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Early ceramics and the origins of village life in lower Central America

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Harvard University, 1987

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Date October 1, 1987

Early Ceramics and the Origins of Village Life in Lower Central America

A thesis presented

by

John Wilton Hoopes, II

to

The Department of Anthropology

in partial fulfillment of the requirements

for the degree of

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ABSTRACT

This thesis describes excavations at Formative Period sites on the perimeter of Lake Arenal in eastern Guanacaste, Costa Rica, defines and describes the Early to Middle Formative Tronadora Complex, interprets the nature of the Zoned Bichrome Period in the region, and discusses the implications of the new data for interpretations of early village life and the emergence of complex society in Greater Nicoya.

Archaeological research in the vicinity of Arenal Volcano has revealed evidence for ceramics, dwellings, and possible maize agriculture dating as early as 2000 BC. The associated ceramics fit stylisticallly within general Early Formative patterns. However, they are sufficiently distinct from complexes to the north and south to suggest that significant processes of regionalization were occurring early in the prehistory of Lower Central America.

Until recently, very little was known about the nature of village life in Costa Rica during the Formative Period (ca. 2000 BC - AD 600). Ceramics dating to 2000 BC or earlier had been identified in Panama, Colombia, and Ecuador to the south and Guatemala, Belize, and Mexico to the north. However, little comparative material was known from Costa Rica. The new data from the Arenal region have made it necessary to re-evaluate of existing models for the appearance of the Formative stage in Lower Central America,

and indicate that broad, unitary models of cultural diffusion do not adequately explain the distribution of early ceramic styles.

By way of comparison, the chronology of Early Formative ceramics in Mesoamerica, northwestern South America, and the Intermediate Area is reviewed in detail, with special attention to the significance of radiocarbon date calibration for the comparison of culture sequences from different regions of Nuclear America.

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ACKNOWLEDGEMENTS

Although it is based primarily on the analysis of two seasons' worth of survey and excavations, this dissertation is in fact the culmination of almost ten years of archaeological fieldwork in Costa Rica, beginning with a memorable summer preceding my Junior year in college. My initial interest in Costa Rican prehistory stems from the encouragement of Michael Coe and Irving Rouse, my undergraduate advisors in archaeology at Yale, who deserve credit for pointing me in the direction of Central America and sustaining my early interests in the archaeology of the "Intermediate Area." It is a credit to their role as teachers during my own "formative period" that I elected to continue a career in archaeology. However, it was with Michael Snarskis and Fred Lange that I shared my first field experiences in Costa Rica, learning to feel comfortable with Spanish and relish the rich humor of ticos. To both of them I owe an enormous debt of gratitude for introducing me to Costa Rica, its people, and the joys of fieldwork in Central America, and I hope that each of them will take due credit for starting me on the path which led to completion of this dissertation.

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As is evident in the body of this thesis, I also owe a great deal to the expert opinions and skills of a number of specialists, who each contributed to the Project's research

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The production of this thesis was by no means a one-man operation. Project maps, which appear in several chapters, were drafted by Payson Sheets. The ceramic illustrations are the product of a joint effort, frequently under pressure, by Paul Jaeckel, Michael McNamara, and myself. Maps of Tronadora Vieja and Sitio Bolívar were drafted by Oliver Radford, who also provided valuable technical support (and a Macintosh) for the production of other figures. Excavation plans and profiles were inked in their final form by Maggie Smart. Final proofreading and preparation of the bibliography were done by Lauren Hoopes.

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CHAPTER ONE
Introduction

Theoretical Considerations

The idea that sedentism, agriculture, and ceramics spread as a single cultural complex throughout the New World is one of the oldest models in New World culture history. Spinden (1917) was the first to propose the idea of a Formative substrate in Nuclear America. His "Archaic" horizon was characterized by pottery and maize agriculture, and was conceived as having originated in the Valley of Mexico and spread outward from there. In the 1970's, Lathrap (1973, 1977) became the chief proponent of a unitary model for the origins of agriculture and ideology in the New World. Inspired by Sauer (1969), and by his own discovery of early ceramics on the eastern slopes of the Andes, Lathrap believed that the tropical forests of lowland South America were the true hearth of New World agriculture, where the origins of a common Formative "basement" were to be found. He succeeded in diverting much attention from coastal adaptations to inland ones, and played a key role in emphasizing the importance of root over seed crop agriculture. However, Lathrap's unitary model also favored broad diffusionary models. To demonstrate the effects of his "Tropical Forest Culture" on Mesoamerican development, it was necessary to find evidence for long-range communication between northwestern South America and Pacific Guatemala, where the Barra and Ocós complexes had been identified as ancestral to Olmec ceramics. Coastwise travel was again invoked, and Lathrap's arguments were bolstered by suggestions that Guatemalan cultures were using Amazonian-style graters to process bitter manioc (Lowe 1975; Davis 1975). Further evidence for unitary origins were seen in a "Tecomate Tradition", which linked the earliest ceramic complexes in Colombia, Peru, and Mesoamerica (Lathrap 1977, c.f. Myers 1978), the tacit implication being that they also shared subsistence practices.

Current evidence suggests that the picture of Formative development in Nuclear America is much more complex than can be explained by unitary models for cultural diffusion. The Swasey culture in Belize, for example, which may date as early as 2000 BC, is totally distinct from contemporaneous complexes from either Pacific Guatemala or South America, and cannot be accounted for by long-range cultural diffusion (Pring 1977, Hammond et al. 1979). Recent evidence indicates the presence of Barra and Ocós sites with maize agriculture on inland river systems in Chiapas (Clark et al., n.d.). Their appearance and as far south as El Salvador (Demarest, personal communication) indicates that early sedentary communities occupied a wide variety of environments and were distributed through several different regions of Central America. The more we learn about them, the more it becomes apparent that Formative cultures in the New World are characterized more by a high degree of local diversity and specialization than by a unity of broad regional patterns. This is especially true when one considers Costa Rica and Panama, where the antiquity of indigenous patterns of Formative development may be comparable to that of regions to the north and south.

Notions of broad similarities in subsistence patterns and a common "Tecomate Tradition" are unwarranted oversimplifications of regional prehistory during the Early Formative period. Most archaeologists working with Early and Middle Formative materials from Mesoamerica have now rejected the interpretation of obsidian chips as evidence for the processing of bitter manioc (Demarest in press). While it is likely that some variety of manioc was known in various parts of Mesoamerica, the identification of a grater chip/budare complex remains inconclusive (DeBoer 1975), and the existence of a manioc-based economy anywhere in the region remains to be demonstrated. Grove (1981) has pointed out the problems of comparing tecomate forms in Central and South America, and a close analysis of Early Formative ceramic assemblages from across Nuclear America indicates that both vessel form and decoration are highly variable even on the earliest time level. Moreover, even the most general patterns display at best distinct stylistic "spheres" rather than a modal "fall-off" from a center of precocious development. The ceramic evidence suggests that if we are to thoroughly understand the processes involved in the emergence of incipient agriculture and village sedentism, it is crucial to devote adequate attention to the particulars of regional cultural history and processes of local adaptations.

In outlining a scheme for the classification of cultural development in the New World, Willey and Phillips defined the Formative stage "by the presence of agriculture, or any other subsistence economy of comparable effectiveness, and by the successful integration of such an economy into well-established, sedentary village life" (Willey and Phillips 1958:146). More recently, Willey (1982) has suggested the concept of an "Early Formative" stage, defined as "a stage transitional from the hunting and collecting economies of both upland and littorine zones into economically successful farming," might be applied to the archaeological record in Lower Central America. He proposes that this stage would resemble the Mesoamerican Early Formative as being a level of "simple village agriculture, early ceramics, and, apparently, of egalitarian society" (Ibid.:179). Because pottery production is an activity which is considered to occur only in the context of sedentary societies, the presence of pottery has long been used to identify an archaeological culture as sedentary. In the Americas, incipient agriculture and sedentism have been very closely linked, and statements like the following are common in the literature:

> The appearance of a ceramic complex in any archaeological sequence usually indicates a degree of sedentariness and presumably an agricultural or at least partly agricultural way of life (Lowe 1971:212).

The logic behind these assertions is that mobile groups with hunting and gathering economies find pottery to be a cumbersome technology. Pots are difficult to manufacture and transport, and many of their functions for the processing of gathered foodstuffs can be duplicated with more easily obtained materials (skins, basketry, gourds, etc.). It is assumed that an agricultural way of life was one of the prime movers in the origins of village life. The process of nurturing incipient cultigens, and the systemic feedback of increased production and population growth (Flannery 1968), associate the origins of agriculture with sedentism. People subsisting on crops which require weeding or watering must remain in one place for at least the period between planting and harvest if they are to protect their crops effectively from weeds and predators. It is tempting to say that because early agriculture is associated with sedentism and early sedentism with ceramics, that pottery must be linked to agriculture. Early pottery and evidence for incipient cultivation frequently appear simultaneously in the archaeological record, and there is a temptation to utilize one to infer the other. However, it is important to realize that there is not an absolute correlation between the use of pottery and domesticated plants. Neither the simple presence nor the sophistication of ceramic technology is a very good barometer for the role of agriculture in a given society. In many parts of the Old World, sedentary village life appears to have preceded the practice of agriculture and pottery technology by several thousand years (Henry 1985).

At sites such as El Paraiso in Peru and Poverty Point in the southeastern U.S., we find evidence of large-scale architecture and high levels of social integration in the absence of pottery. Conversely, in places like Greater Nicoya in lower Central America, ceramic production flourishes in the midst of societies with mixed economies who may have never practiced intensive cultivation (Lange 1984:189). Models which make use of ceramic styles to trace the spread of subsistence adaptations are highly problematic at best, and it is probably wise to consider subsistence strategies and ceramic production independent of one another.

Until recently, most of the earliest ceramics in the Intermediate Area were associated with coastal or estuarine subsistence adaptations, grouped by Willey into the latter half of his "Northwest South American Littoral Tradition" (Willey 1971:264). Puerto Hormiga and Monagrillo ceramics were known from shellmounds or tidal estuaries, and both Valdivia and Machalilla pottery were associated with shellfishing economies. In Mesoamerica, while important early complexes were known from the Tehuacan Valley, the Valley of Mexico, and Chiapas, Pox pottery appeared in a Pacific estuarine environment (Brush 1965), Ocós ceramics were found in mounds with large quantities of shell on the coast of Guatemala (Coe 1961, Coe and Flannery 1967), and Barra sites were also near the Chiapan coast (Green and Lowe 1967). Many of the early ceramic complexes from Mesoamerica and South America were seen to be similar to each other, were more or less contemporaneous, and belonged to coastal-dwelling cultures. Because there was little or no evidence for early ceramics in the intervening Isthmian region, models which depended heavily upon coastwise sea travel were invoked to explain similarities in "Formative" cultures throughout the Americas (Coe 1960). Authors like Meggers, Evans, and Estrada (1965) saw an origin for Formative pottery traditions of the New World in the Jomon ceramic of Japan, from whence they were carried to the Ecuadorian coast. James A. Ford (1969) picked up on their ideas, and gave the diffusionary model its most elaborate expression, mapping routes for the spread of a Formative culture throughout the New World.

In this thesis, I would like to test generalized models for the diffusion or emergence of "Formative" characteristics in the New World through the careful examination of specific local sequences, with special reference to those of northwestern Costa Rica and other parts of the Intermediate Area. Recent excavations in the vicinity of Lake Arenal in the eastern Guanacaste Province of Costa Rica suggest that this region was home to autochthonous, ceramic-using populations as early as 2000 BC. Apparently sedentary populations in this region are contemporaneous with many of the cultures which have been identified as sharing in a unitary diffusion of adaptive strategies from hearths of early agricultural development in South America (Lathrap 1973, 1975; Lowe 1975). However, although the early Costa Rican ceramics show generalized similarities to contemporaneous stylistic complexes in Mesoamerica and northwest South America, they are sufficiently distinct to suggest that distinctive regional traditions were well-developed by the time of the earliest identifiable horizons of ceramic production in Central America. The current data from Costa Rica does not support a model for rapid, widespread diffusion of either Mesoamerican or South American Formative culture through the Isthimian region. Rather, it appears that from at least 2500-2000 BC, and possibly as early as 3000 BC, lower Central America was home to a complex diversity of localized Early Formative cultures. This regional diversity set the stage for later patterns of settlement and subsistence, anticipating the later divergence of cultural strategies and adaptations which characterize lower Central America, Mesoamerica, and northwest South America.

While the concept of a Formative stage is especially useful in discussing the culture history of areas where trajectories of cultural evolution and emerging social complexity eventually were expressed in the form of civilization, its value to the analysis of regions where forms of social organization of greater sophistication than simple village life were slow or late to form is problemetical. Willey and Phillips (1958:171) acknowledged that relationships existed between contemporaneous Costa Rican and Classic Maya and Mexican cultures. Their conclusions are echoed by Snarskis (1978:53), who points out,

> ...the stages used to classify cultural development in Mesoamerica (Preclassic, Classic, Postclassic) do not fit the facts in Costa Rica, where cultures remained in what amounted to a Formative or Preclassic stage throughout the 2500 year sequence known at present.

If we were to correlate stages of cultural development in Costa Rica with those of the Mesoamerica, it could be argued that at no time in Costa Rican prehistory did cultures reach the levels attained in the Isthmus of Tehuantepec by the Middle Formative. For this reason, the term "Formative" is used in this dissertation in its strictest sense: to refer to the very beginnings of "a well-established, sedentary village life" in Costa Rica, as indicated by evidence of dwellings, agricultural production, and a developed ceramic industry.

The problems of relating stages of development between different culture areas have been pointed out by Rowe (1962), who emphasizes the importance of comparing local sequences firmly anchored with absolute dates. He also notes the value of a conception of a "master sequence" of periods to which local sequences could be tied. Although I agree with Snarskis' distinction, my use of "Formative" is more restrictive in the interest of a terminology with pan-regional significance, and "Formative" is also used in the sense of a general "Early Formative period" -- albeit with somewhat irregular temporal boundaries, given the current nature of our knowledge of this period. I have tried to avoid assigning chronological significance to what is essentially a concept which emerged in the context of discussions of a "chronological-developmental scheme" rather than a framework of absolute chronology (Willey 1982:178). However, out of necessity for the evaluation of inter-regional contacts and "influences," I have also tried to maintain strict chronological control of the cultures under discussion. In Mesoamerica, the term "Classic" has come to refer to specific traits rather than strict cultural stages. The term "Classic" has achieved an almost exclusively temporal significance in the Maya area, where massive architecture at El Mirador (Metheny 1979) and other evidence of "Late Preclassic" sophistication are rapidly wearing away the once interchangeable use of "Formative" and "Preclassic." To date there is little evidence in Costa Rica for radical change in sociopolitical organization, the intensity of agricultural production, or settlement hierarchy with the advent of the Early Polychrome Period around AD 500. However, this period does see the appearance of polychrome ceramics and the replacement of jade with gold as the material of choice for ceremonial, prestige, or status artifacts. In a sense, the appearance of elaborate polychrome vessels and gold artifacts may be considered as a sort of "Classic" or "Regional Developmental" period (cf. Willey 1982) in northwestern Costa Rica, despite the lack of political sophistication.

I have chosen to restrict the use of the term "Formative" to the time period which begins with the appearance of ceramics and ends with the period known as "Zoned Bichrome" in Greater Nicoya and Atlantic Watershed terminology. This corresponds roughly to Periods III and IV in the broad regional periodization suggested by Lange and Stone (1984:Fig. 1.1). It was during this period that most of Central America and the Intermediate Area underwent the significant transition from incipient sedentism to ranked society, and it is hoped that by focusing on this period I can throw some light on the developmental processes which lay the foundations for later expansion and sociopolitical sophistication.

A Brief History of Formative Period Research in Lower Central America

The nature and origins of the Formative stage in lower Central America (Fig. 1.1) — a geographical region encompassing central Honduras, El Salvador, Nicaragua, Costa Rica, and Panama (Lange and Stone 1984) — has been of major interest to archaeologists for some time. Spinden assigned the Isthmian region a major role in the spread of agriculture and ceramic technology southward from a supposed hearth in Central Mexico, suggesting that an "Archaic

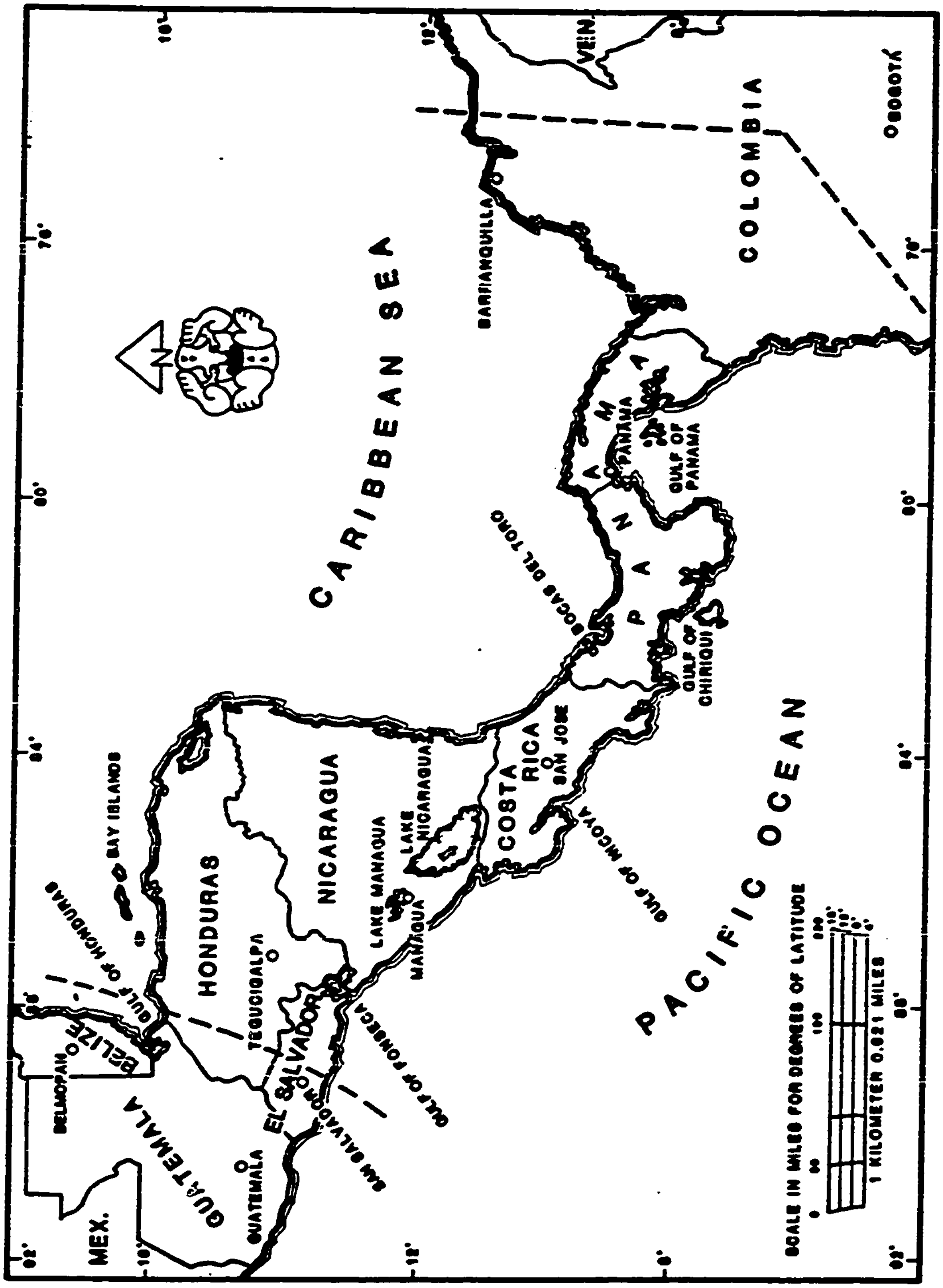


Fig. 1.1: The boundaries of Lower Central America
(Map from Lange and Stone 1984:Fig. 1.1)

Horizon" characterized by stylistic continuities in ceramics and figurine types could be traced as far as the mouth of the Amazon and the central coast of Peru. The root of his "Archaic" hypothesis was the notion that "pottery art spread hand in hand with agriculture" (Spinden 1922:59). Spinden also employed the term "archaic art" to describe styles and techniques characteristic of a common substrate. In areas such as Central Mexico and the Maya Lowlands, these styles were eventually surpassed by the more sophisticated expressions of Precolumbian civilization. In regions beyond the pale of influence of high cultures, such as Costa Rica and Panama, "archaic" techniques were elaborated to become the foundation of subsequent art styles.

Vaillant proposed substituting the term "Middle Cultures" for Spinden's Archaic, and included in this classification the recently discovered materials from the lowest levels of Uaxactun and Holmul (Vaillant 1928). The notion of an "Archaic" cultural substrate with its origins in the early ceramic-producing cultures of Central Mexico as set forth by Spinden was deemed to be "imprecise". Lothrop and Vaillant assigned a greater importance to other regions of Central America, and believed that the phenomenon of an early cultural substrate did not necessarily have its origin in the Central Mexican sequence. Discoveries of early material in both the Maya lowlands and Guatemalan highlands had shifted the focus away from Central Mexico.

They felt that a wide variety of regional cultures had evolved from a common "substratum of traits" which was distinct from the early cultures defined in the Valley of Mexico and which was polythetic -- composed of a number of elements, none of which was exclusively required for the definition of the whole. They defined this substratum primarily on the basis of ceramic traits and called it the "Q complex", using the term "complex" to define a group of traits "which occur in many cultures, and may well have been derived from several distinct ones." Isolated traits of this complex were found in the context of independent pottery traditions "southward through Costa Rica, Nicaragua, Panama, Colombia, Ecuador, as far as Recuay and Chepen in Peru, and northward into Oaxaca, Guerrero, the Huasteca... and Arkansas", although it was admittted that interpretation of their significance was hindered by a lack of accurate chronology (Vaillant 1934:94).

The discovery of assemblages of early monochrome ceramics at Playa de los Muertos (Popenoe 1934), was a major step in revealing the complex nature of early ceramic horizons in Central America. For the first time, ceramics which shared modes with early assemblages from Uaxactun and Holmul appeared outside of the region of full-blown Maya civilization. Vaillant, commenting on the Playa de los Muertos material, remarked: "it is becoming increasingly apparent that the civilization of the Maya takes a relatively small part in the unfolding of Central American culture, and the answer to many of the problems must lie outside the Maya area" (Vaillant 1934:89). He notes that early on, Lothrop had stressed the importance of the Ulua region for understanding the relationship between Maya and non-Maya peoples, and as further work was conducted in central Honduras (Canby 1949) and El Salvador (Longyear 1944, 1947), the temporal depth and complexity of the regions south of the Maya zone became apparent.

The first attempt to formulate an archaeological chronology for the Greater Nicoya Archaeological Subarea (cf. Lange 1984) was that of Coe and Baudez (1961, Baudez and Coe 1962), based upon interpretations of independent stratigraphic testing at sites in western Guanacaste on the Santa Elena Peninsula and in the Tempisque River Valley. Their work had the original intent of locating evidence for cultures with an antiquity comparable to that of La Victoria, on the coast of Guatemala. Although they were unsuccessful in locating very early ceramics, Baudez and Coe were the first to propose a cultural sequence based on stratigraphic excavations and supported with radiocarbon dates. They suggested a succession of four major chronological periods: the Zoned Bichrome, Early Polychrome, Middle Polychrome, and Late Polychrome periods. These were named for general stylistic features in the ceramic sequence, indicating the importance of pottery to archaeological definitions of long-term culture change in the region.

The first descriptions of Greater Nicoya ceramic types in their chronological context were presented in a short paper by Norweb (1964). However, a more exhaustive and detailed study was Baudez' doctoral thesis (1967), a report on investigations in the Tempisque Valley. Lange (1971) made use of the general form of Baudez' periodization and type descriptions in his research in the Río Sapoa Valley, near the border of Costa Rica and Nicaragua. It was also heavily drawn upon by Sweeney (1975), whose own dissertation was based upon an analysis of ceramics from Coe's excavations on the Santa Elena Peninsula. Healy (1974, 1980), analyzing materials excavated in the Rivas region of Nicaragua by Willey and Norweb, also made extensive use of Baudez' work. However, he attempted to adhere to a more strictly defined type-variety methodology, making explicit use of a classification which included taxonomic divisions by ware, group, and variety.

The broad utility of Baudez and Coe's original periodization for interpreting cultural sequences from the Rivas region of Nicaragua in the north to the Gulf of Nicoya in the south (Creamer 1983) testifies to the high degree of uniformity in ceramic styles throughout Greater Nicoya. This unity of ceramic traditions has been one of the principal reasons for this subarea's definition (Lange 1984). The Greater Nicoya ceramic sequence has been crucial to the interpretation of the archaeology of the region, and its revision and fine-tuning has been a significant preoccupation of archaeologists and art historians working with material from the region in recent years (Lange et al. 1984, Lange and Bishop n.d.). Principal concerns of the most recent analysis of Greater Nicoya ceramics have been: 1) "streamlining" lists of ceramic types and type descriptions in order to eliminate redundant categories and facilitate ceramic classification; 2) documenting regional variation in ceramic assemblages and utilizing ethnohistoric documents (Abel-Vidor 1982) to define cultural and geographical subdivisions (e.g. northern and southern sectors) of Greater Nicoya; 3) using compositional analysis to recognize and define processes of pottery manufacture and distribution; and 4) strengthening chronological correlations through more rigorous interpretations of cross-dating and radiocarbon assays.

Although the basic outline of the Greater Nicoya sequence was available in the early 1960's, and an initial ceramic typology for the Atlantic Watershed had been suggested in the latter part of that decade (Kennedy 1968), the working ceramic sequence for the Atlantic Watershed of Costa Rica did not appear in its current form until the late 1970's (Snarskis 1976, 1978). A great deal of archaeological research has been focused on the Central Highlands and Atlantic Watershed regions of Costa Rica in recent years (see summaries by Snarskis 1981, 1984; Fonseca 1981). Much of the data collected from this part of the country has great relevance to an interpretation of the data from the Arenal area. However, the majority of it remains unpublished.

The archaeology of the volcanic highlands and the llanuras, or broad, alluvial plains of Guatuso and San Carlos in the north-central portion of Costa Rica is also poorly known; however, recent efforts have done much to expand our knowledge of the archaeological record in northern and northwestern Costa Rica. Research conducted by Snarskis in central San Carlos (1978), by Aguilar in the Arenal area (1984), and by Norr (1982-83) in the Río Naranjo Valley has suggested that these zones were occupied from as early as the Middle Formative period up to the time of European contact. An increasing body of data (Finch 1982-83; Ryder 1982-83a, 1982-83b; Sheets 1984), has become available from the foothills and valleys of the volcanic range in eastern Guanacaste, complementing our existing information from the coastal regions and the Tempisque Valley.

A detailed analysis of material collected during reconnaissance and excavation of sites in the Arenal area and neighboring valleys by the Proyecto Prehistórico Arenal has now demonstrated that the Cordilleran region was occupied as early Paleo-Indian times, and lithic and ceramic evidence suggests a virtually continuous occupation of the region from the Archaic period through the 15th century AD. Ceramic analysis combined with stratigraphic excavations has revealed the existence of an Early Formative (ca. 2000 BC), pre-Zoned Bichrome complex associated with the remains of a small village, Tronadora Vieja (G-163) -- the earliest known settlement in Costa Rica to date. Site survey and excavation have also revealed a relatively dense population in the region during the Zoned Bichrome period (500 BC - AD 500), during which time we have evidence for the emergence of ranked sociopolitical organization. The association of successive ceramic complexes with volcanic stratigraphy and radiocarbon assays has allowed for the construction of a working ceramic chronology for the Cordillera region (Hoopes 1984), a culture area which includes the Cuenca de Arenal, the Cordillera de Tilarán, and the Cordillera de Guanacaste. Information on the transition from preceramic, Archaic society to sedentary village life and the emergence of Zoned Bichrome period culture has led to a more comprehensive perspective on the nature of society in northwestern Costa Rica during the Formative period. A principal aim of this thesis is the presentation of this new data and the examination of its significance for interpreting processes evident in the regional cultural sequence.

The Cordilleran sequence is presently the longest available for any region in Costa Rica. Albeit fragmentary, lithic artifacts indicate that the area was first occupied during the Paleo-Indian period, and that the region remained populated throughout the Archaic. At the site of Tronadora Vieja, there is evidence for a transition from preceramic lifestyles to an Early Formative pattern characterized by sedentary village life, decorated ceramics, and maize agriculture at around 2000 BC. The early Tronadora Phase was succeeded by an extensive Zoned Bichrome Period occupation, during which the Cordilleran region appears to have participated in many of the same cultural and stylistic traditions as did the Tempisque Valley, Pacific coast and Rivas portions of Greater Nicoya. A divergence from Greater Nicoya traditions is found in the construction of large stone burial mounds and mortuary features, apparently for the use of families or other corporate groups, towards the end of this period. Another notable difference is the apparent absence of a period comparable to the Early Polychrome period (AD 500-800), which is characterized in Greater Nicoya by the appearance of fine polychrome ceramics with "Mesoamerican" motifs. While it is very likely that this period corresponds to the beginning of the Silencio Phase -- the rough equivalent of the Middle Polychrome in the Cordillera region -- sites which clearly date to this time period are unknown. The last two phases of occupation, Silencio and Tilarán, demonstrate continued greater regionalization, with a distinctive growth in the independence of local traditions. The use of elaborate tombs continues in the Silencio Phase, but with a distinctly Central Highland pattern characterized by box-like, <u>laja</u> construction. Gold objects and pottery imported from Greater Nicoya in burials suggest more formal contacts with cultures to the east, west, and south, perhaps initiated by an emergent ranked elite. The last prehistoric phase is characterized by an almost complete absence of both local and imported polychrome ceramics. Instead, there is an emphasis on monochrome vessels with applique decoration, suggesting strong cultural ties with peoples to the east and south.

As with all ceramic chronologies, the sequence for the Cordilleran region will benefit from future fine-tuning and further correlations with absolute dates. The data presented here will provide a foundation upon which future research may be structured. It is hoped that they will invite criticism and stimulate further comparative analyses of cultural assemblages both within Costa Rica and between Costa Rica and neighboring regions, and that they will assist in illuminating patterns of cultural development in Lower Central America. A dialogue on chronologies and basic culture history remains fundamental to present studies of Costa Rican prehistory, and a necessary step towards formulating processually-oriented research.

CHAPTER TWO
A Background to the Current Research

The Proyecto Prehistórico Arenal

The Proyecto Prehistórico Arenal was initiated by Payson Sheets (University of Colorado) and William Melson (Smithsonian Institution) as a multidisciplinary endeavor to make use of the unique depositional environment provided by Volcán Arenal to recover much-needed information on settlement and subsistence patterns in prehistoric Costa Rica. Sheets had first become interested in the effects of catastrophic volcanic eruptions on prehistoric populations through his work at the site of Chalchuapa, where the destructive power of Volcán Ilopango appears to have had a catastrophic effect on local populations during the Late Preclassic period in western El Salvador (Sheets 1976). Subsequent research in tephra deposits from Ilopango at the site of Cerén, in the Zapotitán Valley of El Salvador, revealed the extraordinary depositional environments offered by catastrophic ashfall (Sheets 1979). At this latter site, Sheets was able to recover the remains of a prehistoric house complete with architectural supports, a thatched roof, food stored in pots, and activity areas with evidence for weaving and potting. He was also successful in locating the remains of agricultural fields preserved under the tephra from Laguna Caldera volcano. These were characterized by low ridges upon which maize had been planted, and the nature of preservation was such that excavators were able to identify casts of the stalks and leaves of individual maize plants. This type of information is invaluable to an archaeological study of subsistence practices and prehistoric agricultural systems (Sheets 1982), and it was hoped that the depositional environment around Volcán Arenal would provide similar opportunities to investigate the nature of early subsistence in northwestern Costa Rica. The study region was chosen specifically because of: 1) the presence of an active volcano which had periodically deposited substantial tephra horizons in its immediate vicinity, and 2) the confirmed presence of prehistoric occupations in direct association with volcanic stratigraphy. The primary thrust of the project's research was the investigation of patterns for prehistoric subsistence in the region, making use of the special depositional environments afforded by the volcanic deposits. Based on an interpretation of the a thicknesses of tephra layers and associated soil horizons, Volcán Arenal was believed to be between two and three thousand years old. Its tephra layers therefore corresponded to what would have been an important period of prehistory, and were thought to have sufficient temporal depth to overlap a significant part of the cultural sequence.

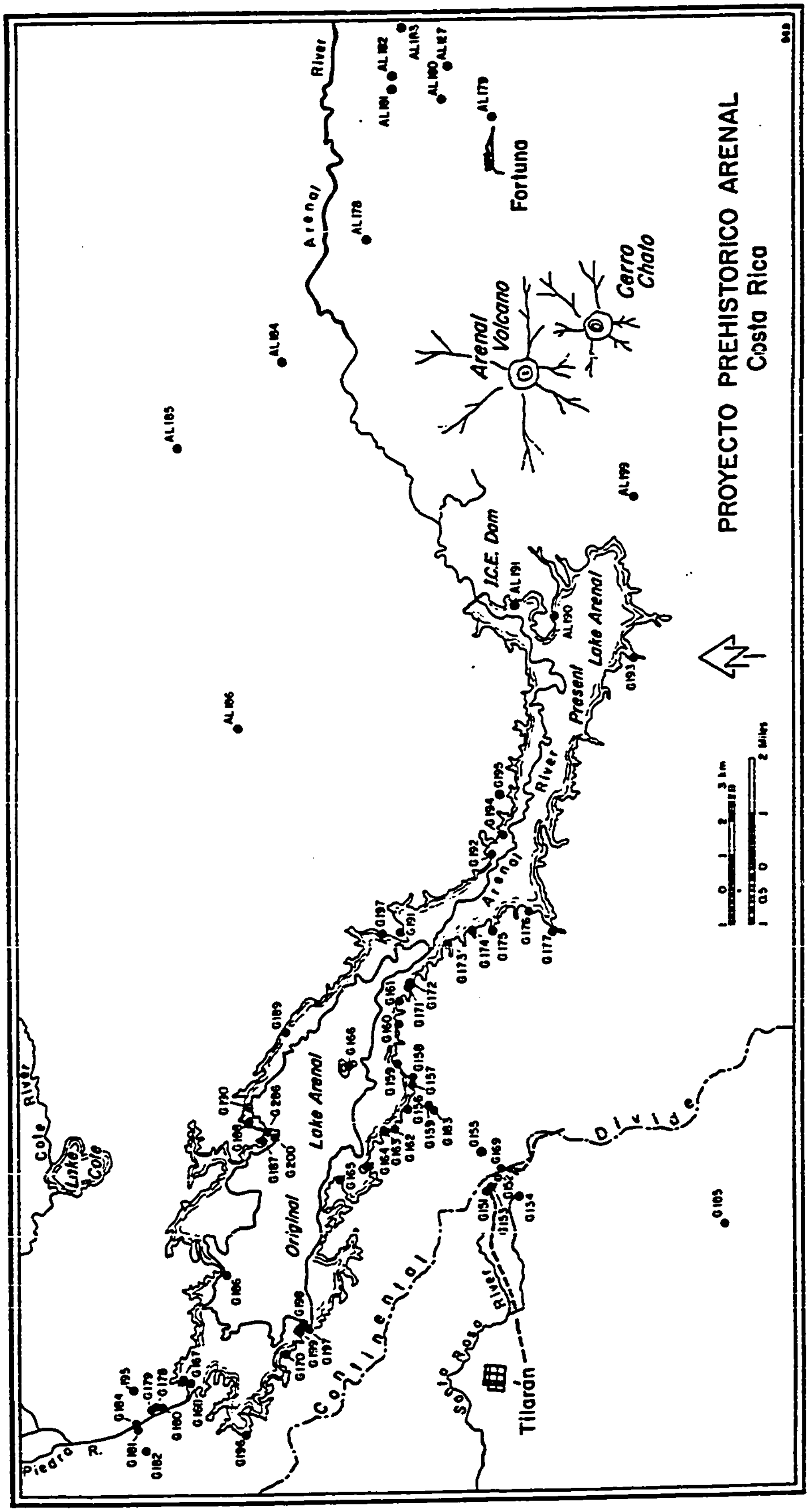
Melson had earlier noticed the presence of pottery in soils developed on tephra deposits while investigating the local eruptional sequence, leading to excavations of selected buried sites by Metcalf (n.d.) and Aguilar (1984). Between May and June of 1981, further reconnaissance was carried out by Sheets with Melson's assistance, with the express purpose of locating additional prehistoric sites which had been buried by ashfall from Volcán Arenal and evaluating the potential of the region for depositional situations similar to that at Cerén. Melson (1978) had noted that small, modern fincas were catastrophically buried during explosive eruptions of Arenal in 1968, and it was believed that the potential for finding similar depositional events of greater antiquity was a good possibility. During Sheets and Melson's reconnaissance, ceramic artifacts were collected from contexts at five different localities where clear stratigraphic relationships could be established between culture-bearing strata and tephra layers deposited by the volcano. Most of these were found to date to the first centuries AD, hinting at the extent of Zoned Bichrome occupations of the region even at this early stage of the research. A second visit by Sheets to the Arenal area in 1982 confirmed the presence of prehistoric funerary features at El Silencio, a private ranch outside of the town of Tilarán, which were also situated in stratigraphic deposits and "sealed" by periodic airfall tephra from Volcán Arenal.

The preliminary field research suggested that the Cuenca de Arenal would be an ideal test region in which to implement a large-scale program of site survey and excavation aimed at the recovery of information on subsistence and human ecology which have often eluded researchers in moist, tropical environments. The multiple eruptions of Volcán Arenal in the recent past (see Appendix B) provided a unique regional stratigraphy, and one which would assist not only with the stratigraphic control of excavations at individual sites, but would provide the opportunity to correlate buried strata and associated assemblages from a variety of sites within the area affected by volcanic ashfall. The volcano itself, which was the site of a violent eruption as recently as 1968, is the subject of ongoing research by Melson and others, and both geologists and archaeologists would benefit from a better understanding of the tephra chronology and the effects of volcanic activity on prehistoric populations. While the size and extent of its prehistoric eruptions could be traced through the examination of geological profiles and petrographic studies, the chronology of the events was largely dependent upon the interpretation of associated archaeological materials. Furthermore, Volcán Arenal's catastrophic eruptions were on such a scale that hypotheses regarding effects of natural disasters on human settlement, agriculture, and land use patterns could also be addressed.

The Project Study Area

Volcán Arenal is a small stratovolcano situated roughly in the gap between the Cordillera de Guanacaste and the Cordillera de Tilarán in the province of Alajue-

FIG. 2.1



PROYECTO PREHISTORICO ARENAL
Costa Rica
Arenal Volcano
Cerro Chato
Fortuna
I.C.E. Dam
Present Lake Arenal
Original Lake Arenal
Arenal River
Continental Divide
Lakes Cote
Cote River
Piedra R.
Santa Rosa River
Tilarán
2 Miles

la, northwestern Costa Rica. Arenal, and its older neighbor Cerro Chato, are part of a string of volcanoes along the central cordillera of Costa Rica. To the south are Poas, Barva, and Irazú, and to the north Tenorio, Miravalles, Rincón de la Vieja, and Orosí. Concepción, a volcano which dominates the landscape of Ometepe Island in Lake Nicaragua, is also a member of this chain. Volcán Arenal had gone largely unnoticed, and was not even considered an active volcano until 1968, when violent eruptions between July 29 and August 10 of that year killed about 80 people and devastated 12 km2 of tropical forest and cultivated land (Melson 1978). Since that time, it has been under investigation by geologists, geophysicists, and seismologists, who have been primarily concerned with elucidating the periodicity and destructive effects of Arenal's eruptions. Many of them have been working closely with the Instituto Costarricense de Electricidad (ICE), which is responsible for the construction and maintenance of the large, earth-fill Sangregado Dam, completed in 1978 to dam the Río Arenal and create a source of hydroelectric power and irrigation water for Guanacaste.

The first research on the tephra sequence of Volcán Arenal was conducted in 1969 by William Melson and George Metcalf, who excavated an archaeological site near La Palma in order to investigate tephra layers deposited prior to the 1968 eruption. They recovered archaeological materials which have been tentatively dated to between AD 1300-1500 (our Tilarán Phase), and the first radiocarbon date associated with Arenal's activities, also from the latest phase of prehistoric occupation (Melson and Saenz 1973). Subsequent earthmoving for land-fill used in the construction of the dam during the mid- to late 1970's exposed several deep geological profiles within approximately 10 km of the volcano, some of them over 20 meters high (Melson 1984). In 1977, one of these profiles was examined in detail by Melson at the site of El Tajo, approximately 7 km west of the volcano's summit (Melson 1978). He was able to discern a sequence of nine distinct major eruptions (Appendix B), and from this characterize the nature of the sequential, eruptive tephra units. Melson's master sequence, termed the "El Tajo Sequence," (Fig. B.1) provided the basis for the identification of the components of the Silencio Sequence, a series of eruptive units and soil strata noted in the Proyecto Prehistórico Arenal study region. Additional information on the regional tephra sequence has come from more recent investigations of strata associated with both Volcán Arenal and Cerro Chato, an older volcano situated immediately to the southeast (Borges et al., n.d.).

The interpretation of the geological data and estimates for the age of archaeological phases are thoroughly intertwined in the formulation of a chronology for the eruptive sequence for Cerro Chato and Volcán

Arenal. A detailed discussion of the dating of the eruptive sequence can be found in Appendix B.

The Scope of the Present Research

In 1983, I was invited by Sheets to join the project as "ceramic analyst." Having participated in excavations at the site of Severo Ledesma in the Línea Vieja region of eastern Costa Rica (Snarskis 1984:212), archaeological survey of the perimeter of the Gulf of Nicoya (Creamer 1985), and excavations at La Guinea in the Tempisque Valley in Guanacaste (Hoopes 1980), I was familiar with pottery from both Atlantic and Pacific assemblages. The Arenal area, situated in the volcanic cordillera between the eastern and western watersheds, was expected to demonstrate characteristics of each, and my background was well suited for the anticipated research.

My principal responsibility to the project was the identification, classification, and interpretation of all ceramic artifacts, including sherds, vessels, and other artifacts collected in the course of both reconnaissance and excavations. With the exception of Aguilar's study (1984), published during our first field season, very little was known about the archaeology of the Arenal area prior to our research. However, preliminary studies had indicated that there were important similarities and homologies between the local ceramics and those from previously described sequences to the west (Baudez 1967) and east (Snarskis 1978). For this reason, Sheets anticipated that a large proportion of the ceramics from the study area could be classified according to existing typologies, and decided in the earliest planning stages of the project (Sheets and Melson 1983) that ceramic analysis would proceed according to practices previously established by researchers in northwestern Costa Rica. The ceramic methodology was therefore predisposed to the use of existing type names and definitions whenever possible, and to the establishment of occupational phases which would be directly comparable to regional sequences elsewhere in Costa Rica. My role in the project was to implement this methodology as expeditiously as possible, providing ceramic identifications concurrent with both excavation and survey and summarizing the results of analyses in written reports at the conclusion of each field season.

The principal thrusts of the ceramic analysis were chronological control, the identification of stylistic relationships between Project ceramics and those from elsewhere in Costa Rica. A secondary emphasis was placed on functional interpretation and technical analysis. The close similarities between Arenal area ceramics and those of culture areas to the east and west made for a great deal of success in developing a workable ceramic sequence. Even in the absence of direct radiocarbon associations, it was possible in the first season of the project to define several stylistic phases (Hoopes 1984) which have since been supported by absolute dating. Given the very small number of whole vessels recovered in two seasons of fieldwork and the relatively limited variety of cultural contexts excavated for any occupational period, questions of vessel function proved very difficult to address. The paucity of whole vessels and lack of evidence for ceramic workshops also limited the depth to which I was able to address questions of ceramic technology, although it was possible to make basic observations concerning paste composition, vessel construction, and decoration.

In addition to the ceramic analysis, I participated directly in the reconnaissance of the southern and western perimeters of Lake Arenal, supervised the excavation of individual operations at El Silencio (G-150) and Tronadora Vieja (G-163), and directed excavations at Las Piedras (G-152), Dos Armadillos (G-154), Viboriana (G-175), and Sitio Bolívar (G-164). Although this research yielded information on several different cultural periods, ranging from the late Archaic to the 16th century, ceramics from the lakeshore survey suggested that the Arenal area had been most densely occupied during the Zoned Bichrome period -- a relatively poorly understood period in northwestern Costa Rica. I had developed a special interest in the Early and Middle Formative periods in a seminar on the Olmec immediately prior to the project's first field season (January-May 1984), and was especially excited when surface collections at Tronadora Vieja yielded evidence for a possible Early or Middle Formative component. Because of their potential for providing information about relatively poorly known cultural periods, Tronadora Vieja and Sitio Bolívar, a single-component Zoned Bichrome period site, became the principal foci of the 1985 field season.

The prominence of Zoned Bichrome ceramics in the project's collections, the large number of sites sampled from this period, the nature of the features excavated at Tronadora Vieja and Sitio Bolívar, and the value of this material for elucidating a poorly understood period of Costa Rican prehistory focused my attention on what I have named the Tronadora and Arenal Phases. These early phases, the associated ceramics, and their significance in the prehistory of lower Central America, the Intermediate Area, and Nuclear America as a whole have become the principal subjects of this thesis.

Research Focus and Aims of the Present Study

The principal research issue at hand is a definition of the "Formative" stage in northwestern Costa Rica on the basis of information available from two seasons of reconnaissance and excavation in the Lake Arenal region. The nature of the Proyecto Prehistórico Arenal and the partitioning of classes of data (survey information, ceramics, chipped stone artifacts, ground stone artifacts, subsistence remains, etc.) among project personnel focused my attention on the large sample of ceramics from a number of sites. I have therefore concentrated on the description and interpretation of relevant excavated contexts, a close analysis of ceramic assemblages with special reference to Early Formative materials, and the classification, description, and interpretation of Formative ceramics from the study area in both narrow and broad geographic and temporal contexts. However, I have also attempted to use the ceramic materials, associated features, and other cultural remains as the basis of an inquiry into nature of the societies responsible for their production and deposition. With respect to ceramics, my approach has been that of a broad, comparative, stylistic analysis. The models suggested by ceramic comparisons are evaluated in light of the more limited but significant data regarding subsistence, settlement patterns, and early social organization.

My principal working hypothesis was based primarily on existing models for Costa Rican culture history -- that many cultural patterns could be explained by external influences from either Mesoamerica or South America on local populations (cf. Snarskis 1978, Healy 1980). The core of my investigation was essentially comparative, seeking to place Arenal area assemblages within a larger cultural-historical framework for Lower Central America (cf. Lange and Stone 1984) and Nuclear America as a whole. However, I believe this approach is justified by the fact that our current knowledge of the prehistory of this portion of the Americas remains extremely limited, in marked contrast to that of larger culture areas to the north and south. A firm base of time-space systematics is essential if one is to address, or even formulate, complex processual questions about past cultures. For this reason, I have devoted a great deal of energy to documenting descriptive and chronological detail. The result is a more thorough understanding of a poorly-known region, whose prehistory reveals the rich diversity of regional adaptations and cultural patterns in Lower Central America from the beginning of settled village life through the emergence of social ranking in northwestern Costa Rica. In the course of research, it became apparent that broad, diffusionary models are of limited value to the explanation of the Formative stage in northwestern Costa Rica, which is characterized more by complex, regional diversity than unitary patterns of cultural development.

The Ceramic Sequence

The ceramic sequence for the Arenal region was constructed using a collection of 12,629 diagnostic sherds from 431 ceramic lots. Almost 75% of these were recovered from stratigraphic excavations, and the remainder were from surface collections. It is based upon ceramic assemblages from stratified sites, associated features and radiocarbon dates, and extensive comparisons with Greater Nicoya and Atlantic Watershed sequences as well as cross-comparisons to sequences from elsewhere in Lower Central America.

Years BC/AD	C-14 Years bc/ad	Lower Central America	Greater Nicoya Periods	Atlantic Watershed Periods	Arenal Region Phases
1500	1400		Late		
1400		Period	Polychrome	Late	Tilaran
1300	1200-1300	VI	----------	Period	---------
1200	1100				
1100	1000		Middle		
1000	900	--------	Polychrome	------------	Silencio
900	800				
800	700	Period	----------	Transitional	
700	600	V	Early	Period	
600	500		Polychrome		---------
500	400	--------	----------	------------	
400	300				
300	200			Zoned	Late
200				Bichrome II	Arenal
100	100				
0				------------	
100	100	Period	Zoned		
200		IV	Bichrome	Zoned	Early
300	200			Bichrome I	Arenal
400	300				
500				------------	---------
600	500				
700				Middle	Late
800	600-700			Formative	Tronadora
900					
1000	900	--------	----------	------------	
1100					
1200	1000				
1300	1100				
1400	1200				
1500	1300				
1600	1400				Early
1700	1500	Period			Tronadora
1800		III			
1900	1600				
2000					---------
2100	1700				
2200	1800				
2300	1900				Fortuna
2400					
2500	2000				

Fig. 2.2: Costa Rican cultural chronology.

While a number of significant formal and decorative modes have been found to be specifically characteristic of Cordilleran pottery, the ceramics of the Arenal area proved to be sufficiently similar to documented assemblages from Greater Nicoya and the Atlantic Watershed that cross-dating with other published sequences (e.g. Baudez 1967, Snarskis 1978, Lange et al. 1984) was possible. Six phases have been defined (Fig. 2.2). These are (with their corresponding periods in the larger regional sequence):

Early Tronadora (2000 - 1000 BC) - Early Formative
Late Tronadora (1000 - 500 BC) - Middle Formative
Early Arenal (500 BC - AD 0) - Early Zoned Bichrome
Late Arenal (AD 0 - 600) - Late Zoned Bichrome
Silencio (AD 600 - 1300) - Early/Middle Polychrome
Tilarán (AD 1300 - 1500) - Late Period

As noted above, the current study will be concerned only with the Tronadora and Arenal Phases of the above sequence, which correspond to Zoned Bichrome and pre-Zoned Bichrome occupations of northwestern Costa Rica.

Methodology

The analysis of ceramics from the 1984 and 1985 Proyecto Prehistórico Arenal field seasons has proceeded in two stages, each with a specific aim and methodology. The first consisted of the construction of a preliminary ceramic sequence for the entire study region, and the principal analytical units were ceramic types and varieties. This stage of analysis was conducted entirely on personal computers during both fieldwork and laboratory analysis. The second stage consisted of a fine-grained analysis of ceramics from the earliest assemblages at the site of

Tronadora Vieja (G-163), and addressed specific questions regarding the chronology of vessel forms and decorative techniques, the distribution of vessels and sherds indicative of cultural activities, and the deposition of cultural materials. This second stage of analysis utilized both personal and mainframe computers and a combination of custom-written software and commercially available statistical and database packages.

The first stage of analysis, whose principal goal was the construction of a working ceramic sequence for the Arenal Basin, first took form during the 1984 season of the Proyecto Prehistórico Arenal. Data collection and analysis, and the rough form of the ceramic sequence, were developed concurrent with both excavation and survey. From the beginning, a high priority was placed on formulating ceramic descriptions which would facilitate comparisons with available sequences from neighboring regions, and an effort was made to apply existing typologies to Arenal ceramics whenever possible. In some instances, this meant the creation of new varieties to accomodate ceramics which differed in distinct and consistent ways from those previously defined. However, in most cases, ceramics could be classified according to existing type designations. Their identification required only a slight broadening of existing type descriptions or an emphasis on the specific characteristics of otherwise well established types as they appeared in Arenal area assemblages. Although an attempt has been made to provide the most thorough descriptions possible, the type descriptions listed here are intended to be used as an area-specific supplement to existing typologies in Baudez (1967), Sweeney (1975), Snarskis (1978), Healy (1980), and other references cited in the text.

Phases and Periods in Costa Rican Culture History

A primary aim of this analysis was the division of cultural materials from the Arenal area into geographically and temporally defined phases which would facilitate site description, provisional dating, and interregional comparisons, and ultimately provide a vocabulary for the discussion of large patterns of cultural development. Because of their significant effect on the interpretation of the archaeological record and Costa Rican culture history, the assumptions which accompany this methodology should be made explicit.

The time-space classification of Costa Rican culture history can be confusing. This is especially true for the subject matter with which this thesis is concerned, which may be variously labelled as the "Zoned Bichrome period", "Periods III and IV" or "Formative" stage (or period, if understood in terms of "Early", "Middle", and "Late") as applied to geographical regions such as "Greater Nicoya," " Costa Rica," "Lower Central America," or the "Intermediate Area". Each term or combination of terms carries a range of specific interpretations as well as implicit assumptions about the archaeological cultures to which it applies, and for the sake of clarity I have attempted to adhere to the terminology of archaeological culture history as defined by Willey and Phillips (1958). However, the very labels applied to archaeologically-defined time periods, regions, and areas both reflect and influence interpretations of archaeological data, and it is hoped that the reasons for their specific applications here are justified by the archaeological evidence.

A recurrent problem in Costa Rican prehistory stems from the use of labels of classificatory groups which are laden with implicit and explicit interpretations of material culture or culture history. The best example of this is the periodization of Greater Nicoya culture history presented by Baudez and Coe (1962), which defined the following sequence based on the interpretation of ceramics from excavations on the Santa Elena Peninsula and in the Tempisque Valley (Note: following a convention employed by the British journal Antiquity, "ad" and "bc" are used in this thesis to designate dates in uncalibrated radiocarbon years, with "BC" and "AD" reserved for calibrated dates. For further explanation, see Appendix A):

Zoned Bichrome Period	300 bc - ad 300
Linear Decorated Period	ad 300-500
Early Polychrome Period	ad 500-800
Middle Polychrome Period	ad 800-1200
Late Polychrome Period	ad 1200-1550

Each "period" was comprised of local phases, defined on the basis of stratigraphic excavations, ceramic analysis, and associated radiocarbon dates. The sequence was intended to assist the archaeologist with the chronological interpretation of sites and components on the basis of ceramic assemblages, and has proven to be relatively accurate as a general description of the sequence for the region known as Greater Nicoya (Norweb 1964, Lange 1984). However, the period names are themselves derived from decorative trends in the ceramics, placing an inordinate amount of importance on decorated pottery and causing a fair amount of confusion where certain styles of decoration do not adhere to "diagnostic" patterns of given periods. Because of what has emerged as a relatively strict correlation of local ceramic phases to regional periods, regional chronology has come to be identified with ceramic chronology. As a result, the addition of local phases and revision of ceramic chronology has brought about direct revisions of regional periodization. The most recent of these are: 1) the elimination of the "Linear Decorated" period as a separate temporal division and its incorporation with the "Zoned Bichrome" period, bringing the terminal date for that period up to ad 500 (Lange 1971, 1980); 2) the extension of the "Zoned Bichrome" period backward as far as 800 bc on the basis of new radiocarbon dates (Lange 1980, 1984); and, 3) the adoption of a more broadly defined lower Central American "periodization" intended to describe the trajectory of cultural evolution for an area extending from central Honduras and El Salvador in the north to Panama in the south (Lange and Stone 1984).

The concept of "phase" as applied here is primarily a means of classifying cultural remains in time and space, and differs from "period" primarily in its geographical restrictions and its emphasis on cultural characteristics rather than strict chronology. However, I have made an attempt to provide rough temporal boundaries for phases described here. These chronological divisions are based primarily on an interpretation of radiocarbon dates associated with Arenal area ceramic assemblages, and with dates associated with similar assemblages or specific types and modes in neighboring regions. Given the limitations of radiocarbon dating, however, the absolute chronology of cultural phases should not be considered without the accompanying caveats.

The Ceramic Sample

The principal excavated sites during the 1984 season date to the Silencio (AD 600-1300) and Tilarán (AD 1300-1500) phases. The El Silencio cemetery (G-150), Las Piedras (G-152), Neblina (G-151), Dos Armadillos (G-154), and other sites yielded burial and domestic assemblages in stratigraphic contexts which helped correlate cultural occupations with the stratigraphic sequence from Volcán Arenal. Because Arenal's tephras blanketed a large portion of the study area and were preserved as visible horizons in the regional stratigraphy, it was possible to amplify the interpretation of radiocarbon dates and stratified assemblages from individual sites to account for a much broader area (Hoopes 1984). At El Silencio, whole vessels found as burial offerings and sherds found in burial and architectural fill provided information on both local pottery traditions and exchange with areas to the west. At Dos Armadillos, a horizontal deposit overlain by a well-preserved tephra layer (Unit 20) provided a sealed and dated domestic assemblage from the Tilarán Phase.

Two of the principal accomplishments of the 1985 season were the acquisition of stratigraphic information on the Tronadora (2000-500 BC) and Arenal (500 BC-AD 600) Phases of the Cordilleran cultural sequence, and the definition of Formative period sites. From survey data and limited testing, two sites were selected as favorable locations for the discovery of features which would provide information on settlement, subsistence, mortuary practices, and human ecology in relation to the eruptive activity of Arenal Volcano. These were Tronadora Vieja (G-163) and Sitio Bolívar (G-164), both located east of the town of Tronadora on the shore of modern Lake Arenal. Each presented a surface assemblage characterized by the predominance of a single ceramic component (Tronadora and Arenal Phases, respectively). Preliminary testing at Tronadora Vieja had demonstrated that most of the cultural material was located in stratigraphic Unit 60 and below -- the earliest tephra and soil horizons to develop on the surface of the Aguacate Formation. At Sitio Bolívar, surface collection at the shoreline yielded an Arenal Phase assemblage which was interpreted as largely domestic, while reconnaissance in a more elevated portion of the site provided evidence for looted burials.

From the point of view of ceramic analysis, both Tronadora Vieja and Sitio Bolívar were extremely fruitful. The former site provided more than 700 diagnostic sherds, over 60% of them dating to the Tronadora Phase. The latter provided an assemblage of almost 6000 diagnostic sherds in deposits pertaining almost exclusively to the latter half of the Arenal Phase. Domestic activity and mortuary features were identified at both sites, providing ceramic types which represented a wide variety of functions.

The ceramic assemblages utilized in the construction of a working chronology for the Proyecto Prehistórico Arenal represent a very wide variety of contexts, sites, time periods, and cultures. Given the location of the study area -- on and near the continental divide and between the Cordillera de Guanacaste and the Cordillera de Tilarán -- such a blending of culture traits might be expected. The ability to make extensive use of cross-dating has not only assisted the interpretations of Cordilleran sequences, but has made possible an independent check on established sequences for the eastern and western regions.

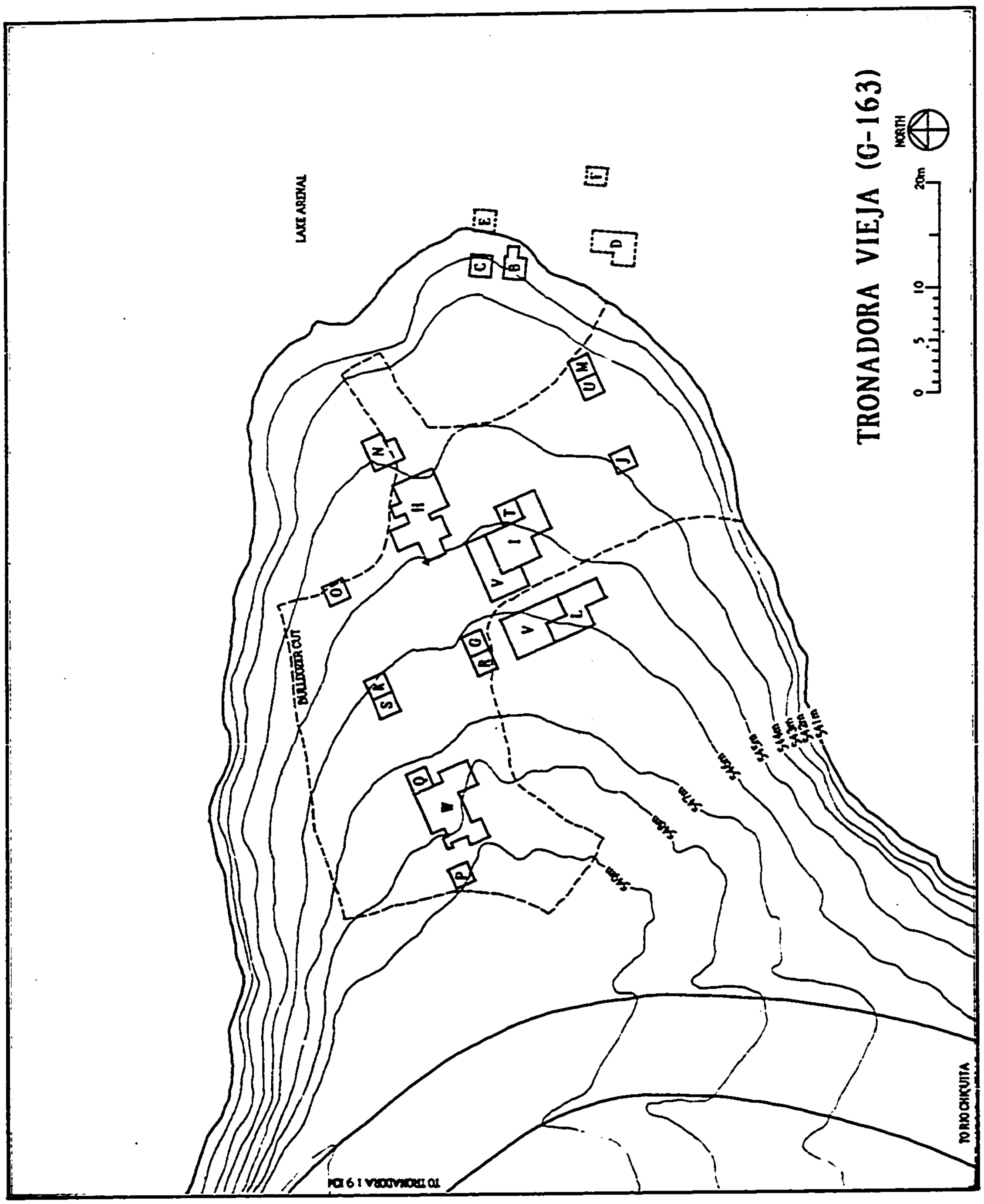
CHAPTER THREE
Excavations at Tronadora Vieja

The most important site for understanding the nature of the Early Formative period in northwestern Costa Rica is Tronadora Vieja (G-163). This site was first recorded during a survey of the southern shore of Lake Arenal by the Proyecto Prehitórico Arenal in March of 1984. At this time, a seasonal decrease in rainfall had resulted in the lowering of the level of the reservoir. Repeated wave action and the fluctuation of the water level during the dry season created and exposed a section of eroded sediments at the lake's edge. Although the site was deeply buried, artifacts from the eroded deposits were scattered across the surface of a section of exposed lakeshore. A collection of sherds and lithics allowed us to assess the general size, nature, and chronology of the site. The decision to excavate at the site was based upon the interpretation of materials from our collections as evidence of a distinct and possibly very early ceramic complex.

Location

The site of Tronadora Vieja is situated on the southern shore of Lake Arenal (Fig. 3.1), and is named for its proximity to a town which is now inundated by the lake. The site is located on the north side of an unpaved road which follows the lake perimeter, and extends (as best we could determine) from the road's edge to the lakeshore. On

FIG. 3.1


TRONADORA VIEJA (G-163)
LAKE ARENAL
BULLDOZER CUT
NORTH
0 5 10 20m
TO RIO CHIQUITA
TO TRONADORA 1.9 KM

the "TILARAN" 1:50,000 quadrangle, it is located at approximately UTM 437,800 m E X 275,300 m N. Tronadora Vieja is about 400 m northeast of the mouth of Río Tronadora, a steeply-cut arroyo of modest size, and immediately to the east of a small and intermittently active quebrada. It is at an altitude of approximately 545 m above sea level, and is located on a gentle, north-facing slope. Before the creation of the present Lake Arenal reservoir, the site overlooked the point at which the Río Tronadora entered a broad, swampy basin at the headwaters of the eastward-draining Río Arenal. The low hills of the Continental Divide rise immediately to the south, but the site provides an ideal vantage point over the broad Arenal basin to the north. Volcán Arenal and Cerro Chato dominate the horizon to the east, and the volcano would have been clearly visible to prehistoric inhabitants of the site. The volcano was very active while excavations of the site were in progress, and on several days treated us to a display of eruptions of dark clouds of smoke, accompanied by deep rumblings and explosions (probably the origin of the location's name -- tronadora translates roughly as "thunderess")

The land on which Tronadora Vieja is located is the property of the Instituto Costarricense de Electricidad (ICE), the national electric company, and was not being utilized for either cultivation or pasture in 1984 or 1985. However, it is not far from the location of the modern town of Tronadora, submerged by the construction of the Sangregado Dam as part of the Lake Arenal hydroelectric project. It is likely that the property was utilized for agriculture during the town's occupation. The small point on which the site is located is now a favorite spot for freshwater fishing.

The horizontal extent of the site is difficult to determine, but it is estimated to be approximately 100 X 60 m (0.6 ha). Construction of the ICE access road along the southern margin of the lake and heavy erosion at the lake's edge have had a clear impact on the site, and it is hard to say how much of the original area of prehistoric occupation is represented by the remaining deposits. On the western margin of the site, severe undercutting has caused the sides of a small quebrada to collapse, leaving vertical cliffs of exposed sediments. On the northern and eastern margins of the site, strata containing artifacts and the remnants of occupational features grade slowly beneath the surface of the lake. The action of wind and waves is contantly exposing archaeological material along the lake's edge, and it was these eroded cultural materials on the lakeshore that first indicated the presence of buried cultural strata.

Natural Environment

Tronadora Vieja (Fig. 3.1) is located in an environmental zone classified according to Holdridge as "Bosque humedo, Tropical," or Tropical Moist Forest (Tosi 1980, Hartshorn 1983:121). This zone is described by Hartshorn as the most extensive in Costa Rica, but also the most discontinuous. It is characterized by tall, semi-deciduous or evergreen forests, usually with abundant palms. The shrub layer is composed of dwarf palms and giant, broad-leafed herbs. Except for occasional ferns, the ground cover is generally bare. Annual rainfall at Tronadora has been measured to be 2600 mm (Tosi 1980). The dry season here is very short, averaging about three months (February-April). The mean annual temperature in this area is 23.6° (Tosi 1980).

The area of the site, which was situated immediately west of the now-submerged town of Old Tronadora, has been heavily utilized for grazing and agriculture. In prehistoric times, it was probably covered with a dense, cool, tropical rainforest. Pollen and phytolith profiles from the site suggest the presence of palms, vines (Malphigiaceae), and saprophitic plants characteristic of tropical rainforests (Piperno, n.d.). Pine (<u>Pinus</u> sp.) pollen was also present, but this species is not native to Costa Rica, and the pollen may have been transported by wind from regions such as eastern Nicaragua (Clary 1986). While Lake Arenal currently encroaches on three sides of the site as a result of the Sangregado Dam, in prehistoric times it would have been a large, marshy lake at a distance of less than a kilometer to the north of the site. This marsh was probably a rich source of birds, fish, amphibians, and other animals for the inhabitants of the site, but the absence of faunal remains precluded confirmation of this assertion.

Site Survey and Testing in 1984

The site of Tronadora Vieja was first identified and a sample of material made by Sheets, Hoopes and Mueller during a survey of the southern lakeshore in March of 1984 (see Mueller 1984). At that time, the distictive nature of the ceramic assemblage and the presence of early decorative modes was immediately apparent. A general collection was made of all sherds, groundstone fragments, and flaked lithic remains on the exposed lakeshore. The initial surface collection yielded a total of 522 sherds. Of these, 115 (22%) were diagnostic as to rim form, decoration, or general vessel shape and were tabulated accordingly (see Appendix C).

A large number of formal and decorative modes which did not overlap with those identified with Arenal, Silencio, and Tilarán Phases were identified when the Tronadora Vieja assemblage was compared to surface collections from other lakeshore sites. Decorative modes such as lip grooving, shell-edge stamping, and heavy punctation, and vessel shapes including bolstered-rim olla-tecomates and flat-based cylinders showed similarities to early phases such as Loma B, Chaparrón, and La Montaña, immediately suggesting the presence of a component related to the earliest-known ceramic complexes in Costa Rica. This hypothesis was later supported by stratigraphic excavations which revealed the presence of this pottery in the lowest occupational strata in the regional sequence.

The "Tronadora Complex" (Hoopes 1985) was initially defined on the basis of surface and excavated assemblages from the 1984 season. In assemblages from the sites of G-162 and G-163, sherds from other phases were few in number, and both rim forms and decoration distinguished Tronadora ceramics from assemblages of other recognized phases. Mode clusters which have since been labelled Tojibe Beige, Tronadora Incised, Tajo Gouge-Incised, and Tigra Grooved-Punctate were all present in the initial surface collection, as were individual early modes such as shell-edge stamping, geometric groove-incised designs, round-bottomed groove-incision, and incisions infilled with red ocher. Arenal Phase sherds in the sample indicated that a component from this phase was present at the site, but the fact that the assemblage was dominated by early-looking modes was taken to indicate a longer or more intensive use of the site prior to the Arenal occupation. Preliminary test excavations at Tronadora Vieja in 1984 yielded sherds and features in Unit 60, on the surface of Aguacate, and in intervening strata.

The initial surface collection from Tronadora Vieja included mano and metate fragments and a ground stone celt in addition to artifacts of chipped or flaked stone. These latter included flake cores, percussion blades, and flakes of chalcedony and jasper, one of which was identified as a biface thinning flake. The most interesting artifact was a complete, bifacially-flaked, Archaic-style point, found just beneath the waterline at the lake's edge.

The identification of early pottery in addition to an Archaic period lithic component suggested Tronadora Vieja would be an ideal site for sampling the early portion of the regional sequence. Initial test pits on the eroded lakeshore followed the natural stratigraphy of tephra horizons and derived soils. These initial stratigraphic excavations at the site allowed us to correlate buried strata with the general sequence pieced together from excavations and observations of roadcuts, and confirmed the stratigraphic placement of the early ceramics. The discovery of charred macrobotanical remains, including a single kernel of Zea mays in association with a small hearth in Unit 60 (Matthews 1984), and a small stone hearth on the surface of Aguacate (Unit 65) suggested adequate preservation of both subsistence and settlement remains. Tronadora Vieja was therefore assigned a high priority for further excavation in 1985.

Excavation Methodology

Full-scale excavations at Tronadora Vieja were conducted between the beginning of February and the end of March in 1985. In all, approximately 140 m^2 were excavated, representing about 5% of the total site area.

The initial site grid was set up with compass and tape, dividing the area to be excavated into 10 X 10 m sections. The location of the first operations was determined by testing the corners of each grid square with a posthole digger to the depth of sterile soil and observing the nature and depth of cultural deposits. With the exception of a small concentration of Tilaran Phase sherds in Unit 30 strata at the southernmost edge of the site, very little cultural material appeared in the uppermost 80-90 cm. Spot testing for inorganic phosphates (Eidt 1976) showed higher concentrations at depths of more than 90 cm below the surface, and the paucity of cultural remains in the upper strata of the site was confirmed by subsequent excavations.

Grid areas which had yielded positive soundings with the posthole digger were selected for initial excavations, and the initial operations were placed in areas with the highest concentrations of artifacts and inorganic phosphates. These operations were begun as 2 x 2 m units, and later expanded as subsurface features became apparent. With the benefit of the regional tephra sequence, known from a number of excavations and other observations of stratigraphic cuts during the 1984 season (Melson 1984, Mueller 1984), it was possible to identify and excavate by natural stratigraphy in all excavations. In instances where natural strata were thicker than 10 cm, artificial levels were used to divide these for closer examination. In all, a total of seventeen operations were opened (Fig.

3.1). Six of these, Operations H, I, L, N, V, and W, were expanded beyond the extent of the original 2 x 2's.

While initial excavations began at the modern ground surface, it became readily apparent that the first 80-90 cm of the site contained virtually no evidence of prehistoric activity. After a month's excavation at the site, a bulldozer was contracted to strip off the strata above Unit 50, saving us a great deal of time spent in removing many cubic meters of relatively sterile overburden. This action made possible a much broader exposure of horizontal features which had been originally buried almost two meters below the modern ground surface. We were only able to excavate a small portion of the area exposed by the bulldozer. However, the fact that culture-bearing deposits are now much closer to the surface will facilitate future excavations at the site.

An initial attempt at both dry screening and wet screening excavated soils through 1/4" mesh proved to be very frustrating. The often moist, clay-laden deposits, espe-cially those most pertinent to cultural occupations (Unit 50 and below), would not pass through the screen without a great deal of effort. Water tended to worsen the problem, turning the soil into very sticky clumps which did not dis-solve easily. Unit 61, a hard tephra layer, would have had to be carefully broken and crushed before it could pass through a screen. Because screening was highly labor-intensive and would have drastically slowed the progress of our excavations, it was abandoned early. Instead, we relied upon careful shovel- and trowel-scraping techniques, and instructed workers to collect 100% of sherds, lithic, and charcoal remains. Special attention was paid to the latter, and all charcoal bits were inspected first in the field and then later in the laboratory for evidence of macrobotanical features.

During excavation, artifacts were collected within each operation in sequentially-numbered lots. While these lots usually corresponded to material from a given excavation level or stratum, they were also used to designate materials from specific features such as hearths, pits, or living surfaces. In addition to ceramics and lithics, samples were taken for pollen, phytolith, petrographic, and macrobotanical analysis. Small fragments of charcoal for radiocarbon dating were routinely collected together from the same excavation level and placed in aluminum foil. Large, consolidated pieces, concentrations of small fragments, and charcoal fragments which preserved the morphology of charred floral remains were collected separately and given special attention. After washing and numbering in the laboratory, excavated material was divided up among several project members for analysis. Chipped and flaked stone was analyzed by Sheets, ground stone by Chenault, macrobotanical remains by Mahaney, Blanco, and Matthews, pollen by Clary, phytoliths by Piperno, tephra and soils by Melson and Knapp, and ceramics by myself. The following discussion draws upon the expertise of both the field crew and laboratory personnel, and their assistance with this chapter is gratefully acknowledged.

Site Stratigraphy

The sequence of tephra deposits from Cerro Chato and Volcán Arenal and their associated weathered paleosols at Tronadora Vieja is similar to that for the Arenal region as a whole (see Appendix B). However, there are some important differences which are specific to the stratigraphy at this site.

As noted above, the uppermost strata at the site were largely devoid of cultural material. Unit 10, the layer of coarse lapilli (tephra grains) deposited during Arenal's 1968 eruption, is present only in small lenses. Unit 20, a second layer of lapilli deposited some 500 years earlier (ca. AD 1400), appears in almost all profiles from the site as disturbed and discontinuous. It has a maximum thickness of 8-10 cm. Unit 30, which contains material dating to both Silencio (AD 600-1300) and Tilarán (AD 1300-1500) phases at other sites in the region, caps underlying deposits throughout Tronadora Vieja. However, it is essentially sterile in all but the southernmost portion of the site, where it yielded a small collection of Tilarán Phase ceramics. Units 40 and 41, which bisect Silencio Phase deposits at site G-150 (Bradley 1984), and are dated to approximately AD 800-1000 (Melson 1984), appear only in small, discontinuous lenses in profiles at the site. They are clearest in Operation N, at the northern end of the site, but are not associated with any cultural remains. Together, Units 30, 40, and 41 appeared as a mottled yellow to brown zone, 30-40 cm thick.

Apart from the rare Tilarán Phase ceramics noted in Unit 30, the latest occupation of the site occurs in what has been labelled as Unit 50 and the "Upper 50's" strata and related paleosols. Unit 50 at Tronadora Vieja was initially believed to correspond to a dark, tephra-derived stratum which appeared at G-150 and other sites in the Río Santa Rosa drainage (Bradley 1984) beneath Units 40 and 41 , where it was associated with the early half of the Silencio Phase (Hoopes 1984). A black zone some 20 cm thick appeared in all profiles at Tronadora Vieja, and was separated from underlying deposits by its visual distinctiveness. Although its position in the stratigraphic column was similar to that of Unit 50 as noted at other sites, petrographic analysis by Knapp (n.d.) suggests that it is compositionally distinct and probably derived from earlier eruptive events. In terms of artifactual associations, it was not possible to make a clear distinction between this stratum and those immediately below it.

Between this black horizon and the next identifiable tephra unit (Unit 55) were a series of strata which were present as a group across the entire site, but were not individually recognizable in all operations. These strata are collectively referred to as the "Upper 50's," and represent Units 51 through 54 of the regional tephra sequence. Together, they appeared as a broad, light brown horizon beneath Unit 50, and were approximately 40-50 cm thick in all profiles. The "Upper 50's" strata yielded a large quantity of cultural material, and represent a period of major Arenal Phase activity at the site. The base of these strata was signalled by Unit 55, a coarse, sandy yellow tephra horizon which appeared as shallow lenses or chunks at the top of Unit 60.

Unit 60, a second black horizon, appeared at approximately 130-140 cm below the modern surface of the site. It varied in thickness from about 10-20 cm, and was rich in cultural remains. This stratum represents what was probably the the later part of the Tronadora Phase occupations of the site (although due to small sample size stylistic differences between Early and Late Arenal could not be correlated with stratigraphic units), and will be discussed in detail below. Between Unit 60 and the Aguacate Formation, a deep clay at the base of cultural occupations throughout the Arenal area, the stratigraphy of the site was characterized by disturbance and discontinuity. These lowermost occupational strata, varying in depth from approximately 5-30 cm, consisted of Units 61, 64, 65. The uppermost, Unit 61, was a dark grey, sandy tephra, usually consolidated and hard. It has been tentatively identified as tephra from the last explosion of Cerro Chato, although it may correspond to the earliest tephra deposited by Volcán Arenal. Unit 61 contained a high density of Tronadora Phase artifacts. This stratum was very distinct in the operations where it appeared. However, it appears to have been heavily disturbed by either cultural or natural processes in some parts of the site. Unit 64 was identified as a relatively shallow layer of brown clay on the surface of Aguacate. It is believed to represent either a thin, tropical forest soil which developed on the underlying clay prior to the first eruptive activity of Cerro Chato or Volcán Arenal or it may be the remnants of heavily-weathered tephras deposited on the surface of Aguacate. This stratum was usually identifiable immediately beneath Unit 61. However, in parts of the site where Unit 61 was absent or unidentifiable, it was identified only as the stratum between Unit 60 and Aguacate. "Unit 65" was used to designate the uppermost surface of the orange Aguacate clay, which in a number of locations yielded cultural materials to a depth of 5-10 cm. This stratum represents the earliest human activity in the Arenal area, which occurred on a very thin tropical soil or directly on the surface of the sterile clay. Aguacate was exposed at approximately 150 cm below the modern-day ground surface.

The volcanic stratigraphy at Tronadora Vieja (Fig. 3.2) is key to interpreting past cultural activity at the site. While we have no evidence for the disruption of

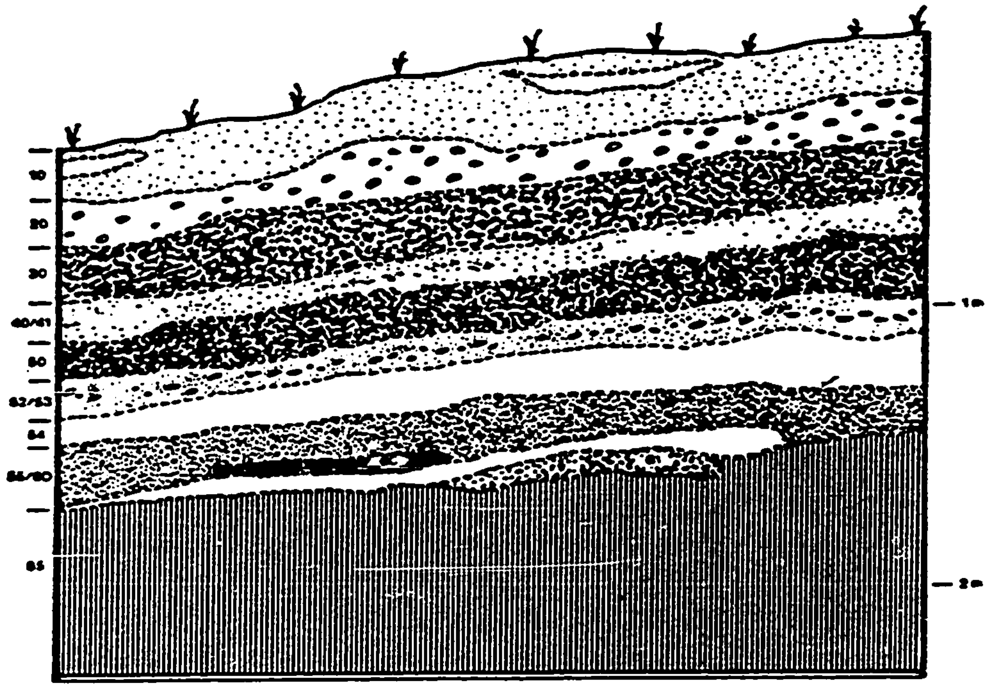


Fig. 3.2: Operation L, Tronadora Vieja.
Tephra strata in southwestern profile.

prehistoric activities by volcanic eruptions at the site, the periodic deposition of volcanic tephra may have had more subtle effects during the prehistoric record. Given that the bulk of the thickness of archaeological strata at Tronadora Vieja was due to the development of paleosols from the weathering of tephra deposits, rather than layers of tephra deposits themselves, there is clear evidence for periodic alterations in the nature of soils in the region. The association between early ceramics and the initial eruptions of Cerro Chato or Volcán Arenal raises questions about possible causal relationships between soil types and "Formative" cultures, which will be addressed below. From a purely methodological point of view, the readily identifiable stratigraphic units made possible correlations between excavations in different operations at the site, and between occupational levels at Tronadora Vieja and other sites in the Arenal area. This has assisted with the identification of specific "macro-assemblages" of ceramics, lithics, features, and radiocarbon dates, which have assisted primarily in the definition of phases of occupation for the region. In turn, chronological control makes possible the reconstruction of patterns of past behavior, because we are able to examine the evidence for events and adaptations at specific times in the distant past.

Reconstruction of Past Activity at Tronadora Vieja

This analysis of excavation results and archaeological remains is aimed at eliciting a history of cultural activity at Tronadora Vieja, and the actual remains will be discussed in conjunction with their interpretation. In order to present the data in its the order of its original chronology, we will begin with the lowest levels in the stratigraphic sequence and work upward through both time and excavated strata.

Fortuna Phase Assemblages

As noted above, the earliest evidence for human occupation in the Arenal area comes from artifacts deposited directly on the sterile clay base represented by the Aguacate Formation. A complete, fluted Paleo-Indian point manufactured from locally-available chert found in the surface of Aguacate at Sitio Bolívar (G-164) is clear evidence that the Arenal basin supported some big game hunters as early as 10,000 BP. While we do not know much about the extent of the Archaic horizon in the region, at Tronadora Vieja, Archaic period activities appear at the base of the site's occupation.

The earliest date for the Fortuna Phase (Sheets n.d.) is one of 3950(3695)3381 BC [Tx-5286: 2940 bc ± 100], from a matrix of unweathered Aguacate at the aceramic site of Piedras del Sol (AL-186). This sample of charcoal was associated with a possible hearth and chipped stone artifacts, interpreted by Sheets as the remains of a late

Archaic period workshop.

The Fortuna Phase is represented at Tronadora Vieja by five radiocarbon dates, all associated with Archaic-style flaked stone artifacts:

3609(3360)3050 BC [Tx-5275: 2650 bc ± 70]
3609(3351)3040 BC [Tx-5278: 2630 bc ± 80]
3360(3066)2920 BC [Tx-5276: 2500 bc ± 70]
3014(2821)2590 BC [Tx-5274: 2260 bc ± 70]
2450(2090)1753 BC [SI-?: 1725 bc ± 100]

All but Tx-5276 come from a concentration of wood charcoal at the bottom of Operation I, 5-10 cm below the apparent surface of Aguacate, and appeared to be the remains of a single fire. These were associated with lithic debitage consisting of chalcedony percussion flakes. Tx-5276 was a large, aggregate sample of charcoal fragments from a 50 X 50 cm area near the bottom of Operation L. It was stratigraphically situated beneath Unit 60 and above a discontinuous patch of tephra interpreted at Unit 61, and was associated with both ceramics and Archaic-style chalcedony biface thinning flakes.

There are several inconsistencies with regard to these dates, all run on samples of charcoal from Tronadora Vieja (see Appendix A for detailed descriptions of each). The dates Tx-5275, Tx-5278, Tx-5274, and SI-? (lab number unavailable) all derive from the same concentration of wood charcoal. However, only Tx-5275 and Tx-5278 (which are virtually identical) overlap each other at the calibrated 2-sigma range. It is possible that the discrepancies result from varying ages in the wood that was burned to form the sample. Wood from the interior of an old tree, or from the internal portions of trees of differing ages, will yield dates which correspond to the time of the wood's growth rather than the time of the tree's cutting (making possible the dendro-correction of radiocarbon dates from species such as bristlecone pine and Irish oak). Charcoal formed from wood in a primary forest, where periodic agricultural clearing would not have lowered the average age of trees, would probably be especially prone to this type of dating problem. If the three samples in fact represent Archaic period activity, this could be one explanation for the discrepancy. However, the last, and youngest, date (SI-?) was run on a portion of the same sample of charcoal as Tx-5274. These two dates do not overlap either, although the 2-sigma ranges do approach each other at around 2500 BC. Laboratory error is also a possibility, but neither of the radiocarbon labs which dated this sample has been able to explain the discrepancy.

Another of these dates which presents interpretive problems is Tx-5276. The horizontally-restricted aggregate sample on which this date was run was collected from the lowermost stratum above Aguacate (Unit 64) in Operation L, and associated lithics included two broad, thin, expanding biface thinning flakes and retouch flakes of translucent chalcedony, which Sheets (n.d.) has identified as Archaic in style. However, the charcoal on which this date was run was also associated with diagnostic Tronadora Phase ceramics, one sherd with a charcoal residue, and a fragment of a charred maize kernel. Tx-5276 is believed to be too early for the Tronado a hase component, and may represent Archaic period charcoal which became mixed with later remains in the soil on top of Aguacate.

A similar contextual problem occurs with the earliest date accepted for the Tronadora Phase, 2470(2166)1834 BC [Tx-5277: 1780 bc ± 100). The sample from which this date is derived came from the uppermost 5 cm of Aguacate, where it was associated with flaked debitage, including three biface thinning flakes, two of which displayed characteristics identified as Archaic in style (Sheets n.d.). However, the artificial 5 cm level associated with Tx-5277 also contained ceramics. It is possible that the occupation on the surface of Aguacate at Tronadora Vieja may have occurred very close in time to the transition from preceramic to ceramic (or "Archaic" to "Formative") society in the region. Definition of this transition is hindered by the lack of better evidence for temporally significant changes in the flaked lithic technology, although Sheets (personal communication, 1986) feels confident about the identification of expanding biface thinning flakes as characteristic of an Archaic period chipped stone industry.

To date, the separation of materials from the Archaic period Fortuna Phase and the Formative period Tronadora Phase is less than ideal, and I have selected 2000 BC as an arbitrary temporal division between the two on the basis of radiocarbon dates associated with ceramics and general comparisons of Tronadora ceramics with other early ceramic complexes such as Barra and Barlovento. However, despite the lack of chronological clarity for this transition, it is readily apparent that the nature of this transition was probably very different from that in central Panama. There, pressure flaking and the production of bifacial projectile points disappear from assemblages as early as 5000 BC (Cooke 1984:268).

Because of the mixture of Fortuna and Tronadora Phase assemblages at Tronadora Vieja, the nature of the Fortuna Phase occupation is unclear. There was certainly some manufacture of stone tools, but it is impossible to be conclusive about the existence of structures and their association with subsistence remains. The vast majority of postholes found in the surface of Aguacate are associated with the Tronadora Phase occupation, based on the nature of deposits in their fill. Fire-cracked rocks and what have been identified by Sheets (1984:151) as fist-sized "cooking" or "boiling" stones were found on the surface of Aguacate in virtually all operations. These may have derived from the same fires responsible for the Fortuna Phase charcoal samples. However, all lots associated with Fortuna Phase lithics and early charcoal also contained Tronadora Phase ceramics, introducing the possibility that these derive from later activity.

The Fortuna Phase artifactual assemblage, defined primarily on the basis of comparisons with other Central American Archaic period industries, is discussed in detail by Sheets (n.d.). It is characterized primarily by small, flaked debitage of chalcedony, jasper, dacite, and petrified wood. Thin, broad, expanding biface thinning flakes are considered diagnostic of the Archaic industry at the site, and these appear in Units 64 and 65 in most operations. The only finished artifact associated with this phase is a projectile point retrieved from the surface of Aguacate, just below the water's edge at the northern end of the site. Sheets (1984:156;Fig. 4D) describes this artifact as a short-stemmed, broadly corner-notched, "Shumla-like" point of highly-weathered dacite, measuring 5.5 x 2.9 x 0.6 cm. Both its form and high degree of weathering identify it as an Archaic period artifact, and Sheets (personal communication, 1986) suggests a date of 4000-3000 BC.

Tronadora Phase Features and Assemblages

As noted above, ceramics appeared even in the very lowest strata at Tronadora Vieja, indicating that both Fortuna and Tronadora Phase peoples occupied the same ground surface. However, while the associations between Archaic period artifacts and soils on top of the sterile Aguacate base are ambiguous, those between early ceramics and these lowermost levels are not. Pottery was found embedded in the surface of Aguacate, in the brown clay which overlay it (Unit 64) and in the hard matrix of Unit

61, the earliest tephra stratum. It also appeared in the softer, black matrix of Unit 60, which was clearly discernable in all operations. These strata had both the highest density of ceramics in the buried deposits at the site and the greatest number of occupational features, such as postholes and hearths. In many instances, features such as postholes were noted to contain both tephra and sherds, tying together cultural and geological activity.

The fact that Tronadora Phase sherds are found throughout these lowermost strata, and in small quantities in overlying levels, has created difficult interpretive problems. The Tronadora Phase occupation at the site is represented by approximately 20-30 cm of mixed and discontinuous strata, comprised of tephra layers and derived soils. Given the wet, tropical forest environment of the Arenal area, bioturbation of these strata (their disturbance by root activity, especially when trees with extensive root systems fall over, and by burrowing animals) was probably great. Disturbance of Tronadora Phase deposits was further compounded by digging at the site during the subsequent Arenal Phase, which in at least two instances penetrated the Aguacate clay to over a meter's depth. Radiocarbon dates were not obtained from levels believed to be transitional between the Tronadora and Arenal Phases at Tronadora Vieja. This, in addition to the depositional problems, makes it almost impossible to accurately date the length of time represented by the Tronadora Phase occupation of the site.

Tronadora Phase materials from other sites consisted almost exclusively of surface assemblages, lacking stratigraphic provenience. To date, there is not sufficient stratigraphic, chronological, or stylistic evidence to subdivide the Tronadora Phase, which is dated at its early extent by radiocarbon dates from both archaeological and geological contexts, and is suggested by stylistic comparisons to have spanned some 1500 years.

The features and artifacts which appeared in the lowermost stratigraphic units at Tronadora Vieja clearly indicated the presence of a small settlement. While good evidence for the plan of a small dwelling appeared in only one part of the site, postholes, fire-cracked rock, debitage from the production of both flaked stone and ground stone artifacts, sherds from utilitarian vessels, charred macrobotanical remains, and charcoal from small fires were present in the earliest strata in virtually all operations at the site.

Tronadora Phase activity began on the surface of Aguacate and continued through the deposition of a relatively thick layer of volcanic tephra, probably from an explosion of the Cerro Chato volcano. However, because of natural and cultural disturbance, it was difficult to discern a clear sequence of Tronadora Phase activities in the lowermost strata over much of the site. The only exception to this was in Operations W and Q, where there appeared to be a clear distinction between activities on the surface of

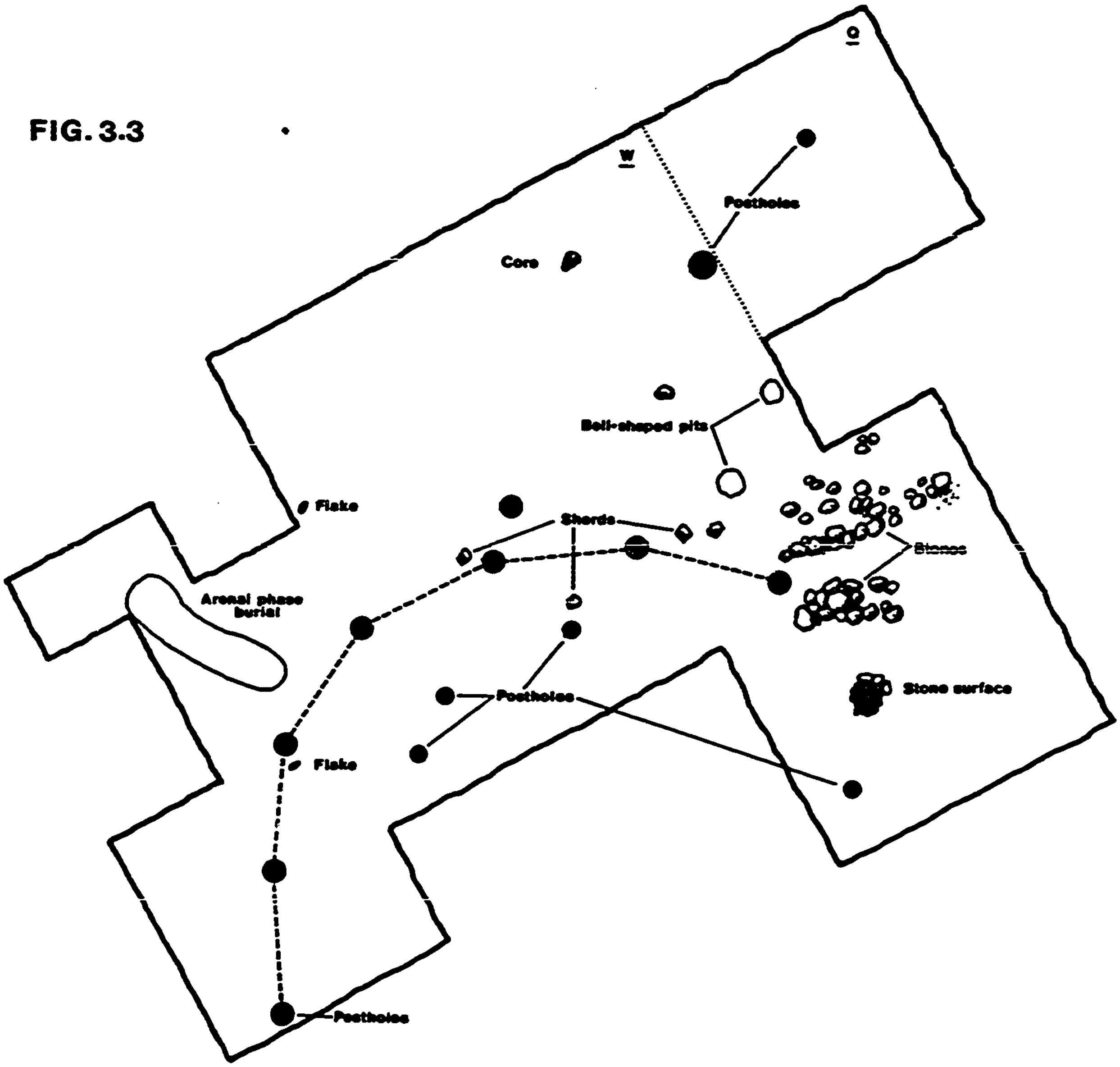
Unit 61 and those immediately below it. In other operations, cultural material was uniformly distributed in the strata between and including Unit 60 and the upper surface of Aguacate. Postholes invariably penetrated Aguacate, and were often capped or filled with tephra from Unit 61.

The following discussion will summarize the evidence for Tronadora Phase activities as it appeared in the first soil on the surface of Aguacate (Unit 64), the first apparent tephra layer above Aguacate (Unit 61), and the overlying black stratum (Unit 60) in the order of their stratigraphic deposition.

Unit 64 and the Surface of Aguacate

The earliest clear evidence for a Tronadora Phase dwelling occurred at the interface of Unit 61 and the underlying stratum, Unit 64. This feature, only half of which was excavated, was situated in the southern half of the site in Operations W and G (Fig. 3.3). It has been labelled House No. 1 (Bradley n.d.). Stratigraphically, it was situated immediately beneath Unit 61, a hard, compact layer of fine, grey tephra which effectively sealed the feature from overlying deposits. The floor of this feature corresponded to Unit 64, and appeared as a thin layer of dark soil approximately 10 cm above the Aguacate clay, at a depth of 145 cm below the modern ground surface. The shape of the house was delineated by a series of seven postholes, spaced 110-115 cm apart in a uniform arc, suggesting a circle approximately 5.25 m in diameter with a projected

FIG. 3.3



Tronadora Vieja (G-163)
operations W and Q
House No. 1

1m

area of 22 m^2. The postholes were 13-16 cm in diameter, and penetrated Unit 64 and Aguacate to a depth of 30-50 cm below the house floor. Each contained the hard, grey Unit 61 tephra to a depth of 10 cm, indicating that the structure had been built prior to the eruptive activity responsible for the tephra's deposition. One of the postholes contained a small, nondiagnostic body sherd. Another contained charcoal fragments and a small flake. The only objects recorded on the interior floor of the house were a flat-lying sherd and a tabular stone. However, a charcoal sample taken from the house floor yielded a date of 2860 (1822)1000 BC [Tx-5279: 1530 bc ± 320] (See Appendix A for a description of the sample and its context). In spite of its large 2-sigma range, this sample and the associated collection of diagnostic ceramics date this feature to the early half of the Tronadora Phase.

In addition to the seven postholes which defined the perimeter of the structure, three smaller and shallower ones were found on the interior. These may have held additional supports for the roof or for platforms, racks, or other structures within the house. Two large and one small posthole outside of the house may represent remains of auxiliary structures.

An area of compacted soil and stone features at the northeastern end of House No. 1 may indicate the location of the door and a cooking area outside of it. The first feature consisted of a dozen small, fist-sized stones overlain by a circular layer (14 cm in diameter) of 78 rounded, marble-sized pebbles. This enigmatic feature was situated on the northeast perimeter of the house, at a point where an evenly-spaced posthole was expected but not found. Bradley (n.d.) suggests it may have been a way of "paving" the threshold to the house. Immediately to the north of this feature was a concentration of 99 "cooking stones" and 57 heat-cracked rocks, covering an area of about 4 m2. While not immediately recognizable as a hearth, the fact that these stones had been exposed to fire suggests that this was a cooking area. Sheets (1984:150-151) cites the prevalence of heat-cracked rocks and "boiling stones" in the Arenal area, and sees in them evidence for a long tradition of stone boiling in the region, which he notes as unusual for ceramic-using, sedentary societies.

Associated with the concentration of cooking stones were sherds with deposits of charcoal on the interior and a fragment of a loaf-shaped mano. Nearby were two small spherical pits which had openings 10 cm in diameter, widened to a maximum of 15 cm, and extended to a maximum of 30 cm into the Aguacate clay. Other artifacts associated with House No. 1 include a small support from a ground stone metate, a flake and flake core of white chalcedony, a fragment of a bifacial tool, and 70 sherds. The ceramic assemblage included rims of Tonjibe Beige and Tigra Grooved-Punctate, one example of the latter having charred material on its exterior. Palynological analysis yielded only a small amount of pollen from the chenopod-amaranth family in a posthole associated with House No. 1 (Clary 1986).

The House No. 1 assemblage clearly represents a small dwelling dating to the Tronadora Phase. According to Naroll's constant (1962; broadly interpreted, it more accurately applies to the floorspace of villages rather than single dwellings), this structure may have been large enough for two adults. The large, evenly-spaced postholes suggest that it was carefully planned and constructed to last, and does not represent a temporary or seasonal structure. The accumulation of stones in the hearth or cooking area also suggest permanence of habitation. While they are only fragmentary, the remains of a mano and metate indicate the processing of plant foods. Evidence from other parts of the site indicate that maize was a part of the diet in Tronadora Phase times, but no direct evidence for maize processing was found in association with the house feature.

As noted above, evidence for sedentary village activity on the surface of Aguacate was found in virtually all operations at Tronadora Vieja. This included the probable remains of two other dwellings, although their plans were not as clear as those of House No. 1. In Operations I and T, several postholes comparable in size to those forming the perimeter of House No. 1 were noted in association with two large scatters of heat-cracked rock and cooking stones on the surface of Aguacate. While four of these postholes, spaced at 1 m intervals, may have formed one side of a dwelling, the floor plan was unclear. Associated artifacts included two flaked cores, a small bifacial thinning flake, a flake of chalcedony, and two sequent flakes from a polished stone celt. Ceramics consisted of rim sherds from thick, Tonjibe Beige olla-tecomates, a rare rim from a narrow-necked bottle, a sherd with geometric groove-incision infilled with ocher, and sherds with charcoal deposits on the interior. Fragments of burned clay and three large concentrations of charcoal on the surface of Aguacate testify to one or more fires associated with this stratum. This charcoal yielded the above-mentioned dates of 3609(3360)3050 BC [Tx-5275], 3609(3351)3040 BC [Tx-5278], 3014(2821)2590 BC [Tx-5274], and 2450(2090)1753 BC [SI-?]. However, all of these samples were recovered from the upper matrix of Aguacate and are believed to pertain to earlier Fortuna Phase activity.

In Operation H, five postholes similar in size to those associated with House No. 1 were noted, but no structure plan was discernable. Adjacent to one posthole were four stacked broad, flat, pointed artifacts manufactured from chipped dacite and interpreted by Sheets (n.d.) as a cache of stone "hoes," or unhafted digging tools. Ceramic associations included Tonjibe Beige rims, groove-incised sherds, and a distinctive orange-paste rim from a Tronadora Incised incurving-rim bowl.

Operations L and V also yielded evidence of Tronadora Phase village activity. While the lowest strata in these operations included Archaic-style lithic debitage, such as flake cores, biface thinning flakes, and the tip of a red jasper bifacial point, they also contained Tronadora Phase ceramics and cultural remains. Postholes similar to those of House No. 1 were found in Aguacate, overlain and filled with the distinctive Unit 61 tephra. One was found to contain a carbonized kernel of _Zea mays_, verifying that this crop was known and utilized at an early date. Another charred kernel of _Zea mays_ was found in association Tronadora Phase ceramics and a possible metate fragment (Lot V11). A fragment of a maize kernel was also found in association with cultural materials associated with the stratum immediately overlying Aguacate in Operation L. These included both Archaic-style flakes and Tronadora Phase ceramics, the latter including rims from a massive Tonjibe Beige storage vessels and the types Tigra Grooved-Punctate, Tajo Gouge-Incised, and Zetillal Shell-Stamped. A sample composed of charcoal fragments from a 50 cm diameter area which appeared to be the remains of a cooking fire associated with this lot (L10) yielded a date of 3360(3066)2920 BC [Tx-5276: 2500 bc ± 70]. In spite of the fact than one sherd from this lot was noted to have charcoal on the interior, this date is considered too early for Tronadora Phase ceramics, and may derive from Fortuna Phase activities.

A single, large fragment of ca. 20 g of charcoal from the upper 5 cm of Aguacate in Operation V yielded a date somewhat more acceptable for the Tronadora Phase. Assayed at 2470(2166)1834 BC [Tx-5277: 1780 bc ± 100], this sample was found in direct association with potsherds, one of which had charcoal adhering to its interior. However, it was also associated with Archaic-style biface thinning flakes.

Given their respective contexts and artifactual associations, the assignment of Tx-5277 to the Tronadora Phase and Tx-5276 to the Fortuna Phase is largely arbitrary. Numerous arguments exist for assigning both dates to either the Fortuna or Tronadora Phase, and these will be discussed below. It should be noted, however, that the rationale for making distinctions between the two is based on interpretations of the ceramic and lithic assemblages as a whole, rather than strict contextual evidence.

Deposits in the soil stratum on Aguacate directly above this charcoal sample (Unit 64) yielded a charred fragment of an unidentified palm fruit in association with an assemblage of Tronadora Phase diagnostics. These included rim sherds of Tronadora Incised, one with a shell-stamped zone, Tonjibe Beige, Tigra Grooved Punctate, and a body sherd of Tajo Gouge-Incised. Two sherds with charcoal residue caked on the interior suggested cooking activity.

In other operations at the site, postholes, heat-cracked stones, and subsistence remains were consistently found with Tronadora Phase ceramics and scattered lithics. Cross-shaped maize phytoliths and a fragment of a Zea mays cupule (Piperno n.d.; Matthews 1984) were found in association with three oxidized stones on the surface of Aguacate in Operation C, and maize phytoliths were also associated with heat-cracked stones at the same level in Operation B (Bradley, Hoopes, and Sheets 1984:Fig. 6). In Operation K, one posthole, 20 cm in diameter and 45 cm deep, had a flat, wedge-shaped rock embedded in the earth at its opening, clearly indicating the stabilization of a loose post. It and another posthole 1 m distant contained fragments of ceramics and were filled with fine, grey tephra. Fragments of burned daub from the overlying Unit 61 stratum suggest that the house was constructed of wattle-and-daub, a common Early Formative building material (Flannery 1976). Additional postholes appeared in Operations P, M, R, and U, and scatters of heat-cracked and cooking stones on horizontal living surfaces appeared in Operations M, S, and U, all associated with ceramics in the thin soil overlaying the Aguacate base.

Unit 61

This stratum was absent in some parts of the site and up to 20 cm thick in others. Because it represents a thick layer of volcanic tephra, probably ejected from the Cerro Chato volcano (see Appendix B), it is believed to have been deposited within a very short period of time. The fact that it was absent or fragmentary in several operations suggests that it was also subject to highly variable erosion. In an ideal depositional environment, this tephra stratum would have been expected to be a culturally sterile layer. However, a large number of artifacts and cultural remains were recovered from its matrix. These represent the residue of activities which occurred before or after this eruption transported upwards or downwards in the stratigraphy by cultural or natural processes. In places, patches of a grainy, yellow tephra indicated intrusions from Unit 55. However, Unit 61 as a whole provided the largest assemblage of Tronadora Phase ceramics at the site, and is securely dated to this phase.

Lithic remains in this stratum consisted of occasional flake cores and a number of dacite celt flakes, one from a polished greenstone celt (Lot V33). Two celt flakes from this stratum in Operation H suggested the presence of a possible celt maintenance area (Sheets n.d.).

As noted above, Unit 61 was discontinuous in several operations. In Operation L, an irregular, linear patch of tephra, 5 cm thick and 50-100 cm wide, ran in a north-south direction through the assemblage of sherds, lithics, floral remains and charcoal associated with lot L10. This feature may represent a natural drainage or footpath in which fine volcanic sand collected and was preserved.

Sherds and other artifacts embedded in the surface of Unit 61 are considered to pertain to activities which occurred immediately prior to the accumulation of Unit 60, a black, clay-laden stratum which overlay Units 61 or 64 in all operations at Tronadora Vieja. One object from this stratum deserves special mention. This was a nearly complete vessel of Zetillal Shell-Stamped (Fig. 6.4) which was accidentally discovered in actively eroding deposits at the water's edge in the northeastern part of the site. It was found in an inverted position, and appeared to be sitting in the matrix of Unit 61. No features were found in direct association. However, a clear line of six postholes which appeared in the eroded shore 5-10 m to the west probably represented the remains of another Tronadora Phase dwelling.

Unit 60

The clearest feature associated with this stratum was situated 10-15 cm above House No. 1 in Operations W and Q, at the interface of Unit 60 and the upper surface of Unit 61, where the tephra layer separated and sealed materials from the underlying habitational assemblage. Cultural remains on this living surface consisted of postholes, scattered heat-cracked rocks and other "cooking stones," macrobotanical remains, flat-lying Tronadora Phase ceramics, and both flaked and ground stone artifacts. Eight postholes at irregular intervals, forming a rough line approximately 3.5 m long, penetrated Unit 61 and were "easily defined" in the compact tephra matrix in the northwestern portion of the excavation. Six of these were 14-18 cm in diameter and 10-16 cm deep; two were 8 cm in diameter and 10-12 cm deep. An unusual deposit of 12 tiny, polished pebbles echoed the "threshold" feature noted in the earlier House No. 1. However, the floor plan of the associated structure was not apparent.

The heat-cracked rocks and stones were scattered over an area of 3 m}, and two fragments of carbonized maize kernels from the deposit support its identification as a hearth or cooking area. Associated artifacts included a small fragment of a knob-legged metate, a small biface fragment, and flaked lithic debitage. The ceramic assemblage (Lot W16) was particularly rich in Tronadora Phase diagnostics, and included the rim of a squat jar with grooving on the neck and burned material on the exterior; sherds of Tajo Gouge-Incised, one of which had curvilinear applique decoration and was worked into a small disk; sherds with shell-edge stamping; and types Tronadora Incised and Tigra Grooved-Punctate. An associated body sherd was noted to have charcoal residue on the interior, probably the remains of culinary activity. The ceramic assemblage from Unit 60 immediately above this feature (Lot W15) was also very rich in decorated and unusual sherds, and included rocker-stamped sherds of Zetillal Shell-Stamped; fragments of a squat, necked jar with circular reed-stamping and burned material on the exterior, and a unique sherd with both groove-incision and pastillage.

Elsewhere at the site, Unit 60 yielded heat-cracked rocks, flaked lithic debitage, and a clear predominance of Tronadora Phase ceramics. In Operation D, pollen analysis yielded a single grain identified as Zea mays from this stratum (Clary 1986). Cross-shaped maize phytoliths were also present in Unit 60 soil samples from this operation (Piperno n.d.).

Arenal Phase Features and Assemblages

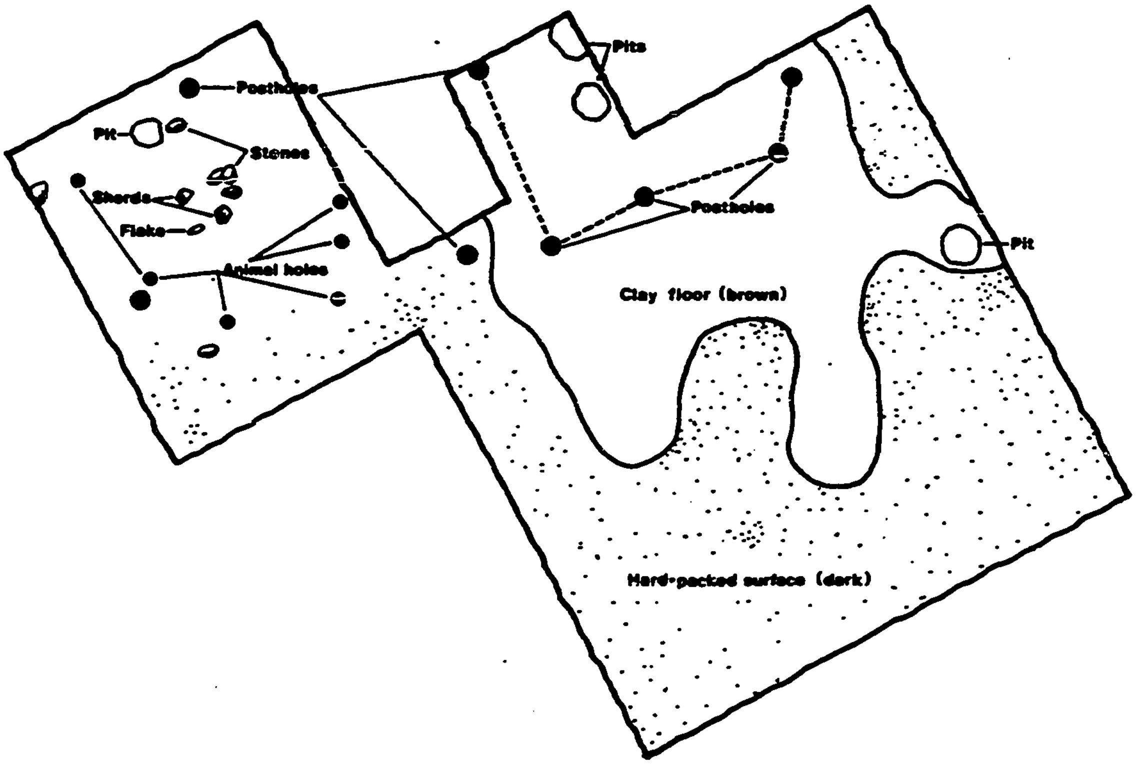
The "Upper 50's" Strata

As noted above, the strata between Unit 60 and Unit 50 represented a typically indistinct series of tephra layers, whose deposition probably spanned a period of several hundred years. Because the natural stratigraphy of these deposits was not always readily apparent, the "Upper 50's" were excavated primarilty in artificial 10 cm levels. With few exceptions, it was difficut to relate features identified in these levels to specific eruptive events of Volcán Arenal. In addition, these strata appear to have been heavily disturbed by both cultural and natural processes. Two of the major features associated with these levels were deep excavations which penetrated Aguacate by over a meter, and occasional Tronadora Phase ceramics appeared throughout the predominantly Arenal Phase portion of the stratigraphic sequence. Given the likelihood that heavy tropical forest vegetation covered the site during much of its prehistory, and that much of it included trees whose extensive root systems took advantage of the steadily thickening accumulation of volcanic tephras and tephra-derived soils, it is surprising that so much of the stratigraphy remained intact.

The clearest tephra deposit in the "Upper 50's" strata was Unit 55, which appeared as a fragmentary layer of patches and chunks of a coarse, gritty, yellow sand immediately overlying the black Unit 60 horizon at depths between 120-140 cm below the modern ground surface. While it is possible that this stratum represents the initial explosive activity of Volcán Arenal, this remains to be demonstrated (see Appendix B) Unit 55 was not thick enough or continuous to contain a significant cultural assemblage. However, it was overlain by Unit 54, a clay-laden soil horizon containing particles of Unit 55. The lowermost features and artifacts in the "Upper 50's" were recovered from Units 55 and 54, and date primarily to the early part of the Arenal Phase.

The clearest habitational feature in Unit 54 was situated in Operation H, at a depth of approximately 120 cm below the modern surface (Fig. 3.4). This consisted of a prepared clay floor penetrated by five postholes and associated with additional postholes, pits, and both lithic and ceramic artifacts. The clay surface, which dried to a highly visible light grey color against a black matrix, was approximately 3.6 m across its largest exposed dimension. Only 6 m} of the feature was exposed by excavations, and the original floor is believed to have been much larger.

FIG. 3.4



Tronadora Vieja (G-163)
operation H
Clay floor (Unit 54)

It was 3-5 cm thick, and surrounded by dense, hard soil. The postholes ranged from 18-24 cm in diameter, and were 10-35 cm deep. They were not situated around the perimeter of the clay surface, but cut across it, suggesting a different type of structure than that noted in Tronadora Phase levels. Three small postholes to the west of the feature may represent an auxiliary structure.

Very few chronologically diagnostic artifacts were directly associated with this feature. The only decorated sherd in clear association with the floor was from the shoulder of a globular jar with a distinct Arenal Phase paste, of the type Huila Zoned-Punctate. It was decorated with vertical and horizontal grooves delineating a zone of heavy punctation. A larger collection of diagnostic sherds was obtained from an excavation lot (H35) representing materials from a depth of 30-40 cm below Unit 50 (or 110-120 cm below the modern ground surface), the 10 cm level corresponding to material immediately above the feature. This lot contained the rim of a small, necked jar of Los Hermanos Beige and a sherd with a "picked" surface reminiscent of that found on Late Preclassic "mushroom stands" from the Maya lowlands (Demarest 1984:Fig. 46). However, a rim of Tronadora Incised and a body sherd with early shell-edge stamping were also present. Other associations consisted of heat-cracked rocks and a small biface thinning flake.

Although no other habitational features as clear as the clay surface were identified at this stratigraphic level in other parts of the site, fragmentary household debris appeared in this stratum in several other operations. Operation W yielded three postholes, 12-16 cm in diameter and 8-20 cm deep, in association with a possible hearth at 125 cm in Unit 54. One of these contained a carbonized maize kernel. Other maize kernels appeared in this stratum in this operation and Operation L. In Operation J, four fragments of an avocado seed (<u>Persea americana</u>) were found in Unit 54 at a depth of 120 cm., and two fragments of a pejibaye seed (<u>Bactris gasipaes</u>) were associated with this stratum in Operation G.

While no remains or indications of mortuary features were associated with Tronadora Phase levels (Unit 60 and below), two such features originated in the lower part of the "Upper 50's" strata. Both date to the Arenal Phase on the basis of stratigraphic and artifactual associations.

The first of these features was a very unusual linear pit, situated in the southwestern extension of Operation W (Fig. 3.3). It was 30-40 cm wide, 140 cm long, penetrated to a maximum depth of 175 cm beneath the surface of the Aguacate clay, and is estimated to have been over two meters deep at the Unit 54 surface from which it originated (Bradley n.d.). The walls of this feature were smooth and vertical, and despite its unusual shape, it appears to have been used for burial. Within this feature were large fragments of necked, Mojica Impressed: Mojica Variety jars and traces of a white, paste-like substance which may have been decomposed bone. Four fragmentary maize cobs, three of which were from immature specimens (Mahaney, Blanco, and Matthews n.d.) were found in association. A sample of charcoal from the interior of this feature (see Appendix A) yielded a date of 2010(597 BC)AD 660 [Tx-5280: 520 bc ± 560]. While a date in the first few centuries BC would probably be correct for this feature, the 2-sigma range on this assay renders it practically useless.

This "trench tomb" is virtually identical to an enigmatic feature excavated at the Viboriana site (G-175) during the 1984 season (Bradley, Hoopes, and Sheets 1984:90; Fig. 11). Both originated in the stratum (Unit 54) immediately above the Unit 55 tephra, and were of comparable depth. Both also appear to date to the early half of the Arenal Phase. Similar features have yet to be reported from sites in either Greater Nicoya or the Atlantic Watershed regions.

The second possible mortuary feature was a large, irregular pit in Operation G. It was excavated into underlying stratum from Unit 54, and penetrated to a maximum depth of 120 cm below the surface of Aguacate, or about 150 cm below the surface from which it originated. Unlike the "trench tomb" in Operation W, this feature had an amorphous shape. Its internal stratigraphy was inverted, with fine Unit 61 tephra filling the bottom of the feature and a block of Aguacate clay at the top. The base was very irregular, as if gouged out with a stick, and fluctuated widely in depth. The feature was found to contain mixed Tronadora and Arenal Phase sherds, a small fragment of burned daub with wattle impressions, a flake of chalcedony, and numerous small pieces of charcoal. The most interesting artifact, however, was a carved, tabular pendant of fine-grained, olive-grey metabasite (Chenault n.d.). Apparently reworked and smoothed after having been broken, this object measured 5.6 x 3 x 1.1 cm. It had a flat, raised, circular protrusion on one surface, and two biconically-drilled holes for suspension. It represents a "bossed bar pendant" (Lange and Chenault n.d.), and was the only object from the site identifiable as a specialized or luxury item. According to Melson (Chenault n.d.), the material is not native to the Arenal area, and may have been imported to the region from the Nicoya or Santa Elena Peninsulas. Although inconclusive, the presence of this object suggests the feature's interpretation as a burial -- possibly disturbed prehistorically -- rather than a borrow pit for clay procurement.

The "Upper 50's" strata above Unit 54 yielded a large number of ceramics, artifacts, and other cultural remains. However, apart from possible postholes and indistinct hearths in Operation W, no clear-cut occupational features were identified. Diagnostic Tronadora Phase ceramics such as Tonjibe Beige and Tronadora Incised were present in these strata, but the majority of sherds were from Arenal Phase types such as Bocana Incised Bichrome, Las Palmas Red-on-Beige, and varieties of Mojica Impressed. Unfortunately, low sherd density prevented the identification of subphases of occupation.

Two carbonized maize kernels were identified in levels between 0-30 cm below Unit 50 in Operation L, in association with scattered heat-cracked stones and occasional charcoal fragments. A seed pulp fragment of pejibaye (*Bactris gasipaes*) was identified in association with Arenal Phase sherds at the same depth in Operation V. Possible maize kernels were also found in "50's" strata in Operation B (Matthews 1984:201;Table 4).

Unit 50 and Overlying Strata

While Unit 50 provided an assemblage of primarily Arenal Phase ceramics, no occupational surfaces or other cultural features were associated with this stratum.

As noted in the discussion of methodology at the site, Units 40, 41, 30 and later strata were essentially sterile at Tronadora Vieja. Apart from a poorly-preserved surface with flat-lying sherds in Operation K, no features were associated with the 11 diagnostic Tilaran Phase (AD 1200-1500) sherds scattered through Unit 30 in Operations K, M, N, S, T, and U. These belonged to the types Malekos Red, Silencio Applique, and San Luis Coarse (Hoopes 1984:142). Of the lithic artifacts associated with these strata, a large, basin-shaped, tripod metate exposed during bulldozing operations is worth mention. Also noteworthy is a biface thinning flake from Unit 30 in Operation V (Lot V17), if only to demonstrate that this artifact type was widely distributed through the site's stratigraphy.

Summary and Discussion

Survey, test-pitting, and extensive excavation at Tronadora Vieja during 1984 and 1985 revealed that the site has three principal components, consisting of Fortuna (ca. 4000-2000 BC), Tronadora (2000-500 BC), and Early Arenal Phase (500 BC - 0) occupations. A small Late Arenal Phase (0 - AD 600) and very small Tilarán Phase (AD 1300-1500) component are also present. The three earliest phases at the site are represented by primarily domestic activities, with very limited evidence for specialized manufacturing, agricultural, ceremonial, and funerary activities.

To date, it has been impossible to say whether occupation of the site was continuous throughout the three earliest phases or whether the cultural remains represent punctuated usage of the same location. There are large gaps in the radiocarbon chronology, and the combination of a moderately disturbed stratigraphy and a small ceramic sample have made it difficult to subdivide long phases of occupation. While catastrophic eruptions of Cerro Chato and Volcán Arenal may have temporarily disrupted activity at the site, there is no evidence that they had lasting effects on either the site's habitability or the desire of populations to occupy this location. While House No. 1 appeared to have been buried by the emplacement of Unit 61 tephra, which probably represents a major volcanic explosion, clear evidence of a catastrophic, Pompeii- or Cerén-like burial of this feature was not preserved. Evidence for a possible structure superimposed directly on the tephra layer above this feature in fact suggests a rapid reoccupation of the location, possibly by the very occupants of the earlier structure.

Both Tronadora and Arenal remains suggest the types of features known as "household clusters" (Winter 1976), assemblages of the remains of structures, domestic artifacts, cooking areas, possible storage pits, and (in the Arenal Phase) burials. However, given the limited evidence, it is difficult to say how large either the Tronadora or Arenal Phase villages suggested by these household clusters may have been.

The very earliest occupation of Tronadora Vieja appears to predate the earliest major eruptions of Cerro Chato and Volcán Arenal, as evidenced by cultural features sealed below the fine Unit 61 tephra. This applies to early Tronadora Phase remains as well as the preceramic Fortuna Phase component. However, it should be noted that this interpretation presumes a relatively small amount of vertical movement of sherds, lithics, and charcoal through what may at one time have been a very loose and sandy matrix.

One of the problems of working with buried tephra strata is that it is usually very difficult to determine or even estimate their original textures and thicknesses. Airfall tephra is subject to both size sorting and compression from the moment of its ejection to its exposure as an archaeological stratum. Depending on the volume, mean particle size, and density of the tephra deposit, bioturbation and natural weathering processes can promote either rapid erosion or stabilization, the latter often resulting in the development of mineral-rich, tephra-derived soils on top of the volcanic deposit.

My interpretation of certain Tronadora Phase features as having occurred prior to a major explosion of Cerro Chato is based on the preservation of large features, such as the area of cooking stones associated with House No. 1, surfaces with flat-lying ceramics, and fragile charcoal and macrobotanical remains beneath Unit 61. Comparisons between the stratigraphy noted in archaeological excavations in the Arenal area with the sequence at the El Tajo Site (Melson 1984) suggest that Unit 61 may correspond to ET10 (see Appendix B), presumed to be one of the earliest tephra strata overlying Aguacate. Three radiocarbon dates recovered from beneath pyroclastic flows associated with Cerro Chato's last explosive activity, which overlap from 2012-1665 BC at the calibrated 2-sigma range, are very close to Tx-5277 and Tx-5279, which overlap from 2470-1834 BC. These latter samples were both buried by Unit 61 at

Tronadora Vieja, strongly suggesting that this tephra layer derives from Cerro Chato and was deposited around 2000-1800 BC. The thickness and high degree of compaction of Unit 61 in some portions of the site suggests that it was deposited rapidly, probably as a single eruptive event. As such, it would have been ideal for preserving cultural remains buried beneath it, in a Pompeii-like depositional environment. While the shallowness of the tephra as deposited at Tronadora Vieja prevented the preservation of intact houses, the exciting possibility remains that Early Formative dwellings remain buried beneath deeper deposits of this stratum elsewhere in the Arenal area.

However, it should be noted that there are also reasonable objections to this interpretation. The presence of artifacts within the hard matrix and its presence in intrusive features such as postholes indicates that at one time it was probably quite soft. No change in Tronadora Phase cultural activities was discernable in the deposits immediately above and below this tephra unit. Given a sufficiently long period of occupation, it would not be hard to imagine that cultural debris on the <u>surface</u> of Unit 61 would completely penetrate this layer as a result of being "lived upon," resulting in a "false" occupational level on the surface of the thin, underlying soil. It also seems likely that postholes excavated into this soft stratum from <u>above</u> might have become filled with tephra as wooden posts decayed in the sandy matrix. It is conceivable that the radiocarbon dates I believe to have been associated with Tronadora Phase activity in levels beneath Unit 61 may in fact derive from late Fortuna Phase activity. However, the direct association of the radiocarbon samples with pottery, some with charcoal residues, argues against this, as does the nature of the ceramic assemblage from within and beneath Unit 61. If the stratigraphic context of these ceramics was the result of trampling and downward motion from overlying levels, one would expect there to have been some sorting with regard to sherd size. However, sherd size differs little between Units 61 and 60. As will be discussed below, the general similarities between Tronadora ceramics and other Early Formative assemblages are not inconsistent with the associated radiocarbon dates.

The presence of Fortuna Phase artifacts to a depth of 10 cm within the upper matrix of Aguacate clearly indicates that Archaic population of the site preceded Cerro Chato and Volcán Arenal's explosive activity. It is not hard to imagine a preceramic society of hunter/gatherers occupying the floor of a tropical rainforest which would have overlain the dense Aguacate clay. However, the relatively shallow, organically-derived soil may not have been as favorable to Formative period agriculturalists, especially if they were dependent on root crops for a major part of their diet (as has been proposed by a number of authors; Lathrap 1971, Lowe 1975, Stone 1977, Cooke 1984). For this reason, the deposition of a mineral-rich tephra --

parent material for the weathering of fertile soils -- might be expected to enhance the region's capacity for supporting early village agriculture.

It is tempting to find a causal relationship between the deposition of the first "recent" (ca. 2000 BC) tephras in the Arenal area and the appearance of the Tronadora Phase occupation, for which we have evidence from pollen, phytoliths, and macrobotanical remains for maize agriculture. However, current evidence suggests that a clear relationship between the two did not exist. Tronadora Phase peoples appear to have been present in the Arenal basin before significant volcanic soils had accumulated on the Aguacate base. However, the fact that Tronadora pottery is found in the greatest quantities in Units 60 and 61 suggests that site use may have intensified with the deposition of fine tephra by explosive eruptions of Cerro Chato. While this tephra would not have been immediately advantageous, and in fact may have had very deleterious effects on the local environment, one hundred or so years of weathering would have made them amenable to more productive agricultural techniques. Over time, the volcano's periodic renewal of soils in the Arenal basin effectively counteracted the normal effects of leaching and erosion which take a toll on soils in tropical areas with a high rainfall. However, early sedentary occupations of the region do not appear to have been closely tied to the availability of prime agricultural land. The ecology of the early lake margin may have been instumental in promoting sedentary village life, but it is also likely that factors other than strictly environmental ones played a significant role in affecting patterns of culture change in the region.

The temporal depth of evidence for the occupation of Tronadora Vieja from the Archaic to Early Formative periods suggests that the preceramic/ceramic transition in the region around 2000 BC was not accompanied by major changes in settlement pattern. While our evidence is admittedly small, such a transition may not have been accompanied by important subsistence changes either. Despite the fact that it immediately succeeds an aceramic cultural tradition, none of the Tronadora Phase pottery appears to be the product of an incipient technology.

The lack of evidence makes it unclear whether Tronadora Vieja was re-used during the Tronadora Phase or continuously occupied throughout the preceramic/ceramic transition. The appearance of a relatively sophisticated ceramic complex as early as 2000 BC suggests: 1) that there was an expansion of pottery-using populations (possibly sedentary agriculturalists) into a region previously populated by low density Archaic hunter-gatherer societies, or 2) that a developed ceramic technology was adopted by local populations who were already semi-sedentary, and "pre-adapted" to sedentary lifestyles and technologies. As yet, there is little evidence to support the first hypothesis. The

Tronadora pottery complex is clearly related to both Chaparrón and La Montaña; however, although the earliest dates are associated with Tronadora ceramics, current chronology is not strong enough to definitively indicate that the other two are not of equal antiquity. If the appearance of Tronadora ceramics is to be attributed to an influx of population, where those people came from remains to be demonstrated. As will be discussed below, stylistic interpretation argues against direct derivation of the Tronadora complex from known Early Formative complexes.

The importance of the Lake Arenal paleoenvironment to early Tronadora populations remains unclear. At the time of the Tronadora Phase occupation of Tronadora Vieja, the Arenal basin was probably filled with a large, swampy lake (a precursor to the artificial Lake Arenal reservoir; Tosi 1980). This would have provided an important year-round source of fish, small mammals, reptiles, and waterfowl. Early agricultural techniques for the production of maize and legumes, such as ridged fields or chinampas, were probably developed along swamp margins. It is possible that an early form of swamp-edge cultivation was practiced by Early Formative inhabitants of Tronadora Vieja. Several other Early Formative sites, most notably La Venta, San Lorenzo (Coe and Diehl 1980), Cuello (Hammond et al. 1979) and the recently surveyed sites on the Pacific coast of Chiapas (Clark et al. 1987), have been noted near or on the edges of swamps or bajos. It seems likely that the rich, mixed economy and agricultural potential of swamp margins may have played an even greater role in the emergence of early sedentary, agricultural communities than the similarly rich environments of coastal and estuarine locations. In the former case, incipient cultivation could have taken place directly alongside or even overlapped prime hunting and fishing territories, reducing the areal distribution of subsistence resources. In a model similar to that of the "garden hunting" suggested by Linares (1976), several types of subsistence resources could be procured from the same ecological zone. This type of concentrated, mixed economy would have reduced the need for seasonal transhumance, and presumably would have been more amenable to sedentary village life. Unfortunately, in the Arenal Basin, further testing of this model is severely hindered by the fact that all evidence for special swamp-margin agricultural techniques has probably been submerged by Lake Arenal.

Reasons why the site was abandoned before the end of the Arenal Phase, not to be reoccupied until the Tilarán Phase remain unclear. A large Late Arenal component, which distinguishes Sitio Bolívar and other sites in the region, was absent at Tronadora Vieja. There was no sign of stone mortuary features, such as those associated with this phase at other sites in the region. While Tilarán Phase ceramics, such as those typical of single-component sites like Dos Armadillos (G-154;

Hoopes 1984, 1985) were present in small quantities, there were no ceramics typical of the Silencio Phase (AD 600-1300). This apparent hiatus of about 700 years in the late occupation of the site may echo processes which occurred earlier in the site's history, perhaps during the late Tronadora Phase, which to date have been very difficult to document.

CHAPTER FOUR
Excavations at Sitio Bolívar

Sitio Bolívar (G-164) provided us with our most detailed information about the nature of the Late Arenal Phase occupation of the Arenal basin. The site was first identi-fied during the 1984 lakeshore survey (Mueller 1984), and was selected for further investigation on the basis of its size, its essentially single-component surface assemblage, and evidence for the presence of stone mortuary features. Large stones which had been disturbed by huaqueros were first pointed out to by an informant who had been farming the site, and the location of the disturbance as noted in 1984 became one of the foci of the subsequent season's excavations. The large surface collection of pottery made at the lakeshore in 1984 had suggested an extensive occupation, and was characterized by a predominance of apparently utilitarian ceramics. However, surface collections also yielded a small, green, serpentinite pendant worked in a fashion similar to that employed for jade artifacts (Chenault and Mueller 1984:191;Fig. 3). Given the presence of looted mortuary features, this site was judged to have a high potential for revealing both habitational and burial patterns from the Arenal Phase.

Location

Sitio Bolívar is situated on a small, elevated point of land above the south shore of Lake Arenal, approx-

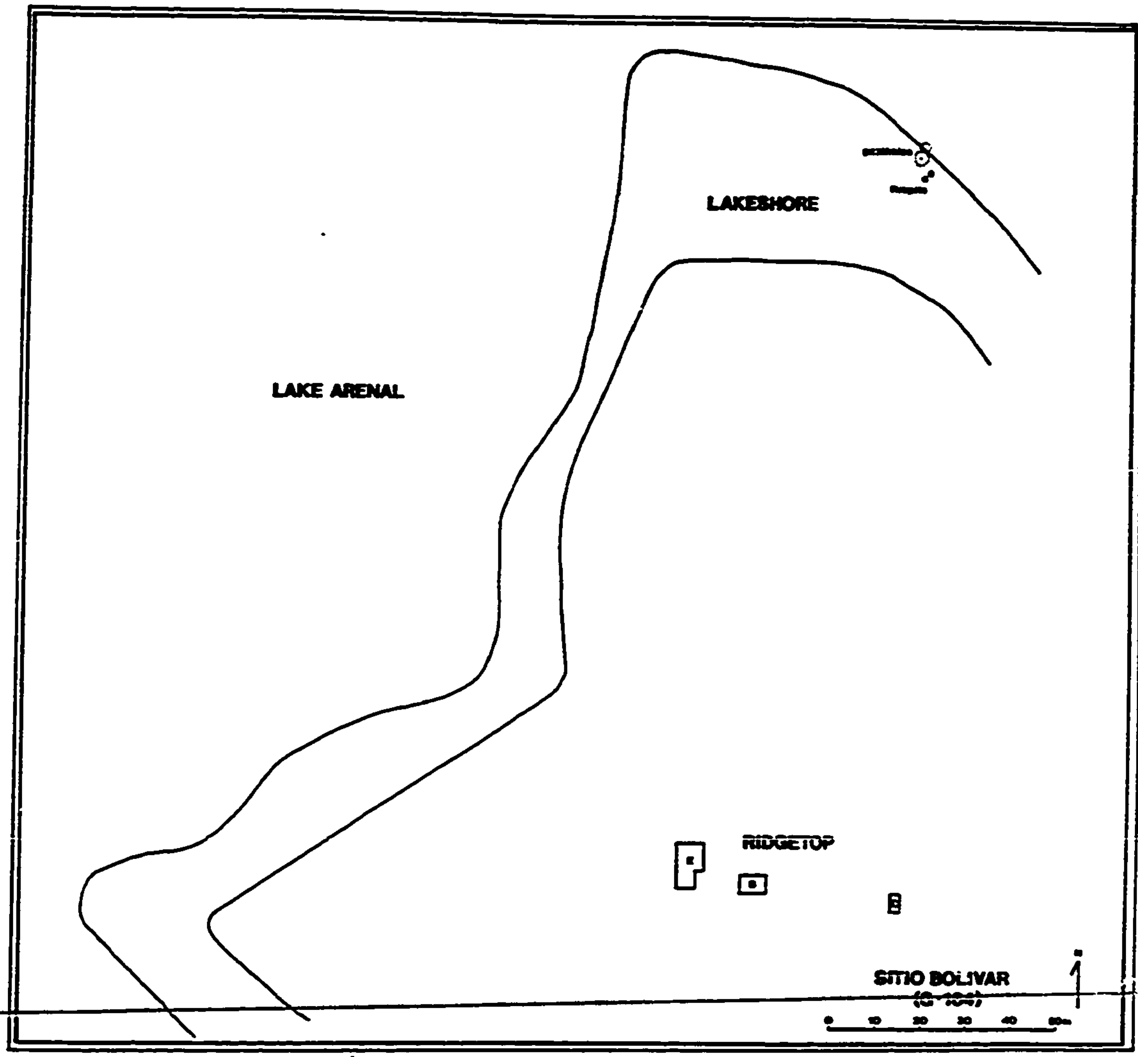


Fig 4.1: Sketch map of Sitio Bolivar, showing locations of lakeshore and ridgetop features

imately 1.25 km directly northeast of the modern town of Tronadora. It is located at approximately UTM 365,000 m E X 763,000 m on the "ARENAL" 1:50,000 quadrangle. The site extends from below the level of Lake Arenal, which has a dry season altitude of ca. 540 m above sea level, to the top of a small, east-west ridge some 125 m to the south (Fig 4.1). The upper, ridgetop portion of the site overlooks the shoreline to the north from a height of approximately 25 m.

The site is named for Quebrada Bolívar, a small drainage whose pre-dam streambed ran 350 m to the west of the site and which now forms a quiet, protected lagoon which is presently a popular spot for fishing, launching small boats, and swimming. Sitio Bolívar is currently the property of ICE, but the site is being farmed under agreements which include the planting of trees in order to control erosion. Modern agricultural activity on the property is practiced year-round, with the principal crops being tomatoes, beans, yuca (sweet manioc), and corn. The southern end of the site is marked by a stand of yuca and several limón trees. The northern half of the site includes a broad, north-facing slope which is planted in corn and beans to the edge of the lakeshore. An old bulldozed road, which appears on the current ARENAL 1:50,000 quadrangle but which has become heavily overgrown since the construction of the Sangregado dam, runs east-west across the site. Current access is via a small two-track road which leaves the main road after a 2.5 km drive east of Tronadora.

Natural Environment

Sitio Bolívar, from the extent of sub-surface features on the southern hilltop to the lakeshore margin in the east, covers an area of approximately 2.5 ha. Its average slope is approximately 7°, on a landform comprised of small foothills which lie between the Cordillera de Tilarán and the Miocene depression of the Arenal basin. These foothills are dissected by a number of small drainages which have been largely denuded for grazing land.

In historic times prior to the construction of the Sangregado dam, the western portion of the Arenal basin was occupied by a large, reed-filled swamp. In prehistoric times, Sitio Bolívar would have overlooked a large lake or marsh to the north. Its local environment would also have had a very different appearance from its modern, deforested condition. By Holdridge Life Zone classification, the area in which the site is located constitutes a Tropical Moist Forest transition into Tropical Premontane Wet Forest (Tosi 1980). Hartshorn describes the Tropical Moist Forest -- one of the most abundant life zones in Costa Rica -- as "a tall, multistratal semi-deciduous or evergreen forest" characterized by abundant Scheelia palm trees (1983:122). The Tropical Premontane Wet Forest is a "medium to tall, semi-evergreen forest with two or three strata, with a few species dry season deciduous" (Ibid.:

124). In either case, ground cover is described as generally sparse with the exception of ferns.

The mean temperature for the Tronadora area is 23.6°. The average annual rainfall is 2600 mm, and the region experiences a three month dry season alternating with a nine month rainy season, with its wettest months in September and October (Tosi 1980). Other important environmental characteristics of the location of Sitio Bolívar are its windiness and frequent cloudiness. Just 6 km to the west of the site, at Sito de la Toma, average annual windspeed has been recorded at 23 km/hr, with a persistent northeast wind blowing during 80% of the year. Windspeeds of 50-60 km/hr have been recorded during the months of December and February. Tosi (1980) describes the cloudiness of the region as exceptionally high. At Arenal Viejo, where measurements were taken over eleven consecutive years, an average of only 4.4 hours of direct sunlight a day were recorded.

A drastic reduction of vegetation has probably affected both average temperature and rainfall levels since the time of occupation of Sitio Bolívar. Prehistoric inhabitants of the site probably inhabited wet, relatively cool tropical forest. It is possible that high winds and reduced sunlight restricted agricultural activity to protected garden plots of relatively low productivity, encouraging a mixed exploitation of both forest products and cultigens.

Site Survey in 1984

Sitio Bolívar was first recorded at the end of March 1984 by Hoopes, Matthews, and Sheets in the course of a shoreline survey of Lake Arenal by the Proyecto Prehistórico Arenal (Mueller 1984). A lowering of the lake's surface during the dry season had exposed an eroded section of buried deposits approximately 10-20 m in width. Ceramic and lithic artifacts were scattered over a length of shoreline 215 m long. Artifact collection was done first in a straight-line transect, 1 X 60 m, and then in a general collection of diagnostic sherds and lithics over the entire explored area. Combined, these produced a total surface collection of 271 diagnostic sherds, 23 lithics, eight groundstone artifacts, and a small fragment of a greenstone pendant. Over 60% of the ceramic assemblage consisted of red-rimmed bowl and jar forms of the type Los Hermanos Beige. Other types included Las Palmas Red-on-Beige, Charco Black-on-Red, Los Hermanos: Cervantes Variety, and varieties of Mojica Impressed, and Arenal Phase sherds represented 99% of the total surface assemblage. Other phases were represented in extremely small proportions, and consisted of two sherds with Tronadora Phase shell-edge stamping, seven sherds of monochrome Tilarán Phase types, and four sherds with an early style of polychrome painting reminiscent of Baudez' (1967: 99;Pl. 33B,E) Lopez Polychrome. Approximately 140 fire-cracked "cooking stones", together with the high proportion of monochrome ceramics, suggested an initial interpretation of the assemblage as the remains of domestic activity.

At the time of the survey, a local informant identified a location near the top of the small loma, where a number of large, round boulders in and near a small excavation were overgrown with heavy vegetation. The size and location of the stones suggested the presence of funerary architecture, although no ceramics or other artifacts were noted on the surface. The informant also commented on lakeshore features, mentioning that the lake level was lower at that time (March, 1984) than it had been at any previous time since dam construction, and that wave action had exposed whole vessels which were subsequently removed. No extensive digging was evident in the shoreline deposits, and appeared to have been confined to the upper portion of the site.

On the lakeshore, a large number of sherds were embedded in intact deposits, and artifacts were noted in layers beneath Unit 50. The initial interpretation of both the domestic and mortuary nature of the site, as well as the stratigraphic position of the cultural occupation, was confirmed through excavations in the 1985 season.

Excavation Methodology

Excavations at Sitio Bolívar began on the first of April, 1985 under the supervision of Hoopes, Chenault, and Sheets. As planned excavation time was limited to just a few weeks, investigation was planned with two specific goals: 1) to determine the nature of the disturbed stone features on the upper part of the site, and 2) to determine whether there was a functional difference between the features on the shoreline and those on top of the small *loma*. The principal working hypothesis was that the shoreline, with its high percentage of monochrome ceramics and large quantity of heat-cracked rocks, was a domestic activity area, while the ridgetop, with large stone features and evidence of looting, was mainly the locus of funerary activities. Investigations were therefore focused on two distinct portions of the site. The first was along the shoreline in the northern half of the site, where it was hoped that natural erosion would assist in the location of artifact assemblages and archaeological features. The second was on the ridgetop in the southern part of the site, at the location of the disturbed stones.

Lakeshore Excavations

The rise and fall of Lake Arenal, whose height fluctuates by several meters between wet and dry seasons, resulted in a dissection of Sitio Bolívar to the north. At the height of the dry season, an exposed shoreline as much as 30 m wide can be revealed by wave action along the shore. Although erosion of the softer strata is severe, harder soils such as the Aguacate formation and portions of overlying tephra layers survive. In these, several important features which penetrated these more durable soil layers, such as postholes and fire pits, were preserved well enough for excavation and mapping. The time of year chosen for our investigations was especially fortuitous, and a daily inspection of the water's edge was successful in locating features as they were exposed by the lowering lake level. Several areas of darkened earth in association with heat-cracked stones had been noted in the initial site survey, and similar features were noted when we returned to the site in 1985. In addition, a large number of circular holes similar to those noted at the water's edge at Tronadora Vieja were observed on the exposed beach in association with large quantities of ceramic and lithic debris.

The dry season lowering of Lake Arenal exposed a horizontal width of approximately 5 m of shoreline during our month and a half stay at the site. It was usually possible to map and excavate features shortly after their exposure, thereby minimizing damage by drying and cracking. This strategy yielded a number of postholes, hearths, and other features, some of which proved to be possible Arenal Phase dwellings.

Little vertical excavation was necessary to define the features found along the lakeshore. Apparent postholes were measured, individually excavated, and then mapped so that larger patterns could be examined. In the case of circular arrangements of postholes, the interior surface was carefully scraped for associated artifacts or features. The hearth and firepit features were cleared of debris, mapped, and photographed. They were then excavated as single features, with collections for pollen, phytoliths, and charcoal taken from places in the feature which appeared to have had the least amount of contact with modern erosional activity. Artifacts which were found eroding from the surface of the shore were located, photographed, isolated, and removed with relatively little horizontal exposure.

To complement the stratigraphic excavations on the ridgetop portion of the site, a 2 x 4 test pit (Operation D) was placed in intact deposits near an eroded section of the shore which had a particularly high density of surface artifacts. Its location was chosen so as to provide an understanding of the stratigraphic associations of shoreline features.

Ridgetop Excavations

In the upper portion of the site, a manually operated posthole digger and pointed steel probe were utilized to test for buried features and to determine the extent of artifact distribution. Holes were dug to the maximum depth possible (about 150 cm) every 10 m along a 40 x 70 m grid centered on a point near the site's maximum elevation. This testing revealed fragments of pottery in nearly every sounding, suggesting a continuous distribution of subsurface cultural remains over an area of approximately 2800 m2. Although cultural materials were discovered at depths as shallow as 30 cm below the modern ground surface, and were apparent on the surface in the vicinity of looters' activity, the majority of artifacts were located at depths between 90-110 cm. Probing with the steel rod in the vicinity of the large stones which had been displaced by huaqueros revealed an extensive concentration of large stones. This location (Operation B), an area to the west where additional subsurface stone features were detected with the posthole digger (Operation E), and a third location where no stones had been detected (Operation C) were selected for excavation.

The principal excavations on the upper portion of Sitio Bolívar were in Operations B and E. Operation B was begun as a 4 X 4 m excavation unit, placed immediately to the south of the disturbed area of large stones. The principal aim of this operation was to discover whether any of the looted features remained intact, and if so, to expose a large enough horizontal area to judge their shape and size. As features were uncovered, this operation was extended by 2 m to the east, providing a total exposure of 24 m^2. Operation E was begun as a 2 x 2 m excavation unit to the west of Operation B, initially located so as to investigate the concentration of large stones encountered during subsurface testing. As a large feature of stones and ceramics was revealed, this operation was expanded for a total exposure of 52 m2.

In the upper portion of the site, a 20 cm "plow zone" was stripped fairly quickly. Excavation proceeded in artificial 10 cm levels until large, buried features were encountered. The nature of these features -- large accumulations of boulders and sherds which appeared to have been deposited within a relatively short period of time -- and the heavily disturbed stratigraphy which resuted from both modern and prehistoric activity were not conducive to excavation in either natural or artificial levels. Instead, excavation was aimed at exposing the features and noting the associations between artifacts and the large stone constructions. Excavated lots, rather than representing strata or levels, were defined by artificial, horizontal divisions of the extensive features and by attributes of the features themselves. Assemblages of sherds which appeared to have been deposited together were excavated as single features. In Operation B, 100% of the ceramic assemblage, including non-diagnostic body sherds, was collected from the midden feature. In Operation E, an initial attempt at a 100% collection was begun. However, due to the sheer volume of material found in association with the stone features in this operation, this was later restricted to diagnostic sherds (rims, handles, bases, adornos, and decorated body sherds).

Site Stratigraphy

In general, the entire stratigraphy of the upper portion of the site was heavily disturbed all the way to the Aguacate base. However, Operation D, the test pit situated near the lakeshore in the lower portion of the site, provided us with a continuous stratigraphic section from the modern ground surface to the Aguacate Base. In this operation, Units 10 and 20 appeared together in a mixed stratum some 30 cm deep. Unit 30 appeared as a grey stratum only 20 cm thick, superimposed on a 10 cm level of Units 40 and 41. Unit 50 was visible in the profile as a dark stratum, approximately 20 cm thick. It overlay a lighter horizon of the same width, interpreted to represent combined Units 52 and 53, tephra strata which had also appeared as indistinct components of the "Upper 50's" strata at Tronadora Vieja. Beneath these was a dark, clay-laden soil which contained a high proportion of small white and yellow particles. This stratum was approximately 15 cm thick, and probably represents a mixture of Unit 54 and eroded material from Unit 55. The greatest artifact density was in the strata beneath Units 40 and 41. Diagnostic ceramics appeared in Units 50, 54, and 55, with the greatest concentration of materials appearing in Unit 54. As with the large sherd deposits excavated in the upper portion of the site, the pottery from strata in Operation D appears to represent primarily the last part of the Arenal Phase. No ceramics from earlier or later phases were found, and there was little or no temporal variation noted within individual ceramic types.

As at other sites in the Arenal basin, Units 54 and 55 were superimposed on a black, clay-laden horizon. However, while in most operations at Tronadora Vieja this black horizon represented Unit 60 and overlay a strat-um of volcanic tephra (Unit 61) and a shallow soil layer (Unit 64), at Sitio Bolívar all three of these strata were compressed into a shallow stratum only 10 cm deep on top of the Aguacate base. The only exception to this was a small lens of light, fine-textured, unweathered tephra on the surface of Aguacate, which may represent a remnant of Unit 61. The Aguacate clay, considered to be the base of deposits derived from Volcán Arenal's activity, lay at a depth of 115 cm below the modern sur-face, indicating that deposits were compressed by approxi-mately 30% of their depth at Tronadora Vieja.

In the upper portion of the site, Unit 20 was intact in much of Operation E. Unlike Operation B, this part of the site had not been looted in modern times, and the stratigraphy appeared to be largely intact down to just below Unit 50. In Operation B, all of the soil strata above what was identified as Unit 50 in the excavated portion of the site (i.e. Units 10, 20, and 30) were badly disturbed as a result of sporadic looting and agricultural activity, especially the planting of deep-rooted yuca. In places, especially in Operation B, Unit 50 itself had been

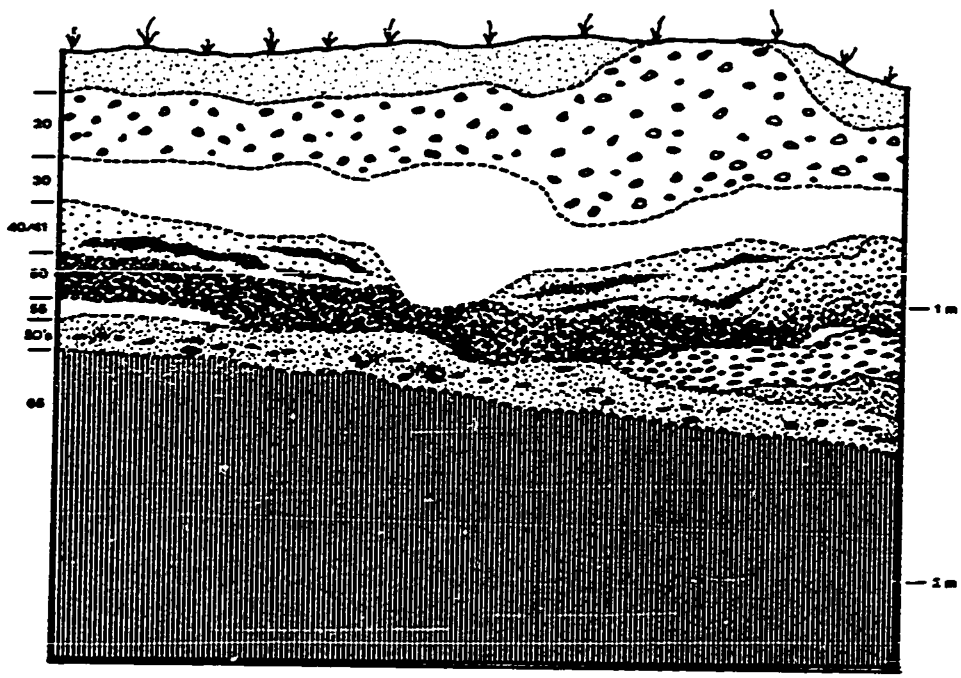


Fig. 4.2: Operation B, Sitio Bolivar.
Western profile, showing disturbed stratigraphy.

disturbed (Fig. 4.2). This stratum, 60-80 cm below the modern surface, was discernable above the underlying features but was most readily apparent in profiles. It was highly discontinuous, and never thicker than 20 cm. Sherds which were recovered from levels above Unit 50 were from Arenal Phase types, a stratigraphic distribution inconsistent with the occurrence of this phase elsewhere in the Arenal basin (Hoopes 1984:145), and were taken as evidence for mixing with underlying strata. Unit 50, albeit heavily disturbed, lay directly over a thick deposit of late Arenal Phase sherds in Operation B (Lot B6). In parts of Operation E, a small amount of soil was noted between Unit 50 and the underlying feature of large stones and Arenal Phase ceramics. This is believed to represent remnants of Units 52 and 53.

Unit 54 at Sitio Bolívar was characterized as a layer of brown soil containing a high proportion of small white particles directly above Unit 55. Unit 55 appeared as a light, yellow-orange, sandy tephra. As at Tronadora Vieja, it was thin and fragmentary, and appeared only in limited patches. Fragments of this stratum were present in the stratigraphy beneath the sherd feature in Operation B.

In both operations, cultural activity appears to have occurred on top of Unit 54, somewhat higher in the volcanic stratigraphy than Arenal Phase features at Tronadora Vieja, which were noted within the matrix of this stratum. In Operation E, the large stone feature appears to have intruded into Unit 54 from above, and this stratum itself was heavily disturbed by cultural activity.

In addition to the highly disturbed "Upper 50's" strata in the ridgetop portion of Sitio Bolívar, Unit 60 and the strata between it and Aguacate were also highly discontinuous. Tronadora and Fortuna Phase components associated with these strata at Tronadora Vieja were virtually absent (two sherds of Tonjibe Beige were noted). These lower strata appeared to have been heavily disturbed by the occupation of the site which followed the development of Unit 54. In Operation E, portions of Unit 60 and Unit 61 were found intact around some of the stone features. However, this appears to have resulted from excavations into these strata for the construction of subterranean stone mortuary features, leaving remnants of Units 60 and 61 intact beneath and around these features. In some cases, prehistoric excavations went down to the level of Aguacate, and in places penetrated it. The large sherd feature in Operation B was underlain by a very hard, black, clay-laden layer with a maximum thickness of 5 cm which may have represented the remains of underlying strata. When dry, this stratum was rock-hard, and could only be removed with macanas and picks. This layer was also discontinuous, and did not appear as a distinct soil horizon in operation profiles. The ceramic assemblage embedded in this matrix was identical to that of the overlying feature, namely Late Arenal Phase, and did not represent an earlier occupation. Unit 61 level was found to overlay a stratum similar to Unit 64 at Tronadora Vieja only in Operation C, a 2 x 4 m test pit to the north of Operation B.

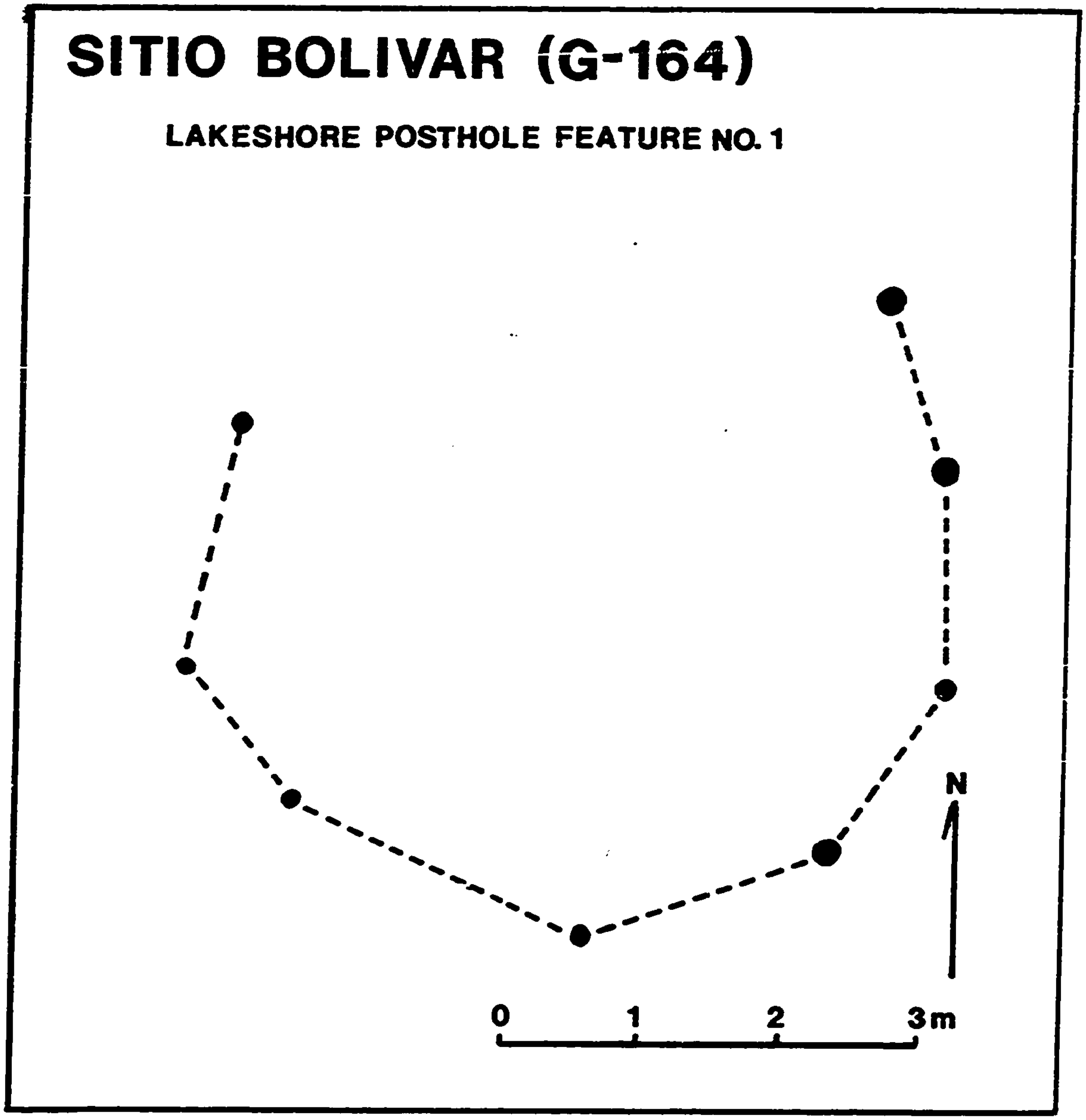
In sum, although archaeological materials were associated with almost all strata at Sitio Bolívar, the chronological nature of the occupation at this site was very different from that of Tronadora Vieja. While the latter site had significant occupations in both "50's" and "60's" strata, as well as on the surface of Aguacate, cultural activities at Sitio Bolívar were probably restricted to a short period sometime after the formation of Unit 54. The variable preservation and compressed profiles of tephra strata in both upper and lower portions of the site can be explained by both natural and cultural processes. The operation in the lower portion of the site was on the leeward side of a large hill which would have interrupted the deposition of airborne tephra. Heavy erosion on the ridgetop may have been responsible for thinning Unit 50 and superimposed strata, bringing sherd and stone features closer to the surface. Finally, both agricultural activity and the construction of buried mortuary features during the Arenal Phase occupation would have disturbed lower levels. The absence of ceramic components from other than the Late Arenal Phase in all assemblages suggests that this site was not heavily utilized either before or after its primary occupation at this time. For this reason, our discussion of this site will be concerned with the description of large, roughly contemporaneous horizontal features rather than successive occupations.

Habitation Features

Lakeshore Features

A horizontal assemblage of features actively eroding from the lakeshore on the northern margin of Sitio Bolívar is interpreted as the remains of dwellings, hearths, and other household activities which date to the same period as the mortuary features found in the ridgetop portion of the site (Fig. 4.3). The nature of activities in the nor-thern part of the site was distinctly different from that on top of the low ridge. There was no evidence on the lake-shore of either large stones or burial pits. Vessels associated with lakeshore features and eroding from the beach were either red-rimmed, monochrome types or had very simple decoration. These were primarily large jars, which probably served the domestic functions of storage and cooking. As noted above, a large number of decorated sherds and a fragment of a greenstone pendant were recovered during the initial surface collection from the lakeshore. How-

FIG. 4.3



ever, the assemblage was composed predominantly of undecorated, domestic forms.

Prehistoric Structures and Associated Features

The remains of two distinct habitational features were identified from patterns of round postholes exposed on the eroded bank. The first appeared as a circular arrangement of six postholes. These were very uniform in size, ranging from 13-15 cm in diameter and 36-45 cm in depth, and were spaced at approximately 120-135 cm apart. One of the postholes had a small, lateral "pocket," suggesting the addition of an extra post for structural support. The northern third of the feature was severely eroded by wave action; however, the six postholes represented approximately 60% of the circumference of a small, circular structure. It is estimated to have been approximately 3 m in diameter, with a total internal area of approximately 7 m^2. Nothing remained of the living surface inside or outside of the feature, with the exception of a small, elevated patch of soil at the western end of the structure.

The remains of a second structure were identified immediately to the west of the first. It was larger than the first, and consisted of a total of eight postholes. As in the first structure, these were relatively uniform in size and spacing, ranging from 14-19 cm in diameter. Distances between postholes ranged from 130-230 cm; however, excluding the largest dimension, the average distance between postholes was approximately 150 cm. The widest space was situated at the southwest end of the feature, and the fact that this side faces away from the prevailing winds suggests that this may represent the entrance to the structure. Due to wave action, a few postholes holes were missing from the perimeter of the circular feature at its northern end. However, approximately 2/3 of the perimeter of the feature was preserved. With an estimated diameter of 5.5 m, it would have had a total floor area of about 24 m^2, making it almost identical in size to House No. 1 at Tronadora Vieja. Unfortunately, all traces of the house floor had been completely eroded.

The internal area of each of the two small structures was relatively small. While the larger one may have been occupied by a family dwelling, the smaller might have been a special function structure such as a sweatbath or covered storage facility.

In the same part of the eroded lakeshore as the two dwellings were two large firepits or hearths, which appeared as large concentrations of charcoal-darkened soil and stones. The first was a circular depression, approximately 135 cm in diameter, excavated into the surface of the Aguacate clay. The bottom of the pit was a very hard and brittle black surface, and the clay at its outermost edges was red and oxidized as a result of burning. The feature contained 75 complete and fragmentary "cooking stones", fourteen sherds (one of which had charcoal adhering to its inner surface), and lithic debris

(Lot A8). Many fragments of charcoal were noted in the matrix of this feature, and a sample for radiocarbon analysis yielded a date of 79(245)410 AD [Tx-5272: 180 ad ± 60]. This date falls squarely within Late Arenal Phase, and the upper half of its 2-sigma range coincides with the estimated date of AD 300-500 for the ceramic assemblages associated with the ridgetop mortuary features. It is believed to accurately date the feature.

A second firepit was situated one meter directly northeast of the first. It was slightly larger, measuring 145 x 170 cm. Like the first, this feature had been excavated into the surface of Aguacate and its bottom was lined with a fine, hard, black deposit. A total of 149 fragments of fire-cracked rock and large quantities of charcoal were recovered from this feature. Artifacts, including a metate fragment and 29 sherds (with one fragment identified as a necked storage jar) were found within the burned and oxidized margins of the pit (Lot A9). A sample of charcoal from this feature was submitted for radiocarbon analysis, and yielded a date of AD 770(919)1000 [Tx-5269: 820 ad ± 50]. This date is thought to be about 400 years too late for the associated cultural remains. Considering that the sample came from a shoreline feature which had been exposed to erosion and repeatedly saturated by water at the edge of Lake Arenal, the chances of its having been contaminated by later organic material are great. Agricultural burning (although illegal) was used to clear fields at the site while we were there, and is a notorious source of modern charcoal in the Arenal basin. No botanical remains have been identified from the two fire pits. The presence of large numbers of "cooking stones" -- whose function was that of either roasting or stone-boiling -- suggests the preparation of meals.

A large number of round holes which may have been postholes were found on the eroded beach in the vicinity of the circular structures and associated hearths. Unfortunately, no other structural remains as clear as the above-mentioned features were identified. A small group of holes to the southwest of the larger circular structure may have been the remains of a small windbreak, built to shelter the two hearths from prevailing northeasterly winds.

In addition to the remains of structures and cooking areas, four small features identified as prehistorically-excavated pits were located along the eroded shoreline. One was located near the two structures, and contained fragments of fire-cracked rock, small body sherds, and some lithic debitage (Lot A10). It was filled with a sandy, dark-grey tephra soil similar to Unit 61, measured approximately 45 cm in diameter, and may have been a trash pit or borrow pit for clay.

Additional Lakeshore Features

Two small pits approximately one meter apart were identified at the southeastern end of the exposed shoreline on the northern edge of the site. The first contained 75 sherds, including rims from Los Hermanos Beige bowls and necked storage jars, a fragment of small carinated bowl of unidentified type, a sherd from a gadrooned Los Hermanos: Espinoza Variety, and a small amount of fire-cracked rock (Lot A11). The second contained four fragments of cooking stones and 19 sherds, including rims of a Los Hermanos Beige bowl and jar (Lot A12). These features are interpreted as trash pits or possibly borrow pits for the extraction of clay.

Two ceramic vessels were found eroding from the lakeshore near these two pits. One was a globular Espinoza Red-Banded olla with a short, outflaring neck, found with its base on the surface of Aguacate. This vessel appeared to have been associated with an intrusive feature, probably originating in Unit 54. The second was a partially reconstructable jar of Los Hermanos Beige, found in situ in a black soil above Aguacate, approximately 9 m northeast of first vessel. Carbonized material adhering to the inner surface of this vessel indicates that it was probably used for cooking.

In addition to the abovementioned fragment of a small greenstone pendant found during surface reconnaissance in 1984, a broken "half-celt" style greenstone avian pendant was found under water approximately 20 m north of the smaller dwelling (Chenault n.d.). This artifact measured 4.3 x 3.2 x 1.2 cm, and weighed approximately 20 g. The broken end of the pendant showed clear evidence of regrinding, and biconical perforations were apparently added to the modified piece. Striations over the entire surface of the pendant suggests that it was in the process of being further reworked at the time it was lost or discarded.

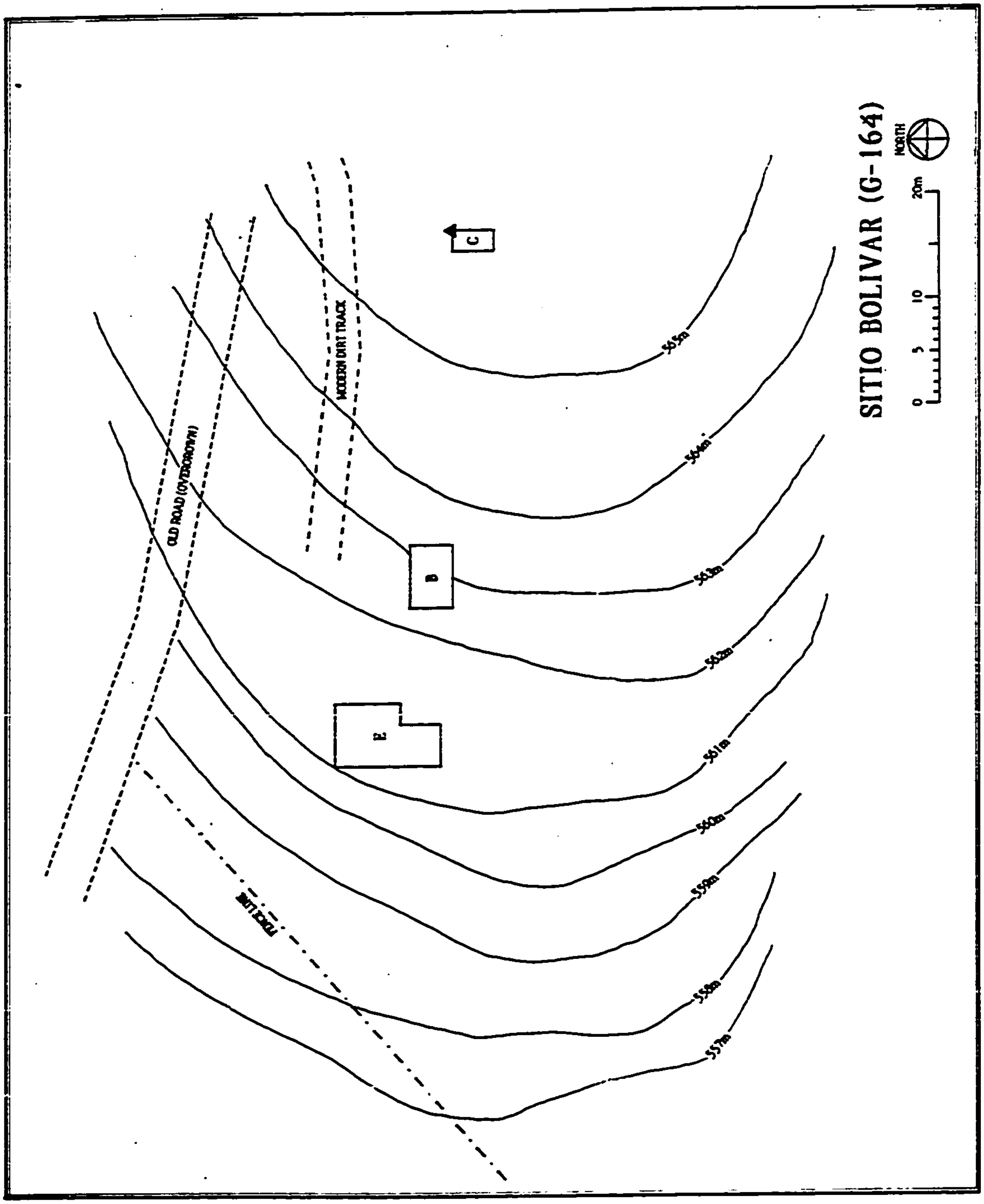
A second artifact of a wholly unexpected nature was also found in the shallow water a short distance off the the beach. This is an exceptionally good example of a complete, Turrialba-style (Snarskis 1978) fluted point, manufactured from local chalcedony. This artifact greatly predates the major occupation of Sitio Bolívar (Sheets n.d.), and is the only paleo-Indian artifact of certain provenience known from northwestern Costa Rica.

Midden and Mortuary Deposits

Features and Assemblages in Operation B

Preliminary ground clearing in the upper portion of the site (Fig. 4.4) revealed that the large, rounded boulders visible on the surface at the eastern end of the operation had been removed by looters from a fairly small area. However, in places disturbance reached a depth of as much as 100 cm below the modern surface. Local informants at the site (several of whom claimed sole responsibility for the damage!) offered a number of possible dates for the disturbance, ranging from one to two years prior to our arrival at the site. Unit 10 tephra was present above portions of looted deposits, and suggested either looting prior to the 1968 eruption of the Arenal volcano or lateral digging. A number of different individuals took credit for

FIG. 4.4


SITIO BOLIVAR (G-164)
NORTH
0 5 10 20m
565m
564m
563m
562m
561m
560m
559m
558m
557m
OLD ROAD (OVERGROWN)
MODERN DIRT TRACK
FENCE LINE
B
C
E

the damage, and all of them stated that no one had found anything but large stones.

The most significant archaeological feature in Operation B consisted of a large, thick deposit of ceramic, chipped stone, and groundstone debris which occupied virtually all of the exposed horizontal area. A total of 9856 sherds and 1229 lithic artifacts were recovered from this one 6 x 4 m operation. The feature lay at depths of between 80-125 cm below the modern surface, averaged 30-40 cm in depth, and covered an area of at least 16 m^2, representing a very dense accumulation of cultural debris. Given the limited variation in ceramic types in Operation B and the extensive disturbance of its upper levels, it seems likely that all of the artifactual material from lots in Operation B was associated with this feature. It appeared to have been deposited in a single event, or at least within a very short period of time.

Initially, the sherd feature appeared to consist of a relatively small number of vessels smashed at the same time. The large stones removed by looters suggested the presence of a large mortuary feature, and it was assumed that the deposit of broken vessels represented a pile of ritually-smashed offerings similar to features overlying Curridabat Phase burials at sites such as La Pesa Vieja (Snarskis, personal communication 1985). There was in fact a small burial pit beneath the western portion of the feature, but it was very poorly furnished and did not appear important enough to have warranted such a large expenditure of goods. Analysis of ceramics, chipped stone, groundstone, and macrobotanical remains suggests that the ceramic assemblage may have been primarily domestic in nature, or at least consisted of household debris rather than specially-prepared funerary offerings.

Two small burials were found immediately beneath the midden deposit. Despite the modest appearance of their size and offerings, the overlying deposition of broken vessels was probably linked to the presence of these features. The first burial (Lot B17) appeared at a depth of approximately 110 cm as a small depression excavated into Aguacate and measuring 60 X 80 cm, with a depth of 20 cm. It was enclosed on the west by six large boulders, one of which appeared to have fallen into the depression. Grave contents consisted of the remains of a small Los Hermanos Beige outflaring-rim jar with a rim diameter of 6 cm, placed in the southwestern corner of the feature. A small amount of charcoal was collected from this feature, but no traces of human skeletal remains were found.

The second burial (Lot B8) was also a small pit excavated down into the Aguacate matrix, with its upper origin in a mixed matrix of brown soil and a high proportion of the Aguacate clay. However, it was not directly associated with any stone features. The depression was roughly oval in shape, oriented northeast-southwest, and measured approximately 115 X 65 cm. The pit was dug to a depth of about

30 cm into pure Aguacate, with a small, lateral undercutting into the clay matrix along its eastern edge. Burial offerings were modest, and consisted of the remains of a large, outflaring-rim Los Hermanos Beige jar, part of a large Mojica Impressed jar, and two large sherd disks which were of the same paste and thickness as the Los Hermanos jar (and were probably made from a single vessel). These measured 8 and 9 cm in diameter, were 0.5 cm thick, and showed a slight degree of the curvature of the vessel from which they had been manufactured. A small amount of a soft, white, paste-like substance was found in the soil within this feature, and may represent decomposed bone. Other than this, no human skeletal remains were evident.

The fragmentary nature of the offerings in each burial is puzzling, and may be indicative of a later disturbance of the interred remains. This did not occur in modern times, as the deposit of sherds and artifacts overlying the second burial was not affected by looting in the vicinity of the first. Given the evidence for massive stone-moving in association with burial pits in Operation E, the absence of similar features in association with the burials in Operation B is also noteworthy.

Artifacts and Other Remains from Operation B

A tabulation of ceramic materials from Lot B6, the largest associated with this feature, indicates that at least 1000 different vessels are represented by the 1492 diagnostic sherds from this lot alone. This figure is based on a careful analysis which placed special emphasis on grouping sherds pertaining to the same vessel, based on the identification of broken pieces which fit together or were identical in shape and characteristics. Over half of these were from vessels of the red-rimmed Los Hermanos Beige type. The two largest form categories for this type were jars with outflaring, unthickened rims (205 vessels), outcurving-necked jars with exteriorly-thickened rims (184 vessels), and open bowls with exteriorly-thickened rims (122 vessels). Other important ceramic types were Mojica Impressed (99 vessels), Charco Black-on-Red (at least 50 vessels), Los Hermanos Beige: Cervantes Variety (27 vessels), and Guinea Incised (17 vessels). All of these are important types of the late Arenal phase, and suggest a date for the assemblage of AD 300-500.

Although there were a large number of decorated types in deposits from Operation B, the assemblage is still suggestive of a midden rather than primary deposit. Sherd size was predominantly small to medium (i.e. less than 7.5 cm across the largest dimension), and there were no vessels identified as fully reconstructable. The only complete ceramic artifact found in Operation B was a very crude, unslipped, miniature tripod bowl, standing only 2.2 cm high with a rim diameter of 3 cm. The poor quality of this miniature suggests it may have been made by someone unexperienced in ceramic craft, possibly a child. Not far from this was found half of a perforated sherd disk spindle whorl, 7 cm in diameter. Both artifacts recall domestic activities.

Ground-stone artifacts from Operation B (Hoopes and Chenault n.d.) support an interpretation of the feature as a midden of household debris. No whole manos or metates were found, and virtually all of the groundstone artifacts were broken or unfinished. All fragments were small, with longest dimensions less than 10-20 cm. The feature contained a total of six metate fragments, five mano fragments, two small burnishing stones (probably used in the manufacture of ceramics), and one small unidentified groundstone fragment. Perhaps the most interesting artifact in the assemblage was a small, unfinished groundstone pendant with a rounded, tabular form. It had two partially-finished perforations, biconically drilled from either side at one end of the artifact.

Chipped stone artifacts in the assemblage included 56 percussion debitage flakes, five flake cores, and one percussion blade (Sheets, n.d.). The most abundant lithic category was "cooking stones," of which 943 fragments and 17 whole specimens were recovered. Chipped stone was mostly fine-grained dacite, with only seven fragments of chalcedony and a few rare pieces of other materials. In a total of 56 flakes, only two hinge fractures were found, indicating highly skilled stone knapping.

As with the ceramics, both ground and chipped stone artifact assemblages are interpreted as domestic in nature. The feature in Operation B probably represents a "secondary midden"; that is, a collection of waste material redeposited in a location different from that of its original disposal.

A small number of carbonized, macrobotanical remains were recovered from deposits in Operation B. Specimens included two possible fragments and one kernel of *Zea mays*, five seeds from unidentified species of palms, two possible seeds from *nance* (*Byrsonomia crassifolia*), and two fragments identified as a species of squash (Curcurbitaceae) (Mahaney, Blanco, and Matthews n.d.).

Of the botanical specimens, the most interesting are the maize kernels. Their presence in this assemblage supports evidence for the cultivation of maize in the Zoned Bichrome period. However, the presence of non-domesticates emphasizes the importance of gathering to local subsistence strategies. The combination of exploitation of wild plants and small gardening appears to have been an important characteristic of indigenous Costa Rican cultures, and while maize was present, it is possible that it did not constitute a major portion of the diet of the prehistoric inhabitants of Sitio Bolívar. As at Tronadora Vieja, no faunal remains were found.

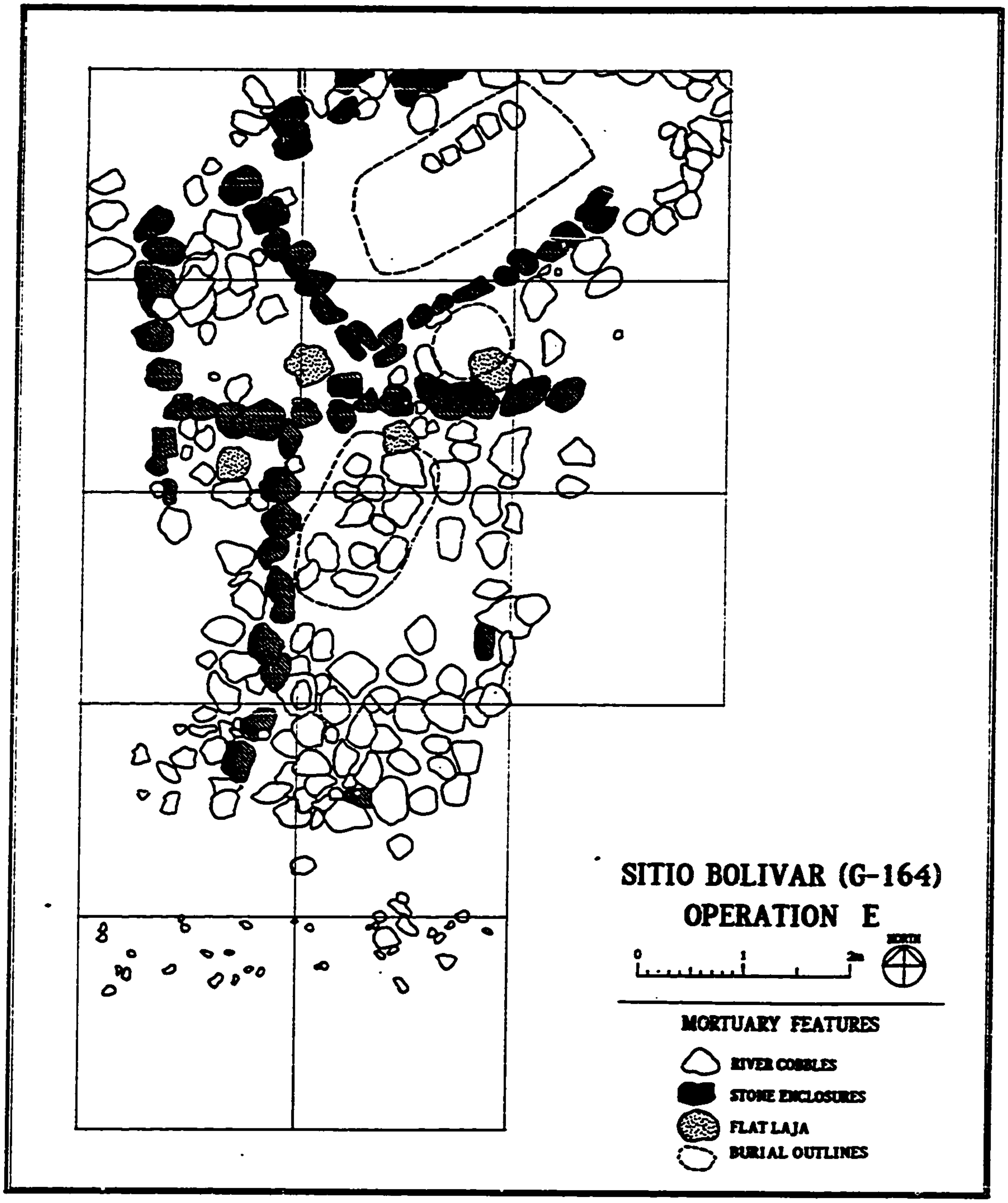
Operation E

Excavations in Operation E revealed the presence of an extensive mortuary complex, consisting of deep tombs marked by stone alignments (Fig. 4.5) and capped with a massive deposit of heavy boulders and rounded cobbles. Large stones and sherds found in the western portion of the original 2 x 2 test pit proved to be the eastern edge of a large feature of boulders and rounded river cobbles (averaging about 30 cm in diameter) overlain by a dense deposit of sherds, lithic debitage and fragments of ground stone artifacts similar to that found in Operation B. In order to further define this feature, Operation E was expanded to the east, south, and west. Despite some 52 m^2 of horizontal exposure, the feature was only partly exposed, with stones continuing beyond the northern limits of the excavation. The exposed portion of the feature measured approximately 7 m north-south and 4 m east-west.

Many of the large, tightly packed stones were upright and in linear arrangments. Once they had been mapped and photographed, all of the stones which were not upright or part of the alignments were removed. This revealed four roughly rectangular stone enclosures.

The fill within these enclosures was excavated to the depth of the sterile Aguacate formation. In the south-eastern enclosure, a concentration of stones was found at about 20-30 cm below the upper stone layer. These stones averaged 20-30 cm in diameter, formed a roughly rectangular

FIG. 4.5


SITIO BOLIVAR (G-164)
OPERATION E
0
1
2m
NORTH
MORTUARY FEATURES
RIVER COBBLES
STONE ENCLOSURES
FLAT LAJA
BURIAL OUTLINES

pattern, and were surrounded by a matrix of mixed soil and Aguacate clay. They were removed to reveal a rectangular pit, approximately 165 x 90 cm, which had been excavated 15-25 cm down into the sterile Aguacate clay. Several sherds, a fragment of a heat-cracked rock, and a small bifacial flake were the only cultural materials recovered from the feature. No bone or other evidence of human remains was recovered from the interior of this feature. However, its size and association with a massive deposit of heavy stones and artifactual debris clearly identified it as a burial pit, and this feature was designated Tomb 1 (Hoopes and Chenault n.d.).

A second feature, labelled Tomb 2, also appeared as a rectangular pit excavated into Aguacate. The edges of this feature were found to correspond directly with the stone alignments noted above it, clearly indicating that the alignments had been placed so as to define the boundaries of the burial pit. Tomb 2 was somewhat larger than the first burial, measuring approximately 225 x 105 cm and penetrating Aguacate to a depth of 30 cm. As with Tomb 1, however, no evidence of bone, ceramic vessels, or other grave goods were found in the depression. The only cultural remain evident within the pit was a small amount of charcoal.

A third burial pit, designated Tomb 3, was situated roughly parallel to the stone alignment which delineated the western edge of Tomb 1. The pit was slightly smaller than the other two burials, measuring approximately 105 x 90 cm, and was excavated no more than 3 cm into the surface of Aguacate. Like the others, this burial was devoid of human skeletal remains. However, it did contain a complete rounded-bit celt. Two small celts, of the straight-bit variety (Chenault n.d.) were unearthed at the base of the stone alignment between Tomb 3 and Tomb 1, just above the surface of Aguacate.

A circular pit, approximately 75 cm in diameter and 110 cm deep, was discovered below the point were the stone alignments cross. It contained very few cultural materials, consisting only of several small sherds and three small, fist-sized stones, located midway through the fill of the pit.

Artifactual Analysis from Operation E

Ceramic analysis indicates that the tomb complex was constructed at the same time as the deposition of the large midden in Operation B. Ceramic types were all diagnostic of the latter part of the Arenal Phase (AD 300-500).

A total of 49 ground-stone artifacts were recovered from the deposit of cultural materials on top of the stone funerary feature in Operation E. This assemblage consisted of 23 fragments of metates, including two with cylindrical legs, and both cylindrical and conical metate supports; 14 mano fragments, mostly from bar-shaped examples; four celt fragments; a disk-shaped fragment of a slate mirror back; three grinding stones; and a "nutting stone" with a small, circular depression. None of the fragments fit together with any other, suggesting either that the broken artifacts were scattered widely over unexcavated portions of the stone feature or that they were originally broken in other parts of the site and deposited on the mortuary feature after its construction. Given the jumbled nature of the ceramic assemblage, which did not appear to be a number of vessels smashed <u>in situ</u>, the latter interpretation seems more likely.

The ground-stone assemblage was a mix of both special and domestic artifacts. The slate mirror back fragment clearly represents an "exotic" artifact, probably acquired through down-the-line trade. However, while elaborately carved metates have been reported from other Zoned Bichrome mortuary assemblages (Lange 1984), the metate fragments associated with the large stone construction in Operation E were not from decorated examples.

A 100% collection of chipped and flaked lithic artifacts was made in of Lots 1-17 in Operation E. Among the most distinctive "artifacts" in this assemblage were very large percussion flakes, apparently knocked from the large boulders and river cobbles that were piled together on top of the mortuary feature. Their presence indicated that the process of construction was not always slow and deliberate. To the contrary, many of the heavy stones on top of the feature were thrown or smashed into place, perhaps as a prelude to the deposition of broken vessels and groundstone debris. Other lithic remains included numerous heat-cracked rocks, probably the debris from domestic cooking activities. However, the frequency of unfractured "cooking stones" was quite low (Sheets n.d.), and although a number of fragments of maize, palm fruits, and other seeds were noted in Operation B, only one specimen of an unidentifiable fruit was found in the artifact concentration over the tomb feature in Operation E.

Interpretations and Conclusions

The Lakeshore Features

Given the narrow strip of eroded shoreline which we were able to sample at the northern end of the site, it is difficult to say much about possible numbers of dwellings or the size of the total habitation area in the lower portion of Sitio Bolívar. The water to the north of the exposed shore is fairly shallow, especially as one approaches the lagoon at the mouth of Quebrada Bolívar. Prior to the construction of the Sangregado Dam, this would have been a broad area of relatively flat ground. Adjacent to a reliable source of fresh water, this location would have been ideal for settlement. It is possible that what now constitutes the lakeshore portion of Sitio Bolívar is only a small part of the level land once utilized by the Arenal Phase occupation, and that a large portion of the site has since been inundated by the waters of Lake Arenal. If so, the total number of dwellings at Sitio Bolívar may have been large. Given the enormous quantities of artifacts recovered from both surface collections at the eroded shoreline and from features on the ridgetop, this site may well have been a major center of activity in the Arenal basin at the end of the Arenal Phase.

Ceramic assemblages on the surface and embedded in preserved deposits along the lakeshore were composed primarily of types identical to those from the mortuary features in the ridgetop portion of the site, with a somewhat lower percentage of decorated types present. As with the mortuary features, all of the shoreline features date to the latter part of the Arenal Phase, most likely around AD 300-500. Because of the heavy erosion due to the seasonal fluction of the lake's level and wave activity, the strata upon which the major shoreline occupation occurred were fragmentary or absent. However, it seems likely that the lakeshore features, like those elsewhere at the site, originated on Unit 54 and intruded downward into Aguacate.

Midden Deposits and Mortuary Features

Analysis of the cultural assemblage from Operation B indicates that the deposit of artifactual material represents a midden of broken vessels and other household debris rather than a primary deposit of ritual offerings. The presence of a high number of monochrome vessels, mostly large, necked storage jars and open bowls, suggests that the ceramic assemblage represents vessels which were part of everyday life. The unfinished artifacts, small pieces of broken manos and metates, and small amount of charred subsistence remains also suggest a domestic assemblage. However, the appearance of simple monochrome vessels in burials indicates that there was not a clear distinction between household objects and mortuary offerings. In addition, sherds with charcoal residue on either interior or exterior surfaces, usually common in domestic deposits, were absent.

The mortuary associations of this feature are not easily dismissed. Excavations in Operation E revealed additional burial pits, and strongly supported the interpretation of a funerary function for the ridgetop portion of Sitio Bolívar. They also yielded large quantities of vessels, deposited in a midden of similar appearance and composition, directly on top of specially-constructed tombs. The feature in Operation B may represent a secondary deposition of material from surrounding burials, perhaps in conjunction with burials of individuals of lower social rank or with smaller families than those buried under the large stone features. This would explain the smaller average sherd size and the larger number of fragments from different vessels noted in the feature in Operation B.

Rather than being either a domestic trash heap or a ceremonial deposit associated with the underlying burials, the midden in Operation may in fact have elements of both. Because no internal stratigraphy could be identified in the 30-40 cm deep midden, it gave the appearance of having been deposited within a relatively short amount of time. However, given our current chronological resolution in the area, it is possible that the feature accumulated over the space of two or three hundred years. Rather than representing a single event which occurred in conjunction with the burials at the base of the deposit, the cemetery area may also have been a dumping ground for broken (and therefore "dead") pots and household artifacts. This point is taken up in detail below.

Unlike the small burials with meager offerings in Operation B, the large stone mortuary complex in Operation E clearly indicates a high regard for those interred there. However, the work invested in transporting heavy stones to the ridgetop from the streambed of the nearby quebrada does not appear to have been for the benefit of a single individual. The "compartmental" nature of the stone enclosures suggests that the feature does not represent a single episode of burial activity. Instead, it appears to have been a facility utilized at intervals by the community or a single family. Spaces between the stones and excavations into the feature appear to have been made as needed, occasionally carrying ceramic and lithic debris into the fill between and within the tombs. However, although sherds were found throughout the feature, the scatter of lithics and ceramics directly on top of the stones may represent a final dedicatory event. This scatter covered the entire feature, and included several whole vessels.

Ceramic analysis suggests that the artifact concentration in association with the river cobbles in Operation E represents a combination of both on-site smashing and discard of whole and partially complete vessels on top of the stone feature. However, the ground stone assemblage consisted exclusively of broken fragments from incomplete artifacts, scattered widely across the feature. Flaked lithics represented a large quantity of domestic debitage, probably brought to the burial complex for disposal.

Large feasts in conjunction with funeral are common to a number of cultures, and can include ritual vessel smashing. At La Ceiba, a site on the Tempisque River dating to the late Middle Polychrome Period (AD 800-1300) and currently under investigation by the National Museum of Costa Rica, such activities are evidenced by a large complex of linear clay ovens and huge quantities of faunal and floral remains in association with burials.

Negative evidence of hearths or baking pits indicates that no cooking of funeral feasts occurred directly on top of the burials at Sitio Bolívar. While the heavy artifact deposit in Operation E may include the remains of a funeral celebration, the virtual absence of charred food remains either adhering to sherds or in the matrix of the deposit argues against this interpretation. It is possible that ritual feasting occurred in another part of the site, perhaps in the vicinity of dwellings near the mouth of the Quebrada Bolívar, and large and "clean" fragments of smashed vessels were selectively collected for deposition on the tombs. However, this also seems unlikely.

The artifacts on top of the mortuary features may have been the personal posessions of the interred. Smashing and depositing them on top of the burials would have removed the "dangerous" objects of the deceased from common use, and may have been the psychological equivalent of placing them within the grave. This might explain both the domestic nature of the artifact deposit and the paucity of offerings within the tombs themselves. According to this model, grave goods, consisting of objects which had been part of the daily activities of the deceased rather than specially-prepared offerings, would have appeared on top of the burials rather than inside them. As a practice related to the burning of the house of a dead relative, the smashing and destruction of vessels would have removed traces of the deceased from the midst of the community. The destruction of still usable objects which had been the property of the deceased may in itself have helped to assuage feelings of grief. At the site of El Carmen (Hacienda Mojica), Ryder (1982-83a:107) reports a contemporaneous burial cache of 14 vessels, most cf which had been ritually "killed" by holes punched in their bases.

An alternative explanation is that the cemeteries, and especially tombs, were considered to be "good" locations for disposing of broken artifacts. Just as burial practices removed deceased individuals from the principal habitation areas, trash heaps and sherd middens would have removed broken vessels from paths and other areas in daily use. The broken vessels could have served as both offerings to dead relatives and markers for grave locations.

No evidence of habitations or domestic activities was found in our limited testing in the ridgetop portion of Sitio Bolívar. One explanation for the combination of both midden and funerary activities in this portion of the site is that the small loma summit was deemed unsuitable for either the concentration of dwellings or agricultural activities, hence its use as a "dumping ground" for the disposal of both people and artifacts. It seem likely that the features represent a cemetery which experienced relatively intensive use in a short amount of time, and that burial practices necessitated the frequent displacement of both soil and artifacts in and upon it. While the large midden of ceramic and lithic debris may not have been directly related to the burials beneath it, this material may indicate the presence of larger and more important mortuary features which were missed by our testing and sampling strategy at the site.

Intra-regional Comparisons

The stone mortuary complex revealed in Operation E has a number of important parallels at other Zoned Bichrome period sites in the Cordillera region. Large stone burial mounds constructed of river cobbles and rounded boulders have been recorded on the western slopes of the Cordillera de Guanacaste at Hacienda Jérico (Finch 1982-83), Hacienda Mojica (Ryder 1982-83a), and Guayabo de Bagaces (Ryder 1982-83b), and between the Miravalles and Tenorio volcanoes in the Río Naranjo/Bijagua Valley (Norr 1982-83) to the northwest of the Arenal region (Fig. 4.6). In all of these locations, mounds appeared either singly or in groups, and were frequently associated with petroglyphs. At Hacienda Jérico, stone burial features ranged from small (1-5 m diameter) tombs to large mounds ranging from 50-70 m diameter and up to 5 m high (Finch 1982-83:99). Human skeletal remains were found in association with stone mortuary features at Guayabo de Bagaces and Sitio Méndez on the Río Naranjo. At Hacienda Mojica, both stone-fill burial mounds and possible habi-tation sites were noted (Ryder 1982-83a:106). Survey of the Guayabo de Bagaces revealed stone mound cemeteries, habitation sites, and cemeteries with associated habitation areas. The largest burial mound recorded was approximately 50 m in diameter and 6 m high. As at Sitio Bolívar, it was noted that most of the cemeteries were located along ridgetops or hilltops above

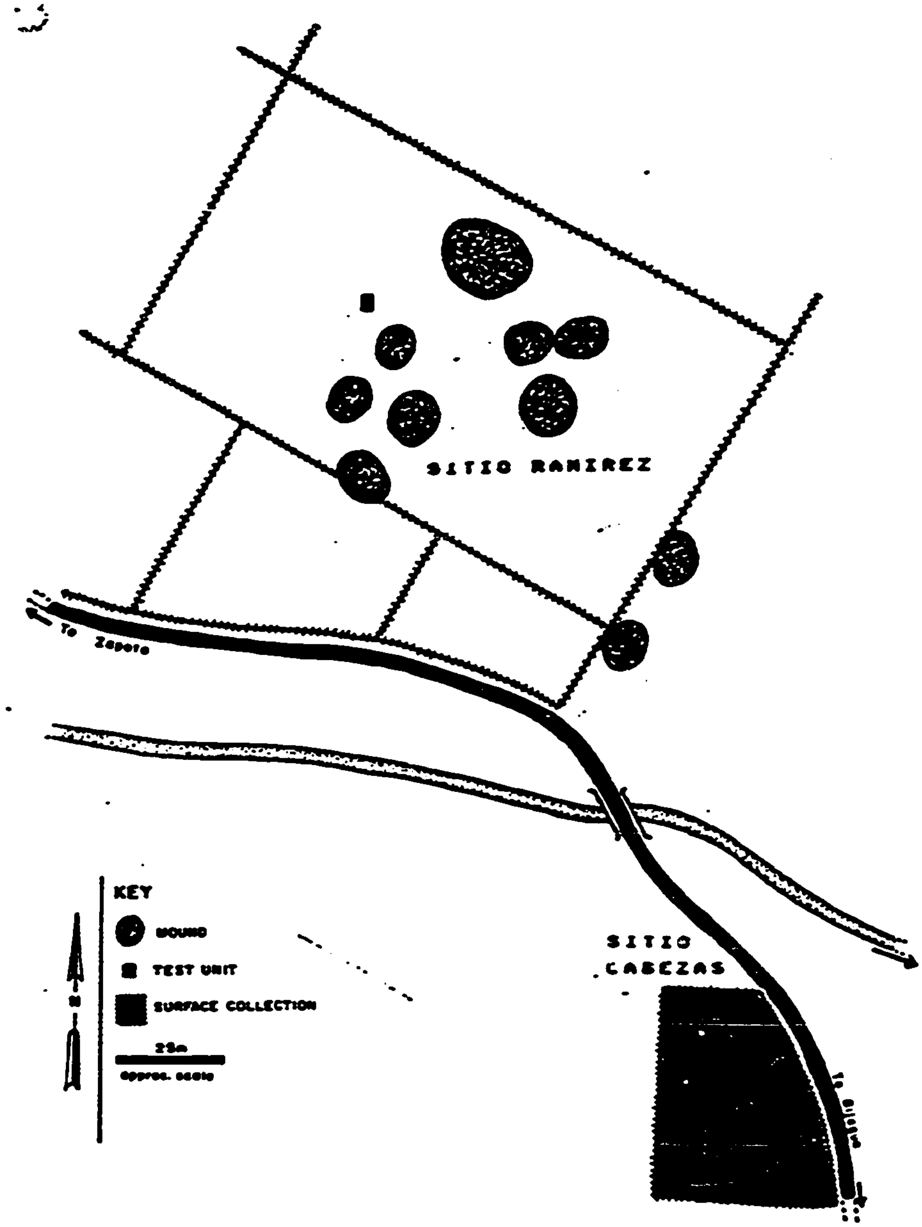


Fig. 4.6: Burial mounds at Sitio Ramirez.
(Map from Norr 1982-83:Fig. 9.3).

the valley floors. (Ryder 1982-83b:123). At all of these sites, the principal occupations and greatest amount of mound construction appears to have taken place during the mid- to late Zoned Bichrome Period, especially during the lattermost part (AD 300-500).

At Sitio Méndez, located between the Miravalles and Tenorio volcanoes in the Río Naranjo/Bijagua Valley (Norr 1982-83:138-140), one of six large mounds was trenched to reveal several burials and a profile of the feature's construction (Fig. 4.7). The mound was overlain by a deposit of crushed vessels and large sherds interpreted as post-burial offerings in the soil around a 1 m thick "cap" volcanic river cobbles. This overlying layer of stones was revealed to be a tight cluster of smaller stone features. Ten of these clusters, whose appearance was very similar to that of the features in Operation E, were found to cover burial pits. Two of these burials were marked by long, natural volcanic slabs. One was fairly elaborate in its construction, with several layers of river cobbles overlying a slab-covered stone crypt. Human skeletal remains, although in fragile and fragmentary condition, were found in four of the burial pits. All four of the interred individuals were identified as adults. As at Sitio Bolívar, burial offerings were extremely sparse. The only artifact recovered from any of the burial pits was a large jar of the type Mojica Impressed, the most

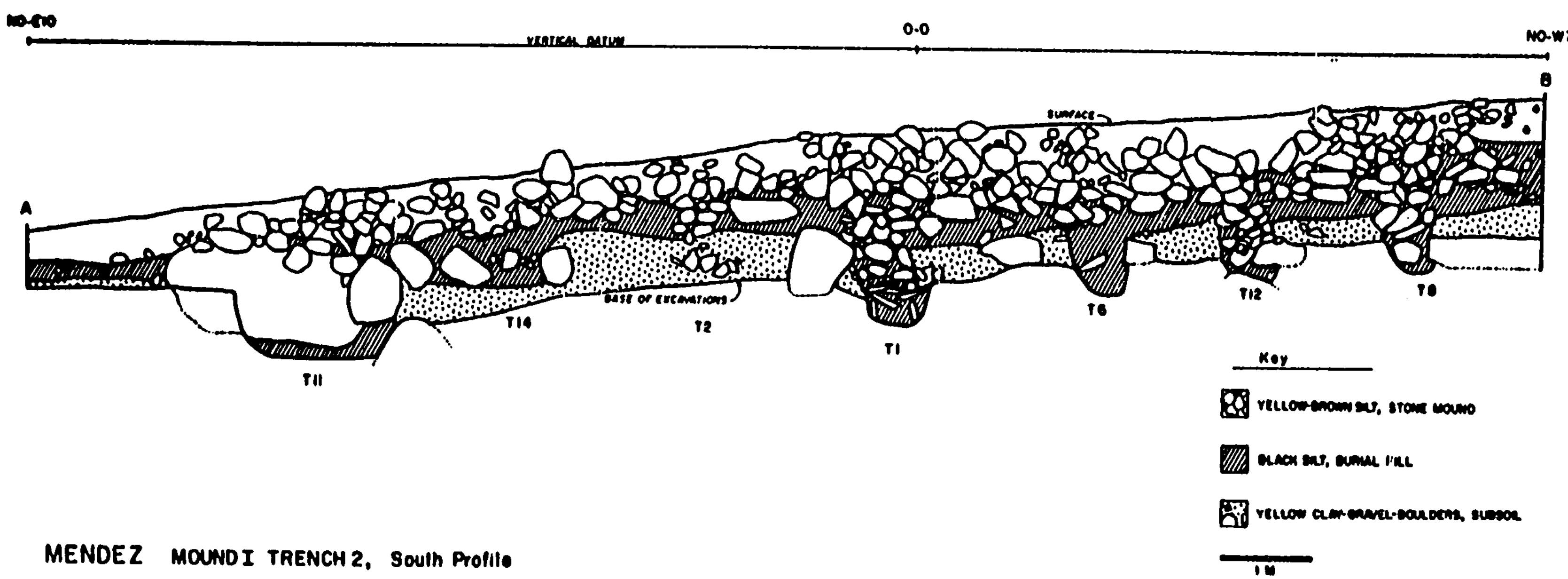


Fig. 4.7: Cross-section of burial mound at Sitio Mendez. (Illustration from Norr 1982-83:Fig. 9.7).

common decorated ceramic type in the assemblages at Sitio Bolívar.

A similar feature is reported from Sitio Murillo, near the town of La Fortuna in the Guayabo de Bagaces region southwest of Volcán Miravalles (Ryder 1982-83b). A small, oval mound, estimated to be about 3 m high and 19 x 26 m across, was found to be constructed of a 2 m layer of medium-sized (10-40 cm diameter) rocks overlaying a layer of large boulders. Excavation revealed three "rock cluster features" which proved to be burials. These were built from combinations of columnar basalt pillars, thick stone slabs, thin lajas, and river cobbles. Fragmentary human skeletal remains were found in each of the three stone features. However, as at Sitio Bolívar, no grave goods were found in association with any of the burials. Ceramics recovered from the mound included Los Hermanos Beige, Cervantes Incised-Punctate, and probably the types Charco Black-on-Red and Espinoza Red-Banded, all of which (or their analogues) were found in large numbers in the sherd deposits at Sitio Bolívar. It seems likely that the burial features at the two sites are roughly contemporaneous, and Ryder interprets the assemblage from Sitio Murillo as dating to around AD 300 (Ryder 1982-83b:126).

Given the size of the mound and its organization into individual stone clusters, Ryder estimates that the Sitio Murillo cemetery may have contained as many as one hundred separate tombs, with at least one individual in each. He also remarks that the internal structure of the mound suggests that it may have been constructed in a single episode (Ryder 1982-83b:126). This differs from the structure of the Méndez mound, where the clustering of individual tombs suggests that,

> ... the mound was not the result of a single effort by organized labor, but probably a continuous, family or community effort as individuals were added to the cemetery throughout the occupation of the site (Norr 1982-83:139).

A third excavated sample of stone mortuary features comes from the site of El Carmen (Hacienda Mojica), located on the eastern bank of the Río Blanco in the sloping plains between the Cordillera de Guanacaste and the Río Tempisque (Ryder 1982-83a:106-110). Like the Méndez Site, this site was characterized by several stone burial mounds. Ceramic assemblages associated with mound construction were virtually identical to those at Sitio Bolívar and suggest that principal occupations at the two sites were contemporaneous.

Excavations at El Carmen exposed part of one mound, all of another, and the area between the two, with a total horizontal exposure of 112 m^2. A rich assemblage of 70 whole or nearly complete ceramic vessels, all dating to the Zoned Bichrome period, were recovered from associated "caches" -- deposits of vessels without associated skeletal remains -- and tombs marked by alignments of large stones. In the first mound, two large caches were found beneath a 1 m deep deposit of stones and a layer of sherd-rich soil. Together, they yielded a total of 20 whole or nearly complete ceramic vessels and a large tripod metate. The ceramic types represented in the caches included Los Hermanos Beige, Charco Black-on-Red, and Guinea Incised. The second cache contained two vessels of Carillo Polychrome, a ceramic type which is usually considered diagnostic of the Early Polychrome period (AD 500-800). Fragments representing most of another Carillo Polychrome bowl were also collected from a concentration of sherds at the northeastern end of the mound. This vessel and the remains of others in the layer of river cobbles overlying the mound are interpreted as post-burial offerings, either placed or smashed *in situ*.

Mound 2 at El Carmen, excavated in its entirety, revealed six caches in association with two sets of parallel stone walls below the mound's stone "cap." These walls appear to represent two distinct constructions, and probably date to two different phases of occupation. One set of walls was associated with four caches, which yielded a total of seventeen ceramic vessels. Types represented included Los Hermanos Beige, Mojica Impressed, Charco Black-on-Red, Tola Trichrome, and Carillo Polychrome, all of which are characteristic of the very end of the Arenal Phase in the Arenal basin. A second set of walls was associated with a cache of three vessels and a rectangular tomb (Fig. 4.8) which contained a trough-shaped metate, two

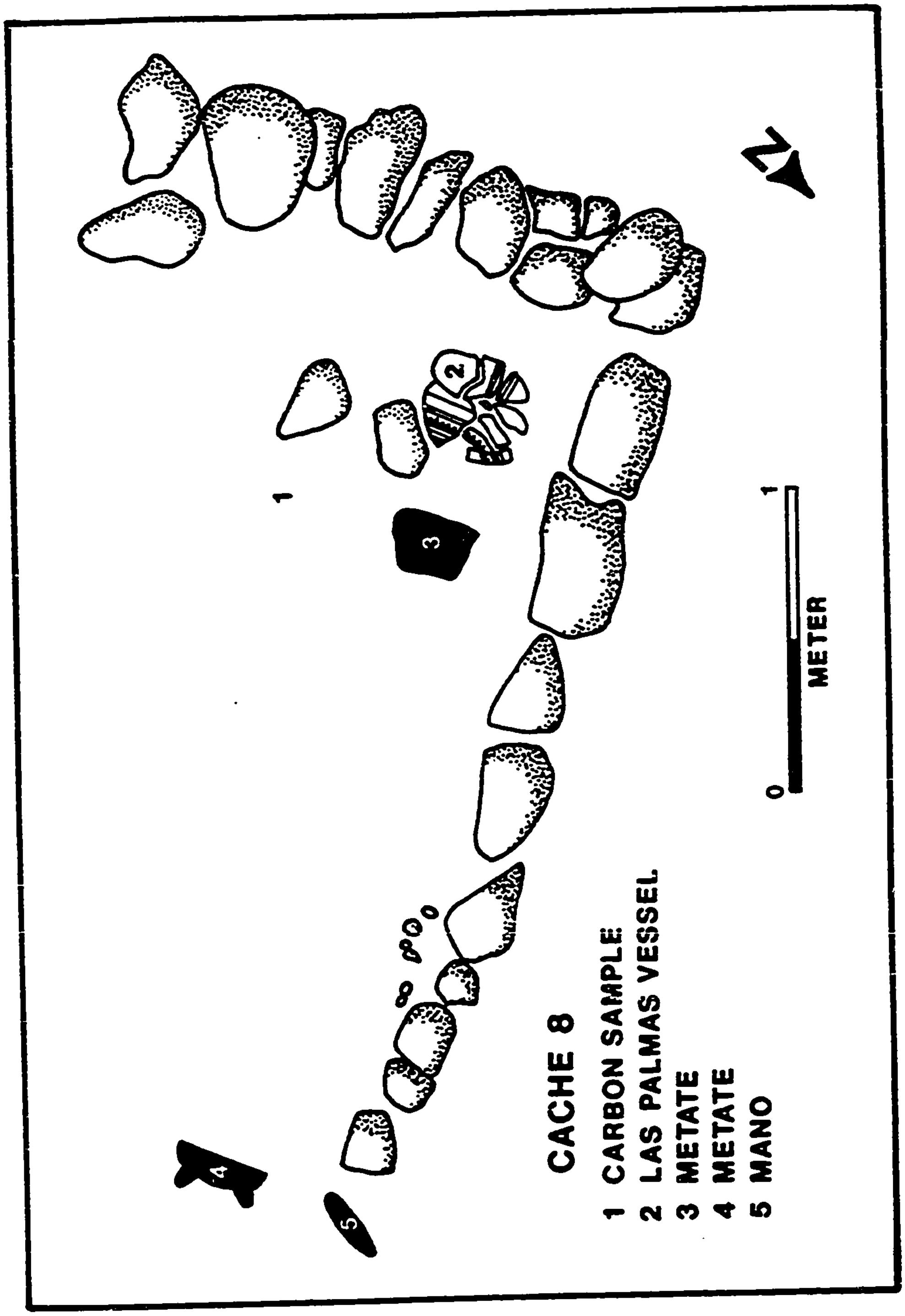


Fig. 4.8: Rectangular enclosure (tomb?) at El Carmen. (Illustration from Ryder 1982-83a:Fig. 7.4).

crude slab metates, a cylindrical mano, and a halved vessel of Las Palmas Red-on-Beige.

Several ceramics associated with late Zoned Bichrome assemblages at El Carmen probably had their origin in regions to the east of Greater Nicoya. A globular bowl with a characteristic over-the-rim handle was found in Mound 1, and surface collections at the site yielded sherds from Tuis Negative and Africa Tripod vessels. These are all representative of the El Bosque complex (AD 0-500) of the Atlantic watershed region (Snarskis 1978), and bespeak interregional contacts which crossed the cordillera at this time.

Unlike the mound at Sitio Mêndez, Mound 2 at El Carmen appears to have been built in stages. On the basis of the ceramic associations, Ryder (1982-83a:112) suggests that there were two or three principal phases of occupation and mound construction. The first, characterized by the tomb the Las Palmas Red-on-Beige vessel, is believed to represent the middle of the Zoned Bichrome Period (300 BC - AD 300). Given the nature of the stone features, this initial activity consisted of the construction of a single, rectangular stone tomb feature. This was followed by the construction of a set of two parallel lines of stones in association with burials, subsequently capped with sherds and a thick layer of stones. The dating of the phase or phases during which this latter activity occurred depends largely upon the chronological significance of Carillo

Polychrome. While it is usually cited as a marker type for the Early Polychrome Period (AD 500-800), Ryder agrees with Lange (1980) that Carillo Polychrome may in fact have appeared at the end of the late Zoned Bichrome Period (AD 300-500) as a "status" ceramic. This would make the cache containing Carillo vessels, found in association with types Los Hermanos Beige and Guinea Incised, contemporaneous with the other late Zoned Bichrome assemblages. The appearance of small quantities of this type in the absence of other Early Polychrome markers at Sitio Bolívar supports this interpretation, and argues for the contemporaneity of stone mortuary construction at both El Carmen and Sitio Bolívar in the period from AD 300-500. The similarity in the construction of features at a number of sites in and immediately west of the Cordillera de Guanacaste and the Arenal region suggests that all of this activity was roughly coeval, and demonstrates a strong regional tradition with respect to the treatment of the dead at this time.

Large stone burial mounds similar to those described above were not recorded in our own survey along the perimeter of the present Lake Arenal. However, their apparent absence is probably due to the nature of the volcanic stratigraphy in the region. Volcán Arenal has erupted several times since the period when these features were constructed elsewhere in the Cordilleran region, and stone burial mounds in most parts of the Arenal basin are probably covered by several layers of tephra and the soils which developed from them. Aguilar reports one such buried mound of river cobbles at the site of Río Chiquito (G-176), where it was uncovered by a tractor which was levelling a small hilltop. He estimated that the mound measured approximately 40 m in diameter and was 3 m high, comparable in size to examples at Hacienda Jérico, Hacienda Mojica (El Carmen), and Guayabo de Bagaces. Ceramic collections at this mound yielded late Zoned Bichrome types in association with Carillo Polychrome, as was noted at both El Carmen and Sitio Bolívar. However, the assemblage apparently also included the types Galo and Cabuyal Polychrome, suggesting a later Early Polychrome Period component to the construction (Aguilar 1984:82-84). Aguilar also reported two or three heavily looted cobble mounds at Sitio Carmelo, near Río Piedras at the western end of the lake (1984:81). Associated ceramics probably represent the Corrida and Arrastrada varieties of Mojica Impressed, and help tie this site chronologically to Sitio Bolívar.

Ryder (1982-83b:127) mentions that the wide variety of forms of burial construction noted at sites in and near the Cordillera de Guanacaste illustrates the complexity and diversity of roughly contemporaneous mortuary practices in the region during the latter half of the Zoned Bichrome period. However, the elements of mortuary features at Sitio Bolívar, such as cobble and boulder construction, deposits of sherds and broken vessels, burial pits marked by alignments of standing stones, and relative paucity of burial offerings at Sitio Bolívar are the same as those found in the larger mounds. While there is a wide diversity in the number and size of mound features, the use of stone burial features appears to have been a strong cultural tradition throughout the cordillera around AD 300-500. It is also a characteristic which is relatively circumscribed geographically. Stone burial mounds are not associated with Zoned Bichrome cemeteries in the Tempisque Valley (Baudez 1967), Nicoya Peninsula (Guerrero 1982-83), or Pacific coast region (Lange 1980, 1984). They are also unknown in the Rivas region of Nicaragua (Healy 1980), where earth-fill prehistoric mounds appear to have been built for habitations and were in use throughout the local sequence. In fact, the stone mounds of the Cordilleran sites appear to have more parallels in the Atlantic watershed region (Snarskis 1978) than they do to the west. While large cobble mounds have not yet been reported from the Atlantic region for this time period, El Bosque Phase (AD 0-500) burials are typically constructed of large river cobbles, and include a form known as the "corridor tomb" in which grave goods and burials are placed between long rows of cobbles (Snarskis 1978:169) in a fashion similar to that noted beneath Mound 2 at El Carmen (Ryder 1982-83a:Fig. 7.2).

There has been a great deal of speculation as to the type of political organization associated with the construction of Zoned Bichrome burial mounds. Much of this is linked to whether these features were been built during a single construction effort or by accretion. Ryder proposes that the large mound at Sitio Murillo contains as many as 100 tombs and was been built in a single episode, and believes that the massive effort might have required the direction of "an individual or group of special status" (1982-83b:127). Norr interprets the Sitio Méndez mound as "a continuous, family or community effort as individuals were added to the cemetery throughout the occupation of the site" (Norr 1982-83:139). To date, there is little evidence to support or refute either model. It is possible that both interpretations are correct, and that there was significant regional variation in social organization and/or mortuary practices in eastern Guanacaste. However, I favor Norr's accretional model for mound construction for the burials at Sitio Bolívar, and am skeptical about Ryder's single episode model.

All of the stone mortuary features excavated to date have been revealed to be burial complexes with multiple tombs, and none of them have been found to be particularly lavish in either their construction or the nature of burial offerings. In fact, despite landowners' private collections and _huaqueros_' reports of jades, ornamental metates, and elaborate ceramics from the stone mounds (Ryder 1982-

83b:124), very few artifacts of any kind have been recovered from the context of these features during controlled excavations. Only at El Carmen were a number of ceramic vessels recovered in association with burials beneath a stone mound, and conditions of preservation are so poor at all sites that little information on social practices can be inferred from the placement or orientation of bodies or patterns of age and health conditions. "Wealthy" burials noted in these stone mounds, possibly represented by Cache 1 at El Carmen (Ryder 1982-83a:107), which contained 14 ceramic vessels, or Cache 2, which contained two vessels of Carillo Polychrome in association with a large carved tripod metate and four other vessels, are not especially impressive as "chiefly" interments. While the use of basalt columns or large, volcanic lajas in tomb construction indicates the expenditure of a fair amount of energy, it is not beyond the amount one could expect from a single family unit. There is little evidence besides the stone mounds for any other centrally-directed constructions during the Zoned Bichrome period, and burial patterns within the mounds themselves have not indicated the hierarchy one would expect for an elite-sponsored mortuary compound. The paucity of grave goods makes the internal chronology of burials in these features difficult to assess, and until we have further data it is probably wise to take a conservative stance on the value of stone mounds as evidence for political centralization.

Hence, while we may see the beginnings of rank in the variable amounts of energy expended in tomb construction and in the accumulation of goods included in individual burials, evidence for powerful chiefs has yet to be found in these features. The sociopolitical organization of the societies responsible for the construction of stone burial mounds during the late Zoned Bichrome period was apparently decentralized. Leadership appears to have resided within individual families or lineage groups. Because evidence for chiefly individuals and centralized political authority is missing, Zoned Bichrome society does not appear to have been organized along the lines of "chiefdoms" (Service 1971). At Sitio Bolívar, the only evidence for social ranking lies in the appearance of imported objects such as greenstone pendants and slate mirror-backs and the differentiation between simple burials covered with sherds (Operation B) and more elaborate burials covered with both stones and sherds. This type of ranking is believed to be typical of complex forms of tribal organization (Habicht-Mauche et al. 1987). The late Zoned Bichrome society at Sitio Bolívar can therefore be understood as a large, semi-agricultural community which was probably organized along the lines of kinship. Its affinities to other sites both in the Arenal basin and the larger Cordilleran region bespeak the existence of a more widespread, regional "culture", possibly maintained through inter-community exchange networks and regional religious sodalities.

Dating Features and Assemblages at Sitio Bolívar

Two radiocarbon dates were obtained from Sitio Méndez mound (Norr 1982-83:140). I believe that the first, at 2129(182-831)1832 BC [UCLA-2167A: 1560 bc ± 80], may date an early Tronadora Phase occupation of the site. The second, at 410(329)132 BC [UCLA-2163: 300 bc ± 60], is interpreted by Norr to date Naranjo and Catalina Phase (early and middle Zoned Bichrome) occupations of the site prior to the mound's construction. Ceramics associated with this date included Mojica Impressed and Bocana Incised Bichrome: Bocana Variety, types which have been placed in the Early Arenal Phase. A zoned punctate type with a fine, grey paste and white infilling also associated with this date was unrecognized in Proyecto Prehistórico Arenal assemblages. Norr (1982-83: 143) notes that ceramics from the stone "cap" of the Méndez mound were similar to, although not identical with, collections from a stone burial mound near Arenal. Excavations at Sitio Ramírez, also in the Río Naranjo/Bijagua Valley (Norr 1982-83:137), revealed buried occupational strata in an area between nine large stone burial mounds. Although later tombs (ca. AD 1000) were found above these strata, samples from the lower levels yielded dates of 93 BC(AD 196)529 [ISGS-1082-83: 130 ad ± 120] and AD 130(408)637 [ISGS-1132: 300 ad

± 100]. The major occupations of both Sitio Méndez and Sitio Ramírez are believed to have occurred during the period from 300 BC to AD 300, slightly earlier than the principal occupation at Sitio Bolívar. However, the later date may in fact represent a contemporaneous occupation.

At the El Carmen site, a large charcoal sample from the rectangular stone tomb in Mound 2 yielded a date of 390(144 BC)AD 54 [UCLA-2167E: 160 bc ± 80]. Its association with a vessel of Las Palmas Red-on-Beige makes this feature contemporaneous with the Early Arenal Phase, and therefore dates an occupational phase at El Carmen which is somewhat earlier than that at Sitio Bolívar (Ryder 1982-83a:109). No absolute dates are available from the second phase at El Carmen, which is probably contemporaneous with the principal occupation at Sitio Bolívar (ca. AD 300-500).

Five radiocarbon dates were obtained from excavations in both the lakeshore and ridgetop portions of Sitio Bolívar. The earliest, 830(400 BC)AD 1 [Tx-5271: 390 bc ± 170], comes from a possible hearth at the base of deposits in Operation B. While it is believed to be too early to date the sherd midden feature from this operation, it is very similar to the date obtained from the base of the excavated mound at Sitio Méndez, and may represent an Early Arenal Phase occupation at Sitio Bolívar. A second date of 182(394)540 AD [Tx-5273:

290 ad ± 70] from the midst of the sherd midden itself and a third of AD 432(642)770 [Tx-5270: 540 ad ± 80] from the matrix of the stone tomb features in Operation E overlap from AD 432-540 within a 95% confidence interval, and may accurately date activities during the principal Late Arenal occupation of the site. A date of AD 79(245)410 [Tx-5272: 180 ad ± 60] was obtained from one of the two firepits associated with postholes on the lakeshore, and the later half of its 2-sigma range roughly corresponds to the estimated period of principal occupation. The second firepit provided a date of AD 770(919) 1000 [Tx-5269: 820 ad ± 50], which is several hundred years too late, does not overlap the first even in the 2-sigma interval, and is believed to have been contaminated.

On the basis of radiocarbon dates and associated features and ceramic assemblages, the principal occupation of Sitio Bolívar is dated to ca. AD 300-500, during which time both the mortuary features on the ridgetop and the habitational features on the lakeshore are believed to have been constructed. At this time, the site was probably quite large. Both macrobotanical remains and ground stone artifacts such as manos and metates indicate the cultivation and processing of maize, but there is also evidence for a continued exploitation of tree crops such as palm fruits and nance. Long-distance contacts with areas to both east and west are suggested by Atlantic watershed ceramics and greenstone pendants of imported materials. The association of a slate mirror-back with mortuary features suggests the possibility of down-the-line trade from Mesoamerican cultures much farther to the north. These have also been found at the site of La Fortuna, just east of Volcán Arenal (Stone and Balser 1965), where they were associated with a ceramic assemblage very similar to that at Sitio Bolívar and dated to AD 300-500 (Baudez and Coe 1966).

The period of Sitio Bolívar's principal occupation coincides roughly with the Early Classic period in the Maya lowlands, during which Classic Maya trade with the southern "hinterlands" appears to have been at its peak (Hoopes 1984b). Costa Rican contact with Mesoamerica at this time may have included a loose network for the procurement of jadeite from southern Guatemala (Lange and Bishop 1982-83). However, contact between Mesoamerican cultures and the Cordilleran region at this time appears to have been confined to the exchange of small trinkets such as slate mirror-backs and occasional incised jades. Neither the appearance of "monumental" burial architecture nor the level of sociopolitical complexity associated with their construction suggests strong cultural influence from Mesoamerica at this time.

CHAPTER FIVE
Ceramic Methodology and Interpretation

Ceramic Analysis in the Arenal Basin

The analysis of ceramic assemblages from the Proyecto Prehistórico Arenal proceeded in two stages. The first was initiated in the field, and consisted of the tabulation of the ceramic assemblage on index cards and the creation of spreadsheet files to facilitate initial interpretation at the level of "types." The second stage of analysis utilized an extensive database of information at the level of modes, compiled in 1986 and 1987 from information tabulated in the field, and was useful in eliciting and testing patterns which were too subtle to appear in the first stage of analysis. All ceramic analysis was focused on the identification of culturally and chronologically significant features of the collection from the site, and attempted to recognize both vertical and horizontal patterns in the distribution of ceramic artifacts.

The basic information upon which the ceramic analysis is based was initially compiled on index cards, and was collected with the application of a computer-assisted analysis in mind. All tabulation of ceramic types and modes was carried out by myself in the Proyecto Prehistórico Arenal field laboratory in Tilarán, Guanacaste during the 1984 and 1985 field seasons. Many of the Lotus 1-2-3 spreadsheets utilized for this stage of the analysis were designed and compiled in the field at this time, providing for immediate use as well as subsequent interpretation.

All ceramics were analyzed by "lot" in the field laboratory, with each lot representing an assemblage of artifacts from a given provenience. These may have been a surface collections from a surveyed site, the ceramics from a particular excavation level, or the contents of a hearth or posthole. Because sherd density in most of the project excavations was low, the vast majority of these lots contained only a small number of sherds. Because it is difficult to recognize trends or patterns in small samples, it was necessary to devise a methodology which would preserve provenience data while allowing for the combination of materials from lots associated with particular volcanic strata or features. The tabulation of ceramics by lot and the entry of this information on a computer spreadsheet made it possible to combine lots electronically according to a wide variety of criteria, and to make multiple comparisons between a large number of different assemblages. In effect, the computer served the function of a large laboratory table on which a vast number of sherds and boxes of sherds could be sorted and rearranged with relative ease.

Tabulations of ceramics from individual lots included a wide variety of data. Basic information consisted of number, vessel part (rim, body, neck, handle, etc.), and sherd size (small, medium, large, etc.). Many sherds could be classified as to type and variety according to existing definitions of ceramic types in the literature of Greater Nicoya archaeology (c.f. Baudez 1967, Sweeney 1975, Lange 1976, Healy 1976, 1980). An attempt was made to adhere to guidelines suggested by the Denver Conferences on Greater Nicoya Ceramics (Lange et al. 1984:Tables 1-4). These conferences, three in all, were organized for the express purpose of bringing together scholars working on the prehistory of Greater Nicoya to "produce a unified set of ceramic descriptions from on those originated by Baudez (1967)" (Ibid.:199). Having participated in the last of these conferences (1984 in San José, Costa Rica) and in a week-long "Greater Nicoya Ceramic International Workshop" sponsored by the Smithsonian Institution in 1985, my use of established types has benefitted greatly from lengthy discussions with many other archaeologists specializing in the region, assisted by hands-on examinations of type collections and whole vessels from a variety of sites throughout Costa Rica. While the usefulness of the typology recommended by the Denver Conferences will always remain open to question and modification (some of which I am proposing in the present work), I believe that a meaningful concensus exists concerning the validity of previously published type designations used in my analysis. This has been demonstrated by their repeated use in the classification of whole vessels in both private and museum collections (c.f. Snarskis 1982).

In addition to published type descriptions, many "types" used at this stage of analysis were actually provisional designations for single modes or mode clusters which were observed to occur with relative frequency in collections specific to the Arenal basin. Several of these designations were later defined as types or varieties, representing newly-defined classificatory categories. Others did not occur in great enough numbers or did not carry enough information with regard to vessel form and other characteristics to warrant a type definition, and have been preserved as diagnostic modes. Their principal purpose of these designations was to provide initial classificatory categories which would facilitate the identification of as many sherds in the collection as possible without "lumping" them into too many groups or "splitting" them to such an extent that meaningful patterns would be hard to recognize. These types and modal clusters constituted the basic unit of analysis for the Lotus 1-2-3 spreadsheets.

Other information tabulated during the initial ceramic analysis falls into the category of modes (Rouse 1960). This included the identification of forms of vessels and vessel parts (rims, handles, bases, etc.), type and placement of decoration, and colors of pastes and surface finishes. It also included the observation of what may be considered "functional attributes," such as wear patterns on bases, supports, and the interiors of bowls, and the presence or absence of deposits of charcoal residue on sherd surfaces. Characteristics of vessel manufacture and sherd preservation, such as the existence of fireclouding or friability and degree of erosion, were also noted. Unfortunately, the nature of our ceramic collections placed severe limitations on the interpretation of vessel function. First of all, the majority of functional attributes that were tabulated appeared in relatively small quantities. Secondly, the number of whole or reconstructable vessels recovered was very low. Attributes such as wear patterns and charcoal residues occurred most frequently on undecorated sherds, and it was usually impossible to associate fragmentary monochrome supports or body sherds with a particular ceramic type or vessel form, thus limiting inferences based on the observation of functional attributes.

At the time of a lot's tabulation, at attempt was made to determine which sherds "went together" or belonged to the same vessel. Extra attention was placed on this in lots from Sitio Bolívar, where the nature of the deposits indicated a high probability of vessels broken _in situ_. However, because the correspondence of sherds to vessels was not always clear, and because broken pots do not lend themselves to a "minimum number of individuals" analysis as well as skeletal remains, analyses at both the level of type and mode represent the numbers of sherds rather than vessels.

Lotus 1-2-3 Analysis

The first stage of analysis made extensive use of Lotus 1-2-3 (Lotus Development Corp.), a commercially available computer program with mathematical, statistical, and database functions. The central idea of the program is the "spreadsheet," a blank grid of rows and columns into which names, numbers, and formulas can be entered. Once the "cells" of the spreadsheet have been filled with information, formulas can be entered which perform mathematical or statistical functions (such as totals, percentages, means, and standard deviations) on designated rows or columns of data. Database functions such as sorting and selecting information in the spreadsheet make it possible to arrange and examine data in a number of different configurations. Graphics functions are also available to draw graphs based on information in a given spreadsheet, assisting with the visualization of patterns in the data. The versatility of this program in the context of archaeological fieldwork was readily demonstrated in the Proyecto Prehistórico Arenal field laboratory, where it was used to maintain records of all materials collected during survey and excavation as well as assisting with data analysis. This program was run on two IBM-compatible personal computers. A COMPAQ portable computer with 512K RAM was used in the field laboratory in Costa Rica during both the 1984 and 1985 seasons. Subsequent analysis was conducted on a Leading Edge Model "D" with 640K RAM.

An important step of this stage of analysis was the selection of "type categories," a working set of types, varieties, and "modal clusters" used for the tabulatations of ceramics from each lot. It was anticipated that a large number of sherds would fall into categories represented by only one or two examples. Given that the two seasons of work by the Proyecto Prehistórico Arenal generated a sample of 12,629 diagnostic sherds divided into a total of 430 different lots (mean = 29.4, but size ranged from 1 to 1506 sherds and sigma = 102.4, indicating high variation in lot size), software limitations made it necessary to limit the total number of type categories utilized. With too many categories for a given number of lots, the program worked sluggishly and patterns were difficult to discern. As the ceramic tabulations were entered into a master spreadsheet, a total of 61 type categories were selected to represent the entire ceramic assemblage. Correlations of these type categories with regional tephra stratigraphic associations revealed that of these, 13 could be assigned to the Tronadora Phase, 21 to the Arenal Phase, 16 to the Silencio Phase, and 7 to the Tilarán Phase. These assignations were subsequently utilized in the interpretation of surface collections from the lakeshore survey, where stratigraphic associations of the assemblages were generally unknown.

The Tronadora Phase type categories and total number of sherds tabulated for each in the total ceramic collection were:

Exterior bolstered *olla-tecomate* rims (later designated Tonjibe Beige)	152
Red-rimmed beige vessels*	94
Horizontal groove-incision on squat, necked jars	83
General groove incision	71
Horizontal grooving on rims and vessel exteriors (Tronadora Incised)	53
Strip appliqué and gouge-incision (Tajo Gouge-Incised)	50
Horizontal groove incision and heavy punctation (Tigra Grooved-Punctate)	36
Single-stroke shell-edge stamping with grooving	31
Cylindrical vessels with light shell-stamping (Zetillal Shell-Stamped)	22
General heavy punctation	13
Geometric groove-incision	6
Black vessels with grooves infilled with ocher ("Atlantic Red-Filled Black Group")	5
Circular reed stamping	4
TOTAL:	620

*This category consisted of vessels which were related to but distinct from both bolstered-rim *olla-tecomates* and thickened-rim jars typical of Los Hermanos Beige.

The Arenal Phase type categories (all based on pre-established ceramic types or groups) and total number of sherds tabulated for each in the total ceramic collection were:

Los Hermanos Beige: Los Hermanos Variety	4515
Charco Black-on-Red	555
Mojica Impressed: Corrida Variety*	318
Los Hermanos Beige: Espinoza Variety*	312
Guinea Incised	198
Red-slipped monochrome	197
Mojica Impressed: Arrastrada Variety*	189
Las Palmas Red-on-Beige	188
Los Hermanos Beige: Cervantes Variety*	165
Mojica Impressed: Mojica Variety	127
Bocana Incised Bichrome: Bocana Variety	101
Mojica Impressed: Congo Variety*	85
Mojica Impressed: Laguna Variety*	66
Zelaya Bichrome	33
Huila Zoned-Punctate	18
General trichrome decoration	17
Tola Trichrome	8
Tamino Incised	8
Carillo Polychrome	7
Anita Fine Purple	4
Zelaya Trichrome	2
TOTAL:	7113

*Varieties of pre-established types which are defined for the first time in this study.

The methods used in ceramic classification can be understood as a "modified type-variety" system, and were adopted in the interest of continuity and compatibility with previously published descriptions of Costa Rican ceramics (Baudez 1967; Lange 1971, 1976; Sweeney 1975). As it stands, this method -- employed by the authors cited above and the recent Denver Conferences on Greater Nicoya Ceramics (Lange et al. 1984) -- differs from the type-variety system as commonly used in Mesoamerica (Smith, Willey, and Gifford 1960, Sabloff and Smith 1969) in that taxonomic structure is more highly restricted. To date, Healy (1980) has been the only author to attempt a classification which makes use of the levels of "ware" and "group". In other references for Greater Nicoya ceramics, the principal unit of classification is the "type", rather than the "group". The type-variety system itself has a number of inherent drawbacks. Foremost is the assumption that the "type" describes a class of whole vessels, rather than a class of sherds (cf. Gifford 1976). In archaeological contexts in general, and especially in assemblages from our project, whole vessels are very rare. However, the vast majority of type classifications are based on sherds. Furthermore, the type-variety system tends to impose a pre-determined structure upon the data. It favors broad groupings and is relatively intolerant of unique variations (or "specials"), which tend to get short shrift in both description and analysis. Despite these shortcomings, the type-variety system is very amenable to inter-regional comparisons, for it allows archaeologists to characterize assemblages in terms of relatively large classificatory categories rather than the multiplicity of independent features which constitute the basis of modal analyses.

The relatively good state of preservation of ceramics in terms of both form and surface finish in Greater Nicoya and the Cordilleran region allowed for the identification of a large number of attributes shared by our ceramics and those in published type descriptions. This is the principal reason why the modified "type-variety" system employed in the existing typologies for Greater Nicoya ceramics was deemed appropriate for the analysis of the Proyecto Prehistórico Arenal collection. My intent was to identify and define types and varieties in a manner consistent with the current literature of the archaeology of northwestern Costa Rica. By adhering to existing conventions of ceramic classification for Greater Nicoya, I hoped to maintain existing standards of ceramic description and make my analysis as accessible as possible to archaeologists familiar with the current literature of the region.

In lieu of detailed compositional information on ceramics from neighboring regions, I am hesitant to define distinct Cordilleran "wares". However, there is no doubt that certain pastes -- especially those containing volcanic tephra and related minerals -- are very characteristic of the Cordilleran region. The level of "group" is deemed to be very useful in the classification of ceramics which have certain characteristics of surface finish, but do not carry sufficient information to allow identification at the level of "type". In our assemblages, the most useful "group" designation is one which would subsume the varieties of both Los Hermanos Beige and Mojica Impressed, all of which share modes of form and surface finish. The concept of "group" is most useful in attempting to characterize modes of form, such as rims and supports, which have a particular paste, surface finish, and vessel shape but are not clearly associated with a decorative technique diagnostic as to type or variety.

Another taxonomic level which we have found useful is that of the "variety". Certain combinations of modes in our assemblages fell under existing type descriptions, but recognizable groups within these categories were believed to be stylistically or technically distinct, or of geographical or chronological significance. In these cases "varieties" have been defined to distinguish variation within a "type" designation.

As will be noted from the above lists, the majority of Arenal Phase sherds could be classified according to existing type definitions, primarily those of Baudez (1967) and Healy (1980). Comparisons between assemblages from the Tempisque Valley, Pacific coast (Lange 1971, 1976), and Rivas regions of Greater Nicoya and those from our collections in the Arenal area facilitated the definition of the Arenal Phase as a chronological unit. Most of the ceramics grouped under this classification are also diagnostic of the Zoned Bichrome Period in the abovementioned areas. The sole exception is Carillo Polychrome, placed by Baudez (1967) in the Early Polychrome Period (AD 500-800) and Anita Fine Purple, an unusual ceramic group described by Snarskis (1978:208) and thought to be a trade ware from southeastern Costa Rica. Although all three of these ceramics are generally attributed to a later time period, they were found in assemblages of Arenal Phase diagnostics.

The correspondence of the above type categories with ceramic phases was based on both comparisons with other assemblages in Costa Rica and on associations with particular strata in the regional tephra sequence. Although "Tronadora Complex" sherds were initially recognized in a number of surface collections as being very different in appearance from known Zoned Bichrome types, their cohesion as a group with chronological significance was not evident until the large surface collection from Tronadora Vieja (G-163) could be compared to assemblages from Chaparrón and La Montaña (Hoopes 1985). While initial test excavations at Tronadora Vieja showed that the sherds with early modes had a positive correlation with the lowermost strata in the regional sequence (Bradley, Hoopes, and Sheets 1984), the associated assemblages of diagnostic ceramics were too small to convincingly affirm these associations. Although the overall collection of excavated ceramics which were classifiable within our 34 "type categories" from Tronadora Vieja is still quite small (681 sherds), it was possible to note important distributions of these categories through the excavated strata, and to therefore confirm the associations between diagnostic ceramics and regional stratigraphy. Unfortunately, sample size and the degree of resolution afforded by our initial classifications did not permit many fine temporal distinctions. These were later tested during a modal analysis which permitted the use of more variables.

An implicit but initial assumption in this analysis has been that the Arenal area was continuously occupied by ceramic-producing peoples throughout the Tronadora and Arenal Phases. It is entirely possible that this was not the case, however. Evidence to the contrary includes a possible 1000-year gap in the radiocarbon chronology, a great disparity in the number of sites which appear to have been occupied during the respective phases, and a general lack of information on both cultural and stylistic aspects of what would have been the transition between the Tronadora and Arenal Phases. However, in none of our excavations was there stratigraphic evidence that a great deal of time had elapsed between the end of Tronadora and the beginning of Arenal Phase occupations. Unit 60, which was found to contain an abundance of Tronadora Phase material, was separated from overlying "Upper 50's" strata -- with Arenal Phase material -- by only a few centimeters depth (represented by Unit 55). Without knowing more about soil formation processes and local weeathering conditions, it is difficult to say how long after the Tronadora occupation Unit 55 was deposited. Unfortunately, we have no radiocarbon dates from the upper part of Unit 60 or from Unit 55 at the site. Given that Tronadora ceramics, dated to ca. 2000 BC by associated radiocarbon samples, are markedly similar to early complexes such as Chaparrón and La Montaña, which have been previously been estimated to date ca. 1000-500 BC, I have chosen to assign the phase very liberal temporal boundaries. There is not yet sufficient evidence to define Tronadora chronology strictly according to the associated radiocarbon dates, which are themselves open to criticism for a number of reasons. Because there is no clear stratigraphic evidence for a discontinuity between the two phases, and because there is only negative radiocarbon evidence to the contrary, I have chosen to interpret the Tronadora and Arenal Phases as continuous until further data indicates otherwise. However, the case for continuity is by no means clear, and given the available radiocarbon dates, I will readily concede that a significant temporal disjuntion between the Tronadora and Arenal Phases is a possibility which merits further investigation.

Type Level Analysis from Tronadora Vieja

The ceramics from Tronadora Vieja were tabulated on a spreadsheet which made use of all 13 Tronadora Phase "type categories," half (11) of the Arenal Phase categories, and three for the Tilarán Phase. Categories which were not used represent ceramics absent from the assemblage. The single biggest problem encountered in the analysis of ceramics from Tronadora Vieja was the extremely low density of diagnostic sherds encountered in all operations at the site. Many excavated lots represented all of the ceramics recovered from an arbitrary 10 cm level in a 2 x 4 m operation, or the material from slightly less than a cubic meter of excavated soil, and a total of only 681 sherds diagnostic as to group or type were recovered altogether. These sherds were divided among a total of 155 lots; however, not one lot from the site was found to contain as many as 20 sherds classifiable within at least one of our 34 "type categories" for the site. Out of the 155 excavated lots containing diagnostic ceramics, only 17 contained ten or more (with a maximum of 19); 28 contained between five and nine; and 110 contained fewer than five diagnostic sherds (48 having only one). In addition, no vertical excavation yielded a high enough sherd density to construct battleship curves of stylistic trends within a single "phone booth"-type (Flannery 1976) operation.

This low number and density of sherds bearing simple diagnostic information from a site with approximately 2 m of cultural deposits presented a number of major analytical problems. Many of the lots which yielded a large number of diagnostic sherds represented combined strata or "thick" excavation levels, and therefore had the poorest stratigraphic proveniences. Conversely, lots with good stratigraphic provenience often yielded the fewest diagnostic sherds. Contexts with a number of clear diagnostics in direct association with good stratigraphic provenience were very rare, and were limited to features such as the house floors noted in Operation W. This meant that on a lot by lot analysis, ceramic associations and stylistic trends could be very difficult to recognize. This problem was compounded by a relatively high degree of mixing of materials from different occupational levels, due to both root and rodent activity and prehistoric features which intruded into older strata. It was not unusual to find a lot with an apparently clear stratigraphic provenience which contained three diagnostic sherds, two from Tronadora Phase categories and one from the Arenal Phase.

For this reason, the combination of groups of excavated lots in order to create interpretable assemblages was essential. In order to do this, sherds were tabulated by operation and lot, and each lot was assigned a number or numbers corresponding to the natural stratigraphic unit with which it was thought to have been associated (30, 50, 54, 60, 61 etc.). Because of vagaries in the preservation of natural stratigraphy and its observation during excavation, not all lots could be readily associated with a single natural stratigraphic unit. Stratigraphic identifications such as "54/55," "60/61," or "61/64" were used to identify lots which included material from more than one unit. As noted in the description of excavation methodology at the site, at attempt to subdivide the "Upper 50's" strata made use of artificial 10 cm excavation levels within a larger natural unit. These were identified by designations such as "50a," representing the first 10 cm below Unit 50, "50b," representing 10-20 cm below Unit 50, and so forth until an identifiable stratum such as Unit 54/55 or Unit 60 was reached. Mixed levels were identified as "50ab" or "50abc." All stratigraphic designations ending in a letter of the alphabet therefore represent artificial levels within a larger natural stratigraphic unit. To avoid confusing artificial and natural stratigraphic divisions, only those artificial levels which did not correspond to separately designated natural levels were used in this analysis. For example, artificial units from near the bottom of the "Upper 50's" strata, such as "50e" or "50de," may have corresponded to Unit 54/55 and were therefore ignored.

The unique volcanic stratigraphy of the Arenal area (Appendix B) made possible the grouping of tabulated lots from several different operations within the site according to their stratigraphic associations. It is these grouped associations by stratum which provide the greatest support for chronological interpretations. Table 5.1 shows the distribution of the 13 "type categories" suggested as Tronadora Phase diagnostics and the 11 identified as Arenal Phase in a sample of 133 grouped lots of known stratigraphic provenience (see Appendix B for a detailed discussion of the regional volcanic sequence and the unit designations employed here). The table presents all of the diagnostic ceramics assigned specifically to the following stratigraphic levels, which appeared in descending stratigraphic succession in all excavations at the site:

	TRONADORA PHASE													ARENAL PHASE											T	A	TOTAL
STRATUM	TB	RR	GRI	GR	TI	TGI	TGP	SS	ZIP	PUN	GEO	ARB	CIR	BIB	LPR	MI	MI:L	HZP	TAM	ERB	CBR	GI	TRI	LHB			
30	1				1															3		1		4	2	8	10
50	1			1	1															1	1		1	1	3	4	7
50a	3	1			1	1		1							1		1	3		3	3			1	7	12	19
50ab		4		1	1	2								1			1			4		1			8	7	15
50b	2			2	1			1						2		1	2			4				6	6	15	21
50c	3		1	3	1	1		1			1			1			1	1		3	2	1		5	11	14	25
50cd	6		1	6	3	1	1	1			1			1			1	2		3	3	1		7	20	18	38
54/55	4			2	2		2								1		2			2				9	10	14	23
60	26	4	7	16	13	12	10	4	6	3		2	2	3	6		1			5				3	105	18	123
60/61	13	5	1	4	2		1	1	3	2							1								32	1	33
61	28	2	7	11	5	6	4	3	8	1		2	2											3	79	3	82
64	12	5	1	6	3		5	5	2	1	1									4				5	41	9	50
65	1			6																1					7	1	8
TOTALS	100	21	18	58	34	23	23	17	19	7	3	4	4	8	8	1	10	6		33	9	4	1	44	331	124	454
30	10%				10%															30%		10%		40%	2	8	10
50	14%			14%	14%															14%	14%		14%	14%	3	4	7
50a	16%	5%			5%	5%		5%							5%		5%	16%		16%	16%			5%	7	12	19
50ab		27%		7%	7%	13%								7%			7%			27%		7%			8	7	15
50b	10%			10%	5%			5%						10%		5%	10%			19%				29%	6	15	21
50c	12%		4%	12%	4%	4%		4%			4%			4%			4%	4%		12%	8%	4%		20%	11	14	25
50cd	16%		3%	16%	8%	3%	3%	3%			3%			3%			3%	5%		8%	8%	3%		18%	20	18	38
54/55	17%			9%	9%		9%								4%		9%			9%				39%	10	14	23
60	21%	3%	6%	13%	11%	10%	8%	3%	5%	2%		2%	2%	2%	5%		1%			4%				2%	105	18	123
60/61	39%	15%	3%	12%	6%		3%	3%	9%	6%							3%								32	1	33
61	34%	2%	9%	13%	6%	7%	5%	4%	10%	1%		2%	2%											4%	79	3	82
64	24%	10%	2%	12%	6%		10%	10%	4%	2%	2%									8%				10%	41	9	50
65	13%			75%																13%					7	1	8

KEY TO TYPE CATEGORIES:

TB - Tonjibe Beige
RR - Red-rimmed beige vessels
GRI - Horizontal groove-incised jars
GR - General groove-incision
TI - Tronadora Incised
TGI - Tajo Gouge-Incised
TGP - Tigra Grooved-Punctate
SS - General single-stroke shell stamping
ZIP - Zetillal Shell-Stamped
PUN - General heavy punctation
GEO - Geometric groove-incision
ARB - Atlantic Red-Filled Black Group
CIR - Circular reed stamping

BIB - Bocana Incised Bichrome
LPR - Las Palmas Red-on-Beige
MI - Mojica Impressed: Mojica Variety
MI:L - Mojica Impressed: Laguna Variety
HZP - Huila Zoned-Punctate
TAM - Tamino Incised
ERB - Espinoza Red-Banded
CBR - Charco Black-on-Red
GI - Guinea Incised
TRI - General trichrome
LHB - Los Hermanos Beige

Table 5.1: Tronadora and Arenal Phase type categories in volcanic strata at Tronadora Vieja.

"30" (9 lots) representing the uppermost culture-bearing stratum; "50" (6 lots), representing Unit 50; "50a" (13 lots), representing material from 0-10 cm below Unit 50; "50ab" (4 lots), from 0-40 cm below Unit 50 (overlaps "50b"); "50b" (8 lots) from 10-20 cm below Unit 50; "50c" (8 lots) representing 20-30 cm below Unit 50; "50cd" (14 lots), overlapping the previous level and representing 20-40 cm below Unit 50; "54/55" (12 lots), representing the strata immediately above Unit 60; "60" (22 lots), representing Unit 60; "60/61", including lots from both of these units; "61" (14 lots) representing the Unit 61 tephra; "64" (14 lots), representing material from the soil overlying Aguacate; and "65" (4 lots), representing the uppermost portion of Aguagate. The upper half of the table shows the number of sherds in each category, and the bottom half show the number of sherds in each category as a percentage of the total diagnostic sherds in each stratum.

As can be seen, a high degree of mixing is evident, especially with regard to sherds identified as Tronadora Phase type categories. Almost equal proportions of sherds from the two phases are found in strata between "50b" and "54/55," indicating heavy mixing between deposits of the two phases throughout most of the "Upper 50's" strata. Some of the Tronadora types appear with equal or greater frequency in the upper levels of the site than Arenal Phase types. General groove-incised sherds, Tronadora Incised, and Tonjibe Beige are especially noteworthy in this regard. Mixing in the first category can be explained by the probable inclusion of sherds of both Tronadora Phase types, Bocana Incised Bichrome, and transitional forms in this classification. The appearance of Tronadora Phase sherds in the upper levels can also be explained by the fact that the total numbers of sherds in Tronadora type categories were in general much greater than those for Arenal types at the site, and therefore a larger number of Tronadora Phase sherds were available to be mixed. Arenal Phase types, on the other hand, appear very infrequently in levels below Unit 54/55. The ceramics which do, the Los Hermanos and Espinoza varieties of Los Hermanos Beige, are both more abundant than other Arenal Phase types in the assemblage.

Despite the mixing of Tronadora Phase types in the upper strata and the relatively low numbers of Arenal Phase sherds in the assemblage as a whole, the association of Tronadora sherds with Unit 60 and below and the association of Arenal sherds with overlying strata is clear. In each of Units 60 (123 sherds), 61 (82 sherds), and 64 (50 sherds), over 80% of the assemblage consisted of Tronadora Phase categories. The "purest" ceramic assemblage came from the Unit 61 tephra stratum, in which 96% (79 out of 82) of all diagnostic sherds belonged to Tronadora categories.

Frequency trends ("battleships") between successive stratigraphic deposits are not so easy to detect. Most of the Tronadora Phase categories show an increase from the upper to the lower strata, and the relative proportions of most "peaked" in Unit 61. Two notable exceptions are Tronadora Incised, which appears in a greater proportion (13 out of 123 sherds, or 11%) in Unit 60, and Tigra Grooved-Punctate, which appears in a higher proportion (5/50 or 10%) in Unit 64. Tronadora Incised, which also appears with some frequency in strata above Unit 60, may have a later distribution within the Tronadora Phase than does Tigra Grooved-Punctate. Within the Arenal Phase, trends are equally difficult to discern. Bocana Incised Bichrome may have increased in proportion within the assemblages, climbing from 2% (3/123 sherds) in Unit 60 to 7% (2/21) in "50b," but this interpretation is badly weakened by the small samples of this type in both levels. Charco Black-on-Red peaks later, as would be expected, first appearing as from 8% (3/38) of the assemblage in Unit "50cd" and increasing to 16% (3/19) in "50a." However, other types show a completely unanticipated distribution. For example, Los Hermanos Beige: Los Hermanos Variety, the most common ceramic type at the Late Arenal Phase site of Sitio Bolívar, has its greatest distribution in the lower half of the "50's" strata but also appears in the "60's" levels.

Given the very small sample and the high degree of mixing, it is very difficult to judge the validity of observations of stratigraphic trends. The 10 cm level immediately below Unit 50 contained equal amounts of Tonjibe

Beige and Charco Black-on-Red in a sample of 19 sherds. Similarly, equal amounts of Los Hermanos Beige: Los Hermanos Var. and Tigra Grooved Punctate appear in a sample of 50 sherds from Unit 64, the lowest occupational stratum at the site. For this reason, the chronological placement of sherds with what have been identified as Tronadora Phase characteristics is based on absolute dating, interregional comparisons, stylistic seriation, and general trends in the overall assemblage, rather than the stratigraphic correlations of specific types at Tronadora Vieja.

Not included in the first table are lots and stratigraphic designations which either do not contain enough material as individual strata to show a significant pattern or do not represent "tight" stratigraphic proveniences. These have been grouped in the second table as "All 50's" (76 lots) and "All 60's" (59 lots), which together represent 87% of all lots found to contain ceramics diagnostic as to type category. These combinations, which yielded somewhat larger samples from the larger stratigraphic groupings, show most of the same trends noted above. Although the sample is small, all of the type categories for the Tronadora Phase appear as larger proportions of the assemblage in the "60's" strata. Similarly, all of the Arenal Phase categories are found in larger proportions in the "50's" grouping. As a group, 73% of the Tronadora Phase sample of 371 sherds from these strata were found in

Unit 60 or below. Of the Arenal Phase sample of 159 sherds, 76% came from the strata above Unit 60.

Given the high degree of vertical mixing which occurred at the site, and assuming that the two phases pertain to occupations corresponding to "60's" and "50's" strata at the site, an examination of the various components as they appeared in operations spread horizontally across the site was attempted with the goal of demonstrating variation in activity areas. However, the distribution of both Tronadora and Arenal Phases and associated types across the operations at the site was relatively even. The relative proportion of Tronadora Phase type categories to those of the Arenal Phase in the assemblage of 684 diagnostic sherds from the site was 69% Tronadora to 31% Arenal (Fig 5.1). While greater variation in these proportions appeared in operations which yielded small samples (fewer than 20 sherds), a 70/30 ratio was echoed in Operations I, L, H, and V, which yielded relatively large ceramic samples of 56, 60, 91, and 117 diagnostic sherds. A notable exception to this pattern was Operation W, in which the remains of two Tronadora Phase habitations were noted. The ratio of Tronadora to Arenal sherds in this operation (in a sample of 79 diagnostic sherds) was 89% to 11%, and all but four sherds in Arenal Phase categories from this operation were situated in strata above Unit 60. The Tronadora Phase assemblage from this operation, most of which was associated with structural remains and household debris in Units 60, 61, and 64, therefore shows the least amount of mixing of any operation. Although an Arenal Phase burial was noted in this operation, the ceramic assemblage associated with the feature and the living surface in which it originated was small.

As with the relative proportions of the two complexes in Operations I, L, H, and V, the proportions of individual type categories within these complexes were very similar to those noted for the site assemblage as a whole. Several small variations in the composition of Tronadora Phase assemblages between operations were noted. Tajo Gouge-Incised sherds appeared in somewhat higher proportions in Operation W than in the site assemblage as a whole. In both Operation W and L, Tigra Grooved Punctate was in higher proportions and Tonjibe Beige in lower proportions than the site average. In Operation I, Tonjibe Beige represented fully 45% of the total Tronadora assemblage. The association of the two decorated types with the house feature in Operation W suggests either that fancy pottery was a regular component of Tronadora Phase household assemblages or that the feature represented the house of a "special" personage. The appearance of a large proportion of Tonjibe Beige in Operation I, which yielded several large deposits of charred wood, supports the identification of this type as having had a culinary function.

Among the Arenal Phase types, which were in very small numbers throughout the site, few patterns in the horizontal distribution of types are apparent. Bocana Incised Bichrome appeared in the highest proportions in Operation V; Los Hermanos Beige: Espinoza Variety, Charco Black-on-Red, and Mojica Impressed in Operation W (where vessels of the latter appeared in an intrusive burial feature); and Los Hermanos Beige: Los Hermanos Var. in Operation H. However, the numbers of sherds of these types represented in the assemblages are so low as to make extended interpretations highly unreliable.

Altogether, while the Lotus 1-2-3 analysis made it possible to observe certain patterns in the ceramic assemblage, this analysis was hampered by the relatively small size of the data sample which could be analyzed. This was largely due to the nature of the site and its excavation. The low sherd density and the large numbers of lots from a wide variety of contexts created a data set of over 4000 pieces of basic information (159 lots x operation, stratum designation, and 24 type categories), each represented as a "cell" in the spreadsheet. The program's chief advantages were its ability to display data clearly in chart form and to quickly and easily group sets of data, perform multiple calculations, and produce charts of "condensed" information. Its primary disadvantage was the limitation of the number of variables which could be handled easily. Out of a total collection of 5383 sherds (including 4482 nondiagnostic body sherds), only 701 were classifiable according to all "type categories" employed in the spreadsheet analysis. While the methodology employed above served to identify general patterns at the site, it ignored all sherds which did not fall under one of the type-level categories.

Mode Level Analysis from Tronadora Vieja

As noted above, the initial data collection anticipated the application of a computer analysis which would be able to examine a more detailed set of attributes than was employed in the Lotus 1-2-3 spreadsheets. In fact, a very wide range of information was recorded for individual sherds and lots. The "type categories" utilized in the analysis discussed above each represented a collection of modes. Other modes, such as paste color or vessel part, were often important factors in classification considerations. However, these do not show up in tabulations of sherds by type. Because the resolution of the type-level analysis was not sufficient to show patterns of modal changes through the stratigraphy at Tronadora Vieja, a more fine-grained approach was adopted to see if analysis at the level of mode would throw more light on changes in ceramics through the long period of time indicated by both radiocarbon dates and comparative ceramic chronology at the site.

The idea for the modal analysis came from similar work performed by Arthur Demarest on ceramics from the site of Santa Leticia, in El Salvador (Demarest 1983), and El Mirador, in Guatemala (Demarest 1984). The basic notion was to construct a data file in which each sherd from the site was represented as a line of numerical code. In this numerical form, the data could be easily read and analyzed by software such as the SPSS-X Information Analysis System (SPSS Inc. 1986), available on the Harvard Science Center DEC VAX 11/780 computer.

A coding procedure was adopted which would allow for the tabulation of all information collected during the initial ceramic analysis. Appendix C lists the "variables," (vessel part, sherd size, surface finish, decoration type, etc.) and possible "values" (rim, body, handle, base, etc.) assigned to each as encoded in the database. In all, 32 separate variables were coded. The number of separate values available for each ranged from 5 to 50, with most having from 10 to 25 different values. Sherd coding is a laborious process, especially when numerical codes are written by hand on standardized 80-column forms, and there is a certain margin of error both in the initial coding and the transfer of data from forms to tape. In order to make the process quicker and more accurate, a simple program in BASIC was written to make use of a personal computer (Leading Edge Model "D") as an interactive coding device. Tabulated sherd descriptions were entered as selections from a "menu" of values for each variable, and the end result was a string of numerical code corresponding to the sherd's characteristics. The resulting data file contained 5383 lines with values for 29 variables, or 156,107 entries -- almost 40 times the information contained in the Lotus 1-2-3 spreadsheet, with much greater detail for each case.

The database compiled for SPSS-X analysis contained information on 100% of the ceramic assemblage collected from Tronadora Vieja, including all non-diagnostic body sherds and ceramics from both surface collections and excavations. Because the basic unit of classification used in the type-level analysis was the "type-category," a large number of sherds which could not be placed within these groups were not available for this analysis. These consisted primarily of non-diagnostic body sherds, but also included one-of-a-kind examples and unclassifiable "diagnostics" (rims, handles, supports, bases, and adornos). The SPSS-X analysis revealed 294 sherds other than undecorated body sherds which had not been included in type categories, increasing the assemblage of "diagnostic" sherds available for analysis by 48%. Using built-in software functions for sorting and dividing the database, it was possible to perform all of the same kinds of functions as those used in the spreadsheet analysis, although not with the same speed or ease. It was possible to examine the database as a whole or create subsets of the data according to virtually any criteria, with the confidence of using the maximum available data.

While the SPSS-X package includes programs which will format and graph the results of procedures, it was found to be a less "user-friendly" process than that provided by personal computer software. Ultimately, using SPSS-X routines to sort, divide, and count sherds in the database and Lotus 1-2-3 spreadsheets to produce charts, tables, and graphs of the information from SPSS-X printouts was found to be an ideal combination for both examining the data and putting it into readable forms.

The total database from Tronadora Vieja consisted of 5383 sherds. Of these, only 137 (2.5%) came from surface collections. The total sample consisted of:

4776 Body sherds (294, or 6%, of which were decorated)
433 Rim sherds
62 Body angles
38 Supports
37 Neck fragments
17 Base fragments
5 Handles
4 Shoulders, and
11 Sherds listed as "other" (including 6 sherd disks).

"Diagnostic" sherds, which consisted of all sherds containing some information as to vessel form or decoration, constituted only 17% (901 sherds) of the entire sample. "Non-diagnostic" body sherds, while of limited use for detecting stylistic change in ceramic assemblages, can throw light on household activities. In addition to variables such as paste color and surface finish, sherd size and the presence of charcoal residues were tabulated to assist with the identification of possible middens or other activity areas.

The most useful function for examining the database proved to be the "FREQUENCIES" routine, which makes it possible to sort the database according to a certain variable, break it into groups, and calculate the frequencies and numbers of any or all of the variables occuring within the subgroups. As noted above, one of the most useful ways of looking at the data from Tronadora Vieja was to combine lots which occurred within the same stratigraphic unit and examine these as assemblages. Further combination of certain stratigraphic classifications was subsequently adopted to create larger samples of sherds with stratigraphic proveniences.

Nine stratigraphic groupings (all but two of which represent natural stratigraphy) were adopted to represent the excavated assemblage from the site:

Unit	Significance	Total (Diag.)
30	Light stratum between Unit 20 and Unit 50	131 (35)
50	Black stratum noted throughout site (left intact by earthmoving)	147 (22)
50ab	Artificial level, 0-20 cm below base of Unit 50	280 (54)
50cd	Artificial level, 20-40 cm below Unit 50	394 (51)
54/55	Culture-bearing strata overlying Unit 60	526 (89)
60	Lower black stratum	1425 (167)

61	Compact, grey tephra layer	522 (76)
64	Dark soil layer overlying Aguacate	386 (80)
65	Materials embedded in the Surface of Aguacate	45 (11)
		3856 (585)

This sample represents about 70% of the total ceramic assemblage from the site. The remainder of the assemblage consists of sherds from surface collections, strata combined during excavation, materials of uncertain stratigraphic provenience, and ceramics from features whose stratigraphic origins were unclear. It is clear that even with the combination of lots from several operations, the total number of sherds diagnostic as to form or decoration from each stratum remains small. The proportion of "diagnostic" sherds in each stratum ranged from 27% in Unit 30 to 12% in Unit 60, with a site mean of 15%. Despite the care with which lots were selected for inclusion in the stratigraphic groupings, some mixing is still apparent in the assemblages.

In order to generate a modal "portrait" of each stratigraphic unit, the database was sorted according to stratum and a "FREQUENCIES" routine performed on each subgroup for a set of modal "variables". This resulted in a printout of frequencies (numbers and percentages) of "values" (individual modes) for each variable in each stratigraphic assemblage. For purposes of speed and flexibility, the SPSS-X printout data on certain modes was entered into Lotus 1-2-3 spreadsheets.

In order to identify which modes had the greatest potential for identifying patterns within the stratigraphic sequence, and in order to eliminate distributions due to chance, chi-square statistics were calculated for each modal variable to determine whether its stratigraphic frequency differed from the total distribution of the ceramic assemblage. In this test for "goodness of fit", the null hypothesis for chi-square calculations was that the distribution of a given mode through the strata was similar to the distribution of all sherds, and the significance level was alpha = 0.05 for a two-tailed (non-directional) test. Modes whose distribution invalidated this hypothesis were identified as ones whose stratigraphic position was not a chance occurrence. Because of the very small sample of modes from most strata, two sets of chi-square analyses were calculated for the data set. The first used nine probabilities, each based on the total number of sherds from each stratum. The second used only two, based on the total number of sherds above Unit 60 and those below and including this stratum. For the second set, relative percentages of sherds from the upper and lower groups were used to identify whether modes which invalidated the null hypothesis tended to be early (i.e. in 60's strata) or late.

Chi-square was also applied, although unsuccessfully, in an attempt to elicit modes which might be diagnostic of early or late facets of the Tronadora Phase. A data set consisting of sherds from only Units 60 and 61, believed to be the most representative and least contaminated of the 60's strata, revealed very few differences which could not be attributed to chance. These consisted primarily of the presence or absence of red paint on rims or appliqué, modes whose variation could very well have been due to differential preservation of sherds in the two levels.

Sherd Size

Not all variables (or modes) pertained to ceramic style. As noted above, information on sherd size, the presence of charcoal, or evidence of burning was tabulated in an attempt to identify patterns of functional or depositional differences between assemblages. Sherd size can be affected by the nature of the ceramics (strength, wall thickness, and vessel size), cultural deposition (including whole vessels as burial offerings, breakage in or around houses, and deposition in trash middens), and natural processes (chemical or mechanical erosion and redeposition by the action of water or animals).

Table 5.2 illustrates the breakdown of sherd size by stratum. The null hypothesis was invalidated for all strata, indicating that sherd sorting by size was not due to chance. For all but Unit 30, relative proportions of

	STRATIGRAPHIC UNIT										ALL STRATA							
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	ABOVE		BELOW		X2	3.8
SHERD SIZE																		
Very small					1	36				37	57.	H1	1	3%	36	97%	21.7	H1
Small	54	97	169	263	370	1136	379	237	33	2738	42.	H1	953	35%	1785	65%	1054	H1
Medium	34	25	72	84	94	172	87	89	8	665	51.	H1	309	46%	356	54%	262.	H1
Large	31	4	27	40	51	50	38	42	2	285	96.	H1	153	54%	132	46%	120.	H1
Very large	1						1			2	16.	H1	1	50%	1	50%	0.81	
SHERDS OF KNOWN SIZE	120	126	268	387	516	1394	505	368	43	3727	2.6		1417	38%	2310	62%	1428	H1
CHARCOAL AND BURNING																		
Charcoal on interior	4		17	10	7	8	11	14	1	72	51.	H1	38	53%	34	47%	30.0	H1
Charcoal on exterior					1	4	3	3		11	7.8		1	9%	10	91%	5.74	H1
Charcoal on int/ext			1	1						2	9.7		2	100%			2	
All charcoal (sum)	4		18	11	8	12	14	17	1	85	49.	H1	41	48%	44	52%	33.9	H1
Blackened interior			1	1	3	4	4	4		17	7.1		5	29%	12	71%	6.73	H1
Blackened exterior	4			3		2				9	54.	H1	7	78%	2	22%	5.72	H1
Blackened int/ext	1		1			21			1	24	31.	H1	2	8%	22	92%	12.7	H1
All blackened (sum)	5		2	4	3	27	4	4	1	50	16.	H1	14	28%	36	72%	20.0	H1
Charcoal and black	9		20	15	11	39	18	21	2	135			55		80			
Fireclouding		1		2		2		1		6	8.3		3	50%	3	50%	2.43	
TOTALS	131	147	280	394	526	1425	522	386	45	3856			1478	38%	2378	62%	1478	H1

Table 5.2: Sherd size and presence of charcoal on sherds from Tronadora Vieja.

sherds from each stratum did not vary by more than 10% from one another. Over 50% of the sherds from this stratum were either medium (5-7.5 cm) or large (7.5-12.5 cm maximum dimension), probably reflecting the thick, heavy nature of the Tilaran Phase pottery associated with this level and the fact that it represented the most recent occupation of the site. By contrast, over 80% of the sherds from Unit 60 were small (2.5-5 cm maximum dimension). This stratum was overlain by a relatively heavy occupation in the Unit 54/55 stratum, and the small sherd size may have resulted from trampling and compression of the occupational level. The fact that a higher proportion of small sherds was not found in Unit 61, a thick tephra layer, or in Unit 64, the soil layer between it and the Aguacate base (Unit 65) may support other evidence that the Tronadora Phase occupation preceded the first deposition of volcanic tephra on Aguacate. If all of the materials in Units 61 and 64 were the result of the downward transport of sherds from Unit 61, "N- and C-transform" (Schiffer 1976) processes such as root action and trampling would create the highest proportions of the smallest (and most mobile) sherds in these lower levels.

An examination of sherds by size in the four largest operations (H, I, L, V, and W) revealed practically no differences in the composition of assemblages.

Charcoal and Burning

In addition to sherd size, the presence of charcoal residues and blackening were also tabulated for the entire assemblage. Care was taken not to remove these residues during the washing and numbering of pottery. Charcoal deposits may be due to culinary activity, but similar residues can also be created by household conflagrations (accidental or intentional), the use of vessels for burning incense or other offerings, certain types of anaerobic decomposition of organic remains, and the use of large sherds in fires of wood or other materials to separate vessels during the firing process in ceramic manufacture. Unfortunately, charcoal residues are rare, extremely friable, and difficult to identify as to their source. Charred sherds were noted in association with wood charcoal in a number of contexts at the site, but nowhere were they in great concentrations. It was hoped that an examination of charred and blackened sherds by both stratum and operation would reveal patterns in the intensity or distribution of culinary or other activities. As in all analyses using numbers of sherds, a common source of error is the assumption that one sherd equals one vessel. Therefore, sherds which could be clearly identified as coming from the same vessel (through partial reconstruction) were counted together.

Out of the entire stratigraphic assemblage (Table 5.2), 85 sherds (2.2%) were found to have charcoal deposits and 50 (1.3%) were fire-blackened. The null hypothesis as applied to all strata was invalidated for charred and blackened sherds. Together, these appeared in the highest relative proportions in Units 30 (9 out of 131 sherds, or 7%), 50ab (20/280 or 7%), and 64 (21/386 or 5%). Specific hearths and household features were not identified in the upper two stratigraphic units, and the proportions of charred and blackened sherds in these strata may be a function of preservation. It is surprising that more of these sherds did not appear in Units 60, 61, or 64, where relatively well-preserved features were found. In terms of horizontal distribution, the largest relative number of charred and blackened sherds appeared in Operation V (5.2%), rather than in Operations H (3.5%) or W (3.2%), where the best-preserved living surfaces associated with "cooking stones" were identified. A negative association of these sherds with habitational assemblages may indicate their regular removal from household areas and disposal by burial or dumping.

Stylistic Analysis

The most important goal of the ceramic analysis at Tronadora Vieja was to elicit evidence for stylistic and/or functional change through the excavated strata at the site. The most useful modal variables for this analysis were: vessel form, rim form, incision depth and design, impressions, appliqué, red painting, and (to a much lesser extent) punctation and black painting. These were chosen both for numbers of sherds which appeared with these characteristics and the variety of expression apparent in each mode. Modal values were examined both individually and in groups (such as "all jar forms" and "all cylinders").

Changes in assemblages of formal and decorative modes through time as represented by variation in the relative proportions of each category in each stratum were expected to reflect gradual changes from Tronadora Phase forms to Arenal Phase ones through the stratigraphic column, and it was initially hoped that the fine-grained modal analysis would throw some light on stylistic change through the more than 2000 years of ceramic-using occupation of the site. As noted in the type level analysis, clear "battleship curves" corresponding to our expectations were very rare. Also, forms which were expected to have been relatively restricted in temporal distribution appeared throughout the sequence. For example, the "olla-tecomate," a form common to the early Chaparrón and La Montaña assemblages (Snarskis 1978:113) yet unknown from later Zoned Bichrome assemblages (Baudez 1967, Lange 1980), is believed to be a clear Tronadora Phase diagnostic. In our stratigraphic assemblage, olla-tecomates appear to steadily decrease in relative proportions from Unit 61 to Unit 50ab. However, they also appear in the small sample from Unit 50, and a single sherd is present in Unit 30. Both of these strata should represent periods of time well after the use of this ceramic form, but low sherd density and a high degree of mixing make this pattern difficult to justify quantitatively. It is likely that stratigraphic distributions reflect the vertical migration of cultural materials as much as they do changes in the actual assemblages. This has seriously hampered the value of our modal analysis, with small sample size and the amount of mixing evident in the stratigraphic behavior of even the most familiar modes making it apparent that only the most general trends in actual stylistic change are observable. In many cases, these were indicated by comparing grouped strata from the "50's" and "60's," as done at the type-level analysis, and observing changes in relative proportions of modes in these larger assemblages.

An additional observation apparent from the modal analysis is that Unit 64, as represented by grouped lots, may not accurately represent the first soil stratum on Aguacate. In some parts of the site, it was not overlain by the Unit 61 tephra layer, and thus was not a "sealed" stratum. This may explain the relatively high frequency of apparently later modes which appear in this stratigraphic category. The assemblage from Unit 61, which was overlain by Unit 60 in all parts of the site, is likely to have been least contaminated by later material. It probably represents the "purest" ceramic assemblage at the site with respect to the Tronadora component. Unit 60 was overlain by a relatively active occupation of the site during the deposition of Units 54/55, and may also contain later material. For this reason, the modal frequencies in Unit 61 are probably the most representative of the Tronadora Phase.

Vessel Form

385 sherds from the stratigraphic assemblage were identifiable as to vessel form, and a total of 19 different vessel form classifications were identified (Table 5.3). Of these, the largest individual category was "olla-tecomates" (108), the incurving, bolstered-rim form characteristic of the type Tonjibe Beige. The second largest category was "necked jars" (89) used to describe a vessel form common to types such as Los Hermanos Beige and Mojica Impressed. Other large categories were "general bowls" (45), "incurving-rim bowls" (27), "tripods" (20), "squat, necked jars" (19), and "cylinders" (19).

Of the forms with higher relative frequencies in the "60's" strata, believed to be representative of the Tronadora Phase assemblage, olla-tecomates, as noted above, show a gradual decrease in frequency from Unit 61 through Unit 60 and the overlying "Upper 50's" strata. True tecomates are also found in upper strata. However, they show a clear association with Unit 65, where they represent 6 out of 10 sherds identified as to vessel form. Although the data are slight, tapered-rim tecomates may be the only vessel form

65 TOTAL ALL STRATA X2 15.5 50's 60's X2 3.84

	STRATIGRAPHIC UNIT										ALL STRATA							
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	50's		60's		X2	3.84
VESSEL FORM																		
Bottle							1			1	6.38				1	100%	0.62	
Tecomate				1	1	1	2		6	11	273.	H1	2	18%	9	82%	1.88	
Olla-tecomate	1	4	2	4	13	39	28	16	1	108	25.7	H1	24	22%	84	78%	11.8	H1
Incurving-rim bowl	1	1	2	3	3	11	3	3		27	0.72		10	37%	17	63%	0.01	
Bowl (general)		1	6	3	15	11	2	6	1	45	23.0	H1	25	56%	20	44%	5.64	H1
Carinated bowl				1	1			3		5	16.4	H1	2	40%	3	60%	0.00	
Tripod	1	1	7	4	2	3		2		20	29.0	H1	15	75%	5	25%	11.3	H1
Jar (general)	8	8	13	6	21	19	3	11		89	42.7	H1	56	63%	33	37%	22.7	H1
Squat, necked jar		1	1	1	1	6	7	2		19	10.2		4	21%	15	79%	2.39	
Necked jar (small)				2				1		3	13.3		2	67%	1	33%	1.01	
Vertical-necked jar	6		1						1	8	136.	H1	7	88%	1	13%	8.18	H1
Necked storage jar	1		3	1	7	2		1		15	21.2	H1	12	80%	3	20%	11.0	H1
Outflaring-necked jar	1									1	28.4	H1	1	100%			1.60	
Composite silhouette jar								1		1	8.98				1	100%	0.62	
Calabash jar	1				1					2	16.3	H1	2	100%			3.21	
Cylinder				1	2	10	4	1	1	19	8.55		3	16%	16	84%	4.08	H1
Short cylinder							1			1	6.38				1	100%	0.62	
Tall, curved cylinder					1	2	2			5	4.54		1	20%	4	80%	0.71	
Sherd disk				1		2	2			5	5.03		1	20%	4	80%	0.71	
INCURVING BOWLS & TECOMATES	2	5	4	8	17	61	23	17	7	144	28.2	H1	36	25%	108	75%	10.8	H1
ALL JARS (minus squat ones)	17	8	17	9	29	21	3	14	1	125	82.4	H1	80	64%	39	31%	40.3	H1
SQUAT, NECKED JARS		1	1	1	1	6	7	2		19	10.2		4	21%	15	79%	2.39	
ALL CYLINDERS				1	3	14	6		1	25	13.3		4	16%	21	84%	5.27	H1
DIAGNOSTIC AS TO FORM	20	16	35	28	68	106	55	47	10	385	31.4	H1	167	43%	218	57%	4.14	H1

Table 5.3: Vessel form distribution at Tronadora Vieja.

identifiable as an Early Tronadora diagnostic. Squat, necked jars, a form associated with Tigra Grooved-Punctate, are found in their greatest proportion (13%, or 7 out of 55 sherds diagnostic as to form) in Unit 61, but are also present in small amounts in Units 50, 50ab, and 50cd. Chi-square analysis demonstrates that their distribution is within chance expectations. Incurving-rim bowls, most frequently represented by the type Tronadora Incised, are found to have a chance distribution through all strata, as are all types of cylindrical vessels. However, when examined according to general distributions above and below Unit 60, cylinders as a group show a strong association with the "60's" strata, where 84% (16 out of 19) of the sherds of this type were found.

Necked jars other than the squat form are not randomly distributed through the strata. As a group, they appear with greater frequency (64%, or 80 out of 125) in strata above Unit 60. The "vertical necked" type has a strong association with Unit 30, and it is also a Tilaran Phase diagnostic. Necked jars are also one of the few vessel shapes to show a clear increase in frequency from Unit 61, where they constitute only 5% (3 out of 55 sherds) of all forms, to Unit 30, where they represent 85% (17 out of 20). However, this distribution is colored by the fact that necked jars constitute 30% of vessel forms in Unit 64, and a single sherd from one was found in Unit 65. Given the prevalence of this form in all Arenal Phase assemblages, it is likely that it had antecedents in the Tronadora Phase. The great discrepancy between its prevalence in Unit 64 and scarcity in Unit 61 may indicate that some lots from the former, especially from parts of the site where Unit 61 was patchy or absent, do not actually correspond to this early soil level.

Bowls were defined in this assemblage as vessels with a maximum diameter at the rim (forms such as large-mouthed jars, plates, and budares were not identified). Examples other than incurving-rim bowls showed a non-random distribution, with a stronger correlation with 50's than 60's strata. They constitute only 4% (2 out of 55 sherds) of the vessel forms in Unit 61. However, nine (19% of 47) were found in Unit 64 and one (out of 10) in Unit 65. Tripod vessels, defined by the presence of supports, were completely absent from Unit 61 and uncommon in Units 60 (3%, or 3 out of 106 sherds diagnostic as to form) and 64 (4%, or 2 out of 47). These appeared with greater frequency in all 50's strata.

The distribution of 222 rim sherds indicates a few general trends as well (Table 5.4). Exterior bolstered rims, of course, show a distribution identical to that of olla-tecomates. The only two examples of tapered, direct rims (both from tecomates) appeared in Unit 65. Rounded, exterior-thickened rims, which were usually associated with necked jars, were found in the greatest frequencies in the 50's strata, although they constituted 5%-9% of the rim

	STRATIGRAPHIC UNIT										ALL STRATA							
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	ABOVE		BELOW		X2	3.84
RIM FORM																		
Direct		1	1	4	2	2		5		15	17.4	H1	8	53%	7	47%	1.42	
Rounded direct		1	1		1	8	3	1		15	4.79		3	20%	12	80%	2.13	
Flattened direct			1	1						2	9.77		2	100%			3.21	
Tapered direct									2	2	169.	H1			2	100%	1.24	
Interior thickened							1			1	6.38				1	100%	0.62	
Rounded interior thickened	1		1	2	1		1	2		8	9.12		5	63%	3	38%	1.97	
Rounded exterior thickened	1	3	4		10	6	2	3		29	20.5	H1	18	62%	11	38%	6.91	H1
Exterior thickened				1		2	1	2		6	5.32		1	17%	5	83%	1.19	
Exterior bolstered	1	4	3	5	13	39	28	16		109	24.2	H1	26	24%	83	76%	9.66	H1
Flattened				1		2	4			7	12.8		1	14%	6	86%	1.71	
Flattened exterior thickened					1	3	3	2		9	6.34		1	11%	8	89%	2.82	
Outcurving	1									1	28.4	H1	1	100%			1.60	
Outflaring direct	1	1		1	1	2				6	7.93		4	67%	2	33%	2.03	
Outflaring tapered								1		1	8.98				1	100%	0.62	
Direct vertical	1					1				2	14.0		1	50%	1	50%	0.11	
Triangular cross-section								1		1	8.98				1	100%	0.62	
Everted	6									6	170.	H1	6	100%			9.65	H1
Flat everted					1					1	6.33		1	100%			1.60	
Folded						1				1	1.70				1	100%	0.62	
DIAGNOSTIC AS TO RIM FORM	12	10	11	15	30	66	43	33	2	222	21.2	H1	78	35%	144	65%	0.95	

Table 5.4: Rim form distribution at Tronadora Vieja.

forms in Units 60, 61, and 64 (in samples of 66, 43, and 33 sherds diagnostic as to rim form, respectively). Everted rims, characteristic of Tilarán Phase vessels, appeared exclusively in Unit 30.

Vessel supports as a group showed a greater association with the strata above Unit 60. The total sample of vessel supports from the site was low, and most support modes show a distribution attributable to chance. While no solid supports appeared in Unit 61, two each out of the five from the stratigraphic assemblage came from Units 60 and 64.

Decoration

A total of 285 sherds, or almost half of all "diagnostic" sherds from the stratigraphic assemblage, were found to have been decorated with some form of red painting (Table 5.5). In the assemblage as a whole, the presence of red paint does not appear to have changed over time. The most common use of red paint was on vessel rims, and this was the primary use of red pigment on over 50% of all rims. Extending the red zone from the lip to the interior of the vessel, however, appears to have a stronger association with strata above Unit 60, and is probably a clear Arenal Phase trait. Linear decoration, whether with narrow or wide strokes, is rare in Unit 61 and increases in frequency through the upper strata. A single sherd with wide vertical decoration was noted in Unit 65. Incised zones of red paint were another common decoration, and appeared in

	STRATIGRAPHIC UNIT										ALL STRATA							
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	ABOVE		BELOW		X2	3.84
RED PAINTED DESIGN																		
Present	4	1	6	5	7	9	3	5		40	13.3		23	58%	17	43%	6.21	H1
On interior				1		2				3	3.87		1	33%	2	67%	0.03	
On interior and exterior					1					1	6.33		1	100%			1.60	
Linear		1	1	2	2	5				11	5.01		6	55%	5	45%	1.22	
Wide horizontal					1		1	1		3	5.23		1	33%	2	67%	0.03	
Narrow horizontal			1							1	12.7		1	100%			1.60	
Wide vertical		1	2	1	2	1		1	1	9	15.3		6	67%	3	33%	3.05	
Wide vertical and horizontal					1					1	6.33		1	100%			1.60	
Incised zoning		1		7	7	24	7	10		56	11.5		15	27%	41	73%	3.15	
On applique							1	3		4	20.3	H1			4	100%	2.48	
Red on strip applique			1	1	1	14	1			18	13.5		3	17%	15	83%	3.57	
Splotchy			2	1	2	4	1	1		11	3.07		5	45%	6	55%	0.23	
Slip on lip	4	9			23	24	30	18	2	110	55.9	H1	36	33%	74	67%	1.46	
Slip on lip and interior			3	1	5	3	1	1		14	11.6		9	64%	5	36%	3.99	H1
Interior and exterior rim								2		2	17.9	H1			2	100%	1.24	
Interior rim only								1		1	8.98				1	100%	0.62	
SHERDS WITH RED PAINT	8	13	16	19	52	86	45	43	3									
BLACK PAINTING																		
Present						1				1	1.70				1	100%	0.62	
Linear		1								1	25.2	H1	1	100%			1.60	
Narrow horizontal		1			1					2	14.7		2	100%			3.21	
Wide horizontal		1	1			1				3	11.2		2	67%	1	33%	1.01	
Wide vertical				2	1					3	12.4		3	100%			4.82	H1
Narrow vertical and horizontal				1						1	8.78		1	100%			1.60	
Incised zoning								1		1	8.98				1	100%	0.62	
SHERDS WITH BLACK PAINT		3	1	3	2	2		1		12	20.3	H1	9	75%	3	25%	6.82	H1

Table 5.5: Painted design distribution at Tronadora Vieja.

relatively high proportions in strata 64 through 50cd, with the highest frequency of this mode in the latter (37%, or 7 out of 19 sherds).

Incision (Table 5.6) was second to the use of red paint as a decorative mode at the site, and was present on 24% of the "diagnostics" from 50's strata (or 52 out of 216 sherds) and 37% from 60's strata (or 123 out of 334 sherds). Round-bottomed groove-incision was by far the most common expression of this mode, and 80% (or 142 out of 177) of the incised sherds were of this type. Because of this, incision depth was a poor modal diagnostic to examine. Through all strata, the distribution of incision does not vary from what would be expected by chance. However, groove-incision does appear to have a somewhat higher frequency in the 60's strata. Incision design, on the other hand, is believed to have had more temporal significance. The ratio of horizontal to vertical incisions in Unit 61 is 86% to 4% (or 18 and 3 sherds, respectively), and 80% to 15% (or 74 and 14 sherds) for all 60's strata combined. However, for the 50's strata it declines to a ratio of 58% to 20% (18 and 7 sherds). Horizontal incision in general is not randomly distributed through the stratigraphy, and shows a higher correlation with Unit 60 and below. Horizontal zoning has a chance distribution through all strata, but is more strongly associated with the 60's strata when a two-part division of the stratigraphy is examined. The small numbers of incised sherds do

	STRATIGRAPHIC UNIT										ALL STRATA							
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	ABOVE		BELOW		X2	3.84
INCISION DEPTH																		
Wide grooving				2	3	5	4	3		17	5.40		5	29%	12	71%	0.57	
Groove-incision	1	1	8	15	17	56	23	19	2	142	10.1		42	30%	100	70%	4.60	H1
Gouge-incision				1	1	3	1			6	2.14		2	33%	4	67%	0.06	
Pre-firing incision	1					1		1		3	11.0		1	33%	2	67%	0.03	
Fine, pre-firing incision			1			4				5	6.41		1	20%	4	80%	0.71	
Fine, post-firing incision				1						1	8.78		1	100%			1.60	
Stick burnishing			1		1	1				3	4.93		2	67%	1	33%	1.01	
MODAL DIAGNOSTICS	2	1	10	19	22	70	28	23	2	177	11.0		54	31%	123	69%	4.58	H1
INCISION DESIGN																		
Horizontal				1	1	5	9	7		23	27.9	H1	2	9%	21	91%	8.54	H1
Single horizontal						1		1	2	4	84.8	H1			4	100%	2.48	
Multiple horizontal			2	2	5	16	4	2		31	5.39		9	29%	22	71%	1.13	
Horizontal zoning				3	1	10	2	7		23	15.4		4	17%	19	83%	4.26	H1
Vertical			1		1	3				5	4.09		2	40%	3	60%	0.00	
Single vertical					1	1				2	3.01		1	50%	1	50%	0.11	
Multiple vertical				1	2	1				4	6.45		3	75%	1	25%	2.27	
Horizontal and vertical			1			4	3			8	7.44		1	13%	7	88%	2.25	
Horiz. and vert. infilled						1				1	1.70				1	100%	0.62	
Horizontal and oblique				1	1					2	6.55		2	100%			3.21	
Oblique					1					1	6.33		1	100%			1.60	
Vertical, oblique, and circles								1		1	8.98				1	100%	0.62	
General zoning			1	1	2	2				6	4.61		4	67%	2	33%	2.03	
Geometric		1				1				2	12.4		1	50%	1	50%	0.11	
Geometric freize	1									1	28.4	H1	1	100%			1.60	
Oblique with ocher						2	1			3	3.07				3	100%	1.86	
Geometric with ocher				1		1		1		3	4.49		1	33%	2	67%	0.03	
Spiral with ocher							1			1	6.38				1	100%	0.62	
Crosshatch with ocher						1				1	1.70				1	100%	0.62	
Parallel lines	1						1			2	16.4	H1	1	50%	1	50%	0.11	
Striations						1				1	1.70				1	100%	0.62	
ALL HORIZONTAL			3	7	8	37	18	17	2	92	21.0	H1	18	20%	74	80%	13.7	H1
ALL VERTICAL			2	1	4	10	3	1		21	4.20		7	33%	14	67%	0.22	
ALL OBLIQUE			2	1	4	12	4	1		24	5.16		7	29%	17	71%	0.85	
ALL WITH OCHER				1		4	2	1		8	3.57		1	13%	7	88%	2.25	
MODAL DIAGNOSTICS	2	1	5	10	15	50	21	19	2	125	11.7		33	26%	92	74%	7.52	H1

Table 5.6: Incision distribution at Tronadora Vieja.

not help with the identification of a pattern, and except for the examples noted above, all modes of incision design are distributed through the strata in a manner not in disagreement with the assumption of random distribution (the chi-square null hypothesis). However, as is noted in the type descriptions of Tronadora Incised and Bocana Incised Bichrome, the use of vertical incision is believed to increase from the Tronadora to the Arenal Phases. Oblique incisions are also found with greater frequency in the 50's than the 60's strata. All types of incisions infilled with red ocher, although too rare in our assemblage to discern a pattern in their distribution, may correspond to Snarskis' "Atlantic Red-Filled Black" group, also noted to be rare in both La Montaña and Chaparrón complexes. Snarskis finds comparisons between this group and Middle Preclassic ceramics from coastal Guatemala (1978:115-116). This mode is unknown in later assemblages from Costa Rica.

Sherds with impressions (62), punctations (48), and appliqué decoration (26) were less common in the stratigraphic assemblage (Table 5.7). The most common types of impressed decoration were single-stroke, shell-edge stamping and shell-edge rocker-stamping. Both of these had a high correlation with 60's strata as a group, although their distribution through the individual strata was not beyond the realm of chance. Shell-edge rocker-stamping, as well as "light" (instument unknown), reed-

	STRATIGRAPHIC UNIT										ALL STRATA					
	30	50	50ab	50cd	54/55	60	61	64	65	TOTAL	X2	15.5	ABOVE	BELOW	X2	3.84
IMPRESSIONS																
Fingernail			2			1				3	16.2	H1	2 67%	1 33%	1.01	
1-row fingernail				1	2					3	10.0		3 100%		4.82	H1
Shell-stamped			1	2		10	3	4		20	7.49		3 15%	17 85%	4.60	H1
Rocker stamped						2	1			3	3.07			3 100%	1.86	
2-row triangle					1	1				2	3.01		1 50%	1 50%	0.11	
Multiple-row triangle																
General zoned			1	1				1		3	8.18		2 67%	1 33%	1.01	
General stamped					2	1				3	7.67		2 67%	1 33%	1.01	
Mojica: Mojica		1			5					6	28.9	H1	6 100%		9.65	H1
Light						3	2		2	7	49.6	H1		7 100%	4.35	H1
Tiny				2	2	1	1			6	7.09		4 67%	2 33%	2.03	
Reed stamped						2	2			4	6.09			4 100%	2.48	
V-shaped					1					1	6.33		1 100%		1.60	
Vertical ticks with ocher						1				1	1.70			1 100%	0.62	
SHERDS WITH IMPRESSIONS		1	4	6	13	22	9	5	2	62	7.97		24 39%	38 61%	0.00	
PUNCTATION																
Horizontal			1	3	1	3	1	3		12	7.23		5 42%	7 58%	0.05	
1-row horizontal					2	2				4	6.03		2 50%	2 50%	0.23	
2-row horizontal						1				1	1.70			1 100%	0.62	
Multiple horizontal				1	1	2	1	2		7	3.75		2 29%	5 71%	0.28	
General zoned			1		1	2	1	1		6	2.21		2 33%	4 67%	0.06	
Large zoned					1	1	1			3	2.80		1 33%	2 67%	0.03	
Fine zoned			1			1		1		3	5.82		1 33%	2 67%	0.03	
Fine vertical								1		1	8.98			1 100%	0.62	
Heavy					1	2	2			5	4.54		1 20%	4 80%	0.71	
Fine				1	1	1		1		4	3.45		2 50%	2 50%	0.23	
Fine with ocher						1				1	1.70			1 100%	0.62	
Punctate applique							1			1	6.38			1 100%	0.62	
ALL HORIZONTAL			1	4	4	8	2	5		24	6.83		9 38%	15 63%	0.00	
ALL ZONED			2		2	4	2	2		12	4.43		4 33%	8 67%	0.12	
SHERDS WITH PUNCTATION			3	5	8	16	7	9		48	8.28		16 33%	32 67%	0.50	
APPLIQUE																
Present		1								1	25.2	H1	1 100%		1.60	
Strip	1	1	2	1		10	1	3		19	6.70		5 26%	14 74%	1.16	
Strip with grooving					2	2	1			5	4.50		2 40%	3 60%	0.00	
Anthropomorphic on body							1			1	6.38			1 100%	0.62	
Pellet				1		2	1			4	2.99		1 25%	3 75%	0.30	
Vertical ribbing						1				1	1.70			1 100%	0.62	
Linear strips						1				1	1.70			1 100%	0.62	
Curvilinear strips						1				1	1.70			1 100%	0.62	
ALL STRIP APPLIQUE	1	1	2	1	2	14	2	3		26	4.75		7 27%	19 73%	1.43	
SHERDS WITH APPLIQUE	1	2	2	2	2	17	4	3		33	4.81		9 27%	24 73%	1.70	

Table 5.7: Impressions, punctation and applique distribution at Tronadora Vieja.

stamped sherds, and tiny, vertical tick-marks infilled with red ocher appeared exclusively in Units 60 through 65. On the other hand, single-row fingernail stamping and the type of shell impressions found on Mojica Impressed: Mojica Variety, appeared more frequently in 50's strata. Other modes were too rare to discern a clear pattern.

On half (24) of the of sherds with punctate decoration, the punctations appeared in single, double, or multiple horizontal rows. However, because of the small sample size, it was impossible to say whether any of these patterns have a temporal distinction. Half of the remaining sherds (12) had punctation zoned with incision, and these appear in equal proportions in both 50's and 60's strata.

The most common type of appliqué decoration was the "strip" appliqué associated with gouging and grooving in the type Tajo Gouge-Incised. The sample of these sherds (26) was small, and examples were found in all nine strata. While the largest sample of these sherds (14) came from Unit 60, the relative frequencies of all strip appliqué were inconclusive, and their distribution conformed to the null hypothesis. Strip appliqué was the only type of appliqué decoration present in the assemblages from Units 30, 50ab, and 54/55. However, when all sherds with strip appliqué are looked at as proportions of the diagnostic assemblage as a whole, they are found with more than twice the frequency in the 60's strata (5.7%, or 19 out of 334) as they are in the 50's strata (2.8%, or 6 out of 216). No decoration of this type has yet been reported from other assemblages in Costa Rica. However, it is probably diagnostic of the Tronadora Phase. The only other important mode of appliqué decoration noted was pellet appliqué, of which four examples appeared in the stratigraphic assemblage. Pellet appliqué is a common decorative technique on the "El Bosque Red on Buff Group" of the El Bosque Phase (AD 0-500) in the Atlantic Watershed region (Snarskis 1978:144). Of the examples at Tronadora Vieja, one appeared in Unit 50cd, two in Unit 60, and one in Unit 61. Their presence is not great enough to be interpreted as chronologically significant.

Multivariate Statistical Analysis

While it was initially hoped that a detailed statistical analysis could be used to elicit patterns of the co-occurrence of modes of form, decoration, and stratigraphic position, a preliminary analysis of the data set revealed that while there were certain clear benefits to objectively-established categories, the relative strengths of these categories for analysis would be seriously hampered by the nature of the sample. In theory, the "stongest" and most valid associations would be those where a number of sherds came from an identical context. However, the co-occurrence of large numbers of diagnostic sherds was rare, and the creation of stratigraphic "contexts" of adequate size required the grouping of a large number of lots from different parts of the site. As noted above, even the analysis at the level of types suggests a high degree of mixing of deposits.

The ceramic sample was relatively small, and consisted of a large number of units, each with only a small number of examples of each variable, making the application of complex techniques such as cluster analysis and factor analysis (Cowgill 1968), and discriminant analysis of questionable value. Cluster analysis is useful when one wants to identify which variables "cluster" in a given population according to a set of variables, and makes use of matrices which indicate the "proximity" of sets of variables. Its application consists of the construction of a dendrogram of clusters linked on the basis of similarity coefficients between pairs of variables. Given modal tabulations, cluster analysis might prove useful in providing objective support to the definition of individual types or groups, or in identifying sets of regularly occurring types among the assemblages. However, identifying which modes frequently "went together" in individual sherds was not a real problem, and the existence of stratigraphic information and comparative assemblages for both Tronadora (i.e. Chaparrón and La Montaña) and Arenal (i.e. Río Tempisque) ceramics meant that extensive analysis to figure out how to separate the two was unnecessary. Furthermore, given both the nature of the strata (discussed in the section on excavations at the site) and the degree of mixing apparent in Units 64, 61, and 60, it was felt that the validity of clusters of modes associated with each of the three units would demonstrate little in terms of ceramic change through the Tronadora Phase. The two "best" and most clearly separated Tronadora Phase assemblages come from apparent living surfaces at the Unit 60/61 and Unit 61/64 interfaces in Operation W. However, even these two do not differ markedly in terms of ceramics.

The single largest problem with the assemblage from Tronadora Vieja is the small number of cases counted for significant variables, even when lots are grouped together by stratum. Cowgill (1970) has pointed out that, when working with small samples, significant problems in correlation analysis are caused by "the attenuation problem", or the total absence of categories from assemblages. When working with small samples, the absence of any examples from a particular category is not a reliable indicator of its presence in the population. Cowgill suggests that in correlation analysis, "mean counts for each category had better be over about 10," or else one has to estimate corrections for reliability (1970:170), therefore diminishing the objectivity of the analysis. Counts this high for the truly interesting variables (vessel form and decoration) were rare in our data set.

Factor analysis, a somewhat more complicated procedure, essentially summarizes a matrix of correlation coefficients. Given the problems mentioned above, the nature of the data would also lead to a number of problems in the interpretation of the results of this procedure.

Discriminant analysis, whose purpose is to find a set of variables which allows one to "discriminate" between groups, requires the definition of either a known set of variables or a group for which variables identifying membership have already been clearly identified. For example, given "typical" Tronadora or Arenal Phase assemblages, discriminant analysis would help to predict to which assemblage a given lot might belong. Given comparable modal information from assemblages from sites contemporaneous with the occupations at Tronadora Vieja, this type of analysis might prove to be a useful tool in justifying claims of similarity between assemblages. Alternatively, given a particularly rich and well-provenienced deposit of Tronadora Phase ceramics, discriminant analysis would be useful in determining the degree of similarity between this and poorly provenienced deposits. However, it has few practical applications to the interpretation of the small assemblages obtained from specific contexts within Tronadora Vieja.

Archaeologists who have worked extensively with statistical analyses (Cowgill 1968, Thomas 1978) have pointed out that knowing when to avoid lengthy and complicated procedures is at least as important as knowing when to apply them. Because many of the patterns which were relevant to cultural interpretation appeared in general frequency distributions and cross-tabulations of selected variables, and could be tested with a relatively simple chi-square procedure, the wisdom of applying complex multi-variate statistics to the database was carefully considered. The vast majority of corresponding modes were evident in the classification and description of ceramic types, and understanding of them would not have improved as a result of "number-crunching". Elaborate analyses would have served little purpose other than to dress up arguments in fancy garments of quantitative reasoning. Whether this methodology would have made them more convincing is doubtful. Given a high cost/benefit ratio and a low probability of elucidating further information on stylistic change, stratigraphic correlations, or cultural associations, I decided not to pursue a more complex analysis of the ceramic assemblage from Tronadora Vieja.

Analysis of Ceramics from Sitio Bolívar

Excavations at Sitio Bolívar did not reveal either the multiple stratigraphic associations or the temporal depth of occupation found at Tronadora Vieja. In fact, the nature of sample size and stratigraphic associations at the former site was almost in diametric opposition to those of the latter. Whereas the chief problem with the analysis of ceramics from Tronadora Vieja was the very small number of "diagnostic" ceramics in lots of known stratigraphic provenience, the major problem encountered at Sitio Bolívar was the sheer volume of the ceramics associated with excavated features. The vast majority of this assemblage appears to have been deposited during a relatively short period of time, and was therefore confined to a small part of the stratigraphic column. The precise identity of the volcanic tephra unit or developed soils associated with the activity at Sitio Bolívar is not completely clear. However, it appears to have occurred on top of Unit 54, probably around the time of deposition of Unit 52 or 53.

While the assemblage of ceramics analyzed from Tronadora Vieja represents a 100% collection from all operations and was pursued to the level of individual modes of form and decoration, the analysis from Sitio Bolívar was confined primarily to the level of types. This was done primarily because the majority (87%) of "diagnostic" sherds from the site could be readily classified as in types previously defined for inland Guanacaste (Baudez 1967). A 100% collection was made during the excavation of Operation B in order to determine whether the sherd deposit represented an assemblage of vessels smashed _in situ_ or post-breakage deposition. Extensive attempts at matching rims and refitting sherds led us to the conclusion that the first hypothesis was unlikely. While the same hypotheses presented themselves for the assemblage from Operation E, the sheer volume of sherds recovered made it impractical to attempt to process a 100% collection from this operation in the field laboratory. For this reason, only "diagnostics" were collected, and a determination of numbers of vessels was based solely on the classification and correspondence of rim sherds, supports, and other decorated sherds.

Altogether, a total of 6675 "diagnostic" sherds were recovered from surface collection and excavations at Sitio Bolívar. Of these, 723 (11%) came from the lake-shore, 2380 (37%) came from Operation B, and 3057 (46%) came from Operation E. The remainder were divided almost equally between Operations C, with 226 (3%), and D, with 289 (4%).

The type-level analysis of ceramics from Sitio Bolívar paralleled that from Tronadora Vieja, and was conducted exclusively on personal computers using the Lotus 1-2-3 program. All of the abovementioned "type categories" for the Arenal Phase were utilized with the exception of Bocana Incised Bichrome. This Early Arenal type, present at Tronadora Vieja, was absent from all assemblages at Sitio Bolívar. Only 46 sherds from the total assemblage at the site were attributed to phases other than Arenal. All but three of these came from surface collections on the lakeshore, and included 27 sherds identified as Silencio Phase types, 13 Tilarán Phase, and six Tronadora Phase.

Operations C and D, placed on the ridgetop and near the lakeshore respectively, were intended to clarify stratigraphic relationships and sample areas which had not been disturbed by mortuary activity. In both of these operations, sherd density was first noted in Unit 50, and cultural material was found in diminishing quantities down to the surface of Aguacate. However, the ceramic assemblages from these operations show little change in composition through the stratigraphic column, and in fact are very similar to the large assemblages associated with features in Operations B and E. Although the pottery from these operations was not found in association with discernable living surfaces, it appears to represent the same time period as other major activity at the site. The uniformity of types represented in these areas where no distinct features were evident suggests that the range of ceramic forms and decoration did not vary much within the site.

The ceramic assemblage from surface collections and shallow excavations on the lakeshore is remarkably similar to that noted in association with the features in Operations B and E (Table 5.8). Because of the nature of features in the two portions of the site -- habitational features on the lakeshore and mortuary features on the ridgetop -- it was initially expected that there would be a noticeable difference in ceramic assemblages. The anticipated distinction was that primarily undecorated, monochrome ceramics would be associated with everyday acti-

SITE OP/	ARENAL PHASE																					
	LPR	MI	HZP	TAM	ERB	CBR	MI:A	MI:C	MI:L	CON	GI	ZB	ZT	CIP	AFP	LP	TRI	CAR	RED	LHB	UNKN	TOTALS
G-164 A	11	22			11	42	20	31	2	4	8	4		20	2	4		1	15	397	34	723
G-164 B	15	1		2	147	220	74	121	3	44	60	13		47	1		6	4	77	1253	145	2380
G-164 C	1				10	24	9	13		5	6			4			1		5	121	11	226
G-164 D	5				17	28	15	18		4	7			1					13	144	16	289
G-164 E	4	1	3		77	134	69	116		27	91	15	2	79	1		7		81	1934	163	3057
79 LOTS	36	24	3	2	262	448	187	299	5	84	172	32	2	151	4	4	14	5	191	3849	369	6675
G-164 A	2%	3%			2%	6%	3%	4%	0%	1%	1%	1%		3%	0%	1%		0%	2%	55%	5%	723
G-164 B	1%	0%		0%	6%	9%	3%	5%	0%	2%	3%	1%		2%	0%		0%	0%	3%	53%	6%	2380
G-164 C	0%				4%	11%	4%	6%		2%	3%			2%			0%		2%	54%	5%	226
G-164 D	2%				6%	10%	5%	6%		1%	2%			0%					4%	50%	6%	289
G-164 E	0%	0%	0%		3%	4%	2%	4%		1%	3%	0%	0%	3%	0%		0%		3%	63%	5%	3057
	1%	0%	0%	0%	4%	7%	3%	4%	0%	1%	3%	0%	0%	2%	0%	0%	0%	0%	3%	58%	6%	

KEY TO TYPES:

LPR - Las Palmas Red-on-Beige
MI - Mojica Impressed: Mojica Variety
MI:L - Mojica Impressed: Laguna Variety
HZP - Huila Zoned Punctate
TAM - Tamino Incised
ERB - Espinoza Red-Banded
CBR - Charco Black-on-Red
MI:A - Mojica Impressed: Arrastrada Variety
MI:C - Mojica Impressed: Corrida Variety

CON - Mojica Impressed: Congo Variety
GI - Guinea Incised
ZB - Zelaya Bichrome
ZT - Zelaya Trichrome
CIP - Los Hermanos Beige: Cervantes Variety
TRI - Unnamed trichrome
CAR - Carillo Polychrome
RED - Red monochrome
LHB - Los Hermanos Beige

Table 5.8: Arenal Phase ceramic distribution at Sitio Bolivar.

vities and decorated types would be more frequently deposited on burials. It was also thought that there would be differences in the assemblages from Operation B, where a sherd midden was deposited directly on top of small, simple burial pits, and Operation E, where sherds were deposited directly on large stone mortuary features. However, these distinctions were not borne out by the composition of the various assemblages.

Table 5.8 illustrates the assemblages from the lakeshore collection and the four operations. In terms of relative percentages, the representation of each type is fairly uniform throughout. Only a few types vary by more than a few percentage points between assemblages. Contrary to our expectations, there is not a bimodal distribution of frequencies of decorated and undecorated types associated with lakeshore and ridgetop assemblages. In fact, Los Hermanos Beige: Los Hermanos Var., the most common ceramic type in all assemblages, appears with greater frequency in the assemblage from the mortuary features in Operation E than it does on the lakeshore. It has been noted that this "type," distinguished primarily by red rims on an unslipped beige paste, is defined by modes which are shared with all varieties of the decorated type Mojica Impressed. However, all four Mojica varieties were also found with slightly greater frequency on the lakeshore than they were in Operation E, as were the types Charco Black-on-Red and Los Hermanos Beige: Cervantes Var. In fact, the only decorated type to appear with greater than a 1% difference in frequency in Operation E was Guinea Incised.

There appear to have been more differences in the frequencies of specific types between the assemblages in Operations B and E. Four types, Tamino Incised, Mojica Impressed: Laguna Variety, Tola Trichrome, and Carillo Polychrome, are found in the former in very small quantities but not in the latter. Two types, Huila Zoned Punctate and Zelaya Trichrome, have the opposite distribution. In general, decorated types are more common in Operation B, which has higher percentages of four varieties of Mojica Impressed, Charco Black-on-Red, and Los Hermanos Beige: Espinoza Variety. However, the differences are relatively small (1-5% of the total assemblage), and may very well indicate more about the nature of the deposit (i.e. vessels broken into more and smaller pieces) than actual cultural differences in ceramic use.

Further differences in the composition of assemblages were expected from ceramics immediately overlying and within the stone enclosures and tombs themselves. However, examination of the lots associated with these shows a frequency of ceramics which is not markedly different from that of the assemblage as a whole. The only exception was one small stone enclosure whose fill contained a few sherds of Las Palmas Red-on-Beige and Huila Zoned Punctate, both of which were rare at the site and are believed to date earlier in the Arenal Phase than the rest of the assemblage from the site. However, these were in association with types Charco Black-on-Red and Los Hermanos Beige: Cervantes Variety.

The type-level analysis of ceramics from lakeshore, mortuary, and stratigraphic assemblages from Sitio Bolívar supports the interpretation of the massive sherd deposits as middens of broken vessels rather than special funerary offerings. The fact that the mortuary assemblages are virtually identical to those from the lakeshore portion of the site suggests either that there was no difference between household ceramics (such as those appearing on the lakeshore, near possible dwellings) and those deposited on burials. Alternatively, there may be ceramics in the scattered lakeshore assemblage which represent material from as-yet unidentified mortuary features in the lower portion of the site.

The uniformity of types and the relative rarity or absence of earlier ceramics, especially Bocana Incised Bichrome, Las Palmas Red-on-Beige, or Tronadora Phase diagnostics, also supports an interpretation of activity at the site as intense, short-lived, and confined to the latter portion of the Arenal Phase. While a very small sample of both Silencio and Tilarán Phase diagnostics appeared in lakeshore collections, recognized types from these phases did not appear in the ridgetop features. However, five sherds of Carillo Polychrome appeared in the assemblage from Operation B. Considering the large, Late

Arenal Phase assemblage with which they were associated, the strict Early Polychrome (AD 500-800) placement for this type should be reconsidered.

Analysis of Ceramics from the Lakeshore Survey

In addition to evaluating materials from excavations, ceramic analysis for the Proyecto Prehistórico Arenal also covered the identification of materials from surface collections made at sites along the perimeter of Lake Arenal during the 1984 and 1985 seasons (Table 5.9). The nature and locations of these sites have recently been discussed in detail (Mueller 1986). Material from a total of 43 sites (including the El Silencio cemetery and sites located in the Río Santa Rosa valley; Sheets 1984) was examined and classified according to 57 "type categories" for the Tronadora (13), Arenal (21), Silencio (16), and Tilarán (7) Phases. Chronological characterizations of sites were based upon a sample of 11,385 sherds diagnostic as to type category. Analysis of this sample was accomplished by means of a large, Lotus 1-2-3 "master" spreadsheet which included all tabulated lots. Mathematical functions facilitated the combination of multiple lots into single site assemblages, and database functions allowed for sorting of these assemblages on the basis of several different variables.

Of 43 recorded sites for which ceramic data was available (19 additional sites were recorded after the 1985 season; Mueller 1986), 20 were identified as having some

SITE	SAMPLE	TRONADORA #	TRONADORA %	ARENAL #	ARENAL %	SILENCIO #	SILENCIO %	TILARAN #	TILARAN %
Predominantly Tronadora Phase Assemblages									
G-162	19	16	84%	3	16%				
G-163	732	513	70%	190	26%	2	0%	27	4%
Predominantly Arenal Phase Assemblages									
G-191	16			16	100%				
G-151	5			5	100%				
G-164	5820	6	0%	5769	99%	27	0%	13	0%
G-171	35	1	3%	34	97%				
G-172	91	3	3%	88	97%				
G-182	25			24	96%	1	4%		
G-183	18			17	94%				
G-184	31			29	94%	1	3%		
G-155	15			14	93%			1	7%
G-186	8			7	88%			1	13%
G-187	72	5	7%	63	88%			4	6%
G-170	65	3	5%	55	85%	7	11%		
G-177	254	7	3%	213	84%	32	13%	2	1%
G-175	183	2	1%	153	84%	15	8%	13	7%
G-168	50	5	10%	41	82%	1	2%	3	6%
G-158	5	1	20%	4	80%				
G-192	10			8	80%			2	20%
G-179	10			8	80%	2	20%		
G-176	63	1	2%	47	75%	15	24%		
G-190	6			4	67%			2	33%
G-159	15			10	67%	5	33%		
G-165	89	26	29%	55	62%	6	7%	2	2%
G-178	10	1	10%	6	60%	3	30%		
G-167	26	3	12%	14	54%	7	27%	2	8%
G-166	188	7	4%	92	49%	11	6%	78	41%
G-174	46			17	37%	18	39%	11	24%
G-181	8			3	38%	5	63%		
G-180	86			29	34%	43	50%	14	16%
Predominantly Silencio Phase Assemblages									
G-152	19					19	100%		
G-153	119			4	3%	114	96%	1	1%
G-150	1361			104	8%	1195	88%	62	5%
G-156	169	47	28%	23	14%	77	46%	22	13%
G-157	14	4	29%	2	14%	6	43%	2	14%
G-189	16					9	56%	7	44%
Predominantly Tilaran Phase Assemblages									
G-169	471	2	0%	2	0%	230	49%	237	50%
G-173	12			4	33%	2	17%	6	50%
G-160	15					6	40%	9	60%
G-161	251	8	3%	12	5%	23	9%	208	83%
G-154	96					15	16%	81	84%
G-188	19			2	11%			17	89%
G-185	9							9	100%
43	11385	661	6%	7171	63%	1897	17%	836	7%

Table 5.9: Ceramic phase distribution at Proyecto Prehistorico Arenal Sites.

Tronadora Phase ceramics, and 38 (88%) were found to have Arenal Phase components (Table 5.9). Tronadora Phase materials were predominant at only two, G-162 and Tronadora Vieja (G-163), where they represented more than 60% of the total sample of ceramics diagnostic as to type. However, reasonable samples (fewer than 25 sherds and 25% of the assemblage from each) were also collected at sites G-156 and G-165. Arenal Phase ceramics were predominant at over half of all sites surveyed. The fact that they also appear at sites with earlier and later components suggests that population density in the Arenal basin may have reached its peak during this phase. The technological quality of pottery in the region appears to have been uniformly high for the Tronadora Phase, which precedes the Arenal Phase, and for the Silencio Phase, which follows it. Arenal Phase ceramics appear to have a higher degree of uniformity in decoration and form than either of these, and it is possible that the abundance of Arenal Phase ceramics reflects characteristics of pottery production (such as highly efficient production) rather than demographics. However, the differences in numbers of sites from the various phases are very marked, and I believe they reflect a real population increase followed by decline.

While the primary value of surface assemblages was for identifying chronological components of surveyed sites, these assemblages also provided us with the most useful information for subdividing the Arenal Phase. During the tabulation of survey assemblages, it was noted that some groups of Arenal Phase types often appeared at the same site, while others rarely occurred together. At Tronadora Vieja and both G-156 and G-165, where Tronadora Phase ceramics appeared as a significant component, decorated Arenal ceramics included the types Bocana Incised Bichrome, Las Palmas Red-on-Beige, Mojica Impressed: Mojica Variety, and Huila Zoned Punctate, while presumably later types such as Charco Black-on-Red were in low frequency. These three sites may have occupations dating to the transition between Tronadora and Arenal Phases.

Sites where the abovementioned Arenal types represented a high proportion of the assemblage are considered to date to the Early Arenal Phase (500-0 BC) and slightly later. The "La Isla" site (G-166) had the highest quantity of Bocana Incised Bichrome sherds of any site recorded, although it had very few Tronadora Phase sherds. The only other decorated Arenal Phase types at this site were Las Palmas Red-on-Beige and Mojica Impressed: Mojica Variety. The assemblage from Sitio Viboriana (G-175; Bradley, Hoopes, and Sheets 1984) was dominated by early Arenal Phase ceramic types, as were sites G-177 and G-172.

Late Arenal assemblages were exemplified by types such as those found at Sitio Bolívar. This site (G-164) and G-187 were the only two to show clear assemblages from this time period, although several others, including G-183 and G-184, may also date to this time period.

SITE	BIB	LPR	MI	MI:L	HZP	TAM	ERB	CBR	MI:A	MI:C	CON	GI	AN	ZB	ZT	CIP	TT	TRI	CAR	RED	LHB	TOTALS	TRON #	TRON %	AREN #	AREN %
	ARENAL PHASE																						TRON		AREN	
G-166	36	7	5																		44	188	7	4%	92	49%
G-172	1	20	13	6																	48	91	3	3%	88	97%
G-171		9	8	3																	14	35	1	3%	34	97%
G-151	5																					5	0	0%	5	100%
G-159		1	4																		5	15	0	0%	10	67%
G-186	4																				3	8	0	0%	7	88%
G-158	1	2																			1	5	1	20%	4	80%
G-192	3																			1	4	10	0	0%	8	80%
G-161	1	1																			10	251	8	3%	12	5%
G-153			1																		3	119	0	0%	4	3%
G-179			1																		7	10	0	0%	8	80%
G-178			1																		5	10	1	10%	6	60%
G-177	4	55	18	13		3		4													116	254	7	3%	213	84%
G-165	3	4	10	3	2											1					32	89	26	29%	55	62%
G-156	2	2	5	3	2			1													8	159	47	28%	23	14%
G-175	9	31	27	13	1	1	2	4						1		2	1				61	183	2	1%	153	84%
G-168		4	6													1					30	50	5	10%	41	82%
G-176		9	6	5				4													23	63	1	2%	47	75%
G-170	14		1	4				1									3				32	65	3	5%	55	85%
G-163	13	19	9	14	8	2	38	10			3	4						2			68	732	513	70%	190	26%
G-174	2	2						2													11	46	0	0%	17	37%
G-155		1	2	1				1				1									8	15	0	0%	14	93%
G-190					1					1											2	6	0	0%	4	67%
G-180			1													2					26	86	0	0%	29	34%
G-183	2						1	2				1						1	1	1	9	18	0	0%	18	100%
G-182			2					4		1	1										16	25	0	0%	24	96%
G-187		2	1			1		1	2	15						4					37	72	5	7%	63	88%
G-164		36	24	5	3	2	262	448	187	299	84	172	4	32	2	151	4	14	5	191	3849	5820	6	0%	5774	99%
G-181								1													2	8	0	0%	3	38%
G-188										1											1	19	0	0%	2	11%
G-167																2					12	26	3	12%	14	54%
G-191												1				1				1	13	16	0	0%	16	100%
G-184										1						1			1	3	24	31	0	0%	30	97%
G-150								75				18									11	1361	0	0%	104	8%
34	100	205	145	70	17	9	303	558	189	318	88	197	4	33	2	165	8	17	7	197	4546	9901	639	6%	7167	63%

KEY TO TYPES:

BIB - Bocana Incised Bichrome
LPR - Las Palmas Red-on-Beige
MI - Mojica Impressed: Mojica Variety
MI:L - Mojica Impressed: Laguna Variety
HZP - Huila Zoned Punctate
TAM - Tamino Incised
ERB - Los Hermanos Beige: Espinoza Variety
CBR - Charco Black-on-Red
MI:A - Mojica Impressed: Arrastrada Variety
MI:C - Mojica Impressed: Corrida Variety

CON - Mojica Impressed: Congo Variety
GI - Guinea Incised
AN - Anita Fine Purple (Group)
ZB - Zelaya Bichrome
ZT - Zelaya Trichrome
CIP - Los Hermanos Beige: Cervantes Variety
TRI - Unnamed trichrome
CAR - Carillo Polychrome
RED - Red monochrome
LHB - Los Hermanos Beige: Los Hermanos Variety

Table 5.10: Distribution of Arenal Phase ceramics at Proyecto Prehistorico Arenal sites. (Early Arenal sites are at top of table).

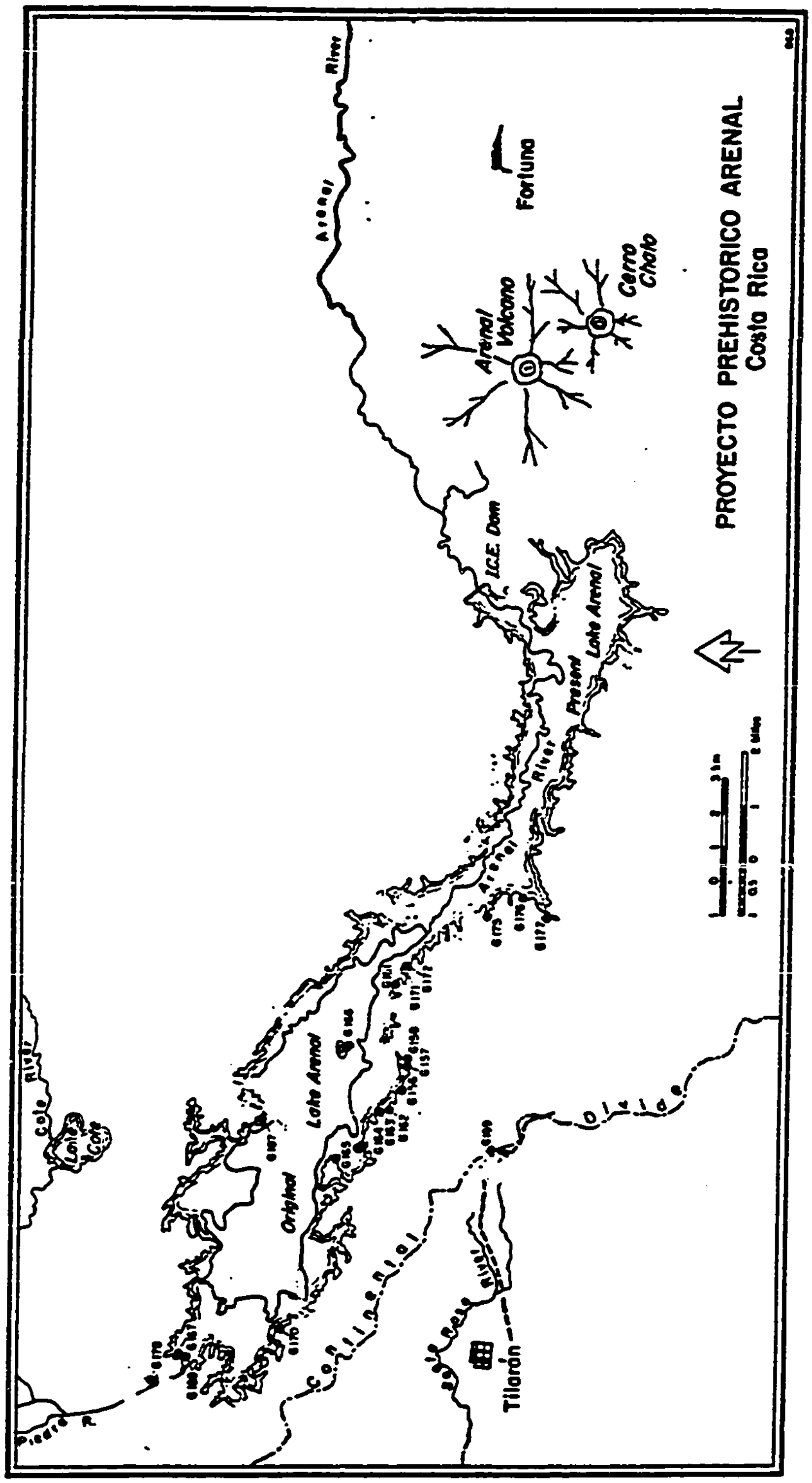


Fig. 5.1: Distribution of Tronadora Phase ceramics on Lake Arenal (sites with one or more sherds).

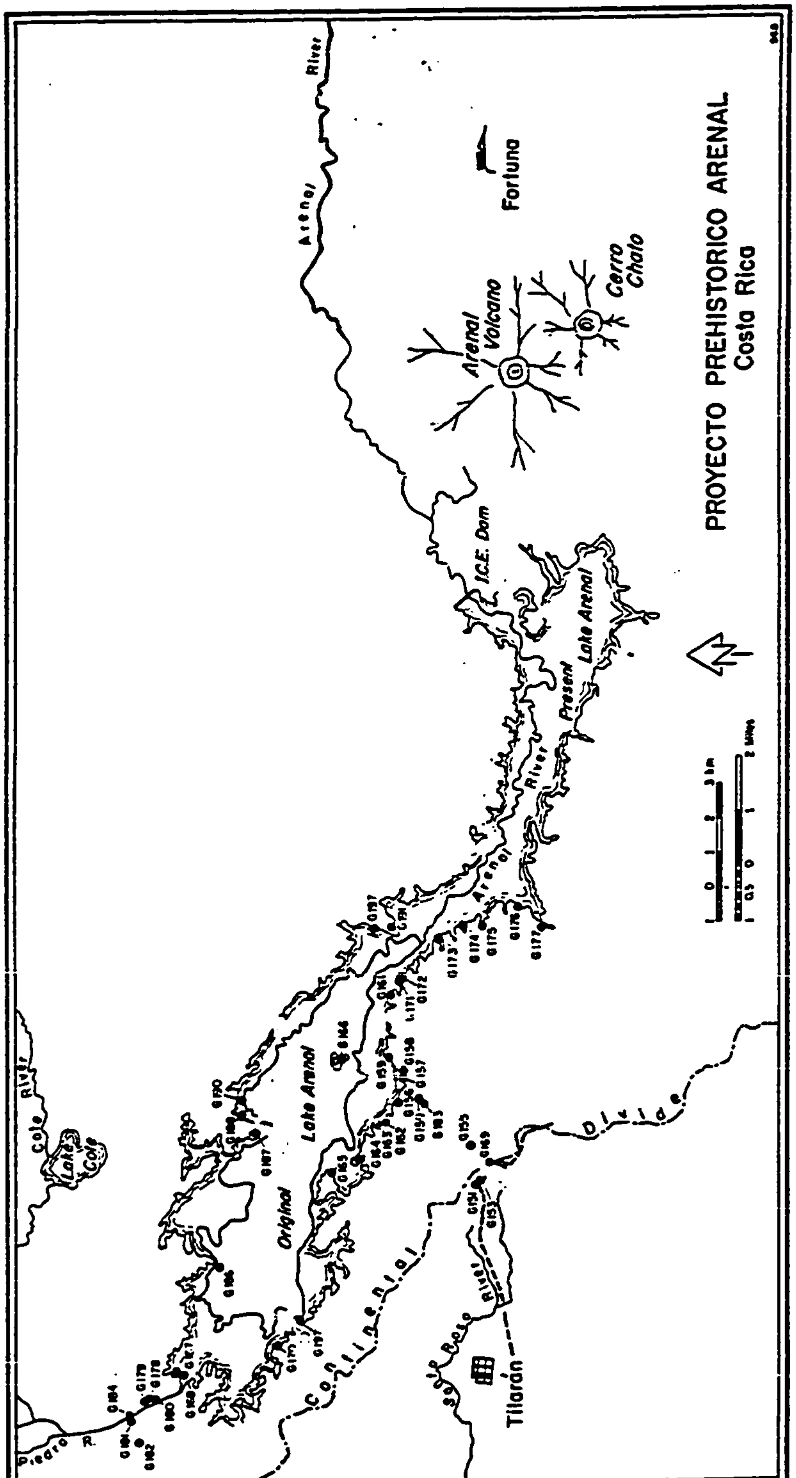


Fig. 5.2: Distribution of Arenal Phase ceramics on Lake Arenal (sites with one or more sherds).

Table 5.10 lists the 36 sites with Arenal Phase components containing deccrated sherds from this phase. They have been placed in order by percentage of "early" or "late" decorated types present in the Arenal Phase assemblage from each site. The "Totals" column lists total diagnostic sherds collected from each site in both surface collections and excavations, and the last two columns list Tronadora and Arenal assemblages by number and percentage of the total. The decorated types have been ordered across the top row according to rough temporal priority, from Bocana Incised on the left to Carillo Polychrome on the right. Sites with predominantly early assemblages occupy the upper two-thirds of the table, and those with predominantly later assemblages are in the lower third.

The relative distribution of sites with significant components dating to the Tronadora and early and late Arenal Phases is plotted on Figs. 5.1 and 5.2.

Ceramic Correlations and Regional Volcanic Stratigraphy

In an attempt to correlate ceramic phases with stratigraphic units, 280 lots of known stratigraphic affiliation were combined for a region-wide sample of 7241 sherds diagnostic as to "type category" from eight stratigraphic designations (Table 5.11). Close to 720 sherds were recovered from Unit 30, most of these from the El Silencio cemetery (G-150) and Dos Armadillos (G-154). The sample from Units 40 and 41 is small, and its composition suggests a fair amount of mixing. 733 diagnostic

STRATUM	TRONADORA #	TRONADORA %	ARENAL #	ARENAL %	SILENCIO #	SILENCIO %	TILARAN #	TILARAN %	TOTALS
30	2	0%	14	2%	346	48%	358	50%	720
40/41	9	18%	4	8%	31	61%	7	14%	51
50	3	0%	144	20%	556	76%	30	4%	733
Upper 50's	81	2%	5279	98%	1	0%	1	0%	5366
54/55	21	46%	25	54%					46
60	142	79%	26	15%	11	6%			179
61	80	96%	3	4%					83
64	50	79%	13	21%					63
280 LOTS	388	5%	5508	76%	945	13%	396	5%	7241

Table 5.11: Distribution of ceramic phases in Arenal Basin tephra stratigraphy.

sherds were collected from Unit 50, the majority of these from El Silencio. The "Upper 50's" designation consists of 5279 ceramics from Units 52, 53, the artificial levels below Unit 50, and features at Sitio Bolívar. The sample from Units 54 and 55 is also small, and consists primarily of the sample from Tronadora Vieja. Virtually all of the sherds excavated from Units 60. 61, and 64 come from the Tronadora Vieja site. Of these, both Unit 60 and Unit 61 indicate similar degree of the mixing (or overlap) of Tronadora and Arenal Phase types. Unit 61, on the other hand, is an almost pure deposit of Tronadora Phase material.

The very earliest occupation of the Arenal area by Formative (ceramic-producing) cultures occurred just prior to the initial eruptive activity of either Cerro Chato or Volcán Arenal, sometime around 2000 BC. Tronadora Phase activity may have continued throughout the deposition of the first tephras in the region, with populations taking advantage of the fertile soils which developed from these over time. Some 84% of ceramics diagnostic as to "type category" recovered from Units 64, 61, and 60 were identified as belonging to the Tronadora Phase, the remainder being from the Arenal Phase. Eleven sherds identified as Silencio Phase types from Unit 60 probably represent intrusions into this stratum at the El Silencio site. The number and proportion of Tronadora Phase ceramics is significantly greater in strata below Unit 55 than above it.

The deposition of Unit 55 coincides roughly in time with the transition from the Tronadora to the Arenal Phases. However, it is still unclear whether this transition was in any way related to Volcán Arenal's effect on the local environment. The strata identified as Units 54 and 55 have more or less equal amounts of both Tronadora and Arenal Phase ceramics, although the sample from these strata is too small to indicate whether this is due to stylistic change or the mixing of material from overlying and underlying levels.

The problem of whether the Arenal area was continuously occupied from the inception of the Tronadora Phase through the Arenal Phase is a thorny one. As indicated by ceramic analysis, there is no clear stratigraphic break in the cultural sequence at Tronadora Vieja to account for a possible gap of 1000 years gap in the radiocarbon chronology of the site. Due to apparent prehistoric disturbance, Tronadora ceramics continued to appear in predominantly Arenal Phase levels. While comparisons between Tronadora ceramics, dated to around 2000 BC, and other early Costa Rican assemblages, dated to around 1000-500 BC, suggests possible stylistic continuities, there is little direct information for either supporting or rejecting the idea of a continuous occupation. We simply do not have enough information on cultural activity in the area from roughly 1000-500 BC, the time period which would pertain to a supposed transition from the Tronadora to the Arenal Phases. To date, the archaeological record in the Arenal Basin has not yielded sufficient information on human occupations of the area for us to say whether periodic volcanic eruptions or any other factors had any major effects on local demography at this time. However, the continuous use of the El Silencio cemetery (Bradley 1984; Hoopes n.d.) before and after the deposition of a thick volcanic tephra from Volcán Arenal midway through the Silencio Phase suggests that catastrophic volcanic ashfalls did not always have a dramatic or lasting effect on human activities.

The Arenal Phase is clearly associated with the "upper 50's", stratigraphic horizons above Unit 54 and below Unit 50. Arenal Phase ceramics were plainly situated in "50's" strata at Tronadora Vieja, Sitio Bolívar, Viboriana, and other sites in the Arenal basin. Unfortunately, although the ceramic sample from these strata dominates the total collection from the 1984 and 1985 seasons, the sample size from stratified levels within the "50's complex" was not great enough to clearly document specific changes in assemblages or the correlation of individual units with either the Early or Late Arenal Phases.

Because the assemblage of Arenal Phase materials from the site of Tronadora Vieja is stylistically earlier than the assemblage from Sitio Bolívar, these two sites provide the greatest potential for dividing the phase. The principal Arenal Phase occupation at Tronadora Vieja appears to have been associated with Unit 54. However, artifacts from this phase at the site were not confined to a clear stratigraphic level but dispersed throughout the "50's" strata. At Sitio Bolívar, the principal occupation may have occurred within the upper part of Unit 54. However, it may also have occurred on top of this unit. Because of the disturbed and intrusive nature of the stratigraphy at this site, the ceramics from Sitio Bolívar have been grouped with those of the "Upper 50's." While many artifacts were found in Unit 54, it seems likely that cultural activity at Sitio Bolívar occurred on top of this soil, and not during its formation.

The dates of 390(265)45 BC [SI-3459: 220 bc ± 65] and 86 BC(AD 173)390 [I-10804: ad 120 ± 80] from El Tajo (Aguilar 1984:74) were obtained from charcoal associated with what appear to be Arenal Phase ceramics in a soil developed on top of El Tajo Unit 8 (Silencio Unit 55), which was in turn catastrophically buried by El Tajo Unit 7 (Silencio Unit 54; Melson 1984). Together, the radiocarbon assays overlap from 86-45 BC at the corrected 2-sigma range. Given a period of about 500 years and the soil development which would have occurred during this time, an association of the cultural materials from Sitio Bolívar with Unit 53 would be consistent with both geological and chronological interpretations.

In general, although a large number of sherds from this Phase were recovered from this stratum, Arenal Phase occupations appear to have occured prior to the deposition of Unit 50. The assemblage at Sitio Bolívar appears to be "on the verge" of the transition into the polychrome-dominated Silencio Phase, and it clearly underlay this stratum. Knapp (n.d.) has noted that the stratum which was visibly identified as Unit 50 at Tronadora Vieja does not correpond minerologically to the stratum with the same designation at site G-151, although its stratigraphic position with respect to overlying deposits is identical. It is possible that local conditions made for a variable erosion of "Upper 50's" strata and their associated soils, and that the black level at Tronadora Vieja in fact represents an earlier (or at least different) tephra unit.

As demonstrated by excavations at El Silencio (Bradley 1984), the predominant occupation of Unit 50 occurred during the first part of the Silencio Phase, around AD 600-900. Primary deposits of Silencio Phase ceramics were sealed beneath Units 40 and 41. Only a very small Arenal component was present at the site, and this may have been associated with earlier strata. No clear Silencio Phase types were found at either Tronadora Vieja or Sitio Bolívar, and no excavated sites were found to have a significant amount of material from both Silencio and Arenal Phases.

Unit 30, which probably represents the time period from AD 900-1400, is almost equally divided between Silencio and Tilarán Phase materials. There appears to have been little change in the occupation or use of the

El Silencio cemetery before and after the deposition of Units 40 and 41, and therefore brief but intense volcanic activity appears to have had little effect on local populations. Silencio ceramics from Units 50 and 30 at the site show little change in composition with regard to ceramic types. Only one type, Belén Incised: Ayotes Variety, showed any significant difference in frequency between the two strata. It is much more common in Unit 30 contexts (corresponding to the second half of the Silencio Phase) than Unit 50.

The association of Tilarán Phase materials with the upper portion of Unit 30 was best documented at the site of Dos Armadillos (G-154), where a 100% Tilarán Phase assemblage was found in a sealed deposit directly beneath the coarse lapilli of Unit 20. A single C-14 date of AD 1300(1356)1422 [Tx-5079: ad 1380 ± 30] was obtained from charcoal associated with this assemblage. The dating of Unit 20 is supported by two other assays from charcoal obtained from the burned bark and wood of trees buried by the pyroclasitic flow which may have been associated with this eruption (Melson and Saenz 1974). These provided dates of AD 1414(1437)1479 [SI-576: ad 1500 ± 30] and AD 1432(1450)1622 [SI-577: ad 1550 ± 30], and the overlap of the calibrated 2-sigma ranges suggests that the Unit 20 tephra was deposited at around AD 1450.

CHAPTER SIX
Tronadora Phase Ceramics

Early and Middle Formative Periods in the Arenal Basin

The Early (2000-1000 BC) and Late (1000-500 BC) Tronadora Phases represent the earliest ceramic-producing cultures yet encountered in the Cordilleran region. They are characterized by the Tronadora Complex, an assemblage of compositional, formal, and stylistic modes (Hoopes 1985). The most common vessel forms are massive "*olla-tecomates*" with exteriorly bolstered rims, *tecomates* with comma-shaped rims, flat-bottomed cylindrical vessels with "hyperbolic" profiles, and squat, necked jars. Pastes are generally finer than those of later periods, and tend to be well-oxidized and light beige or brown in color. The majo-ity of Tronadora Phase ceramics are characterized by a "speckled" paste, marked by the inclusion of small (ca. 0.5 - 1 mm) particles of white to grey pumice tephra. The principal decorative modes of the Tronadora Complex are red rims, round-bottomed grooves made when the paste was firm, dentate stamping and rocker-stamping with the wavy edge of a shell, rows of heavy punctation, deeply-incised geometric patterns, zoned bichroming, infilling of incisions with red ocher, and an unusual decoration produced by a combination of red-painted strip applique and gouge-incision. Vessel supports are notably absent from Tronadora Phase assemblages.

As was noted in an assessment of ceramics from surface collections during the 1984 season (Hoopes 1984, 1985), the Tronadora Complex stands out as a unified stylistic assemblage which is readily separated from assemblages of other phases. It bears a very strong relationship to the other early ceramic complexes of Costa Rica, and shares a number of important modes with early ceramics from Guatemala, Nicaragua, and Panama. There are some important similarities between Tronadora ceramics and those of Greater Nicoya, especially to types Schettel Incised and Bocana Incised Bichrome of Lange's Loma B phase (Lange 1980). However, these are thought to be due to a linear development of Loma B types out of earlier Tronadora Complex traditions. In this respect, ceramics from Tronadora Vieja provide the first secure evidence of cultural patterns predating the Zoned Bichrome period in northwestern Costa Rica.

Tronadora Phase Sites

While Tronadora Phase sherds were identified at 20 out of the 43 sites sampled during the 1984 and 1985 seasons of the Proyecto Prehistórico Arenal (Fig. 5.1), the quantities of diagnostic sherds from these site were generally very low. Only four sites yielded assemblages of 15 or more sherds attributable to this phase. These were (in the order of their importance) Tronadora Vieja (G-163) with 474 sherds, G-156 with 47, G-165 with 26, and G-162 with 16, of which the first and last were the only ones to show a predominance (50% or more) of sherds from this phase.The

G-163	TRONADORA PHASE													
OP	TB	GR	TI	TGI	RR	GRI	TGP	SS	ZIP	PUN	ARB	GEO	CIR	TOTALS
A	25		11	8	4	13		3		2		2		68
B	2				1									3
C	3		2	1	2	1	1							10
D	5		4		1									10
E	2											1		3
F							1	1						2
G		1	1	2	2									6
H	19	8	7	5	7	2	2	2	5	1	1			59
I	17	5	4	1		2	3		2	2		2		38
J	4	2		2	4	3				2				17
K	2													2
L	10	6	4	4	3	3	5	1	4	2				42
M	9	4	1		4		1	1						20
N	2	1	1											4
P			1	1	1	1								4
Q		2	1	1	2	2	3	1						12
R	4				1				2					7
S	1	1		1										3
T	2	1					1							4
U	7	1			3			3		1				15
V	19	14	11	6	3	3	5	7	5		1		1	75
W	15	13	5	9	1	3	10	4	4		3		3	70
	148	59	53	41	39	33	32	23	22	10	5	5	4	474

Table 6.2: Distribution of Tronadora Phase type categories in operations at Tronadora Vieja.

TRONADORA PHASE														
SITE	TB	RR	GRI	GR	TI	TGI	TGP	SS	ZIP	PUN	GEO	ARB	CIR	TOTALS
G-156		13	18	9		1	2	1		2	1			47
G-157		1	2			1								4
G-158			1											1
G-161		1		1		5	1							8
G-162		9	7											16
G-163	148	39	33	59	53	41	32	23	22	10	5	5	4	474
G-164	1	2	1					2						6
G-165		9	14			1	1			1				26
G-166		3	4											7
G-167		1	1					1						3
G-168						1		4						5
G-169			1	1										2
G-170	3													3
G-171		1												1
G-172			1	1										2
G-175		2												2
G-176		1												1
G-177		6												6
G-178		1												1
G-187		5												5
20	152	94	83	71	53	50	36	31	22	13	6	5	4	620

Table 6.1: Distribution of total assemblage of Tronadora Phase type categories.

composition of the total assemblage from this phase at all sites is illustrated in Table 6.1, and the distribution of Tronadora Phase sherds in surface collections ("Op A") and excavated operations at Tronadora Vieja is illustrated in Table 6.2. The stratigraphic distributions of types and modes at this site have been discussed in greater detail in the preceding chapter.

Diagnostic Modes and Types of the Tronadora Phase

While the definition of ceramic types for the Tronadora Phase is somewhat hampered by the fairly small quantities of sherds available for interpretation, even a preliminary establishment of types helps provide a vocabulary with which to discuss assemblages and features dating to this phase. Ceramic types as analytical units provide a convenient way of expressing frequently recurring groups of modes or attributes for purposes of interregional as well as intra-site comparisons. With the exception of very broad type classes, such as the Atlantic Red-Filled Black Group or the Chaparrón Zoned Red on Brown Type (Snarskis 1978) -- the latter of which might better be understood at the level of group -- both Chaparrón and La Montaña ceramics have been analyzed and quantified to date only at the level of modes.

To assist with the definition and identification of Tronadora ceramics, we will first discuss ceramic modes diagnostic of this phase. We have also defined five types on the basis of recurring groups of formal and decorative modes.

Diagnostic Modes of the Tronadora Phase

The principal modes of the Tronadora Complex were described in brief after the 1984 season of the Proyecto Prehistórico Arenal (Hoopes 1984, 1985), based on an assessment of surface collections and test pits at Tronadora Vieja and other sites. With few exceptions, these modes are shared with those of Snarskis' (1978) Chaparrón and La Montaña Complexes, and preliminary identifications were based on comparisons with Snarskis' assemblages. Excavations at Tronadora Vieja in 1985 provided stratigraphic data to support the early placement of these ceramics, and yielded a collection of over 400 diagnostic sherds on which to more clearly define the phase.

The chief diagnostic modes of the Tronadora Complex are as follows (alphanumeric designations refer to modes described in Snarskis 1978):

FORM

1) Large olla-tecomates with exteriorly-thicked, massive rounded or angular rims (R11).

2) Restricted-neck hemispherical bowls, thicker at the rim than on the sides. These almost always have round-bottomed grooving along the lip (R6), and constitute our Tronadora Incised type.

3) Restricted-neck jars with exteriorly-thickened rims. Vessel walls are less rounded than those of the large olla-tecomates, and decoration is usually found on

the exterior immediately beneath the rim.

4) Tall, cylindrical vessels with flat bases. Walls gradually curve inward, and the base is always the widest part of the vessel (Snarskis 1978: Fig. 25a).

DECORATION

1) Round-bottomed groove-incising, often used to zone horizontal bands of red paint (D10).

2) Round or oblique punctation zoned with groove-incising (D17), found beneath the rim on exteriors of both bowls and jars.

3) Red-painted strip appliqué emphasized by gouge incision, executed on the vessel body when the paste was very soft. This distinctive mode is peculiar to the Tronadora Complex, and is unlike anything known elsewhere in Costa Rica. Strip appliqué can be either linear and circumferential or can form curvilinear designs and figures. Unfortunately, the latter type has only been found in small fragments, and the full design motifs are unknown.

4) Wavy shell-edge stamping (D18). This mode has two distinct manifestations. The first is as a series of vertical impressions in a circumferential band around the vessel exterior, delineated with groove-incising. The second is as a very fine (sometimes barely visible) stamping on an unslipped surface, used to fill large zones when the paste is very soft and smooth.

5) Hard-edged, multiple incisions, sometimes infilled

with red ocher. This mode recalls incision on Middle Formative ceramics from Mesoamerica, and is technically and stylistically related to decoration found on Snarskis' Atlantic Red-Filled Black Group (1978:76). One example from Tronadora Vieja has a curvilinear design, and the only rims known with this mode are direct and unthickened, probably from cylindrical bowls.

Other decorative modes include punctate, button-like appliqué or pastillage (Snarskis 1978: Fig. 10jj), cord-marking (Ibid.: Fig. 24x), and circular reed-stamping (Ibid.: Fig. 24dd).

PASTE

There appears to be a much greater variety of pastes in Tronadora materials than in either Chaparrón or La Montaña. Snarskis describes a paste for La Montaña materials whose most outstanding characteristic is the presence of grey particles, up to 1 mm in size, identified as a possible basalt temper (1978:71). According to Snarskis, "virtually every Middle Formative sherd... whether from Turrialba, the Linea Vieja, the Central Valley or San Carlos, has possessed this grey-speckled paste" (Ibid.). Most of our Tronadora Phase sherds are in fact "grey-speckled." The grey to white specks are probably particles of the basaltic andesite lapilli deposited by eruptions of Volcán Arenal prior to El Tajo Unit 7 (see Appendix B), although in the earliest ceramics they may represent inclusions deriving from prior volcanic activity which were present in the parent clays (presumably the Aguacate Formation). Unfortunately, due to small sample size and poor stratigraphic data, it has not been possible to identify what might be considered "pre-Arenal" Tronadora Phase pastes.

The nature of the aplastic tephra inclusions (often referred to as an "ash temper" by archaeologists) has a temporal significance in the Arenal region. Tephra inclusions are ubiquitous in ceramics from all phases in the Cordillera de Tilarán, and represent a wide range of materials. Although the white, pumice-like particles found in Tronadora Phase ceramics are also present, Arenal Phase ceramics can be distinguished by the presence of tabular black crystals of hornblende. Their appearance in the ceramics may correspond to the deposition of El Tajo Unit 7 (Silencio Unit 54), which "marks Arenal's first eruption of dacitic magmas" (Melson 1984:47), and is characterized by a distinct deposition of hornblende-phyric dacitic lapilli.

It is unclear whether the presence of aplastic inclusions of volcanic tephra in Tronadora Phase ceramics was intentional or coincidental, given their overwhelming presence in soils and clays of the region. However, the high concentration of tephra inclusions in some pastes strongly suggests the addition of a volcanic temper to the clay. No examples of an organic or fiber temper were noted. In the event of a conscious selection of an inorganic tempering material, fine tephras would have been available in well-sorted deposits at a number of locations around Volcán Arenal, and would have presented an obvious source of aplastic material for the prehistoric ceramicist. The high shrinkage rate of montmorillonite clays, which are volcanic in origin (Shepard 1956:376), would have necessitated the presence of an aplastic component, whether naturally present, added to, or supplimented by the potter.

PRODUCTION TECHNIQUE

All Tronadora Phase ceramics identified to date have been constucted entirely by coiling, rather than modelling, to achieve the final vessel shape. The manufacturing technique shows a considerable degree of techical competence, and with the possible exception of the often friable rims of Tonjibe Beige vessels, no examples were noted of sherds which had fractured along the lines of poorly-welded coils. All sherds had carefully-smoothed surfaces on both interiors and exteriors of vessels, with only an occasional example showing wiping or smoothing on the interior surface. Where wiping was evident, it consisted of narrow, horizontal marks, such as those that would have been produced with the fingertips of the potter. A high-luster finish was evident on some sherds, especially on red-slipped rims, and stone-burnishing may have been a common technique for finishing vessels. However, factors of preservation limited the number of sherds on which this appeared.

Ceramic Types of the Tronadora Phase

Given the size of our assemblage of Tronadora Phase ceramics from Tronadora Vieja, it has been possible to define a few preliminary type designations which may be useful for interregional comparisons. Large portions of whole vessels are known only for Zetillal Shell-Stamped, but each type was thought to have been represented by a sufficient number of sherds to justify its designation.

TYPE: Tonjibe Beige

VARIETY: Tonjibe

COMPLEX: Tronadora

SPHERE: Cordillera and Central Highlands

DESCRIPTION:

Principal Identifying Modes:

1) Heavily bolstered rim and characteristic profile,
2) Large, thick-walled vessels,
3) Beige-colored paste and exterior,
4) *Olla-tecomate* form,
5) Red paint on upper and exterior surfaces of lip.

Paste, Temper, Firing, Etc.:

All examples are characterized by two distinctive inclusions: a dense temper of grey-white particles which appear to be a ground pumice tephra, and shiny black crystals of hornblende which appear throughout the paste. While the former are more or less uniform in size, the latter vary from very small particles to larger inclusions. Other minerals which are present include feldspar, rounded grains of quartz, and occasional grains of olivene.

In general, pastes are a light beige to orange-beige in color. All are completely oxidized, and do not demonstrate darkened cores, even in thicker examples of rims. Paste texture is usually relatively fine, although it will have a slightly grainy texture due to aplastic inclusions. Fracture is irregular, and a large number of rims are easily broken if not already crumbling. Many of the thickest bolstered rims are longitudinally cracked and fractured, falling into several pieces upon excavation. It is supposed that this is due to structural weaknesses of the massively-thickened rims, exacerbated by pressures of soil and long exposure.

Surface Finish And Decoration:

Rims are usually painted with a hard, glossy red paint on the lip surface, and well-preserved examples show a surface finish which is whitish-grey in color. Tonjibe Beige vessels appear to have had typically unslipped or "floated" finishes, with the exception of the upper, exterior surface of the rim. This was usually slipped with a fine-textured but thick, dark red pigment. This rim decoration is most often in the form of a wide red band, filling the space between the curved angles of the upper surface of the rim. It may be used only on the outside half of the rim surface, but in no case does it extend down to include the exterior surface of the rim (where it has a vertical or insloping plane).

It has been noted that on a number of vessels, there is a thin black residue on the interior of the lip and/or partially covering the red portion of the lip. This is interpreted as the charred remains of a liquid or semi-liquid substance which was cooked or heated in the vessel, and interpreted as evidence that these vessels had a primarily culinary function. Other than this thin residue, no other evidence of use or wear has been detected.

A few examples are colored a dark, chocolate brown on the exterior while they retain a light beige interior. In at least one instance, this appears to have resulted from the actual application of a thick, dark slip of a fine material. It was applied to the exterior before the red slip was added to the vessel rim.

Form and Function:

The vessel form of Tonjibe Beige is identified as that of an _olla_-_tecomate_ after Snarskis (1978:335; Rim Form Mode R11). This form is defined as that of an incurving-rim _tecomate_ with the addition of a heavy, thick roll of clay as a bolster on the rim exterior (Fig. 6.1). This creates a horizontal and vertical surface on the vessel rim. The functional significance of this addition is unclear, but it is possible to make a few speculations. First and foremost, it tended to strengthen the rim, making it more resistant to breakage than an unbolstered rim (although thick rims from excavated contexts frequently fractured into several small pieces). Secondly, it may have served as a

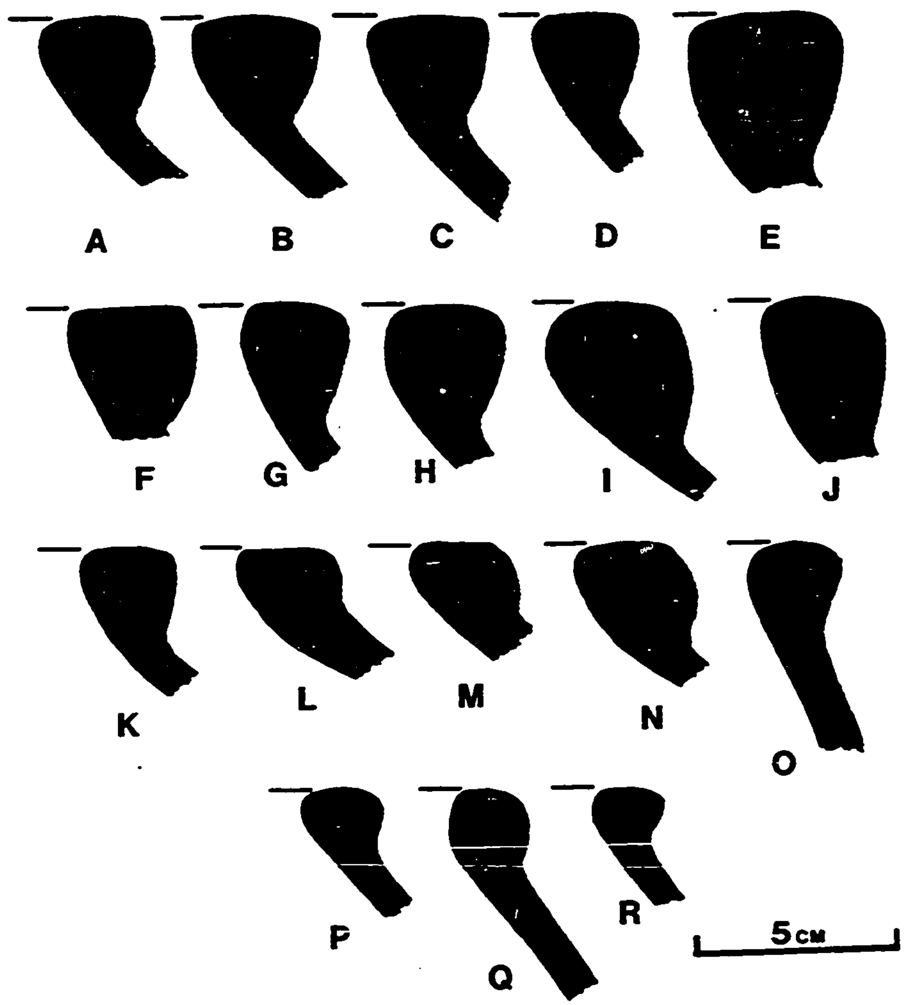


Fig. 6.1: Tonjibe Beige <u>olla</u>-<u>tecomate</u> profiles. All are from Tronadora Vieja. Proveniences: A (K4), B (I5), C (M1), D (V52), E (H23), F (P3), G (V8), H (H21), I (M 6/1), J (M2), K (L2), L (T4), M (M2), N (L13), O (W18), P (P3), Q (R2), R (H4).

handle-like grip for picking up and moving the vessels. The rim shape, in terms of both size and profile, fits comfortably into the palm of the hand, providing a form upon which one could gain a much firmer grip for picking up and moving the vessels. The rim shape, in terms of both size and profile, fits comfortably into the palm of the hand, providing a form upon which one could gain a much firmer grip than on a thin, direct-rim form. If, as is suspected, these were the primary culinary vessels of the Tronadora Phase, this design would have facilitated their use and transportation. The presence of this thickened rim would have also permitted the use of ropes or lashed sticks in moving heated vessels -- a difficult maneuver on direct-rim _tecomates_. Given the size of these vessels (rim diameters for this type vessels are in the range of 30 - 50 cm), they would have been very heavy. No handles of any kind were found in Tronadora Phase levels. While the globular form of these vessels is simply an inference, it appears that the vessel rim would have been the primary grip for moving these vessels. No supports have been associated with Tronadora Phase levels, and it is assumed that the bases of Tonjibe Beige vessels were simple and rounded.

It is presumed that these vessels were the principal utilitarian vessels of the Tronadora culture, and that their primary functions were in cooking and possibly short-term storage of water or other liquids (such as fermented beverages).

INTRA-SITE LOCATIONS AND CONTEXTS:

A total of 148 sherds identified as Tonjibe Beige were recovered from surface collections (25 sherds) and excavations (123 sherds) at Tronadora Vieja. The excavated sherds were in exceptionally low densities in stratified deposits, and were distributed through 17 separate operations. The largest samples were from Operations H (19); V (19); I (17); and W (15); followed by Operations L (10); M (9); U (7); D (5); J and R (4 each); C (3); B, E, K, N, and T (2 each); and S (1).

Of the Tonjibe Beige assemblage at Tronadora Vieja, 88 sherds (59%) were recovered from Unit 60 or underlying strata. Only 35 (24%) came from "50's" strata (25 sherds were in surface collections), where they may have been transported by disturbance.

INTER-SITE LOCATIONS AND CONTEXTS:

Within the Arenal area, Tonjibe Beige sherds were noted at only three of the 43 sites sampled and surveyed, for a total assemblage of 152 sherds. These come from G-163, with a total of 148 sherds collected in both sample and survey, G-170, with three sherds, and G-164, with one.

As noted above, sherds very similar to Tonjibe Beige are found in the assemblages from La Montaña and Chaparrõn (Snarskis 1978). Sherds corresponding to this type have not been reported from any other sites in Greater Nicoya. However, I have seen ceramics very similar to Tonjibe Beige in collections from Palenque Tonjibe (San Rafael de los Guatusos) and Sitio Mêndez at the Museo Nacional de Costa Rica, San Josê.

Coe and Diehl (1980:154; Figs. 126k, 151s) illustrate "heavy restricted-orifice bowls with large rim bolsters" in the Mojonera Black type of the Chicharras and San Lorenzo Phases (1250-900 BC) at San Lorenzo which are reminiscent of the typical Tonjibe Beige form. Profiles of another Chicharras and San Lorenzo Phase type, Aguatepec Thick (Coe and Diehl 1980:Figs. 130b, 153), also demonstrate a rim bolstering very reminiscent of Tonjibe Beige. Vessel shapes of this type are described as "extraordinarily large, basinlike bowls" with flat bottoms which "persist into the San Lorenzo phase and must have had some special function" (Coe and Diehl 1980:156). No flat bases (including those of Zetillal Shell-Stamped) are thought to have come from Tonjibe Beige vessels.

CULTURAL SIGNIFICANCE:

The name of this type derives from Palenque Tonjibe, in San Rafael de Guatuso, where sherds of this type were found by the late Enrique Herra (Snarskis, personal communication 1985). This is the most common vessel type in

Tronadora Phase deposits, and is also characteristic of Middle Formative Costa Rican assemblages from Chaparrón and La Montaña (Snarskis 1978). The tecomate form is widespread in prehistoric ceramic complexes throughout the Americas, and is an important vessel form in many Early Formative ceramic assemblages in Mesoamerica and South America. The closest analogies to the characteristic bolstered-rim olla-tecomate outside of Costa Rica are found in late Early Formative assemblages in the Gulf Coast of Veracruz.

CHRONOLOGICAL POSITION:

Tonjibe Beige is the most common type in all Tronadora Phase assemblages, and is not characteristic of either the early or late facet of the Tronadora Phase. Its Early and Middle Formative placement is based both on its association with early radiocarbon dates and its similarity to ceramics from Chaparrón and La Montaña assemblages.

TYPE: Tronadora Incised

VARIETY: Tronadora

COMPLEX: Tronadora

SPHERE: Cordillera

DESCRIPTION:

Principal Identifying Modes:

1) Round-bottomed grooving, primarily along the vessel lip and the exterior of the vessel rim.
2) Red paint between grooves, with an unslipped vessel body.

3) Incurving-rim bowl or tecomate forms.

4) Horizontal, round-bottomed grooved decoration in combination with bichroming on vessel body.

Paste, Temper, Firing, Etc.:

Tronadora Incised sherds have a paste which is smooth to slightly grainy in texture, and usually a dark brown or grey in color. This type displays a diagnostic "speckled" paste, with dense inclusions of what appears to be a weathered pumice tephra. This appears in sections and freshly-scraped surfaces as a high proportion of angular particles which are grey to white in color, and are very soft and friable when tested with a sharp, steel probe. It is thought that this is a pumice or "volcanic ash" temper, added to minimize the destructive effects of the high shrinkage rate of montmorillinite clays. Other aplastic inclusions are occasional crystals of hornblende with platy cleavage and rounded grains of feldspar. In general, the pastes are similar to those of Tonjibe Beige, although there is a tendency for the paste to have a somewhat finer texture.

A single sherd of this type (Fig. 6.2:A, Pl. 6.1:A) was identified with a paste which is completely distinct, and more similar to that of later Bocana Incised Bichrome and Las Palmas Red-on-Beige sherds than to Tronadora Incised or Tonjibe Beige. This sherd has a markedly orange paste with a high proportion of small hornblende crystals. However, the "speckled" appearance caused by the high density of grey to white particles differs from that of the Arenal Phase pastes. This suggests that the tech-

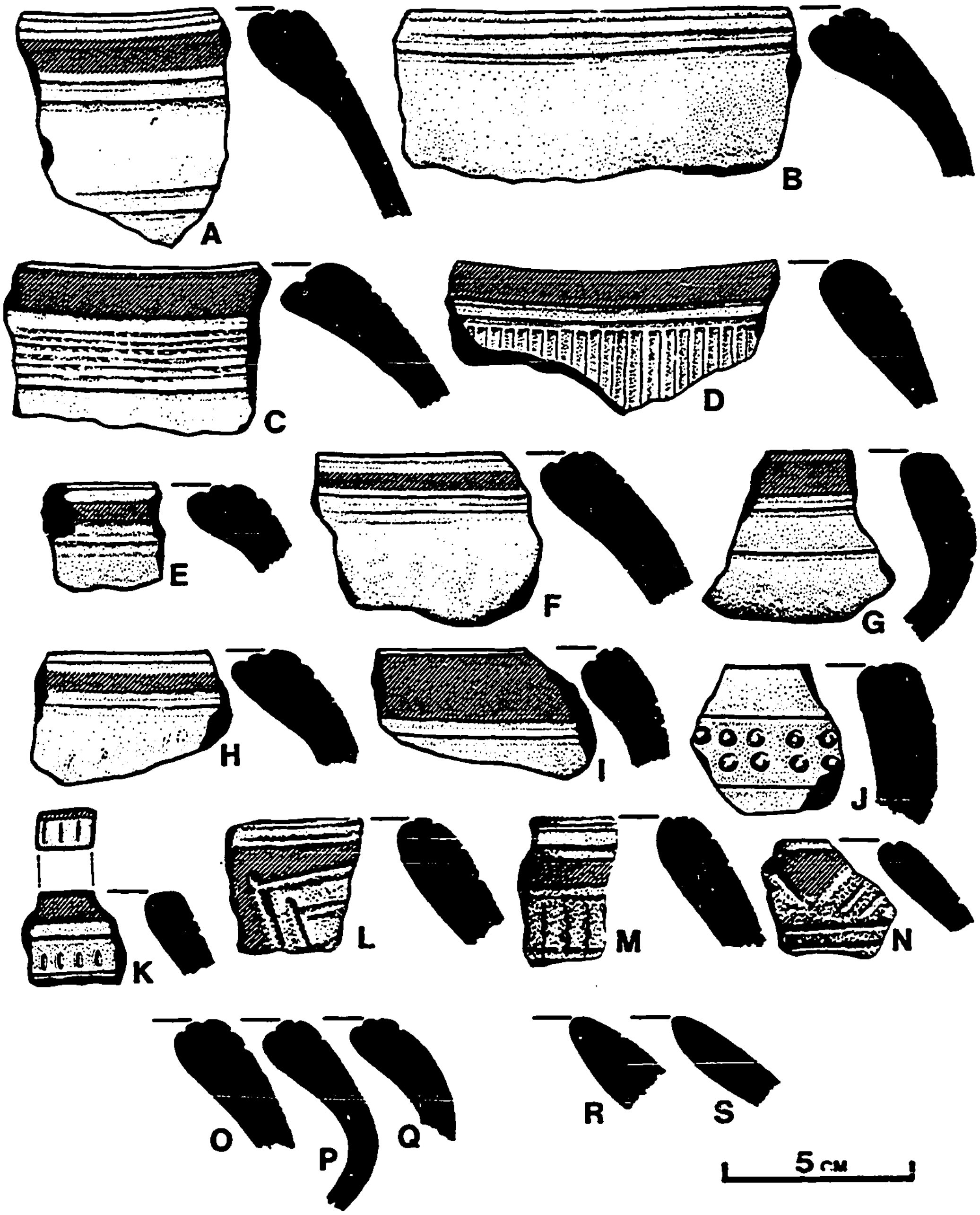
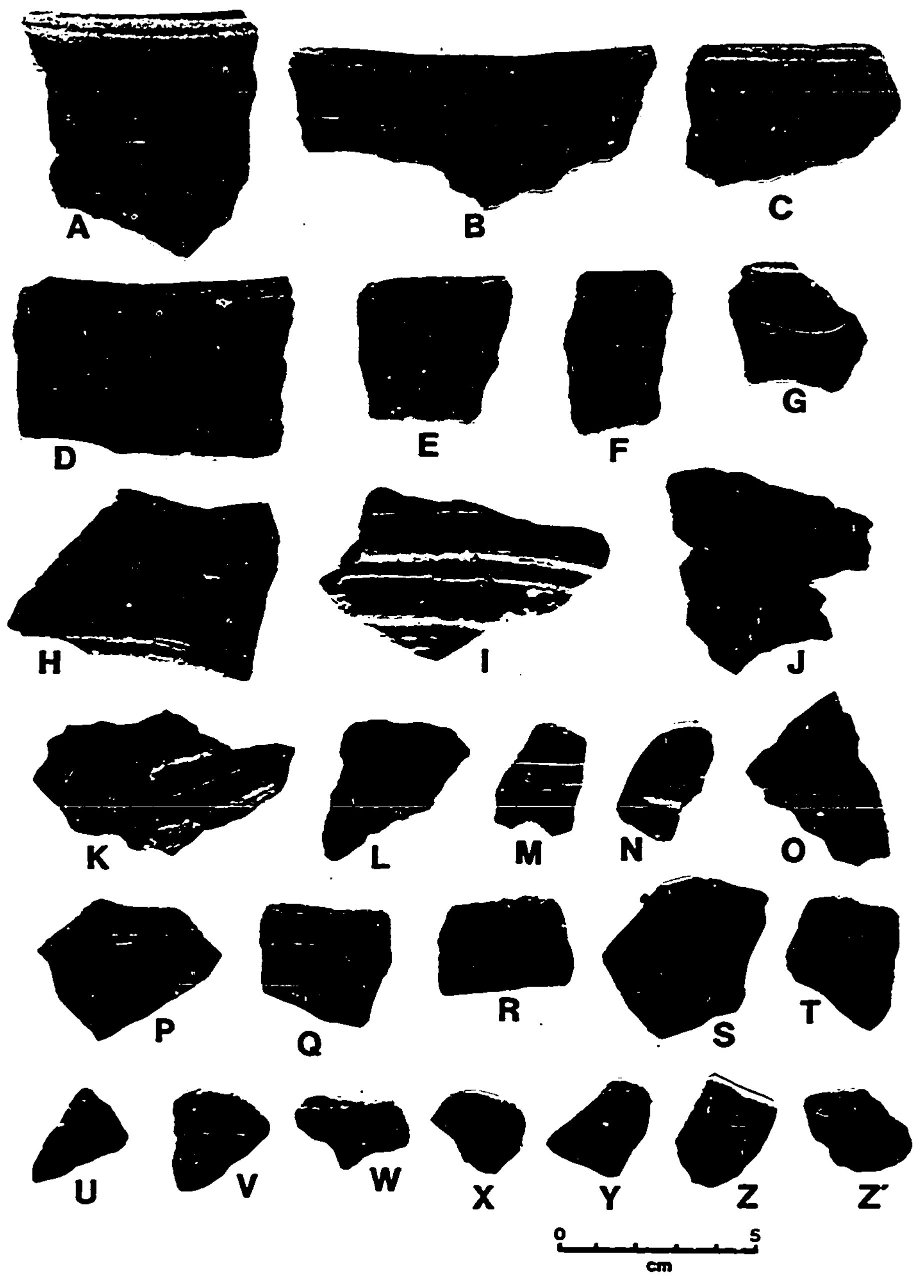


Fig. 6.2: Tronadora Incised sherds.
All but J are from Tronadora Vieja. Proveniences : A (H25), B (N4), C (H26), D (I22), E (V8), F (P3), G (I5) H (H9), I (V30), J (IF 38), K (Q3), L (G4), M (G4) N (V5), O (H4), P (I21), Q (W32), R (L6), S (H6).

PLATE 6.1
Tronadora Phase Ceramics

Types Tronadora Incised (A-G); Tajo Gouge Incised (H-O); and Tigra Grooved Punctate (P-Z'). All sherds are from the site of Tronadora Vieja. Proveniences (operation and lot no.) are: A (H25), B (I22), C (H9), D (H26), E (G4), F (V8), G (V5), H (V20), I (W32), J (W32), K (A1), L (W18), M (H15), N (W16), O (I9), P (W2), Q (L14), R (W18), S (W18), T (?), U (W18), V (L7), W (W16), X (V4), Y (M2), Z (L10), Z' (L6).

PLATE 6.1



nique used in manufacturing this sherd may have differed from that used to prepare other Tronadora Incised vessels only in the choice of clay or the firing environment. The choice and addition of temper appears to be the same as that of other Tronadora Phase types. It is possible that this sherd represents an importation from another region, but it seems more likely to represent the utilization of a clay source which saw more use in the later Arenal Phase than it did during the Tronadora Phase.

Surface Finish And Decoration:

Surface finish is smooth and often white in color. Tronadora Incised surfaces are unslipped and smoothed, or occasionally "floated" -- a technique whereby wetting of the clay surface creates a colloidal slip from the vessel paste itself. However, a durable red slip or paint is found on the horizontal spaces between lip grooves or occasionally on the vessel exterior in horizontally-zoned areas. While frequently eroded, it is bright and polished on examples that are well-preserved. Typically, the red paint is applied to the inner and exterior horizontal zones of the vessel rim or lip, leaving the topmost surface of the lip grooved but unslipped (Fig. 6.2). There is a fair amount of variation, however, and there are a few examples where the entire rim has been slipped red and left without grooves (cf. Snarskis 1978:Fig. 106,D10). Other variations which deserve mention are the use of short, vertical shell-stamped marks to fill a horizontally-zoned band about 1.5

cm wide (Fig. 6.2:M; Pl. 6.1:F); reed stamping (Fig. 6.2:J; Pl. 6.2:M) the execution of a geometric pattern of wide grooves and painted areas immediately betneath the rim on the vessel exterior (Fig. 6.2:L,N; Pl. 6.1:E,G); and multiple horizontal or vertical grooves, also on the exterior immediately below the vessel rim (Fig. 6.2:C-D; Pl. 6.1:B,G).

The nature of the grooving technique used on Tronadora Incised vessels is an important diagnostic of the Tronadora complex, and has been used to separate sherds of the Tronadora and Arenal Phases. The incisions on Tronadora Incised have a smoother and more carefully-executed quality than that which appears on Bocana Incised sherds from the Arenal Phase. The edges of the wide grooves are rounded and smooth, indicating that ridges and bumps produced by the grooving instrument were removed (probably by smoothing with fingers) before firing. Most grooves have fine drag-marks running along their interiors. The average width of the grooves may be a means of distinguishing earlier from later sherds. Tronadora Incised "groove-incision" appears to differ from the sharper incision of Bocana Incised in width. Tronadora Incised grooves are almost always <u>more</u> than 2 mm wide, and are usually closer to 3 mm. Bocana Incised incision, especially on the "combed variety" identified in Arenal Basin samples, is usually <u>less</u> than 2 mm wide. While there are a number of notable exceptions, vertical incisions are far more common on Bocana Incised than on Tronadora Incised. Finally, the decoration on Tronadora Incised is almost always restricted either the vessel lip or the uppermost portion of the vessel exterior. Bocana Incised vessels, on the other hand, are characterized by incised decoration which covers the vessel body.

The red paint on Tronadora Incised sherds, where well preserved, is usually thick and bright, and somewhat less fugitive than that on Bocana Incised vessels. In a large number of examples, it has retained a bright, reflective luster, even where partially eroded. The red paint appears to have been applied after the execution of the circumferential grooving, and its principal purpose was to fill the narrow horizontal zones between grooves. On vessel rims, the painted zones are wider than the unpainted ones, measuring 4-5 mm in width (the narrower, unpainted zones are 2-3 mm in width).

Form and Function:

Tronadora Incised profiles indicate that the primary vessel forms were tecomates and incurving-rim bowls (cf. Snarskis 1978:Fig 69; Rim Form Mode R6). Because no whole vessels were encountered, it is difficult to say which of the two forms was more important. While many sherds appear to have been from deep, globular incurving-rim bowls or jars, others show a sharp curvature on the vessel side which is clearly part of a shallow, round-bottomed dish form. Tronadora Incised rims are typically thickened at the lip to about twice the thickness of the vessel wall. This thickening does not appear to have resulted from the addition of clay to the vessel lip, but from a vessel shaping technique which decreased the thickness of the walls while leaving the rim thickened. In some vessels, there is a rounded profile on the interior of the lip, as if the space inside the vessel completed the form of a sphere. In other examples, however, the interior profile curves upward at the lip, suggesting a slightly pear-shaped interior space. While a fairly fine descriptive point, it may prove significant in tracing a technological connection between the manufacture of Tronadora Incised vessels. Navarījo complex vessels of coastal Chiapas, also dating to the Early Formative period, have a characteristic pear-like shape (Shook and Hatch 1979).

The thickening of the vessel lip and the relatively broad lip surface differ markedly from that of Barra and Ocós tecomate rim forms from southern Mesoamerica (Green and Lowe 1967, Lowe 1975, Coe 1961). These latter are typically direct or tapered in profile, and relatively thin. Tronadora Incised vessels are much thicker and heavier, and may have been so constructed to withstand a greater amount of functional stress. Tronadora Incised vessels would have been very large and heavy. Presumably they withstood more wear and tear than thin-walled tecomates.

INTRA-SITE LOCATIONS AND CONTEXTS:

The Tronadora Incised type, defined here for the first time, was noted only at the site of Tronadora Vieja (G-163), where 53 sherds were recovered from surface collections and excavated deposits. A total of 11 sherds of this type were found on the surface of eroded deposits. Excavated Tronadora Incised sherds were distributed through 12 separate operations, with the largest sample coming from Operation V (11 sherds). The remaining sherds came from Operations H (7); W (5); D and I (4 each); C (2); and G, M, N, P, and Q (one each).

A total of 29 Tronadora Incised sherds (55% of the total for this type) came from Unit 60 or below at Tronadora Vieja, while 11 (21%) came from "50's" strata. Eleven sherds came from surface collections at the site.

INTER-SITE LOCATIONS AND CONTEXTS:

The incurving-rim bowl (and to a lesser extent the true tecomate) have been associated with a number of early ceramic-producing cultures in the Americas. Rim profiles of Tronadora Incised closely approximate those of the Cuadros Phase of coastal Chiapas and Guatemala. The use of multiple-grooving on the vessel lip is a mode which is present on Ocós sherds from Coe's sample at La Victoria (Coe 1961). It is also a distinguishing mode on sherds of the Schettel Incised type, first defined by Norweb (1964) for the Rivas region of Nicaragua and subsequently identified in excavations on Ometepe Island (Haberland 1966) and northwestern Guanacaste (Lange 1971, Lange and Scheidenhelm 1972).

There is probably a direct relationship between Schettel Incised and Tronadora Incised. However, there are some marked differences between the two types in terms of surface finish, rim profile, and vessel form. A significant difference noted in direct comparisons between Tronadora Incised sherds from the Cuenca de Arenal and Schettel Incised sherds from Willey and Norweb's excavations in Rivas (analysed by Healy and currently housed in Harvard's Peabody Museum) is the complete absence of painted decoration on the latter. Schettel Incised sherds appear to fall into two groups: those covered with a durable red or orange slip and those slipped a beige or brown color. Only a few examples have variable slipping, with red slip only on the lip surface and vessel interior. The vessel forms of Schettel Incised are described by Healy (1980:226) as bottles and open, flare-walled bowls. Classification as "bottles" is based on typical rim diameters of 5 cm, but it is my opinion that an alternative classification of Schettel Incised forms as jars with short, vertical necks would be more accurate. While no examples of whole vessels of this type are known from controlled excavations, I have seen vessels in the Museo Nacional de Costa Rica and in private collections where red-slipped, Schettel-like rims appear along with decoration which would be classified as Rosales Zoned Engraved. It is possible that the rim form associated with Schettel Incised was a style of long duration. Schettel Incised has a "highly distinctive, flanged and incised" rim (Healy 1980:225) with a triangular profile. With the exception of the execution and placement of lip grooves, this triangular rim form it is very distinct from that of Tronadora Incised. However, Healy (1980:Fig. 103, bottom row) also illustrates two examples with rounded profiles. These are somewhat more similar to Tronadora Incised, but apparently pertain to vertical-walled, rather than incurving dishes or bowls. In addition, while Shettel Incised rims are frequently grooved on the interior, this was <u>not</u> noted on any sherds of Tronadora Incised.

While both Tronadora Incised and Schettel Incised are distinguished by the use of round-bottomed groove-incision on vessel lips, there is a difference in quality of the incision used on both types. Tronadora Incised incision is deeper, and was executed when the paste was still relatively soft (although not as soft as Bocana). Schettel Incised incision, on the other hand, is typically shallow, and was added after the clay was leather-hard. In addition, while Tronadora Incised incisions are rarely less than 3 mm in width, Schettel incisions can be as narrow as 1 mm. Edges of the grooves on Schettel Incised are not as carefully smoothed.

Schettel Incised sherds are harder than Tronadora Incised examples. The nature of red or orange slipping found on Schettel Incised sherds is totally unlike that found on any sherds from the Arenal area until the mid- to late Arenal Phase. The quality of the red or orange slip on Schettel sherds is very sophisticated. It is thick and hard, although somewhat crazed as a result of differential shrinkage during firing. In summary, while Schettel and Tronadora Incised types do share some important modes in the use and placement of wide, grooved incision, the differences indicate that the two types are culturally distinct. It is believed that Schettel dates later than Tronadora Incised, and that it may have developed from a Tronadora Incised-like type. Healy (1980:225) classifies Schettel Incised as "Palmar Ware," a name borrowed from Bransford (1881) and defined by Healy as having:

> Well mixed temper: temper ususally 50 per cent of paste. Tempering particles include quartzite, mica(?), andesite, chert(?), and shiny black particles which may be volcanic ash. Paste colour is usually brown (5YR5/2) to dark brown (5YR3/3) or grey. Surfaces are usually slipped, after smoothing, with a natural coloured slip, and/or with a red slip. Lightly polished (Healy 1980:84).

Tronadora Incised differs from Palmar Ware in terms of surface finish and specific aplastic inclusions. The distinctive "speckled" temper of grey to white particles in Tronadora pottery does not appear in Schettel Incised ceramics from the collection analysed by Healy. Rather, these have a temper of hard, dark grey particles -- probably ground andesite. However, the presence of a large number of hornblende crystals with irregular cleavage (Healy's "volcanic ash") is shared by the two types. A single sherd from Healy's collection did have a "speckled" paste comparable to that of Tronadora ceramics. This was a bona fide bottle neck included with the Schettel Incised sherds, which, although it lacked either slip or incised decoration, did have an "apron" profile.

Lange (1980) includes Bocana Incised and Schettel Incised together under the classification of "Palmar Ware," characteristic of the "Zoned Incised/Loma B" Phase on the Guanacaste coast and estimated to date from 800-300 bc on the basis of radiocarbon dates from the Vidor Site and other sites in Greater Nicoya. He also remarks, "there seemed to be only slight difference between Bocana Incised Bichrome, Toya Zoned Incised, and Schettel Incised when decorative modes were considered" (1980:36). However, he also places Schettel Incised as late as the Orso Phase (300 BC - AD 300) on the basis of its occurrence in contexts with Rosales Zoned Engraved and the appearance of Schettel-type rims on vessels with Rosales-type decoration (Lange, personal communication 1984). While the intermediate transitional forms remain unclear, stratigraphic evidence indicates Tronadora Incised precedes and overlaps the appearance of Bocana Incised. Stylistic evidence suggests that it probably precedes Schettel Incised. Separating the three in terms of absolute chronology, however, is another matter altogether.

The relationship between Tronadora Incised and ceramics of either southern Mesoamerica or northwestern South America is not as clear. Healy (1980:227) notes that Coe (1961:Fig. 21k) illustrates "an Ocós Buff type from La Victoria, Guatemala, which has similar everted, downward flaring rim with concentric grooves around the circumference." Although it apparently pertains to an open bowl rather than a bottle or jar, this example is similar to Schettel Incised. Another sherd of (Ocós Phase) Ocós Buff, illustrated by Coe (1961:Fig. 21h) and inspected by the author in the Peabody Museum collections, is grooved on the lip and has a rounded profile. It is very similar to the rounded, buff-colored sherds in the Rivas collection, but the form and surface finish differ from Tronadora Incised. Other examples of grooved lips appear in the Conchas Phase at La Victoria. These include Ocós Black (Coe 1961:Fig. 30e), Ocós Gray (Coe 1961:Fig. 30m), and Río Blanco Orange (Coe 1961: Fig. 33e). The example most similar in form and "feel" to Tronadora Incised is from a Conchas Red-on-White tecomate with a single, wide lip groove (Coe 1961:Fig. 14).

It is fair to say that round-bottomed grooving is an important decorative mode throughout the Early and Middle Formative sequence at La Victoria. However, in no examples is it precisely duplicated by the form characteristic of Tronadora Incised. A single sherd of Tronadora Incised with short incisions on the lip perpendicular to a red-slipped rim may be distantly related to grooved and gadrooned rims of Ocós Specular Red. Here again, however, the comparison is between an Ocós flaring-wall bowl and a Tronadora incurving-rim bowl, and the differences are as notable as the similarities.

Shell-stamping, as found on a single sherd of Tronadora Incised, appears to have its closest analogies in Panama. However, these are not close at the level of type (or even group), and will be further discussed below in our discussion of shell-stamped sherds.

CULTURAL SIGNIFICANCE:

This type was defined after the initial analysis of surface ceramics from Tronadora Vieja in 1984. It is one of the most common types of the Tronadora Phase, and is also known from La Montaña and Chaparrón (cf. Snarskis 1978: Fig. 12f-i; Fig. 22a-f; Fig. 23w), where it was termed La Montaña Fugitive Red-on-Cream and Chaparrón Red-on-Brown.

CHRONOLOGICAL POSITION:

Tronadora Incised is a clear diagnostic of the Tronadora Phase. However, stratigraphic evidence is insufficient to place it in either the Early or the Late Tronadora facets. On stylistic grounds, its affinity to both Bocana Incised Bichrome and Schettel Incised suggests the latter. However, it is also possible that this type dates several centuries earlier than 1000 BC.

TYPE: Tigra Grooved-Punctate

VARIETY: Tigra

COMPLEX: Tronadora

SPHERE: Cordillera

DESCRIPTION:

Principal Identifying Modes:

1) Combination of broad, round-bottomed grooving and heavy punctation.
2) Squat, short necked jar forms.
3) Red paint on upper and exterior surfaces of vessel rim.
4) Distinctive "speckled" paste.

Paste, Temper, Firing, Etc.:

While this type is represented by a relatively limited sample, all of the sherds have a characteristic Tronadora Phase paste, identified by a high proportion of white to grey particles which appear to be weathered pumice tephra. This paste is shared with Tonjibe Beige and Tronadora Incised types, and helps to solidify relationships between this type and others of the Tronadora Phase. Other inclusions consist of very small particles of black hornblende and occasional angular particles of white feldspar. In general, the paste is uniformly oxidized and a dark grey or brown in color. Paste texture is fine, although fracture is irregular.

Surface Finish And Decoration:

Tigra Grooved-Punctate is similar to Tronadora Incised and Tonjibe Beige in that the only apparent slip on the vessel is a red ocher paint applied to the rim. It differs, however, in the occasional application of red paint to grooved or punctate decoration on the exterior immediately below the vessel rim. The greater part of the vessel surface was unslipped or "self-slipped" (i.e. "floated"). An unusual characteristic of this type is that frequently the vessel interior is lighter than the exterior. This appears to have been the result of vessel use, caused either by fire-smudging of the vessel exterior during cooking over a smoky fire or by the application of organic substances after the vessel had been completed and was in use.

Tigra Grooved-Punctate (Fig. 6.3:A-G,J-O; Pl. 6.1:P-Z'; Pl. 6.2:A-H) is characterized primarily by the presence of wide zones of heavy punctation immediately below the rim on the vessel exterior. These are frequently zoned by horizontal lines of round-bottomed groove-incision, especially at the juncture of the thickened rims and the vessel body. The nature of the punctations varies widely within this type, and the diameter of individual punctate marks ranges from 2-4 mm. Punctate marks can be either rounded or oblique, and their shape is as much dependent upon the angle of insertion of the punching implement as it is on the instrument's shape. Some marks are teardrop-shaped, and were produced with a relatively sharp implement. Others are round and blunt.

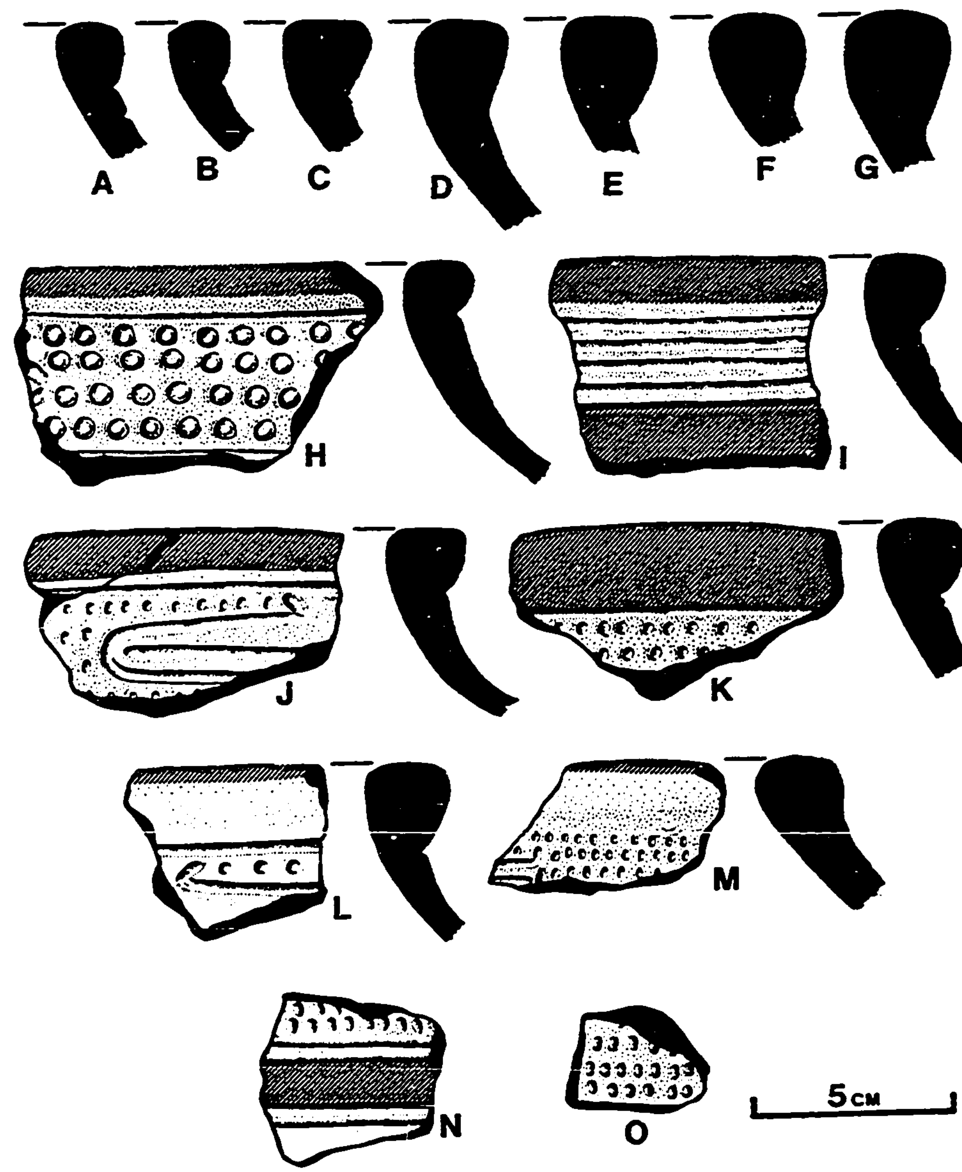
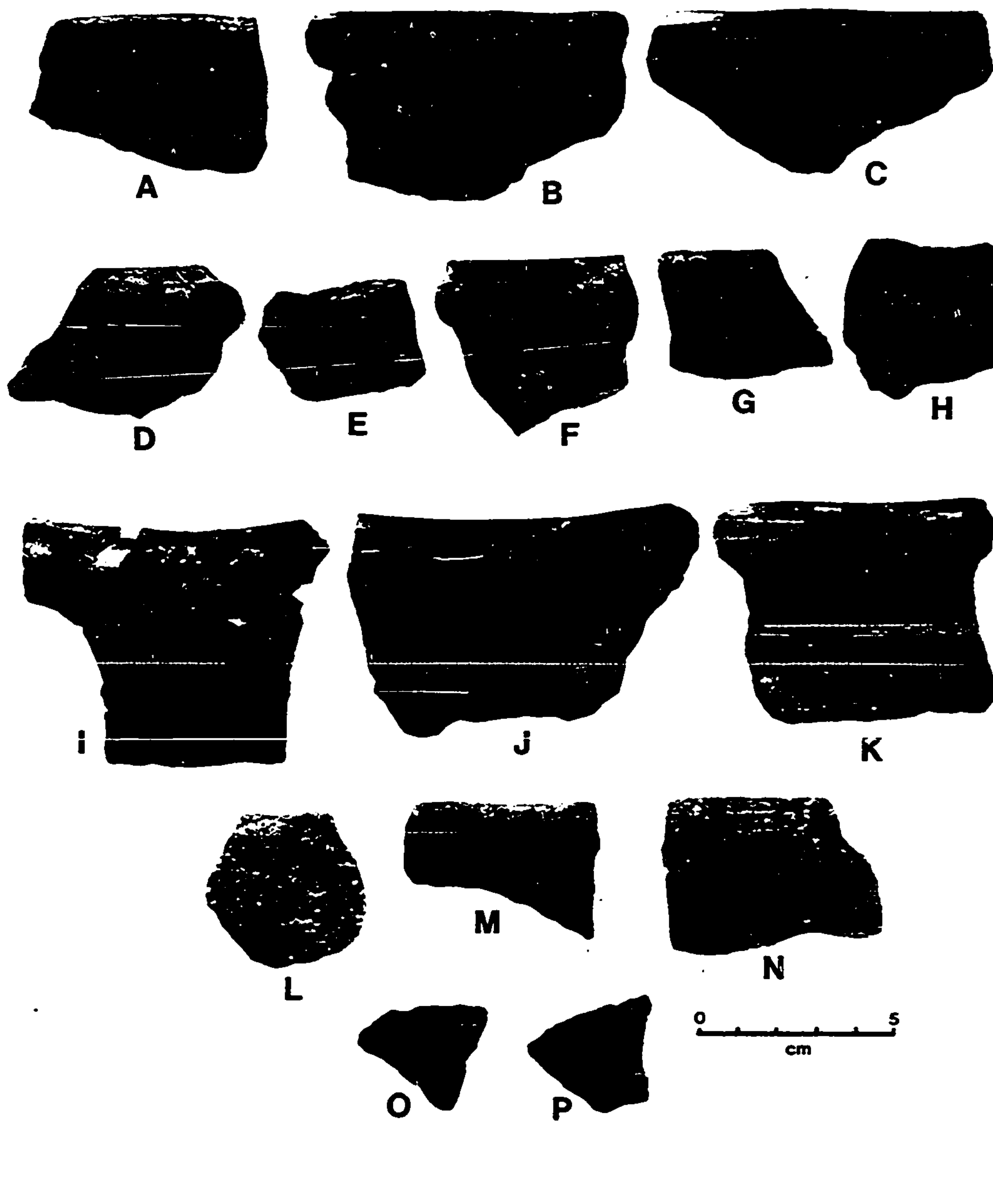


Fig. 6.3: Tigra Grooved-Punctate (A-G, J-O); reed-impressed jar (H); squat, groove-incised jar (I). All sherds are from Tronadora Vieja. Proveniences: A (L2), B (V8, C (H48), D (W18), E (L10), F (H3), G (P3), H (W3), I (W16), J (L2), K (I23), L (W16), M (W34), N (W18), O (L14).

PLATE 6.2
Tronadora Phase Ceramics

Tigra Groove-Incised (A-H); cord-marked olla-tecomate (I); reed-stamped (J, L, M, O, P); groove-incised squat jar (K); coarse "folded" rim (N). Proveniences: A (W18), B (L2) C (I23), D (W34), E (W16), F (W16), G (V8), H (W18), I (L14), J (W3), K (W16), L (IF38), M (W3), N (H22), O (V24), P (W15). All but L, an "isolated find" on the shore of Lake Arenal, are from Tronadora Vieja.

PLATE 6.2



The sequence of the application of the various decorative techniques on sherds of this type is evident from close inspection of several examples. After the vessel and rim had been shaped and dried to a tough consistency, the grooves were incised in the paste. After the grooving was complete, punctuations were added. The application of red pigment was the last stage, as is evident from its presence in both grooves and punctations. In examples with oblique and curvilinear grooving (Fig. 6.3:J,L; Pl. 6.2:B,E,F), some red ocher paint appears to have been applied to the groove itself in order to highlight the design.

These last-mentioned examples of other than horizontal grooving are notable exceptions to the strict type description. On several sherds of Tigra Grooved-Punctate, the punctate area is crossed by combinations of oblique and curvilinear groove-incision, sometimes enclosing small zones of heavy punctation. Unfortunately, no examples which were complete enough to indicate the nature of the entire design are known.

Form and Function:

Tigra Grooved-Punctate is not characterized by a single vessel form. Its diagnostic decoration appears on tecomates and incurving-rim bowls (Snarskis 1978: Fig. 23s-u) and squat, short-necked jars, although the latter form predominates. The decoration on bowls appears immediately beneath the rim on the exterior, and on the necks of squat jars. In general, this latter vessel type had a flat, exteriorly-thickened rim with a squared or "blocky" profile (Fig. 6.2:A-M). The width of the flat rim surface was approximately 1.5-2 cm, and a red slip was applied to the upper and exterior surfaces. The exterior extent of the lip was often decorated with a horizontal groove, below which was the slightly-outcurving vessel neck. Shoulder angles or vessel walls and bases have not been identified for this type, so the precise vessel shape remains unknown. Without knowing whether the profile of the vessel was sharply recurved ("carinated") or more rounded, it is impossible to reconstruct the vessel shape or size. However, the identification of punctate decoration only on sherds from the vessel neck suggests that it did not occur on the vessel body. One sherd was identified with horizontal grooving and a wide red band on what was probably the uppermost portion of the vessel body, indicating that while punctation probably occurred only on the vessel neck, both painting and grooving extended to the vessel sides.

Many of the sherds show the residue of carbonized material on the exterior, while the interior is clean and light in color. This suggests these vessels may have been used for cooking. Tigra Grooved-Punctate squat jars are the predominant necked vessel of the Tronadora Phase, implying that this type was associated with a different function than either Tronadora Incised or Tonjibe Beige. Reed-impressed and incised necked jars (esp. Fig. 6.3:H-I;

Pl. 6.2:J-K) also had traces of burned material on the exterior. While the evidence is admittedly slim, it appears likely that necked jars were employed for cooking within the hearth or firepit. The absence of evidence of burned material on the interior of the vessel neck implies either that the substance being heated was water or that any burning of material which was <u>inside</u> the vessel occurred only on the lower portion of the vessel.

INTRA-SITE LOCATIONS AND CONTEXTS:

The total sample of Tigra Grooved-Punctate consists of 36 sherds, all but four of which come from Tronadora Vieja (G-163). At this site, the sample derives entirely from excavated contexts in nine separate operations. The largest sample comes from Operation W (10 sherds), followed by Operations L and V (5 each); I and Q (3 each); H (2); and C, F, M, and T (one each).

Of this type, 22 sherds (69%) came from Unit 60 or below at Tronadora Vieja. The remaining 7 sherds (22%), came from "50's" strata.

INTER-SITE LOCATIONS AND CONTEXTS:

Sherds of this type were noted at only four sites in the Arenal area: Tronadora Vieja (G-163), with 32 sherds; G-156, with two sherds; and G-161 and G-165, with one sherd from each. The total sample identified as diagnostic as to type therefore consisted of 32 sherds.

A squat, necked jar similar to examples (esp. Fig. 6.3:I; Pl. 6.2:K) from Tronadora Vieja is known from the site of Santa Rita, Belize, and is illustrated in the catalogue from the exhibit "Maya: Treasures of an Ancient Civilization" (Clancy et al. 1985:Cat. No. 1). The similarities lie in the nature and application of the horizontal grooving on the vessel neck. This is the only clear comparison between our assemblages and those dating to the Swasey Phase in Belize, which in general differs from Tronadora in both vessel shapes and its emphasis on sophisticated techniques of surface finish instead of plastic decoration.

CULTURAL SIGNIFICANCE:

The significance of the designs on the exterior of the vessel neck is hard to determine, given their fragmentary nature. Sherds of this type appeared in Chaparrón assemblages, but not in those of La Montaña, and may have geographical significance. Because of its incised and punctate decoration, Tigra Grooved-Punctate is probably ancestral to the Arenal Phase type Huila Zoned-Punctate, which belongs to the Greater Nicoya ceramic sphere.

CHRONOLOGICAL POSITION:

As with Tronadora Incised, the sample size and stratigraphic information for this type is insufficient for placing this type either early or late within the Tronadora Phase. The squat, jar form is very different from that found on later Bocana Incised ceramics. As noted above, it may be distantly related to similar vessel forms in the early Swasey complex in Belize. Sherds of Tigra Grooved-Punctate were important diagnostics in the ceramic assemblage from House No. 1 at Tronadora Vieja, which is dated by a radiocarbon assay of ca. 1822 BC [Tx-5279], suggesting a placement early in the Tronadora Phase.

TYPE: Zetillal Shell-Stamped

VARIETY: Zetillal

COMPLEX: Tronadora

SPHERE: Cordillera

DESCRIPTION:

<u>Principal Identifying Modes</u>:

1) Very light shell impressions or rocker-stamping with the edge of a shell.
2) A "floated" or unslipped surface (possibly a light slip of the same clay as the vessel paste).
3) Zoning with round-bottomed grooving.
4) Tall, cylindrical vessels with a "hyperbolic" profile

<u>Paste, Temper, Firing, Etc.</u>:

Zetillal Shell-Stamped sherds are often light cream in color, lighter than all Tronadora Phase types except Tajo Gouge-Incised. However, our sample has a full range of cream, beige, brown and dark brown sherds. The most distinctive aspect of the paste is the relatively high proportion of a soft, white tempering material. These appear as soft, white particles with irregular shapes, some of which actually contain small black crystals of hornblende. This paste differs from the Tronadora Phase types Tonjibe

Beige and Tronadora Incised in that the latter are tempered frequently with particles which are a darker shade of grey. In Zetillal Shell-Stamped, the temper particles are very soft and friable, and crumble easily when a sharp steel probe is applied. The temper concentration is approximately 20-30% of the paste, with inclusions as large as 1 mm in diameter. Testing with a dilute solution of HCl was used to confirm that the white inclusions were not calcite -- a common aplastic inclusion in ceramics from regions with a karst topography, such as the Maya Lowlands.

In addition to the white particles, probably a light pumice tephra, there are a large number of free crystals of hornblende. Light colored inclusions of feldspar and an occasional ferric spherule are also present.

While the majority of sherds -- especially those most diagnostic of this type -- have this distinctive paste, there are a number which have a temper more similar to that of Tronadora Incised or Tronjibe Beige. That is, the predominant aplastic inclusion is a light to dark grey particle rather than white.

Surface Finish And Decoration:

The surface color of Zetillal Shell-Stamped sherds ranges from a light cream to a pale orange. Paste and surface are generally identical in color; however, examination under the binocular microscope indicates that many of the vessels were slipped. A thin layer of clay particles with a minimum of aplastic inclusions was deposited on the vessel surface after shaping (and probably incising), but prior to the addition of impressed decoration. This may have been accomplished by actually slipping the vessel in a colloidal solution prepared from the same clay with which the vessel was manufactured.

This type, like Tronadora Incised and Tajo Gouge-Incised, is characterized by a unique form of decoration thought to be distinctive enough to warrant the definition of a ceramic type (Fig. 6.4; Pl. 6.3:K,M-Z). This is the use of very light impressions on the exterior vessel surface, often zoned with shallow groove incisions. These impressions are most frequently accomplished with the wavy edge of a shell. Given the length of the impressions, the shell was probably cut into a relatively narrow, tabular form, not more than 2 cm in width. Shell-edge stamping appears in a variety of forms throughout the Tronadora and Arenal Phases in the Arenal Basin (cf. Fig. 6.5:J-M; Pl. 6.3:L,T-F'). What distinguishes its manifestation in Zetillal Shell-Stamped from other examples is the extreme delicacy of the impressions and their decorative context. They are so light that they are often invisible without using an angle of illumination which can highlight the minute surface contours. The intended effect of this technique was clearly the texturing of a decorative zone on the vessel, rather than the creation of a pattern composed of individual marks.

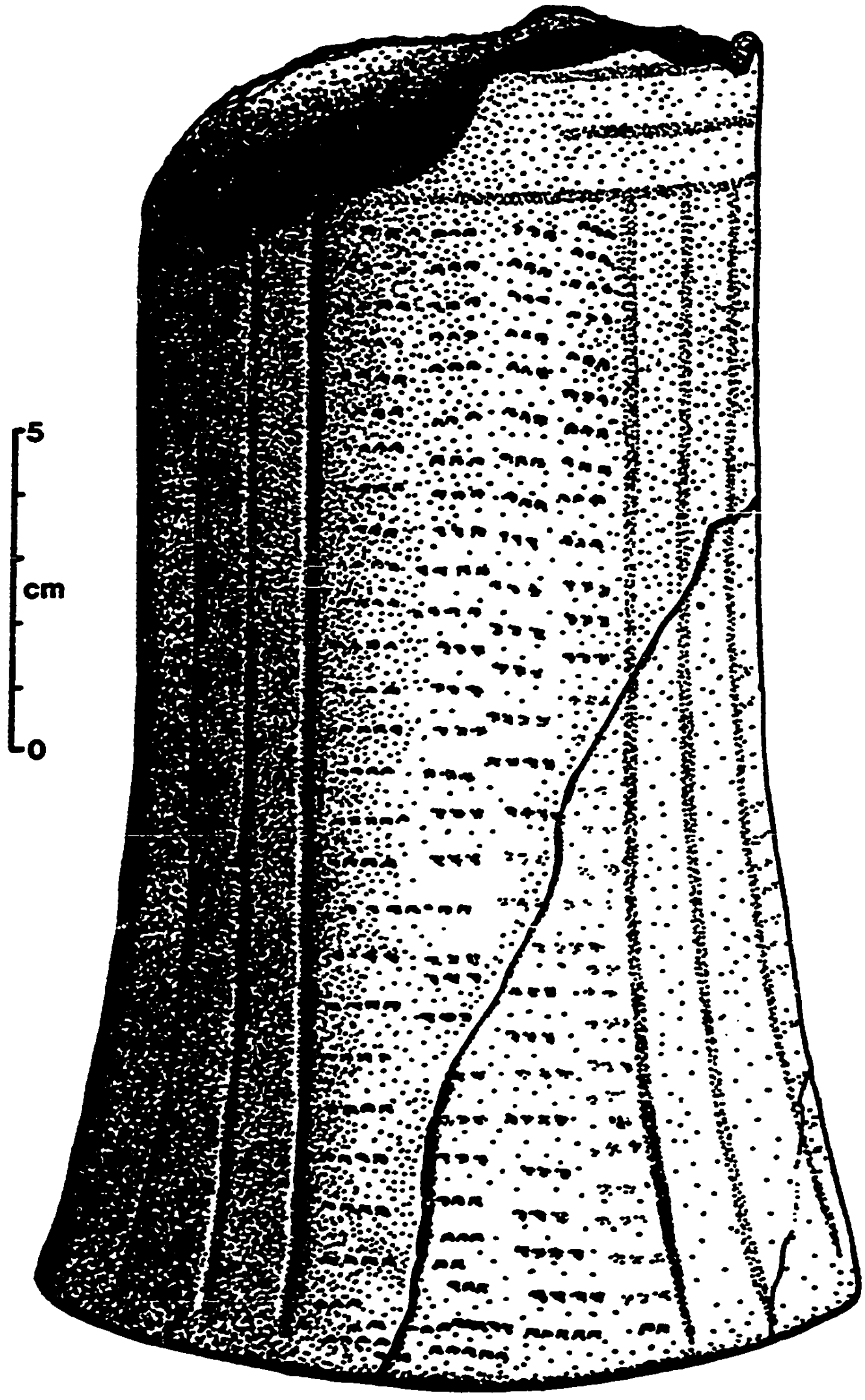
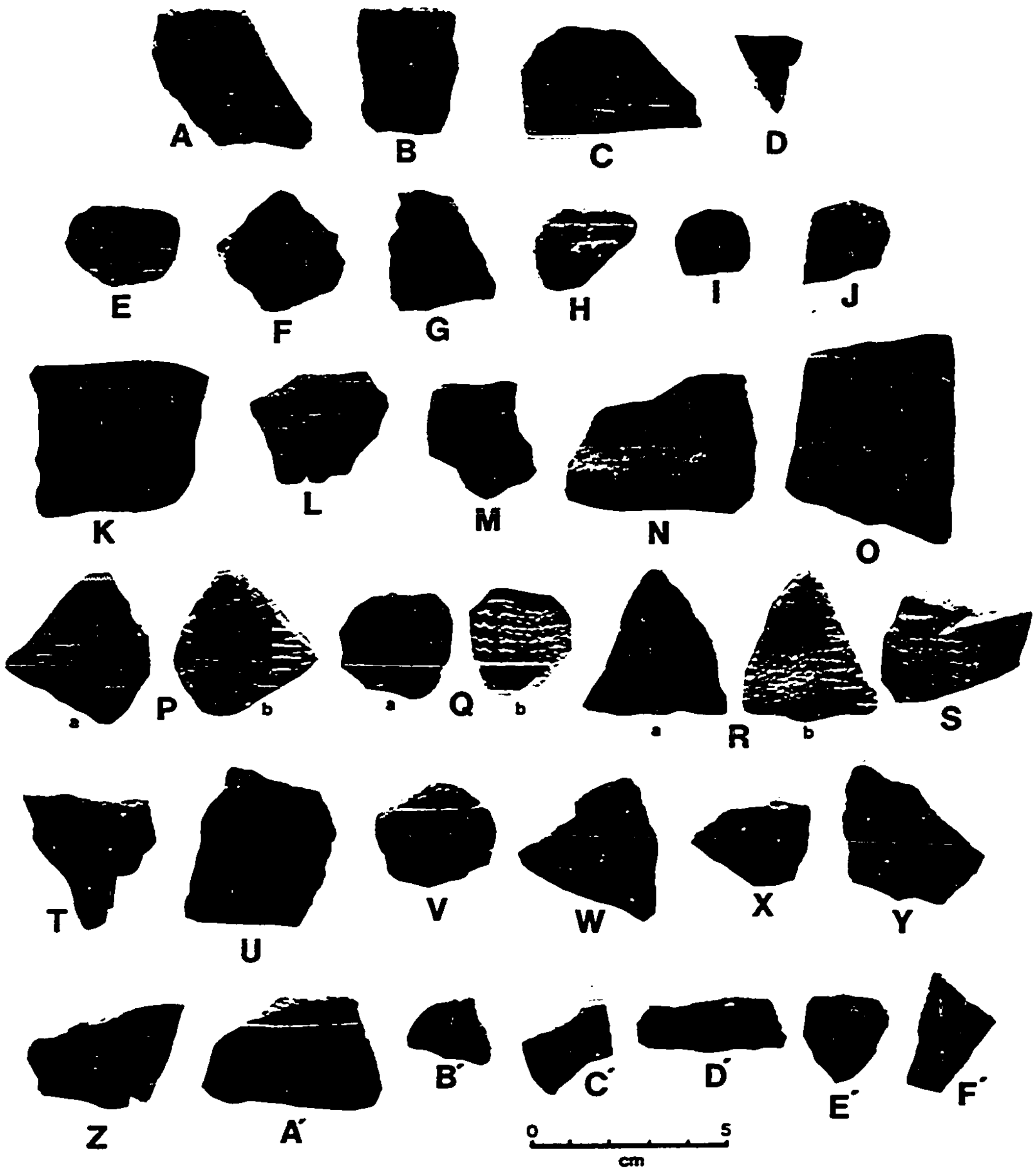


Figure 6.4: Zetillal Shell-Stamped vessel from eroded lakeshore at G-163,

PLATE 6.3
Tronadora Phase Ceramics

Atlantic Red-Filled Black Group (A-J); Zetillal Shell-Stamped (K, L-S), including a vessel base fragment (N) and a possible rim (K); and general shell stamped (L, T-F'). All are from Tronadora Vieja. Proveniences: A (V24), B (M3), C (H10), D (?), E (W3), F (I11), G (W7), H (I26), I (U2), J (W32), K (H5), L (V51), M (W15), N (W3), O (W17), P (V11), Q (L14), R (V12), S (L14), T (V6), U (L14), V (W18), W (V8), X (W28), Y (W3), Z (U3), A' (W16), B' (M4), C' (H1), D' (V19), E'(V29), F' (N37). Sherds P, Q, and R are shown with both the sherd itself (a) and a plasticene impression (b), to emphasize the faint rocker-stamping pattern. Sherd S is the plasticene impression alone.

PLATE 6.3



One important technique utilized in the decoration of this type is shell-edge "rocker-stamping," in which the shell instrument was "walked" along the vessel surface, creating a zig-zag pattern of marks. This technique is also found on Early Formative ceramics of southern Mesoamerica, most notably Ocós sherds from La Victoria (Coe 1961:Fig. 47:a-y), Early Ajalpan sherds from the Tehuacán Val-ley (MacNeish et al. 1971). Rocker-stamping is an important decorative technique in the ceramics of a number of Early Formative complexes in both Mesoamerica and South America, most notably those associated with Olmec and Chavín/Cupisnique cultures. However, Chicharras Phase rocker-stamping from San Lorenzo tends to emphasize the creation of an attractive zig-zag pattern, in which the decorating instrument is rocked with sufficient pressure and "walked" with sufficient lateral movement to create a distinct design element (Coe and Diehl 1980:Fig. 132). The rocker-stamping used in Zetillal Shell-Stamped vessels is more similar to that of early Ocós ceramics than Chicharras examples. Lateral movement of the impressing implement was extremely slight, and only a few examples are clear enough to demonstrate its zig-zag application. In most examples, side-by-side applications of marks will overlap, and impressions may be repeated within a single application to insure continuity of the textured pattern. It appears that the symbolic value of the rocker-stamped <u>pattern</u> was minimal, and that the significance of the technique was its utility in creating a specific textured zone. Application appears to have been fairly rapid, minimizing the time necessary to decorate a large vessel.

Not all of the impressed decoration on this type is rocker-stamping. Single, shell-edge impressions used to fill zones are also diagnostic. As with the rocker-stamping, these impressions are usually shallow, and the intent is to create a textured zone, rather than use the individual shell impressions as design elements. A technique very similar to that used on Zetillal Shell-Stamped also appears on sherds from the Gulf Coast of Veracruz, some of which are very similar to those from northwestern Costa Rica (cf. García Payon 1966:Lam. XLIII,1). A single known example displays stamping with the back of a shell, and is virtually identical to a sherd illustrated by Coe (1961:d').

Other methods of surface texturing closely related to the shell-edge stamping probably appear on the same types of vessels in Tronadora Phase assemblages. Very few examples of these were recovered from our excavations, but their similarity to Ocós sherds warrants discussion. These techniques include cord-marking or textile impressions, in some cases combined with groove-incised zoning (cf. Coe 1961:Fig. 49). In all cases, the intent to create textured zones on the vessel exterior appears to have been identical to that of the makers of Ocós

Phase vessels. On one example, cord-marked or fabric-impressed zones are delineated by two shallow, parallel grooves, 2 cm apart.

Grooved decoration on this type appears in circumferential rings, usually around the neck and base, and single or multiple vertical elements demarcating longitudinal zones. The grooved decoration on this type has a different quality from that on other Tronadora Phase types. As with the impressions, it tends to be shallow, although this is not universally true. On the single vessel of Zetillal Shell-Stamped recovered (Fig. 6.4), as well as on sherds which are large enough to be diagnostic as to vessel form, the grooves are placed vertically on the vessel exterior and appear in groups of two or more. Horizontal grooves are also present, intersecting the vertical elements and circumscribing the uppermost portion of the vessel. Horizontal grooves <u>may</u> also appear just above the vessel base. Groove width ranges from 2.5-4 mm.

Vessel interiors are undecorated, but occasionally show signs of wiping or smoothing. On one sherd, vertical wiping is evident on the interior of a cylinder, indicating that smoothing was probably done by the potter reaching down into the deep vessel from the mouth.

While the addition of red slipped zones does <u>not</u> appear to have been typical of this type, two sherds which belong at least to the same taxonomic group as Zetillal (i.e. have extremely well-preserved and vivid red ocher paint on an unslipped, orange paste. In one example, it appears as a wide (3.5 cm) band on the interior of an outcurving, direct rim (Fig. 6.5:N; Pl. 6.3:K). The band extends to the interior edge of the vessel lip, and does not continue onto the vessel exterior. In the other example, the slip appears to be zoned on the vessel exterior by wide grooving.

Another sherd (Fig. 6.5:M; Pl. 6.3:Y), which may also be from a vessel in the Zetillal group, was pointed out by Snarskis (personal communication, 1985) as being very similar to the type specimen from Zetillal de Ipís (Snarskis 1978:Fig. 25a). It is a slightly curved body sherd, from near the rim or the base of a "hyperboloid" cylinder vessel. It is decorated with a combination of groove-incision, deep, single-stroke shell-edge stamping, and an appliqué pellet with three round punctations. All of these modes, as well as the sherds' similarity to the ZIP vessel, are indicative of close ties with the La Montaña complex.

Form and Function:

Zetillal Shell-Stamped is distinguished as much by its unusual form as by its characteristic decoration. The diagnostic Zetillal Shell-Stamped form (Fig. 6.4; Fig. 6.5:O-Q) is a tall, cylindrical vessel with a flat base and "hyperboloid" pro-file (Shepard 1956:235). This distinctive shape results primarily from the expansion of the vessel diameter at the base and (slightly less so) at the rim. The walls of these vessels appear to have been vertical for most of the length of the vessel, and body sherds of this type are characterized by a cylindrical curvature. The expansion of the vessel at the base was accomplished by thickening the walls, with little or no change in the vessel's interior diameter. A largely complete vessel of this type was recovered at Tronadora Vieja (G-163) from eroding deposits at the edge of Lake Arenal, confirming identifications of a few fragments of vessel bases. These tall, cylindrical vessels appear to have had diameters between 10-15 cm. The vessel from Tronadora Vieja was missing its uppermost portion and rim, but appears to have been about 25 cm tall when it was complete.

The function of this unusual vessel form is unclear. Snarskis (1978:70) has suggested that it may have served as a pottery drum. However, lacking an opening in the bottom or other aperture which would have permitted the escape of air from the interior, it is doubtful that the vessel would have had much resonance when a membrane was placed over the opening. Most of the base fragments are heavily reduced on the interior, but this may have resulted from poor circulation of oxygen on the vessel interior during firing. A single sherd shows the remains of a thin layer of charcoal residue on the inside of the basal angle, suggesting some substance had been burned in the vessel or charred while cooking. Another possible function would be the use of these vessels as incensarios, in which a plant resin or other aromatic material was placed in the bottom of the vessel and burned. The tall, chimney-like shape would have inhibited rapid oxidization and promoted the production of smoke. However, as with the drum, the addition of a small aperture would have made this function more efficient. If these tall forms were designed for cooking, we might infer from their specialized shape that the substance being prepared was also of a special nature. A beverage prepared from a material which would have left a residue in the bottom of the vessel, such as a cacao drink made from ground or mashed beans, or a soft food might have been the source of the charred deposits. It is worth noting that the exterior of vessel bases do not show evidence of burning or reduction. Without experimentation or further inference based on ethnographic examples, it will be difficult to say more about possible functions of these distinctive vessels. Hopefully, future research will provide us with more information on the origin and evolution of this vessel form.

INTRA-SITE LOCATIONS AND CONTEXTS:

The sample of Zetillal Shell-Stamped ceramics in the Arenal area consisted of 22 sherds and one partially-reconstructable vessel (Fig. 6.4), all from the site of Tronadora Vieja (G-163). The sherds were distributed in very small quantities in six separate operations: H and V (5 each); L and W (4 each); and I and R (2 each). The partial vessel was retrieved from eroding deposits at the edge of

Lake Arenal, where it was embedded upside-down in the matrix of what appeared to be either Unit 60.or 61.

All but two of the 22 sherds from Tronadora Vieja came from Unit 60 or underlying strata.

INTER-SITE LOCATIONS AND CONTEXTS:

While the only sherds classified as Zetillal Shell-Stamped came from Tronadora Vieja, the wavy, shell-edge stamping motif (which is dinstinct in its execution and not itself diagnostic of the type), appeared on 31 additional sherds from five sites: Tronadora Vieja (23), G-168 (4), G-164 (2), G-156 (1), and G-167 (1).

Vessels of Zetillal Shell-Stamped appear to be common to the Tronadora, Chaparrón, and La Montaña compexes. With the exception of the partial vessel recovered from Tronadora Vieja, the only other nearly complete example of this type comes from the site of Zetillal de Ipís (16-ZIP), in the suburbs of San José. That example is decorated with a combination of "zoned rocker stamping... appliqué pellets, fillets and stylized human figures, coupled with broad line circumferential grooving" (Snarskis 1978:69;Fig. 25a). Among published assemblages from lower Central America, two "scarified vessels" from the Chiriquí region of western Panamá illustrated by MacCurdy (1911:100) appear to be somewhat related. One of them is a "bell-shaped, flat-bottomed tripod" from Caldera, on which "the scarified surfaces give the effect of having been produced by some textile fabric" (Ibid.:Pl. XXVIe). The other is a tall (26.5 cm) vessel with a flat bottom and flaring rim (Ibid.:Pl. XXVIa), decorated with vertical zones of scarification which are separated by sets of three incised lines. It differs from Tronadora vessels in that it is painted on the interior and exterior. It is also a thick (r 1 cm) and sturdy vessel. With regard to its function, MacCurdy remarks:

> "the vessel, though empty, could be overturned with difficulty... Its serviceableness as a containing vessel was relatively small. On the contrary, it would hold weighty substances without danger of bursting and may have seen service in that capacity. It does not seem to have been used over the fire, but a majority of the vessels in the scarified group were so employed" (1911:100).

Tronadora-like ceramic complexes may have had a direct influence, through exchange or direct cultural contact, on the "Scarified Wares" of Chiriquí.

CULTURAL SIGNIFICANCE:

With regard to vessel form, Snarskis notes, "The thick-walled basal angle and flat bottom are especially diagnostic, not appearing in any other period in the [Atlantic] regional sequence" (1978:70) These tall, cylindrical vessels disappear from Central Highland and Atlantic Watershed assemblages in the phases which follow Chaparrón and La Montaña. In Greater Nicoya, tall, cylindrical forms associated with types such as Diría Incised may be derived from Zetillal-like vessels. Well-known examples of Diría have deep circumferential incision and a finish which is either natural, zoned in red, or red and black on a natural background.

CHRONOLOGICAL POSITION:

As with other Tronadora types, there is little stratigraphic evidence to support the placement of this type early or late in the phase. The presence of light shell stamping or shell-edge rocker-stamping, however, links this type to Early Formative ceramics in Mesoamerica and Panama which date ca. 1500-1000 BC.

TYPE: Tajo Gouge-Incised

VARIETY: Tajo

COMPLEX: Tronadora

SPHERE: Cordillera

DESCRIPTION:

Principal Identifying Modes:

1) Designs in strip appliqué emphasized by gouging and groove incision.
2) Red paint on strip appliqué.
3) Fine pastes, cream to grey in color.
4) Distinctive paste composition.

Paste, Temper, Firing, Etc.:

The paste of Tajo Gouge-Incised is distinct from that of the "speckled" wares of other Tronadora Phase types. The white to grey tephra temper is absent, and the principal aplastic inclusions are clear, subrounded grains of quartz, fibrous, opaque white particles of feldspar, and black hornblende crystals. One inclusion which appears in this type but has not been noted in other Tronadora Phase types is large (> 1 mm) gold to salmon-colored flakes of (biotite) mica. These do not constitute a large percentage of the aplastic inclusions, but are evident in all of the sherds in our sample.

Pastes range in color from a light cream to light orange, with cream predominant. Sherds of this type frequently stand out in assemblages because of their light color and fine paste. In general, oxidization is complete throughout the thickness of the sherd. However, this is also one of the few Tronadora Phase sherds to show an occasional reduced core.

Surface Finish And Decoration:

Tajo Gouge-Incised ceramics are unslipped and have a dull finish, with the exception a high-luster paint on the appliqué decoration. Vessel interiors show signs of wiping and smoothing. The very unique form of decoration which characterizes this type is not clearly related to other roughly contemporaneous ceramic complexes in the Americas, and has no apparent derivations in any later Costa Rican ceramic styles. This decoration consists of the application of narrow strips of clay in single, circumferential bands or as part of complex motifs composed of either curvilinear elements or perpendicular and parallel lines (Pl. 6.1:H-O). These appliqué strips are typically 4-6 mm in width (although on one example a segment is as wide as 1 cm), and carefully painted with a bright, red ocher slip. The contour of the appliqué strip is then emphasized by grooving, gouging, or scooping channels on either side of the strips. Where a complex motif has been created by joined strips of appliqué or curvilinear designs, gouging close to the appliqué can leave small ridges within the design, between the appliqué elements. This technique produces a decoration rich in depth and texture, and may be distantly related to the tradition of carved ceramics in early Middle Formative assemblages of Mesoamerica. Designs were executed when the paste was relatively soft, and the sequence of application was strips first, grooving or gouging next, and painting last. This form of decoration was highly sophisticated, and the few fragments we have of complex motifs are tantalizingly suggestive of a rich iconography -- especially in patterns composed of curvilinear elements.

No rims, necks, supports, or other portions of Tajo vessels have been identified, and it is therefore impossible to know how they might have been decorated. It is possible that some of the outcurving, red-lipped jar rims from Tronadora levels are from Tajo Gouge-Incised vessels, but this remains to be verified through paste comparisons. Until more complete examples of this type can be identified in collections or from excavations, we can say little about the decorative motifs represented with the distinctive painted appliqué.

Form and Function:

All of the sherds of this type are body sherds, and appear to have come from large, globular vessels. While our paste characterization will assist in the identification of vessel rims and other sherds diagnostic as to form from this type, none have been identified to date.

INTRA-SITE LOCATIONS AND CONTEXTS:

The largest sample of sherds of this type comes from Tronadora Vieja, where a total of 41 were recovered from surface collections and eleven separate operations. Eroded surface deposits yielded only 8 sherds, and excavated sherds were widely distributed through Operations W (9); V (6); H (5); L (4); G and J (2 each); and C, I, P, Q, and S (one each).

A total of 22 sherds, or 54% of the assemblage of this type, came from Unit 60 or underlying strata at Tronadora Vieja. Seven sherds came from "50's" strata, and eight were recovered from surface collections.

INTER-SITE LOCATIONS AND CONTEXTS:

The sample of this ceramic type consists of a total of 50 sherds from six different sites, including Tronadora Vieja. Much smaller samples come from G-161 (5 sherds), and G-156, G-157, G-165, and G-168 (one each).

Elsewhere (Hoopes 1984, 1985), I have stated that there may be a relationship between Tajo Gouge-Incised and the Gulf Coast Olmec type Calzadas Carved (Coe and Diehl 1980:162-170). However, the comparison between the two is by no means close. Baudez (personal communication, 1985) has agreed that there are similarities between Tajo Gouge-Incised and certain carved types, but explicitly rejects a parallel between this type and his early (Jaral Phase) central Honduran type Bográn Incised (Baudez and Becquelin 1972). Stip appliqué itself, usually notched or impressed, appears on early ceramics from Yarumela in the Ulua Valley of Honduras and Parita Bay in Panamá, but in neither instance does the technique compare favorably with that found on Tajo Gouge-Incised. The light colored, fine paste and the careful application of a bright red slip is more of a northern, Mesoamerican tradition than a southern one. However, no good parallels are yet known from southern Mesoamerica.

CULTURAL SIGNIFICANCE:

Tajo Gouge-Incised and Zetillal Shell-Stamped are the only Tronadora Phase ceramics decorated extensively on the vessel body rather than simply the neck or rim, and there is little doubt that they both served special functions. Because of its distinctive decoration, Tajo Gouge-Incised is thought to suggest possible interaction between an early Costa Rican stylistic sphere and cultures of Early and Middle Formative Mesoamerica (to be elaborated in Chapter Eight).

CHRONOLOGICAL POSITION:

While stratigraphic evidence is largely inconclusive, on stylistic grounds this type probably pertains to the latter half of the Tronadora Phase. The use of appliqué has not been noted in any other Tronadora Complex types, and the evidence for complex, curvilinear motifs is slight. Tajo Gouge-Incised stands out from the assemblage as a whole for two reasons: it does not share the characteristic "speckled" paste found in other Tronadora types, and it has no parallels at all in either the La Montaña or Chaparrón complexes.

Discussion

These five types are the only ones we have been able to define from the Tronadora assemblage so far. Other combinations of modes are more varied in expression, limited in number, and crosscut useful type designations. From our small sample and limited stratigraphic information, it is very difficult to say with certainty which types or modes are most characteristic of our Early and Late Tronadora divisions. For the most part, the separation of these two facets is based upon comparisons with contemporaneous assemblages in other parts of Nuclear America. There are a large number of assumptions and problems inherent in long-distance comparisons of Formative assemblages. However, until more sites and larger samples of early cultural material are obtained, this will be the only way to take advantage of the few known dated assemblages for chronological purposes.

Interregional Comparisons

None of the sherds from Tronadora Vieja are as "primitive" or poor in quality as either Pox (Brush 1965) or Purrón (MacNeish et al. 1970) ceramics from Mexico, nor as simple as the great majority of Monagrillo ceramics from Panama. No part of the assemblage gives the impression of an incipient ceramic technology. Pastes are generally well-fired, and vessel forms demonstrate a relatively high level of sophistication. As noted above, the predominant vessel form of the Tronadora Complex is the bolstered-rim *tecomate*. Pointed and comma-shaped rim profiles are also found in the assemblage from Tronadora Vieja (Fig. 6.1:P,R-S). The *tecomate* form, probably initially an imitation of natural gourd forms, is widespread throughout the Americas in the Early Formative period. The broad distribution of this form in the earliest ceramic assemblages from a variety of regions has been the source of a great deal of speculation regarding the diffusion of culture and ideas (Ford 1969, Myers 1978). The *tecomate*'s appearance in combination with other distinctive Early Formative modes in the Tronadora assemblage suggests the partici-pation of the Cordilleran region of Costa Rica in much larger cultural patterns which appear throughout Nuclear America between 2000 and 1500 BC.

Other important Tronadora modes with widespread distribution through Central and South America in the Early Formative period are round-bottomed grooving, heavy punctation, shell-stamping (sometimes "rocker-stamping"), and red zoning. In Panama, these modes appear on pottery from the Monagrillo and Sarigua Phases. In Mesoamerica, they are diagnostic of Barra and Ocós ceramics from the Pacific coast of Guatemala and Chiapas (Green and Lowe 1967, Lowe 1975, Coe 1961), Ajalpan ceramics from the Tehuacán Valley (MacNeish et al. 1970), and other Early Formative assemblages (cf. Lowe 1978). However, side-by-side comparisons of Tronadora ceramics and type collections of Panamanian and Guatemalan pottery at the Peabody Museum indicates that the Costa Rican sherds are far more similar to Ocós ceramics than any of the Panamanian examples. While some Ocós pottery, most notably the thin-walled, sharply-incurving "pumpkin" <u>tecomates</u> , had no parallels in the Tronadora assemblage, others were virtually identical. Among these were sherds with rocker-stamped and shell-stamped decoration, punctation, and groove-incision. The two sherds illustrated by profiles in Fig 6.1:R-S, with red bands on the exterior vessel rim, are typical of the simple, red-rimmed <u>tecomates</u> common to several Mesoamerican Early Formative assemblages. Open bowls with bright red hematite slipped rims from both assemblages were very close in form, color, and paste.

Those modes of form and decoration which are shared by

Tronadora, Barra, and Ocós (as well as early South American complexes such as Tesca, Canapote, Barlovento, and Machalilla) (Bischof 1972, Meggers et al. 1965) are presumed to characterize our Early Tronadora Phase (2000 - 1000 BC). The types Tonjibe Beige, Tronadora Incised, and Zetillal Shell-Stamped probably first appeared during this period. The Late Tronadora Phase is characterized by those modes which are transitional into Loma B Zoned Bichrome (Early Arenal) types. These include combinations of grooving and bichroming similar to Bocana Incised Bichrome. It is also likely that Tronadora modes similar to "Olmec" or other Middle Formative ceramics, such as the unusual Tajo Gouge-Incised decoration and sherds infilled with ocher (Fig. 6.5:A-I Snarskis' "Atlantic Red-Filled Black" category), date to the Late Tronadora Phase (1000 - 500 BC). Given the possible early dates for Loma B ceramics, some Bocana Incised Bichrome sherds may belong in the Late Tronadora Phase. Unfortunately, stratigraphic data and sample size at Tronadora Vieja were not adequate to address problems of sub-dividing the Tronadora Phase. The persistence of the use of round-bottomed grooving and punctation into the Arenal Phase makes the transition between Tronadora and Arenal particularly hard to define. Characteristics of Early Arenal ceramics which are not found in Tronadora include: vessels with supports; a predominance of vertical, rather than horizontal, groove-incision; red-painted zones and decoration which are not

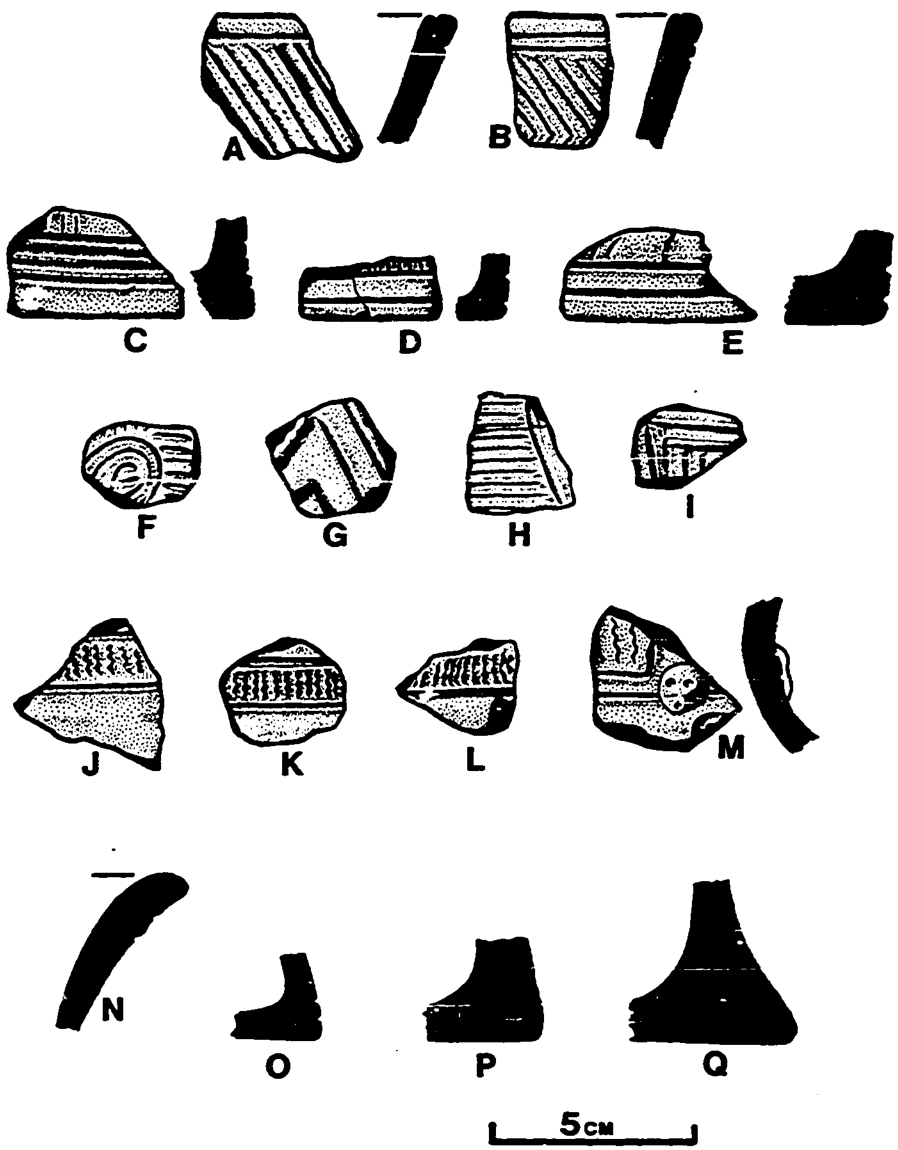


Fig. 6.5: Atlantic Red-Filled Black (A-B, F-I); cylindrical vessels (C-E); shell-stamping (J-M); and Zetillal Shell-Stamped profiles (N-Q).

All sherds from Tronadora Vieja. Proveniences: A (V24), B (M3), C (H10), D (I5), E (M2), F (L14), G (I11), H (W7), I (V8), J (V8), K (W18), L (W28), M (W3), N (H5), O (Q3), P (I20), Q (W3).

sharply zoned with incision; and multiple, "combed" incisions.

Dating the Tronadora Phase

Nine radiocarbon dates are available from the Tronadora Vieja site, four of which pertain to the preceramic Fortuna Phase, and five of which were from ceramic-bearing contexts. Three of the dates for Tronadora Phase ceramics are earlier by 1000 years than any dates yet accepted for Costa Rican ceramics (two dates, one each from the sites of La Montaña and Sitio Méndez, may be associated with early ceramics, but neither has previously been considered acceptable given their ambiguous contexts and the lack of contemporaneous, more acceptable dates). However, they compare favorably with dates for Early Formative ceramic complexes in Ecuador, Panama, Colombia, and Guatemala, and confirm the participation of Costa Rican cultures in developmental patterns widespread throughout Central America and northwestern South America at this time.

Stratigraphic information from Tronadora Vieja indicates that the earliest ceramic-producing inhabitants of the site may have occupied the same living surface as the preceding Archaic cultures. This consisted of a thin, tropical-forest soil situated on top the clay Aguacate Formation. The Tronadora Phase occupation continued through the initial eruptions of Arenal Volcano, which deposited large quantities of tephra in the Arenal area, contributing greatly to the formation of fertile soils in the region. Four early radiocarbon dates were associated with lithic artifacts and debitage of the Fortuna Phase embedded in the top of the Aguacate Formation at Tronadora Vieja (See Appendix B for the nature and context of all Proyecto Prehistórico Arenal radiocarbon assays). These range in time from 3609(3360)3050 BC [Tx-5275: 2650 bc ± 70] to 2450(2090)1753 BC [SI-?: 1725 bc ± 100], and are presumed to date the very end of the Archaic period occupation of the region. A fifth date for the Fortuna Phase from the single component Fortuna Phase site of AL-186, 2336(1999)1740 BC [Tx-5286: 1685 bc ± 100], supports a terminal date of 2000 BC for the Archaic Period in the Arenal basin. The two dates for the beginning of the Tronadora Phase occupation of the site come from stratigraphic units immediately above the Aguacate Formation. These are 2470(2166)1834 BC [Tx-5277: 1780 bc ± 100] and 2860(1822)1000 BC [Tx-5279: 1530 bc ± 320]. The dendro-corrected 95% or 2-sigma confidence interval of the first date falls within that of the second, yielding a calibrated overlap range from 2470 -1834 BC.

One date, 3360(3066)2920 BC [Tx-5276: 2500 bc ± 70], remains highly problematical. It was found in the context of the tephra unit overlying the Aguacate base (Unit 61), and comes from a possible hearth. It was associated with thick sherds of Tonjibe Beige and other ceramics (one with carbon residue), lithic debitage, and a charred maize kernel. Excavation notes taken at the time the sample was collected state, "This sample appears in the matrix as a large quantity of small fragments, probably the remains of a cooking fire. These are directly associated with Tronadora Phase material, and this aggregate sample will probably provide us with the best current date for the Tronadora Phase. Any contamination of this sample would have to have resulted from a mixing of this charcoal with fragments from later fires brought down by root action." Despite the nature of the associations and the confidence with which this sample was collected, we are very reluctant to push the beginning of the Tronadora Phase back one thousand years earlier on the basis of a single date. Given the early dates for Monagrillo ceramics in Panama, the presence of pottery in Costa Rica at 3000 BC would not be surprising. However, until further radiocarbon dating supports the earlier determination, we have chosen to place the end of the Archaic period Fortuna Phase and the beginning date of the Tronadora Phase at 2000 BC.

The Tronadora Complex is very closely related to a number of early ceramic complexes from the northern llanuras, Atlantic Watershed, Central Highlands, and Greater Nicoya regions of Costa Rica. Barva Phase ceramics, recently defined in the Central Highlands, are reported to be very similar (Snarskis, personal communication 1985), as is the newly discovered Curré Complex, from the site of the same name in the Diquís region of southern Costa Rica (Corrales 1985). However, these assemblages have no associated radiocarbon dates. Of Snarskis' (1978, 1984) Chaparrón and La Montaña Complexes, Tronadora is most similar to Chaparrón. Unfortunately, no dates are available from the site of Chaparrón, located in the San Carlos plain of north-central Costa Rica.

Snarskis (1978:106) obtained a total of five dates from "Layer D", a stratum containing early ceramics at La Montaña, a site near Turrialba in the Atlantic Watershed region. (See Appendix B for a detailed listing of the nature and context of all Costa Rican radiocarbon assays). These are:

2271(1779)1430 BC [UCLA-2113A: 1515 bc ± 160]
800(661)596 BC [UCLA-2113D: 550 bc ± 60]
800(661)596 BC [UCLA-2113N: 550 bc ± 60]
800(388 BC)AD 52 [UCLA-2113B: 325 bc ± 160]
400(277)122 BC [UCLA-2113M: 280 bc ± 60]

Although the fourth date above has a late central date, its 2-sigma range overlaps that of the second and third dates. The last date may have been contaminated by charcoal from a later, La Selva Phase cemetery at the site. The earliest date, run on charcoal bits collected from a large horizontal area, was initially rejected as being too early. This assessment was supported by the presence of natural charcoal without radioactivity (sample UCLA-2113O) in one of the units from which these small pieces were collected (Snarskis 1978:107). However, its similarity to the dates from Tronadora Vieja strongly suggests that it may be more accurate than previously thought. A date of 1427(1133)833 BC [UCLA-2167F: 960 bc ± 100] from the site of La Fábrica (Lange and Stone 1984:Appendix 5) is the only one from this period in the Central Highlands region; however, its association with early ceramic forms is unclear.

At the Méndez site on the Río Naranjo, northeast of the Arenal area but still in the Cordilleran region, Norr (1986) identified ceramics similar to those from Chaparrón, which she includes in her Naranjo Phase. This phase is defined as temporally equivalent to Lange's Loma B Phase at the Vidor site, and Norr dates it to 800 - 300 bc (uncorrected). Norr reports two dates from the Mendez site. The first, 2028(1825)1645 BC [UCLA-2167A: 1550 bc ± 60], was taken from sterile subsoil immediately below the initial cultural level at the base of a large funerary structure. The second, 410(329)132 BC (UCLA-2163: 300 bc ± 60), came from ceramic-bearing deposits in the same feature. The first date comes from wood charcoal obtained from a "culturally sterile stratum under Mound I" at the site, and the second from " an occupational level at ground surface at the time the Mendéz Mound I was constructed" (Norr 1986:140). Norr interprets the first date as the early limit of the site's occupation, and both illustrated examples (Norr 1986:Fig. 9.9a-c) and inspection of a sample of Norr's ceramics at the Museo Nacional de Costa Rica indicate that sherds from the lowest levels at Sitio Méndez are identical to those from

Tronadora Vieja. While the contextual association of the early date and early ceramics at Méndez is poor, current evidence suggests that it may in fact have been deposited by Tronadora Phase cultures at the site.

The earliest date for ceramics on the Pacific Coast of Greater Nicoya comes from the Vidor site (Lange 1980:35). There, in very deep levels, sherds which bear similarities to those from Méndez and Tronadora Vieja were associated with a date of 1291(988)830 BC (UCLA-2177A: 880 ± 80 bc). Because the "Loma B" pottery associated with this date is similar to both Tronadora Phase pottery from Tronadora Vieja and later Zoned Bichrome ceramics such as Bocana Incised Bichrome, the Loma B Phase is considered to overlap with the Tronadora Phase beginning around 1000 BC.

In Nicaragua, Haberland (1978:412) has suggested a date of as early as 1200 bc (cal 1400 BC) for ceramics from his Dinarte Phase on Ometepe Island, based on comparisons with material from the Guatemalan coast and the assertion that the succeeding Angeles Phase dates as early as 500 bc (cal 600 BC). So far, Haberland (1966) has published only a preliminary report on his work on Ometepe Island, and his Dinarte Phase ceramics remain poorly illustrated. However, one of his examples appears to be a cylindrical vessel similar to Zetillal Shell-Stamped. Based on his own examination of photographs of sherds from Tronadora Vieja, Haberland believes that Tronadora and Dinarte ceramics are very likely one and the same (personal communication 1985). There is a close relationship between incised and zoned-incised decoration on Angeles Phase ceramics and the type Bocana Incised Bichrome -- a marker for the Loma B phase -- and Angeles may correspond to the Early Arenal Phase. The stratigraphic superimposition of Angeles over Dinarte levels, and their clear separation by a layer of volcanic tephra is in line with, and therefore supports, the proposed relationship between Tronadora and Early Arenal pottery.

While Tronadora ceramics have many features which are not known from Mesoamerica, indicating strong regionalization in cultural patterns at this early time period, the number of similarities suggests the common participation of northwestern Costa Rica and parts of southern Mesoamerica in broad developmental systems and interaction networks during the Early Formative period. Two dates for Barra ceramics from the Paso de la Amada site in coastal Chiapas (Lowe 1975:29) are very close to those we have for Tronadora. These are: 2290(1662)1055 BC [I-8161: 1410 bc ± 225] and 2027(1603)1135 BC [I-8162: 1350 bc ± 160]. Although there were no radiocarbon samples associated with ceramics from this phase, Ocós was estimated to date to approximately 1300-1100 bc (which calibrates to 1500-1350 BC; Coe and Flannery 1967:70).

The principal culture-bearing soils and tephra layers at Tronadora Vieja were Units 50 and below. Unit 50 was essentially sterile, and yielded only six diagnostic sherds. Of these, two were Tronadora types, probably a result of heavy mixing in the "upper 50's" stratigraphic units. A large number of Tronadora sherds (26% of the entire assemblage of diagnostic Tronadora Phase ceramics) was found together with Arenal Phase pottery in levels below Unit 50 and above Unit 60. However, the greatest concentration of Tronadora Phase sherds appeared in Units 60, 61, and 64 . These stratigraphic units correspond to El Tajo Units 9 and 10, and are derived from the earliest eruptive activity of the Volcán Arenal (Melson n.d.; Knapp n.d.). A small sample of Tronadora sherds were embedded in the surface of Aguacate (Unit 65), and may predate the deposition of Arenal tephras. One radiocarbon sample from a hearth in a well-developed soil layer on top of El Tajo Unit 8 (i.e. Silencio Sequence Units 55 and 55A) yielded a date of 390(265)45 BC [SI-3459: 220 bc ± 65]. A second sample from the same stratum yielded a date of 86 BC(AD 173)390 [I-10804: AD 120 ± 80] (Aguilar 1984:74). These two dates when calibrated overlap within a 2-sigma range for only 41 years, from 86-45 BC. According to Melson, the amount of time needed for the accumulation of the soil unit from which the date was obtained suggests that the deposition of the El Tajo Unit 8 tephra may have occurred as much as 450 years earlier (Melson 1986:47), or around 500 BC. All levels below Unit 55 at Tronadora Vieja (that is, Units 60, 61, and 64) would be older than this. At Tronadora Vieja, Units 60 and below yielded almost pure deposits of Tronadora ceramics.

The division of the Tronadora Phase into Early and Late facets results primarily from the desire to subdivide a very long (2500-year) cultural phase into units of greater heuristic value. Despite a detailed analysis of ceramic modes and types from the lowest strata at Tronadora Vieja, it has not been possible to identify ceramic characteristics which are highly diagnostic of each sub-phase. However, it is possible to suggest general trends. The choice of 1000 BC as a tentative boundary corresponds to the date of 1291(988)830 BC [UCLA-2177A] from Loma B deposits at Vidor. Late Tronadora ceramics are those which appear to be transitional between Tronadora/Chaparrón/La Montaña complexes and "Palmar"-like Loma B types such as Schettel Incised, Bocana Incised Bichrome, and Toya Zoned Incised (Lange 1984), and the division is intended to suggest both contemporaneity and continuity between the Late Tronadora Phase and the earliest ceramics of the Pacific region of Greater Nicoya.

The terminal date for the Tronadora Phase is based on an estimate of 500 BC for the date of deposition of Unit 55 (El Tajo Unit 8), an event which is neither well understood nor well documented, and two radiocarbon assays. The two earliest dates associated with Arenal Phase ceramics are

2010(597 BC)AD 660 [Tx-5280: 520 bc ± 560] and 830(400 BC)AD 1 [Tx-5271: 390 ± 170]. The first of these was associated with a Mojica Impressed: Mojica Variety vessel in a tomb-like feature at Tronadora Vieja. However, its large standard deviation severely limits its value for chronological interpretations. The second comes from a hearthlike feature at the base of an almost exclusively Late Arenal ceramic assemblage at Sitio Bolívar. While it was not directly associated with diagnostic Early Arenal ceramics, Tonjibe Beige and Bocana Incised Bichrome were present in very small quantities, and this sample may date the site's earliest occupation. The three other dates associated with early Zoned Bichrome material in Guanacaste cluster between 300-250 BC. These are the 410(329)132 BC [UCLA-2163] date from Sitio Méndez cited above (Norr 1986:140), a date of 400(262)90 BC [UCLA-2177B: 250 bc ± 60] from Orso Phase deposits at Vidor (Lange 1984), and a date of 754(271 BC)AD 60 [GsY-100: 245 bc ± 130] from Catalina Phase deposits at Ortega (Baudez 1967). It is clear that the Tronadora/Arenal transition is one topic which sorely merits further investigation. As noted above, it is possible that there is an overlap of Bocana Incised Bichrome and related types with Late Tronadora assemblages. If Zoned Bichrome ceramics evolved out of Tronadora Phase precursors, as we believe they did, this development is very important to document.

Intrasite Distribution of Tronadora Phase Ceramics

Tronadora Phase ceramics were found in the lower levels of all operations at Tronadora Vieja. The most interesting association of Tronadora ceramics and occupational features was in Operation W, where they were associated with the floor of an early house.

In the nine excavation lots from Unit 60 and below in Operation W, 95% of the 73 diagnostic sherds recovered belonged to the Tronadora Phase. The most common type was Tonjibe Beige (14 sherds), followed by Tigra Grooved-Punctate (9 sherds) and Tajo Gouge-Incised (9 sherds). Small amounts of Tronadora Incised (5), Zetillal Shell-Stamped (4), and Atlantic Red-Filled Black (3) were also present. Mode-groups included shell-stamping (4), general groove-incising (16), and jars with reed-stamped circles (3). Two sherds of this last group were especially interesting because they had a thick, black substance adhering to the vessel neck on the exterior, decorated surfaces. Although this substance appeared to be charcoal, it did not burn when held over a flame. Its nature and purpose are unknown, but the presence of this substance suggests a post-firing modification which was probably carried out in a domestic context. The assemblage of types and modes discovered in association with the apparent habitation features is intriguing. While Tonjibe Beige was almost certainly a utilitarian vessel, both Tajo Gouge-Incised and Zetillal Shell-Stamped are probably special-purpose ceramics. Their presence initially suggested that the dwelling may have been the home of an individual of somewhat different status than the other occupants of the site. However, this interpretation is not supported by ceramic assemblages from other operations. Although the greatest number of sherds of Tajo Gouge-Incised appears in Operation W, both this type and Zetillal Shell-Stamped occur in similar quantities in Operations H (5 and 5), L (4 and 4), and V (6 and 5). An examination of other types and modal categories also shows that their proportions do not vary significantly over the site.

Summary

Although roughly contemporaneous, Tronadora ceramics are similar to the Panamanian complexes of Monagrillo and Sarigua only at the level of general modes (red rims, groove-incision, shell stamping). As with Chaparrón, (Snarskis 1984), Tronadora's closest affinities are to ceramics from southern Mesoamerica. However, in spite of notable homologies between Tronadora and Ocós, there are significant differences. The bolstered rim form (Tonjibe Beige) and tall, cylindrical vessel (Zetillal Shell-Stamped) are absent in Early Formative complexes outside of Costa Rica. Furthermore, the earliest dates for Barra and Ocós (Lowe 1975, Clark et al. 1987), are still younger than those for Tronadora. If there is a linear relationship between the Costa Rican and Mesoamerican complexes, the influence is from south to north, not the reverse. However, there are no forms in northern assemblages which can be derived from Costa Rican precedents. There are many more dated sites and a much wider variety of Early Formative decorative modes in Mesoamerica than in Costa Rica, and an argument for a Costa Rican origin for northern traditions based on the current evidence would be highly presumptuous. Recent excavations by Blake and Clark (1987; Clark et al. 1987) have yielded evidence for a possible "chief's residence" during Ocós/Cherla times at Aquiles Serdan, suggesting that the nature of Early Formative society in Mesoamerica may have been more highly centralized than contemporaneous cultures in Costa Rica, a situation which was probably not conducive to influence from the latter to the former. Important components of Mesoamerican complexes which are rare or absent in Tronadora assemblages, such as flat-based bowls and true _tecomates_, have local precedents in ground stone artifacts. Solid ceramic figurines, important Barra/Locona/Ocós artifacts (Blake and Clark 1987), are absent in Tronadora. For now, Tronadora ceramics are best interpreted as the manifestation in Costa Rica of broad patterns of stylistic and technological development in the Early Formative from an as yet undefined cultural substrate, rather than the result of the unilinear diffusion of an early ceramic style.

CHAPTER SEVEN
Arenal Phase Ceramics

The "Zoned Bichrome" Tradition in the Arenal Basin

While the use of incising or painting to delineate decorated zones is one of the chief decorative modes of Zoned Bichrome ceramics in the Tempisque Valley and on the Pacific Coast, this does not appear to have been as important in the Cordilleran region. Types such as Bocana Zoned Bichrome appear with some frequency in Arenal Phase surface assemblages. However, Rosales Zoned-Engraved, Tola Trichrome, and other marker types of Zoned Bichrome assemblages to the west were rare or absent.

In general, the use of zoned geometric designs (areas of color outlined with either incision or painting) is rare in Arenal Phase assemblages, except for the type Bocana Incised Bichrome. While zoned punctation and shell-stamping are common in the Tronadora phase, these diminish in popularity during the subsequent phase. The only type with zoned punctation to appear during the Arenal Phase is "Huila Zoned Punctate", a type originally defined by Baudez (1967:59). This type is poorly represented in Tempisque Valley and coastal assemblages, and it is also rare in the Cordillera.

The Arenal Phase is more accurately characterized by the use of linear painting and stamped decoration than by zoned decoration. Las Palmas Red-on-Beige and Charco Black-on-Red are the two types most representative of the former. The different varieties of Mojica Impressed and the type Congo Impressed best represent the latter tradition.

Arenal Phase Sites

Of 62 sites recorded during the 1984 and 1985 field seasons, more than half demonstrated a higher percentage of Arenal Phase (500 BC-AD 500) ceramics than those of any other phase. A total of 35 sites sampled bore some ceramic evidence of an Arenal Phase occupation (i.e. Arenal Phase types other than Los Hermanos Beige, which may appear in earlier or later phases). In addition to Tronadora Complex materials, a strong Arenal Phase component was found at Tronadora Vieja (G-163). At Sitio Bolívar (G-164) and several sites surface collected in the lakeshore survey, virtually all ceramics belonged to the Arenal Phase.

Tronadora Vieja (G-163)

A total of 210 Arenal Phase sherds were recovered in excavations at Tronadora Vieja, of which 121 (58%) were located in 50's strata. Among the types represented (in the order of their importance) were: Los Hermanos Beige (78), Espinoza Red-Banded (47), Mojica Impressed: Laguna Variety (18), Bocana Incised Bichrome (14), Las Palmas Red-on-Beige (20), Charco Black-on-Red (11), Huila Zoned-Punctate (9), Mojica Impressed: Mojica Variety (5), and Guinea Incised (5). All of these are important types in Zoned Bichrome assemblages throughout much of Greater Nicoya, and their presence supports an interpretation of the Arenal Phase as representing a time of strong cultural affinities between the Arenal area and regions to the west. One interesting difference between this assemblage and those of the Tempisque Valley is the inclusion of Espinoza Red-Banded, a type defined by Healy (1980) in the Rivas region of Nicaragua. The strong representation of this type in Arenal area assemblages suggests ties with the north as well, perhaps as part of a Cordilleran tradition extending along the volcanic chain.

The presence of Charco Black-on-Red, a primarily Late Arenal Phase diagnostic, at Tronadora Vieja suggests that the Arenal Phase occupation of the site extended through both the Early and Late facets. However, it should be noted that the sherds representative of this type differed from those of more typical Late Arenal assemblages. Black-painted decoration was executed in wider strokes, rather than the narrow lines noted at Sitio Bolívar. This may be a characteristic of early examples of this type, but our sample was not large enough to clarify this point. Based on the composition of the Arenal Phase assemblages at both sites, the Arenal component at Tronadora Vieja appears to have been earlier than that at Sitio Bolívar.

Sitio Bolívar (G-164)

What it lacked in longevity, the Arenal Phase occupation at Sitio Bolívar made up for in intensity. Almost 6000 diagnostic sherds were recovered from relatively small excavations, providing us with a very large assemblage which appears to have been restricted in time to the last 200 years of the Arenal Phase.

The single most important type at this site was Los Hermanos Beige. The second was Mojica Impressed (Corrida, Arrastrada, and Congo varieties). Other important types in the Sitio Bolívar assemblage were Charco Black-on-Red, Espinoza Red-Banded, Guinea Incised, Los Hermanos Beige:Cervantes Variety, Zelaya Bichrome, and unidentified trichrome sherds. There are a number of early-looking modes which appear in this assemblage, most notably Usulután-type resist decoration and medial-flange bowls (both on Guinea Incised), but altogether the ceramics represent an almost classic collection of "Linear Decorated" types. The presence of a few sherds of Carillo Polychrome confirms the dating of this site to what would correspond to the transition between late Zoned Bichrome and Early Polychrome periods in Greater Nicoya.

Viboriana (G-175) and La Isla (G-166)

Surface collections from these two sites provided the best diagnostic assemblages for the Early facet of the Arenal Phase. They yielded samples of 153 and 92 diagnostic Arenal sherds, respectively. Types which were found in large numbers at Sitio Bolívar, such as Charco Black-on-Red and Guinea Incised, were rare or absent at these sites. Conversely, types such as Bocana Incised Bichrome and Las Palmas Red-on-Beige were present. Excavations at Viboriana indicated the stratigraphic position of

Early Arenal sherds in the lower "50's" strata, but the sample of sherds from excavated contexts at this site was too small to yield evidence for stylistic change over time. At La Isla, a total of 36 sherds of Bocana Incised Bichrome were collected from eroded surface deposits, the largest sample of this type from any site surveyed or tested.

Dating the Zoned Bichrome Period

Lange (1980) was the first to attempt a phase breakdown of the long Zoned Bichrome period in Greater Nicoya, which he divides into three phases at the Vidor site on the basis of style, the stratigraphic distribution of several ceramic types, and comparisions with other dated assemblages of Zoned Bichrome ceramic types. The proposed dates for Lange's three phases in uncalibrated radiocarbon years are Loma B (1000-300 bc), Orso (300 bc - ad 300), and Mata de Uva (ad 300-500).

Of these, Loma B has the poorest absolute chronology. Its beginning date, originally proposed at 800 bc (Lange 1980), has since fluctuated from 500 bc (Lange et al. 1984) to 1000 bc (Lange, personal communication 1985), the latter largely influenced by estimates of Tronadora Phase chronology. Only one radiocarbon sample has been associated with a single- component Loma B assemblage. Charcoal from a small hole containing cultural remains and associated with a large hearth or oven (Abel-Vidor 1980:47-49;Fig. 5) yielded a date of 1291(988)830 BC [UCLA-2177A: 880 bc

± 80]. The oxidized pit feature with which this sample was associated was suggestive of a possible oven for the firing of ceramics (Ibid.:48), and its context yielded early sherds decorated with groove-incision. These sherds were interpreted by Lange as similar to that found on the type defined as Toya Zoned Incised, and he remarks:

> The ceramic technique at this time separated zones by the use of heavy, broad incising on vessel bodies, or legs of vessels. In contrast to the following phase, many of the zoned areas were subsequently left in the natural buff clay color. The earlier named "Palmar Ware" (Lothrop 1926:248-249) is characteristic of this period... Palmar Ware includes Bocana Incised Bi-chrome, which is also present in the succeeding Orso phase (1980:40).

Calibrated, UCLA-2177A suggests a beginning date for the Loma B phase at around 1000 BC. Because Loma B and "Palmar Ware" ceramics are very similar to certain Tronadora Phase ceramics, especially the type Tronadora Incised, I believe that the two overlap to some extent. Given the <u>very</u> scant data for Loma B chronology, it seems unreasonable to attempt to push the dates for ceramics characteristic of this phase back before 1000 BC. However, to acknowledge a close stylistic relationship between the earliest ceramics of Pacific Greater Nicoya and the Arenal area, I have suggested a terminal date of 500 BC, rather than 1000 BC, for the Tronadora Phase. However, the data for the time period from 1000-500 BC in the Arenal area is practically nonexistent, and this terminal segment of the Tronadora Phase ("Late Tronadora") should be treated with a great deal of caution in interpretations of the local cultural sequence.

The sample from the Vidor site remains the only one in clear association with Loma B ceramics. However, citing similarities between sherds from both Chaparrón and Loma B assemblages and those from the lowest strata at Sitio Méndez (Norr 1982-83), Lange suggests a date on charcoal of 410(329)132 BC [UCLA-2163: 300 bc ± 60] as an approximate terminus for the Loma B phase at around 300 bc (or 300 BC -- this date is virtually identical to its calibrated equivalent). The sample from which this date comes was associated with "Middle and Late Zoned Bichrome ceramics" (Norr 1982-83:140), and not a specifically Loma B assemblage; however, it is the earliest date from a clearly cultural deposit at Sitio Méndez, where early ceramics had been found. An earlier date from underlying deposits, UCLA-2167A: 2129(1861)1832 BC, was not clearly associated with cultural remains (although it _is_ very similar to those associated with Tronadora Phase pottery). The terminal date for Lange's Loma B phase is also based on the appearance of the type Bocana Incised Bichrome in later assemblages from the sites of Vidor and Ortega, (Baudez 1967) dated by associated radiocarbon dates to around 300 BC.

Although Lange's succeeding Orso Phase sees the continued presence of Bocana Incised, it is characterized primarily by the appearance of fine incised or engraved zoning. The marker type for this phase is Rosales Zoned Engraved. According to Lange (1980:40), the Orso Phase is contemporaneous with the Catalina and Chombo phases of the Tempisque Valley and Santa Elena Peninsula, respectively, and corresponds to the Zoned Bichrome period as initially defined by Coe and Baudez (1961). This "Middle" Zoned Bichrome phase is dated by several radiocarbon assays. The earliest of these is UCLA-2163 (cited above) from Sitio Méndez. This is followed by a charcoal date of 400(262)90 BC [UCLA-2177B: 250 bc ± 60] from Orso levels at Vidor (Lange 1980:Fig. 1).

Only one other date is available for the early half (300 BC - 0 AD) of the middle Zoned Bichrome phase in Greater Nicoya. This is a date of 390(144 BC)AD 54 [UCLA-2167E: 160 bc ± 80], run on a "fist-sized" sample of charcoal from within a possible burial feature at the El Carmen site, in the foothills west of the Cordillera de Guanacaste (Ryder 1982-83a:109). A fourth radiocarbon sample -- GsY-100 -- which may be associated with this time period, is somewhat problematic and will be discussed in greater detail below.

The latter half of the middle Zoned Bichrome phase (AD 0-300) in Greater Nicoya has been dated by three radiocarbon assays. One of these, a date of AD 163(539)1030 [Y-809: ad 420 ± 280] on charcoal from stratified midden deposits at the site of Matapalo on the Santa Elena peninsula, may have been contaminated during preparation.

It is described as "a little late, though not impossibly so" (Radiocarbon 3:132,Baudez and Coe 1962). The two other dates are: 390(AD 129)AD 598 [Y-810: ad 80 ± 200], on charcoal from a stratified midden with Zoned Bichrome pottery underlying Early Polychrome deposits at Matapalo (Baudez and Coe 1962); and 93 BC(AD 195)529 [ISGS-1086: ad 130 ± 120], on charcoal associated with middle and late Zoned Bichrome ceramics beneath a stone mortuary feature and overlying sterile soil at Sitio Méndez in the Río Naranjo Valley (Norr 1982-83:140).

Two additional radiocarbon samples for this time period, which I believe have had an unwarranted influence on the interpretation of Zoned Bichrome chronology, are GsY-100 and its counterpart Y-850, both from the site of Ortega in the Tempisque Valley (Baudez 1967). GsY-100 is based on two separate "runs" on a sample of charcoal from a large, oval oven or hearth associated with Catalina Phase ceramics. Two assays of one part of this sample yielded dates of 511(275)2 BC [GsY-100 (1): 271 bc ± 100] and 410(350 BC)AD 48 [GsY-100 (2): 218 bc ± 98], for a calibrated average of 400(277)72 BC [GsY-100: 245 bc ± 130] (Baudez 1967:26-27; Radiocarbon 8:139). However, the original charcoal sample was split for a third assay, which yielded a much later date of AD 132(325)533 [Y-850: ad 250 ± 70] (Baudez 1967:27; Radiocarbon 3:132; misquoted and misinterpreted by Healy 1980:306 as being "B.C."). The assays for GsY-100 and Y-850 do not overlap at even the calibrated 2-sigma range, suggesting either contamination or laboratory errors. This discrepancy should have led Baudez to reject one or the other. Instead, he simply takes the numerical average of the two as the correct date for the sample (1967:205). His original estimated dates of 300 bc - ad 300 for the Catalina Phase -- which have become historically entrenched in subsequent chronologies, including Lange's -- are based on the possibly fallacious acceptance of <u>both</u> GsY-100 and Y-850. To arrive at his estimated dates for the Catalina Phase, Baudez says that he simply rounded both dates to their 1-sigma extremes (1967:205), although this is not exactly true (that would have yielded an estimate of 400 bc, rather than 300 bc, for the earlier date). The problem is further compounded, though to a somewhat lesser extent, by the fact that Baudez calculated his uncalibrated radiocarbon dates (years bc/ad) by subtracting either 1960 or 1962 from uncorrected "bp" dates, rather than using the standard "present" of 1950. Given the major differences in the apparent age of samples GsY-100 and Y-850, it is probably best to treat both with caution. If either is to be used, their contextual association with types such as Bocana Incised Bichrome and Las Palmas Red-on-Beige -- both found in assemblages associated with dates in the 300 BC - 0 AD range rather than later ones -- supports the validity of GsY-100 rather than Y-850. There is therefore very little evidence in the radiocarbon dates for assigning particular significance to the 300 bc - ad 300 time period, and especially to the latter date.

The Mata de Uva, or "Zoned Painted" phase corresponds to the "Linear Decorated" period defined by Baudez (1967: 194). This phase has variously been considered as representing a separate period, as part of the succeeding Early Polychrome period (Baudez and Coe 1962; Stone 1977), or as a continuation of Zoned Bichrome patterns (Lange 1971, 1980). According to Lange, it is signalled by the appearance of Tola Trichrome and ceramics zoned with painted, rather than incised lines at coastal sites. This latter phase, and the ceramic traits associated with it, are identified by Lange as,

> ... a continuation, or termination, of Zoned Bichrome patterns... the ceramics from the phase are most clearly seen as a evolution from the preceding Orso phase, and not as the initial phase of the succeeding Early Polychrome Period (1980:41).

There are no radiocarbon dates available from either "Linear Decorated" or "Mata de Uva" contexts in Greater Nicoya, and the latter part of the Zoned Bichrome period has been dated largely on the basis of the existing dates for the succeeding Early Polychrome period. There are a total of nine radiocarbon dates (see Appendix B for detailed listings) which have been associated with Early Polychrome assemblages in Greater Nicoya, all but two of which intercept the calibration curve (Stuiver and Becker 1986) within the 130-year period from AD 640-770. If we exclude a single date of AD 980(1109)1269 [M-1172: ad 1030

± 75] from Chahuite Escondido as too late (Sweeney 1975), these dates range in age from a date of AD 431(644) 800 [Y-811: ad 555 ± 90] on charcoal in a stratified midden at Matapalo (Baudez and Coe 1962, Sweeney 1975) to AD 640(815)1151 [Y-1125: ad 780 ± 120] on charcoal from the Cruz site on Ometepe Island in Nicaragua (Healy 1980:306). Baudez (1967:208) based his terminal date for the "Linear Decorated" period and the beginning date for the Early Polychrome period on three assays: Y-811 (cited above) and two dates on charcoal from the still unpublished site of Ayala in Granada, Nicaragua, AD 430(644)866 [Y-1124: ad 560 ± 100] and AD 540(648)796 [Y-1122: ad 570 ± 70]. The earlier of the Nicaraguan dates (Y-1124) was stratigraphically situated some 90 cm below the latter, and was initially interpreted as associated with middle Zoned Bichrome ceramics. The later date (Y-1122) was thought to be "on the line" between Early Polychrome A -- contemporaneous with Lange's final Zoned Bichrome phase -- and Early Polychrome B (Willey in Radiocarbon 5:334). Although the associated collections have not yet been analysed, Healy briefly examined the associated materials, and remarks that he would "unquestionably" date "the layer" with which these dates were associated to the Early Polychrome period (1980:306).

Given the available radiocarbon dates, the transition between the late Zoned Bichrome and Early Polychrome periods may be nearer to AD 600 (or even AD 650) than to AD

500. The former date is significant in that it is roughly contemporaneous with the end of the Early Classic period in the Maya Lowlands, at the long- count date of 9.8.0.0.0, or AD 593 (Proskouriakoff 1950:112, Willey and Mathews 1985:1). Virtually all of the Maya artifacts which have been reported in Costa Rica (c.f. Stone 1977;Figs. 78,85) are Early Classic in style. These include jades and slate disks, both of which are known exclusively from late Zoned Bichrome contexts (Stone and Balser 1965, Baudez and Coe 1966). The Early Polychrome period, as its name implies, is characterized by the appearance of fine polychrome ceramics. The diagnostic ceramic type of this period is Galo Polychrome, which Baudez (1967:208) noted as being very similar to "Ulua Polychromes" of central Honduras. Many of these in turn share important characteristics with Late Classic ceramics of the Maya Lowlands (Viel 1985). It is tempting to align the end of the Arenal Phase with the end of the Maya Early Classic period. However, the limited evidence for regular contacts or significant influence between northwestern Costa Rican cultures and the Maya lowlands makes such an inference and its implications difficult to support at this time. Although the evidence for a strict correspondence of the Zoned Bichrome/Early Polychrome transition in northwestern Costa Rica with the Early Classic/Late Classic transition in the Maya Lowlands is still very slim, I believe that a date of AD 600 for the end of the Zoned Bichrome period more accurately reflects both

radiocarbon and comparitive data in Greater Nicoya than does a date of AD 500.

Dating the Arenal Phase

The Arenal Phase is conceived as encompassing all three of Lange's coastal phases, and therefore as corresponding to the duration of the Zoned Bichrome tradition in Greater Nicoya. It begins with the appearance of Bocana Incised Bichrome, a type found in both Loma B and Orso assemblages. However, unlike the coastal Greater Nicoya sequence, the dating of the Arenal Phase is been affected by the identification of earlier Tronadora Phase ceramics. Because of a possible stylistic and chronological overlap between certain Loma B ceramics and those of the Tronadora Phase, the end of the Tronadora Phase (and the beginning of Arenal) has been given a more-or-less arbitrary starting date of 500 BC, somewhat later than the dates which have been suggested by Lange as the beginning of the Zoned Bichrome period.

For the sake of chronological resolution, the Arenal Phase has been divided into two facets, Early and Late Arenal. Because existing radiocarbon determinations for the separation of these two sub-phases do not yet support specific dates for identifiable stylistic changes, the Arenal Phase has been been arbitrarily divided in two at AD 0. In the case of the assemblage from Sitio Bolívar, both radiocarbon dates and ceramic comparisons suggest a chronological placement in the latter half of

Late Arenal (i.e. AD 300-600). However, without more detailed knowledge of the ceramics or cultures from the time period between AD 0-300, it is difficult to justify the assemblage from Sitio Bolívar as a stylistic subphase with chronological significance in the Arenal area. This latter portion of the Late Arenal Phase is marked by the presence of "Linear Decorated"-type ceramics and trichrome decoration. It ends with the appearace of polychromes, probably around AD 600.

There are three radiocarbon dates from Proyecto Prehistórico Arenal excavations which may date Early Arenal (500-0 BC) activity. The first is a date of 2010(597 BC)AD 660 [Tx-5280: 520 bc ± 560], from a sample of charcoal recovered from the fill of a trench-like burial feature at Tronadora Vieja. This feature, situated in Operation W, originated in Unit 54 and penetrated Aguacate to a depth of 175 cm. The sample was assoicated with the remains of two jars of the type Mojica Impressed:Mojica Variety, as well as four fragments of _Zea mays_ cobs. While the averaged, central calibrated date of this assay is close to the estimated beginning of the Arenal Phase, the extremely large 2-sigma range severely limits the reliability of this assay.

The second date, 830(400 BC)AD 1 (Tx-5271: 390 bc ± 170), comes from charcoal collected from a possible hearth at the bottom of the large midden feature in Operation B at Sitio Bolívar. This feature consisted of a dense concentration of ceramics, lithics, and subsistence remains. The associatied pottery assemblage consisted of types considered to be diagnostic of the latter half of the Late Arenal Phase. This date is much earlier than others associated with the same ceramic types, and may represent charcoal from activity which predates the principal occupation of the site. While some sherds of Las Palmas Red-on-Beige were present at the site, as well as three Tronadora Phase sherds, the principal type which would have been expected in association with a date of this age -- Bocana Incised Bichrome -- was absent from the associated assemblage.

The third date, 800(50 BC)AD 640 [Tx-5081: 80 bc ± 300], is derived from an aggregate sample of charcoal pieces from two different test pits at Tronadora Vieja. Unlike the above dates, it was associated with Tronadora Phase ceramics in what were identified as "60's" strata during test excavations at the site in 1984 (Bradley, Hoopes, and Sheets 1984). While the early end of this assay's 2-sigma range would be acceptable for Tronadora ceramics, its central date is much too late. Given its exceedingly large standard deviation and relatively poor stratigraphic provenience, this particular assay should be assigned a very limited significance.

In terms of ceramic comparisons, the principal type of Lange's Orso Phase, Rosales Zoned Engraved, was absent from ceramic assemblages in the Arenal area. However, many other types diagnostic of the Catalina and Chombo phases (provisionally dated 300 bc - ad 300; Baudez 1967, Sweeney 1975) were present in our assemblages. In spite of a paucity of relevant radiocarbon dates, the presence of these types suggests that there was an extensive occupation of the study area at this time.

Radiocarbon dates which derive from activity dating to the early half of the Late Arenal Phase (AD 0-300) come from two sites. The first, from Sitio Bolívar, is a date of AD 79(245)410 [Tx-5272: 180 ad ± 60]. It was run on a large, aggregate sample of charcoal recovered from a concentration of burned material in a possible hearth or cooking pit on the shoreline portion of the site. Although the sample was recovered from a naturally eroding feature, and may have been contaminated by modern charcoal from nearby agricultural burning, it is considered to be an acceptable date for the associated ceramic assemblage. The second date, identical to the first, comes from 1984 excavations at the El Silencio (G-150) hilltop cemetery (Bradley 1984). This assay, also AD 79(245)410 [Tx-5078: 180 ad ± 60], comes from charcoal collected from the fill of a slab-built tomb which was probably constructed during the Silencio Phase (AD 600-1300). The charcoal sample was not directly associated with any Arenal Phase ceramics. Rather, the tomb from which it was recovered was found to contain Silencio Phase ceramics, human remains, and a small gold avian pendant. However, Late Arenal Phase ceramics were found elsewhere at the site. This suggests that the sample may represent redeposited charcoal, derived from a previous Arenal Phase occupation of the site.

Turning our attention to the latter portion of the Zoned Bichrome period, termed "Zoned Painted" by Lange (1980), it is significant that fragments of sherds which may be transitional into the polychrome tradition appear in deposits at Sitio Bolívar. During the initial survey of G-164, four sherds from the surface collection were tentatively identified as Lopez Polychrome, the earliest of Nicoya polychrome types. Four sherds in the large assemblage in Operation B at Sitio Bolívar have been identified as an incipient variety of Carillo Polychrome. These sherds demonstrate a combination of Las Palmas red line decoration (including multiple-brushing) and Charco black line techniques in the production of Carillo-type motifs. It is unusual that these early polychrome sherds were so rare in such a large collection of broken pottery. It seems likely that they represent what were very rare vessels to begin with, and appeared only in high status graves. The presence of these sherds is the most compelling evidence for placing the date of the assemblage at Sitio Bolívar in the later half of the Late Arenal Phase.

Two radiocarbon dates from Sitio Bolívar help support a date for the principal occupation of the site during the latter half of the Late Arenal Phase (AD 300-600). The first, at AD 182(394)540 [Tx-5273: ad 290 ± 70], comes from a single, large chunk of charcoal directly associated with a dense midden of ceramics, lithics, and subsistence remains (including fragments of _Zea mays_) in Operation B in the ridgetop portion of the site. The second, at AD 432(642)770 [Tx-5270: ad 540 ± 80], comes from a sample of wood charcoal collected from the matrix of sherds and artifacts overlying stone mortuary features in Operation E. The first date is the only one (apart from Y-850, discussed above) from this portion of the Zoned Bichrome period in Guanacaste. The second is very close to several samples (most notably Y-811, Y-1124, and Y-1122, cited above) which have been associated with Early Polychrome assemblages in Pacific Guanacaste and Nicaragua. Both of these assays, which overlap around AD 430-540 at the 2-sigma range, are considered to be acceptable dates for the associated features and artifactual assemblages. Together with the acceptable shoreline date, AD 79(245)410 [Tx-5272: ad 180 ± 60], they suggest an occupation of the site towards the end of the Zoned Bichrome period (ca. AD 300-600).

A fourth date, AD 770(919)1000 [Tx-5269: ad 820 ± 50], was obtained from a hearth partly exposed by wave action on the lakeshore, and may have suffered by contamination from recent charcoal derived from modern agricultural burning. The feature from which this sample came was virtually identical to a nearby hearth or cooking pit from which a date of AD 79(245)410 [Tx-5272: ad 180 ± 60] was obtained. Although both features had been subject to similar erosional conditions, the later date is considered to be aberrant on the basis of its inconsistency with both the associated ceramic assemblage and other dates from this site. Alternatively, this date partly overlaps a date of AD 640(815)1151 [Y-1125: ad 780 ± 120], currently the latest date for an Early Polychrome context (Healy 1980:306). Given the presence of Carillo Polychrome at the site, it is conceivable that a date early in the 2-sigma range of Tx-5269 is associated with an early Silencio Phase occupation of the site. However, I believe this latter alternative is unlikely.

As with the earlier Rosales Zoned Engraved type, Tola Trichrome, the marker type for Lange's Mata de Uva phase, was extremely rare in our assemblages. However, a large number of other types of the "Zoned Painted" horizon were present, especially at Sitio Bolívar. These included Charco Black-on-Red, Guinea Incised, Los Hermanos Beige:Cervantes Variety, and Zelaya Bichrome. The assemblage at Sitio Bolívar also included rare trichrome sherds and fragments of Carillo Polychrome, an Early Polychrome type, suggesting a date very close to the Zoned Bichrome transition. Early Zoned Bichrome types such as

Bocana Incised Bichrome, Las Palmas Red-on-Beige, and certain varieties of Mojica Impressed (see discussion below) were rare or absent at this site, as were any Tronadora Phase ceramics. All indications suggest that Sitio Bolívar was basically a single-component site occupied during the very last part of the Zoned Bichrome period in the Arenal area. The large assemblage from this site has been used as a type assemblage for Late Arenal ceramics.

Like the "Zoned Bichrome" period defined by Lange's three phases, the Arenal Phase has a duration of over 1000 years. While the ceramic evidence does not yet allow us to make a three-part division on the basis of either stylistic change or stratigraphic relationships such as the one suggested by Lange, it has been possible to identify patterns in assemblages from surface collections and excavations which allow a division of the Arenal Phase into two roughly equal facets. The first of these, designated as "Early Arenal", dates from approximately 500 BC to the beginning of the Christian era. The second, "Late Arenal", dates from AD 0 - 600.

Early and Late Arenal assemblages were defined on the basis of ceramics from sites whose Arenal Phase components appeared to represent occupations of relatively short duration, and an attempt was made to verify this division with stratigraphic data. Unfortunately, both Early and Late divisions of the Arenal Phase were not clearly represented in the stratigraphy of any excavated site, and a clear stratigraphic verification of ceramic change through this phase remains to be documented. A determination of which types or modes were "early" or "late" was based on comparisons with dated, stratified assemblages in the Tempisque Valley or Pacific Coast regions, which shared a large number of both types and modes with Arenal assemblages, as well as on stratigraphic associations. The most useful assemblages were those where the full range of Arenal Phase types was not present, and where the principal decorated types pertaining to this phase could be placed in either an early or late grouping. To a certain degree, subphase divisions were supported by radiocarbon dates.

The Early Arenal subphase was represented almost exclusively by surface collections, although a small amount of material in stratigraphic context was recovered at the sites of Tronadora Vieja (G-163) and Viboriana (G-175). The two principal Early Arenal surface assemblages came from Viboriana and La Isla (G-166). Late Arenal ceramics were rare or absent at the latter sites, reinforcing their value as representative samples of Early Arenal material.

The principal Late Arenal assemblage was excavated at Sitio Bolívar, where an exceptionally large assemblage of pottery which appeared to have been deposited in a short amount of time contained very few sherds from Early Arenal types. The identification of Sitio Bolívar as a Late Arenal occupation is further supported by the presence of a few sherds of Carillo Polychrome -- a marker type for Early Polychrome (AD 600 - 800) assemblages in Greater Nicoya. Radiocarbon dates would also place this assemblage in the latter half of the Arenal Phase. Two dates from the Ramírez site, 92 BC(AD 196)529 [ISGS-1086: ad 130 ± 120] and AD 130(408)637 [ISGS-1132: ad 300 ± 100], are reported in association with ceramics representing "the Catalina and Ciruelas phases of the Zoned Bichrome Period" (Norr 1986:140).

The beginning date of the Arenal Phase has been placed at 500 BC more on the basis of cross-dating and rough estimates of the beginning date of the Zoned Bichrome period in Greater Nicoya than on any solid absolute dates or stratigraphic data. The earliest portion of the phase is signalled by the appearance of Bocana Incised Bichrome sherds. Characteristic of this type are large, tapering hollow supports with rectangular apertures, decorated with red paint zoned by deep incision. Cordilleran examples of these supports are reportedly identical to one associated with "Loma B" ceramics and the date of 1291(988)830 BC [UCLA-2177A: 880 ± 80 bc] from a large "oven" feature at Vidor (Lange 1980:35; Snarskis, personal communication 1985). They also match unprovenienced examples at the collection of the Instituto Nacional de Seguros in San José, Costa Rica, said to be from the San Carlos plain (Snarskis 1982:88 -- upper right illus., note transposed captions). An example of one of these supports was excavated at Viboriana (G-175), where it was associated with sherds of Mojica Impressed and Las Palmas Red-on-Beige.

The Arenal Phase material at Tronadora Vieja, while a relatively small sample with limited stratigraphic provenience, provides our best stratigraphic information on the phase. The site was occupied during most of the Arenal Phase, and some ceramics from both Early and Late Arenal were present. The best radiocarbon dates for comparison (see Appendix B for the nature and context of these samples) come from Level 6 at Baudez' site of Ortega (1967: 205), which yielded an assemblage very similar to that from the "Upper 50's" strata at Tronadora Vieja. Two dates, 754(271 BC)AD 60 [GsY-100: 245 ± 130 bc] and AD 132(325)533 [Y-850: ad 250 ± 70], both on charcoal from the same hearth-like feature, were associated with the types Bocana Incised Bichrome, Charco Black-on-Red, Las Palmas Red-on-Beige, and Mojica Impressed ceramics at this site. (As noted above, these assays do not intersect at the calibrated 2-sigma range, and I suspect that the later of the two can be rejected.) A date of 390 BC(AD 129)598 [Y-810: ad 80 ± 200] was obtained from coeval levels at Matapalo (Coe and Baudez 1962, Sweeney 1975). Ryder (1986:109) reports a date of 390(144 BC)AD 54 [UCLA-2167E: 160 bc ± 80] in clear association with a Las Palmas Beige vessel at the site of El Carmen. This would suggest that the Arenal Phase occupation of Tronadora Vieja dated to the few centuries before and after the time of Christ. The beginning date of 500 BC for the Arenal Phase is therefore based on the appearance of Bocana Incised Bichrome; the end date of AD 600 is based on the appearance of Carillo Polychrome in association with "Linear Decorated" types such as Zelaya Bichrome, Guinea Incised, and Los Hermanos Beige: Cervantes Variety.

Given the importance of the early Tronadora Phase material at Tronadora Vieja, this site becomes crucial for understanding the transition between the Tronadora and Arenal phases. One of the most important aspects of the stratigraphy at Tronadora Vieja is that levels bearing a predominance of Tronadora Phase ceramics were overlain by those bearing Arenal Phase types. To date, little is known about the antecedents to the Zoned Bichrome period in Greater Nicoya. The only other sites in Greater Nicoya where pre-Zoned Bichrome ceramics are represented are those on Ometepe Island (Haberland 1966) and the Río Naranjo (Norr 1982-83). At the site of Los Angeles on Ometepe Island, Dinarte Phase ceramics were found beneath levels containing early Zoned Bichrome pottery, labelled the "Angeles Phase" by Haberland. Angeles Phase ceramics were found below levels containing types such as Rosales Zoned Engraved and Schettel Incised, and it was remarked that they "seem to be connected with the Bocana Zoned Incised and Toya Zoned Incised of Baudez..." (Haberland 1966:401). At Sitio Méndez, Norr reported a mixture of Loma B- and Catalina- type ceramics from the lowest levels of a Zoned Bichrome mound. The 410(329)132 BC [UCLA-2163] date from Sitio Méndez corresponds well with other early Zoned Bichrome dates, as well as the Early facet of the Arenal Phase. As noted above, the Méndez ceramics also included a number of Tronadora Complex sherds. It appears that Angeles ceramics correspond to Early Arenal and Lange's Loma B Phases, Dinarte ceramics (as noted above) are equivalent to Tronadora, and that the lowermost levels at the Méndez site contained a mixture of Tronadora and Early Arenal types.

At Los Angeles, Angeles Phase ceramics were separated from Dinarte Phase pottery by a sterile layer of hard volcanic tephra, and the two phases were both temporally and stylistically distinct. However, at Tronadora Vieja, the stratigraphic division between Tronadora and Arenal ceramics was not as clear. The site appears to have been continuously occupied through the two phases, but a fair amount of mixing occurred between Arenal and Tronadora levels. The changes which occurred in ceramics from one phase to the other are difficult to trace and even harder to substantiate. However, general patterns and distinctions have been discussed in the section on Tronadora ceramics. These can be verified only through further testing and analysis. How and why stylistic and cultural changes occurred at this time is a very important question, especially considering the significant developments occurring in Mesoamerica between 1000 and 500 BC.

TYPE: Bocana Incised Bichrome

VARIETY: Bocana

COMPLEX: Arenal

SPHERE: Cordillera

DESCRIPTION:

Principal Identifying Modes:

1) Multiple grooving alternating with red-painted zones in a vertical pattern on the exterior of jars and bowls.
2) Horizontal or vertical bands of red paint delineated by groove-incision on vessel body or supports.
3) Squat, tripod, incurving-rim bowls and short-necked jars.
4) Large, hollow, tapering conical supports.
5) Solid, long, conical, "faceted" curving supports.

Paste, Temper, Firing, Etc.:

Most Bocana sherds from the Arenal area have an orange surface and paste with a high percentage (ca. 30-40%) of rounded and angular clear particles of quartz and possibly plagioclase feldspar up to 1 mm in diameter, angular hornblende crystals, and fragments of what might be decomposed pumice tephra. Volcán Ware varies in color when oxidized from an orange (Munsell 7.5 YR 7/6) to a duller greyish-orange ("light brown"; 7.5 YR 6/4). The quartz and black hornblende inclusions in an unslipped paste are its principal characteristics. Bocana Incised pastes differed from Tronadora Phase ones in that they included a greater proportion of small crystals of black horneblende than is present in earlier types. These may have been what Healy tentatively identified as obsidian inclusions (1980:92).

Firing varies from complete oxidation to partial oxidation, in which a dark, reduced core remains.

Surface Finish And Decoration:

Bocana Incised Bichrome in the Arenal area is characterized by grooved, vertical incisions in combination with zoned red slipping on a beige to orange unslipped surface. Unlike Tronadora Incised and other Tronadora Phase sherds with incised decoration, vertical, rather than horizontal incision predominated.

One of the principal characteristics of Bocana pastes is the lack of any kind of slip. The only addition to the surface of Bocana Incised Bichrome in the Cuenca de Arenal were bands or zones of red paint, which sometimes show crazing as a result of variable shrinkage rates between slip and paste. The only sherds which show any finish beyond a very light kind of "self-slipping" are the large hollow conical supports, which will occasionally have traces of a whitish pigment on a light grey (7.5 YR 7/2) "patina," which is still not a slip. Unfortunately, the sample of these large hollow supports is not great enough to provide any definitive data.

The principal decoration on Bocana Incised Bichrome is a series of four or more vertical grooves (wide, round-bottomed incisions made when the clay was fairly soft) on the vessel exterior, alternating with vertical zones of red ocher paint (Fig. 7.1:J-K; Pl. 7.1:A-D). Decorative technique ranges from wide, round-bottomed grooving to hard-

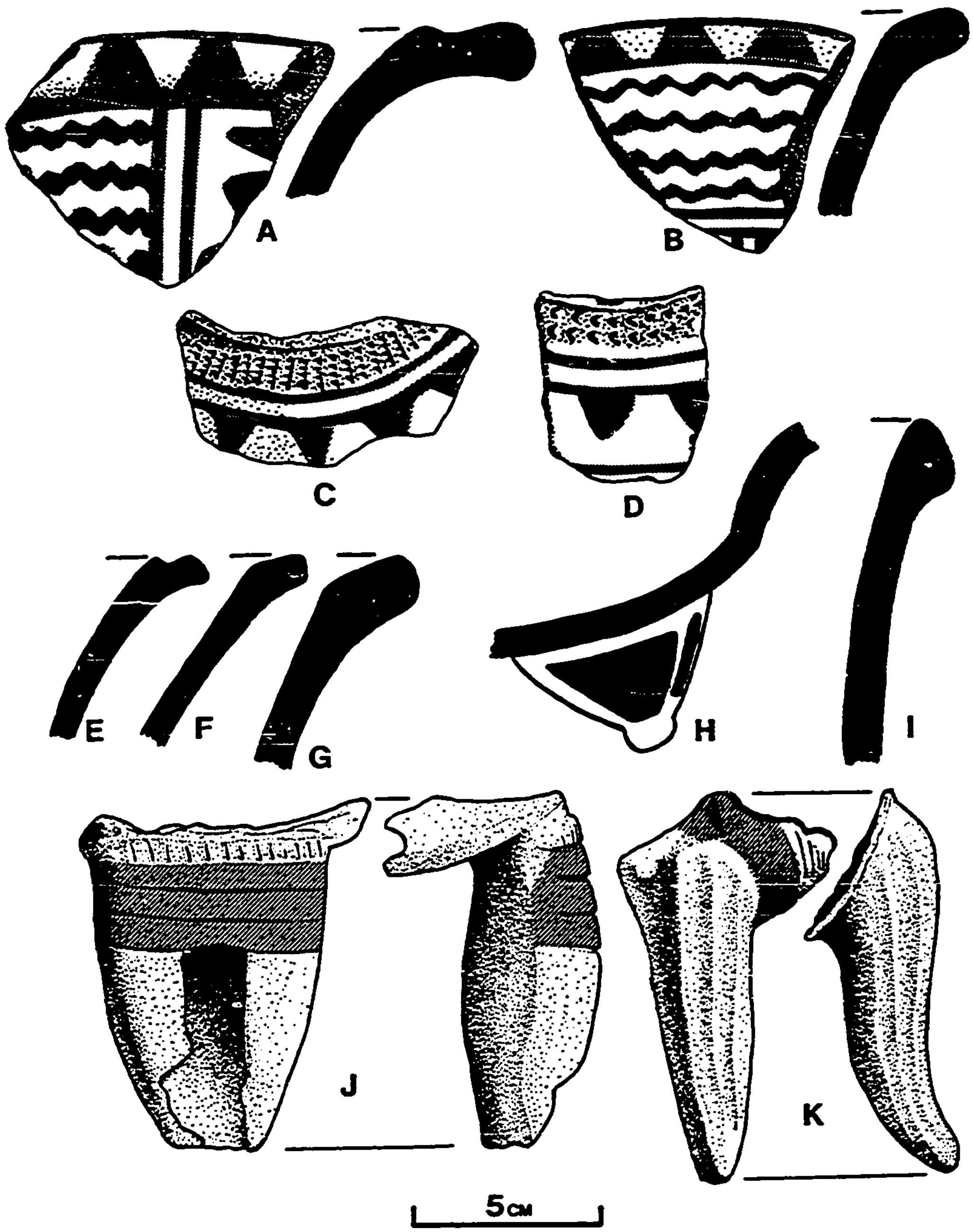
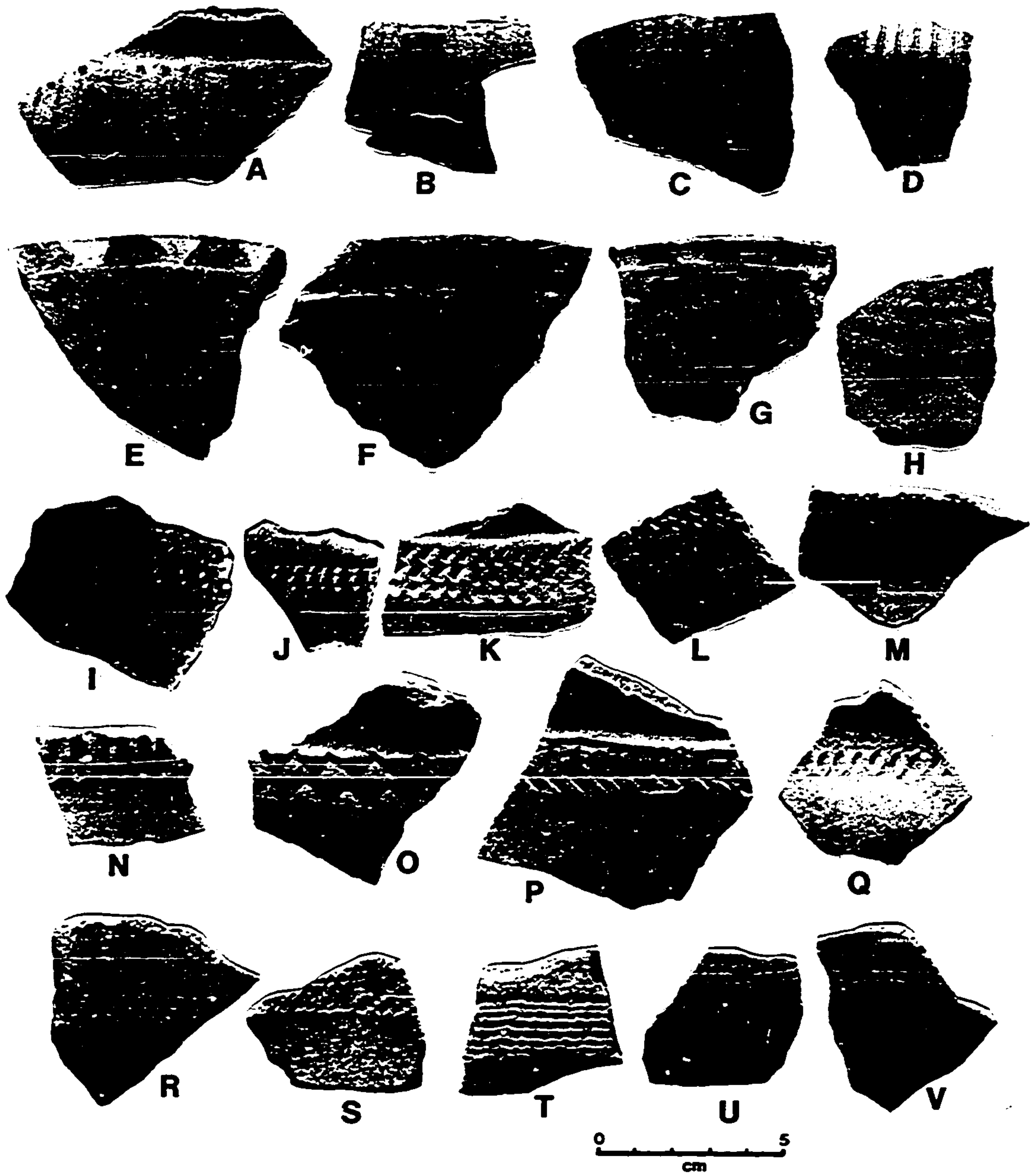


Fig. 7.1: Las Palmas Red-on-Beige (A-I);
Bocana Incised Bichrome supports (J-K).
Proveniences: A (G-177-A1), B - D (G-175-A1), E (G-172-A1), F (G-175-A1), G (G-171-A1), H (IF9), I (G-164-A1), J (G-175-A1), K (G-166-A1).

PLATE 7.1
Arenal Phase Ceramics

Bocana Incised Bichrome (A-D); Las Palmas Red-on-Beige (E-H); Mojica Impressed: Mojica Variety (I-L); Mojica Impressed: Laguna Variety (M-Q); Mojica Impressed: Corrida Variety (R, S); and Mojica Impressed: Arrastrada Variety (T-V). Proveniences: I-P (G-175-A1); Q (G-171-A1); R-V (G-164-B6).

PLATE 7.1



edged, deep incising. Incisions are usually found in multiple sets of 3-4 vertical lines, corresponding to the decoration on Baudez' "combed variety" (1967:63; Pl. 19) and Healy's "Bocana variety" (1980:91; Fig. 26). The paint or slip appears in most cases to have been applied after the grooving. Occasionally, it bleeds into the grooved areas. This decoration looks identical to examples from the Tempisque Valley (Baudez 1967:63;Pl. 19). In some cases, the multiple grooving can fill large zones which alternate with zones of red. An important distinction between Bocana Incised Bichrome and the vast majority of Tronadora Phase grooved sherds is that decoration on body sherds of the former is almost always dominated by vertical elements. On the latter, vertical grooves are rare.

Another type of incised bichroming (which possibly represents another type or variety, such as the "Santiago Appliqué" of the Denver Ceramic Conference: Lange and Bishop n.d.) is found on the uppermost part of large, tapering hollow supports. This takes the form of horizontal bands (0.75-1.75 cm wide) in red (Munsell 10 R 4/8) which are delineated by deep horizontal grooving.

There is a great deal of variation in the grooving technique, which varies from very light, very narrow (1 mm), shallow grooves to deeper and wider (2 mm) grooves with more sharply-defined edges. There may be some temporal variation (probably a transition from Tronadora Phase grooving types) in Bocana Incised Bichrome, but evidence for this from stratigraphic excavations is still skimpy.

Two variations from the standard Bocana Incised Bichrome formula warrant mention here. One is an incurving, _tecomate_ vessel with a direct rim and two painted bands delineated with grooving on the exterior lip. Another is a globular body sherd with a geometric motif composed of a red painted band delineated with narrow grooving which forms an angular arc on a beige surface. The decoration matches that on a vessel illustrated by Snarskis (1982:88; upper right-hand vessel, note transposed captions).

Form and Function:

With the exception of the _tecomate_ fragment mentioned above, the few rim sherds with Bocana Incised decoration were simple and direct, from incurving-rim bowls. However, there have been a number of sherds with portions of both globular body and curving jar neck. Given their abundance in the same assemblages as Bocana Incised Bichrome sherds, it seems likely that the rims we have been calling Los Hermanos Beige are also associated with Bocana vessels.

Two types of vessel supports have been provisionally classified with sherds of Bocana Incised Bichrome. The first is a solid support, lacking either slipped or incised decoration. Some of these are smooth and round to elliptical in cross-section. Others are "faceted", like bananas with more than three sides, and have roughly polygonal cross-sections. Although Baudez (1967:Pl.48F) identified a support of this type as "Monte Cristo Beige," this support type has been found attached to a body sherd with typical Bocana Incised decoration (Fig. 7.1:K). While a close connection between the Costa Rican and Guatemalan vessels is <u>not</u> supposed, the placement of these supports on vessels is virtually identical to that on Victoria Coarse tripod vessels from La Victoria (Coe 1961:Fig. 14).

The second support type is a hollow, broad, tapering rattle support with an elliptical cross-section. These are typically 10-15 cm long, and have a large, rectangular aperture (ca. 1.5 cm wide) down the middle of the exterior (Fig. 7.1:J). They are decorated on their uppermost portion with two or three horizontal red bands outlined with grooving. This support type often shows traces of a thin grey or white wash, and occasionally has appliqué decoration. While not included in the type as defined by Baudez, supports of this type were found in Arenal assemblages with other Bocana sherds and are decorated with incision and red bichroming. The examples from the Arenal area are identical to supports on vessels in the Museum of the Instituto Nacional de Seguros in San José which are reported to have come from San Carlos in the Atlantic Watershed (Snarskis 1982:88, upper right illustration -- note transposed captions). This support type was found associated with the early Loma B date (UCLA-2177A: 1060 BC ± 260) at the Vidor Site (Lange, personal communication

1985), but is thought to be stylistically inconsistent with Tronadora ceramics. While its identification as Bocana Incised is open to debate, its appearance in assemblages with Bocana suggests that it is closely related.

The most common vessel is a globular "cuspidor"-shaped vessel with a recurved profile and solid supports. Designs on the recurved globular jars extend to the limit of the vessel shoulder, and the neck is undecorated -- a feature which adds to the problem of identifying rim sherds of this type. Simple, incurving-rim bowls are another vessel form for this type. A third form would be a large, globular jar with large, hollow rattle supports (see above comments).

Bocana Incised Bichrome vessels, with the exception of the more elaborate examples, may have functioned as serving vessels. No sherds of this type were identified with charcoal deposits or burned areas.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Tronadora Vieja, nine sherds were recovered from "50's" strata, while three came from Unit 60 or below.

No sherds of this type were found in either surface collections or excavations at Sitio Bolívar.

INTER-SITE LOCATIONS AND CONTEXTS:

A total of 101 sherds of Bocana Incised Bichrome were collected from 15 separate sites in the Arenal area. The largest sample, 36 sherds, came from surface collections at La Isla (G-166). This was followed by Tronadora Vieja (14 sherds), G-170 (14 sherds), and Viboriana (G-175), with 9 sherds.

As noted above, Bocana Incised Bichrome is very close (and possibly identical) to the Palmar Ware from Nicaragua noted by Bransford (1881:69-70) and Lothrop (1926: Pl. CXIV). One small vessel of which appears to be of this type was reported from Las Huacas (Hartman 1907), possibly from a late Zoned Bichrome context.

The type name "Bocana Zoned Incised" was first used by Coe and Baudez (1961). Baudez (1967:63) then defined the type "Bocana Incised Bichrome" on the basis of assemblages from sites in the Tempisque Valley. His description derives from a sample of 1913 sherds, of which 544 are from La Bocana, 1353 from Ortega, and 16 from La Guinea, the majority of which are from Catalina phase assemblages. Sweeney (1975:79) reports a total of seven sherds, three from Matapalo and four from Chahuite Escondido, and Healy (1980:91) cited five sherds from sites in the Rivas region of Nicaragua. The type is also present in the Sapoá River region (Lange 1971) at sites including Las Pilas (Lange and Scheidenhelm 1972:243), and on the Bay of Culebras at Vidor (Lange 1980). Sherds very similar to Bocana are illustrated from Los Angeles phase assemblages on Ometepe Island (Haberland 1966).

CULTURAL SIGNIFICANCE:

Bocana Incised Bichrome is the marker type for Early Arenal Phase assemblages in the Arenal area, and is associated most frequently with types such as Las Palmas Red-on-Beige and Los Hermanos Beige: Espinoza Variety. Its wide geographic distribution in Greater Nicoya suggests that it may have been widely traded. Neutron activation sourcing of this type (Bishop, personal communication 1985), suggests that there may have been a number of loci for its manufacture. However, there is no data yet to indicate that this type was not manufactured at all of the sites where it has been found. Given the relative simplicity of its decoration, Bocana may have many analogues. It may well be stylistically related to the "Scarified Ware" of the Concepción phase in western Panama, but the nature of early contacts between Panama and northwestern Costa Rica remains unclear.

CHRONOLOGICAL POSITION:

Bocana Incised Bichrome is a diagnostic type of Lange's Loma B Phase at the Vidor Site, and is considered a marker type for the earliest Zoned Bichrome assemblages in Greater Nicoya. It is likely that Bocana Incised derives directly from incised types of the Tronadora Phase. The transition between the Tronadora and Arenal phases is still poorly understood, and Bocana Incised may well appear sometime during the Late Tronadora Phase. However, until further information for defining the transition is available, Bocana Incised may be considered as a marker type for Early Arenal.

TYPE: Las Palmas Red-on-Beige

VARIETY: Las Palmas

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Red decoration on an unslipped, "floated", or "self-slipped" beige to orange surface.
2) Designs composed of vertical and horizontal lines, multiple wavy lines, and solid triangles.
3) Combinations of rows of Mojica Impressed-type shell impressions with red-painted motifs.
4) Open tripod bowls, carinated tripod bowls, restricted-neck globular jars, and incurving-rim bowls.

Paste, Temper, Firing, Etc.:

Pastes are hard, and range from an orange beige to a grey beige in color. Principal inclusions are grains of quartz, crystals of hornblende, plagioclase feldspar, and particles of pumice tephra (?). Thin-walled vessels are completely oxidized, but thicker sherds have dark, reduced cores. In general, the paste is fine in texture and has few large inclusions. Fractures are smooth and regular. Occasionally, sherds will have small hollows and pits left on the surface by organic matter which vaporized upon firing.

Surface Finish And Decoration:

The finish of Las Palmas Red-on-Beige is difficult to define as a slip, although in some ways it resembles one. The crazing which results from a variable shrinkage between slip and paste is absent, and inclusions in the paste are clearly visible on the vessel surface. It is not possible to isolate and chip off small fragments of the surface finish, as is usually possible with a slipped vessel. No difference between surface and paste is evident in carefully cleaned edges of sherd profiles. Rather than a true slip, Las Palmas Red-on-Beige appears to have what might be called a "self-slipped" or "floated" finish, produced by rewetting the surface of the vessel before it is completely dry to create a film of fine paste particles in colloidal suspension across the vessel surface. However, it is also possible that the finish was created by compacting the surface through stone polishing. Alternatively, a very thin wash may have been prepared from the same clay as that from which the vessel was made. At any rate, no discernable slip of a material distinct from that of the vessel paste is apparent. The color and characteristics of the surface are similar to those of unslipped vessels, and are identical to those of the vessel paste. As noted above, the surface color is typically an orange-beige (Munsell 7.5YR 7/4 to 7.5YR 6/6).

Painting was executed with a red (Munsell 10R 4/6 to 10R 4/8) ocher in a water mix which immediately soaked into the vessel surface. Painted lines are not raised, and do not appear as a thick slip, but are thoroughly integrated into the vessel finish. The red paint cannot easily be chipped off with the aid of a steel blade or probe, and comes away with fragments of paste. On most examples, the paint is a clear red ocher pigment. In a few examples, however, tiny particles of grey to white weathered tephra are a constituent of the paint. The average width of the painted lines is 3-4 mm, and with the exception of rim bands, painted lines never exceed 5 mm in width.

Decorative motifs vary widely, considering the limited number of elements available. The basic painted elements are: 1) multiple, straight red lines, 2) groups of 3-4 wavy lines, 3) equilateral triangles attached to a single red line, and 4) circumferential lines with short, perpendicular line segments (Fig. 7.1:A-G; Pl. 7.1:E-G). All of these modes may be found in vertical or horizontal combinations, with the greatest variety in execution appearing on the interior of open bowls or the exterior of restricted-neck jars. The exteriors of open bowls rarely demonstrate more than a series of horizontal lines circumscribing the vessel. Painting on the interiors of bowls is restricted to the interior surface between the lip and the base angle. So far, no decoration has been found on the inside of bowl bottoms.

Groups of wavy lines appear on the interiors of bowls, sometimes bounded within rectangular zones. A common element at the bottom of the interior frieze of bowls is a horizontal line with pendant vertical line segments. Series of triangles are found in bowls on the inside of the vessel rim, with apexes pointing up. On jar necks and shoulders, the points always go down. Wavy lines were accomplished with a multiple brush, and are found in groups of three to four. The fact that the brushes were flat rather than tapered is suggested by the fact that up-strokes are frequently wider than down-strokes, and almost never narrower. The lip surface of Las Palmas Red-on-Beige vessels, even small, direct-rim incurving bowls, is always painted red.

Stamping or impressing in combination with painting has appeared only on the shoulders of jars (Fig. 7.1:C-D). Its execution is identical to that of the stamped decoration on vessels of Mojica Impressed: Mojica Variety. Stamping may have been done with the edge of a shell or a 2- or 3- pronged implement. From the angle of impression, it appears that most stamping was done with the right hand. Individual marks have the shape of a sideways letter "U". These individual impressions range from 1-5 mm in diameter, and fill a circumferential horizontal band approximately 1 cm wide.

Form and Function:

The two most common vessel forms of Las Palmas Red-on-Beige are complex-silhouette, open tripod bowls and restricted-neck globular jars. The other form is a small, slightly incurving, direct-rim bowl.

Rim forms include outcurving, slightly thickened lips and a unique grooved or channelled form identical to the "hooked" rims from Protoclassic Maya assemblages in El Salvador and Guatemala (Sharer 1978:Fig. 14 e4-9,e12-16, Fig. 18 a8-9,b9-12; Demarest 1984:Fig. 45b,e-f). These latter are outcurving, slightly thickened rims with a broad groove or channel which runs circumferentially around the upper lip, creating a slight "step" and characteristic rim profile (Fig. 7.1:A). Examples of direct-rim bowls have a very slight thickening on the inner surface of the rim. Jar rims of this type were not easily identified, and were probably classified as Los Hermanos Beige.

The vessel walls of open tripod bowls are outcurving, with a slight angle or carination delineating the convex bowl interior. Exterior angles on bowls are unaccentuated, but interior angles (at the intersection of wall and bottom) may be slightly grooved. Shoulders of jars indicate that the vessels had tightly restricted necks. Jars were decorated exclusively on the exterior.

Only a few examples of Las Palmas Red-on-Beige supports were identified as belonging to this type, probably because painted decoration on or near this part of the vessel was rare. These are hollow, stubby, conical rattle supports, with two rectangular slits cut into the clay with an edged instrument. An interesting addition to one example of this support type was a small appliqué button at its tip (Fig. 7.1:H). In some examples, a shallow groove delimits the attachment of the support to the vessel.

Fireclouding and burning was rare on Las Palmas Red-on-Beige vessels, and no examples were found with deposits of charcoal or other material. The one support which is well preserved does not show signs of heavy wear. Interiors of jars are clean. In sum, there is no evidence to indicate that these vessels were used for cooking. Inference suggests that the open bowls were serving vessels. Restricted-neck jars may have been so designed to hold water or other liquids.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Tronadora Vieja, eight sherds of this type came from the "50's" strata, while six came from Unit 60 or below.

At Sitio Bolívar, 11 sherds came from surface collections and 25 from excavations. Of the excavated sample, 15 came from the sherd "midden" in Operation B.

INTER-SITE LOCATIONS AND CONTEXTS:

The total sample of Las Palmas Red-on-Beige consists of 188 sherds, and comes from 17 different sites in the Arenal area. This type was present in the largest numbers in surface collections at G-177 (46) and Vibcriana (31), and appeared in both surface collections and excavations at Sitio Bolívar (36 sherds, representing less than 1% of the total diagnostic assemblage) and Tronadora Vieja (20 sherds, or almost 10% of the diagnostic assemblage).

Las Palmas Red-on-Beige was initially defined by Baudez on the basis of his analysis of ceramic assemblages from the Tempisque Valley (Baudez 1967:88). It is very similar to Matazana Red-on-Brown (Ibid.:87), which Healy (1980:117) remarks is similar in turn to the Nicaraguan type Espinoza Red-Banded. However, this latter type has been construed as something altogether different in our analysis (see below).

Baudez (1967:87-88) reports 339 sherds of Las Palmas Red-on-Beige from the site of Ortega. He cites a total of 234 sherds of Matazana Red-on-Brown: 124 from La Bocana, 105 from Ortega, and 5 from La Guinea. A third type, "Tempate rouge-sur-beige," was defined on the basis of 149 sherds from Ortega (Ibid.:90), but I have been unable to distinguish this from Las Palmas. Sweeney (1975:144) notes six sherds of Las Palmas, one from Chahuite Escondido and five from Matapalo, but does not report any Matazana sherds. Healy (1980) does not report any sherds of either Las Palmas or Matazana from sites in Rivas, and according to Lange (personal communication, 1986), this type is rare in assemblages in either the Río Sapoa or Bay of Culebras regions.

CULTURAL SIGNIFICANCE:

The identification and classification of Las Palmas Red-on-Beige in Arenal Basin assemblages is based on Baudez' description and illustrations of the type (especially 1967:Pl.22F,G). However, Baudez does not report bowl forms for either Las Palmas Red-on-Beige or Matazana Red-on-Brown, although bowls with diagnostic decoration were more common than jars in our sample. While some of our sherds may have in fact belonged in Baudez' classification as Matazana Red-on-Brown, our sample was not large enough to allow for this fine distinction. The principal difference between the two types in Baudez' description is that Matazana Red-on-Brown tends to be darker in color and has a predominance of straight over wavy lines. Although he was able to distinguish the two types at the site of Ortega, it is our opinion that the two types described by Baudez may represent unnecessary taxonomic "splitting," and we propose combining the two types into a single one, designated Las Palmas Red-on-Beige Red-on-Beige. A complete jar of this type in the collection of the Instituto Nacional de Seguros is illustrated by Snarskis (1982:31).

Interestingly, sherds from Rivas which are very similar to examples from the Cuenca de Arenal have been classified as "Usulután Resist: Variety Unspecified" by Healy (1980:239-241;Fig. 110). Although two examples were from restricted-neck vessels, these sherds are primarily from open bowls, a portion of which are described as being slipped with "a cream to honey (10YR7/6) colour... Over these sherds were painted, using a multiple (5-7) prong brush, a series of red (10R4/8) lines, wavy and straight." These have grooved rims which appear to be similar to those noted in our assemblages, and Healy describes them as "a type of imitation resist" (Healy 1980:240), which in fact do not use a resist technique at all. These sherds may in fact represent Las Palmas Red-on-Beige or an analogous Nicaraguan type.

Although he did not find any examples of Usulután-like resist decoration in his assemblages, Baudez (1967:206) suggests that multiple-brushed wavy line decoration appearing on ceramics of Greater Nicoya during the Zoned Bichrome period may be an attempt to imitate (using a positive, rather than negative design) the Usulután ceramics of Preclassic and Protoclassic southern Mesoamerica. I would go further, and suggest that Las Palmas Red-on-Beige bowls, as they appear in the Cuenca de Arenal, also copied Usulután ceramics in terms of vessel form. The open, carinated tripod bowl is not found in Tronadora Phase assemblages; and although lip grooving is a Tronadora technique, its characteristic expression in the "hooked" rims of Las Palmas Red-on-Beige is too close to Mesoamerican examples to be anything other than an imitation of northern styles.

As noted above, Lange (personal communication, 1986) does not interpret Palmas Red-on-Beige as characteristic of Pacific coast assemblages. Given its frequency sites along the Río Tempisque and in the Cordillera region, it appears to be a type of primarily inland distribution. While the inference remains to be supported by further evidence, the similarity between Arenal forms and those of Rivas and the appearance of Usulután-like modes in Las Palmas Red-on-Beige implies that contacts with northern regions early in the Zoned Bichrome period may have been stronger in the northern Cordillera region than on the coast.

The use of multiple-brushed wavy lines of red ocher pigment, which appears earliest on Las Palmas Red-on-Beige, survives in later types such as Carillo Polychrome, Cabuyal Polychrome, and Jiménez Polychrome. Motifs such as multiple-brushed straight and wavy lines and triangles similar to those painted in red on Las Palmas Red-on-Beige also appear in black on a red slip in the Charco Black-on-Red type in the Arenal Basin. Jar shapes of the two types were very similar, as illustrated by Snarskis (1982:31); however, carinated, tripod bowls with "hooked" rims are not known for the latter type.

CHRONOLOGICAL POSITION:

The Usulután style dates as early as the Middle Preclassic in southern Mesoamerica, appearing in the Chul Ceramic Complex at Chalchuapa, El Salvador around 400 BC

(Sharer 1978:125). Given the nature of the relationship between Las Palmas Red-on-Beige and Usulután types, it is hard to make comparisons to Salvadoran types even at the level of group. The major groups at Chalchuapa are Jicalapa (Chul Complex, 400-200 BC), Izalco (Caynac Complex, 200 BC - AD 200), and Chilanga (Vec Complex, AD 200-400), all of which overlap our Arenal Phase. All three are characterized by multiple-brush decoration, but only the Jicalapa and Izalco groups share vessel forms and rim profiles with Las Palmas Red-on-Beige. Jicalapa Usulután is distinguished by the use of a "thick, soft, creamy white slip", and the resist pattern appears as cream or white lines through an orange finish (Sharer 1978: 30). The surface finish of Izalco Usulután is very similar to that of Las Palmas Red-on-Beige. That is, "surfaces of the vessel were well smoothed and, when leather hard, stone polished until the fine surface particles were compacted so as to resemble a thin slipped surface" (Sharer 1978:39). "The Usulután decoration appears as lighter lines, usually a salmon-pink... against areas of a darker, dull red or orange" (Ibid.). It is believed that, of the three groups, Izalco Usulután is the most likely to have provided direct inspiration for Las Palmas Red-on-Beige. However, this type is also close to resist-decorated Guinea Incised (see below), on which the design elements and execution are very different from that of Las Palmas Red-on-Beige.

Primarily on the basis of similarities in form to Jicalapa and Izalco Usulután, Las Palmas Red-on-Beige is believed to date to the middle portion of the Arenal Phase, overlapping Early and Late facets. Its tentative dates are conservatively estimated at 300 BC - AD 300.

MOJICA IMPRESSED

An important decorative mode of the Arenal Phase is the use of various implements to stamp rows of small marks on the necks and shoulders of unslipped vessels. The type designated "Mojica a impressions de coquille" by Baudez for the Tempisque Valley (1967:57;Pl. 16) was ubiquitous in both Early and Late Arenal Phase assemblages. I have defined a total of five varieties of Mojica Impressed based on differences in impressed patterns. Mojica Impressed vessels appear to have been used primarily for storage. No functional differences were noted between varieties, but they do appear to have temporal significance. The Mojica Variety and Laguna Variety are both diagnostic of the Early Arenal Phase. The Corrida Variety, Arrastrada Variety, and Congo Variety are all diagnostic of the Late Arenal Phase.

TYPE: Mojica Impressed

VARIETY: Mojica

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Diagnostic stamping or impressions in a narrow band on shoulders of vessels with a "natural" finish.
2) Utilitarian vessels, ranging from small serving vessels to large storage jars.
3) Red-slipped vessel rims.

Paste, Temper, Firing, Etc.:

Mojica Impressed vessels are usually hard and well-fired at the surface, but a reduced core is present in most examples. The paste is similar to that of other Arenal Phase types, in that it typically contains large quantities of hornblende crystals. There may be a larger proportion of clear quartz and feldspar inclusions in pastes from this type than in Las Palmas Red-on-Beige or Bocana Incised Bichrome (but this remains to be verified in thin sections). Although this type appears to have been largely utilitarian, the paste of Mojica Impressed vessels is moderately fine in texture, and wall thickness rarely exceeds 1 cm. Some very thin walled specimens (< 5 mm) were recorded, but these were the exception, and may represent smaller jars for daily use in cooking or serving. The color of Mojica Impressed vessels varies widely, ranging from a light beige to brown to dark brown (Munsell 5YR 3-7/4; 2.5YR 5/6,6/8; 10R 4/6, etc.). Fractures are smooth and regular. Occasionally, organic inclusions in the paste will have burned out upon firing, leaving small pits.

Surface Finish And Decoration:

The surface finish of Mojica Impressed is similar to that of Las Palmas in that it lacks the cracking caused by differential shrinkage of slip and paste. Vessel surfaces of the Mojica Variety are generally very smooth, and have a slight luster. Because of its smoothness, the typical Mojica Variety finish could almost be called "waxy," although it is typically hard and resistant to scratching with a fingernail. The finish on this type is termed "natural" because exterior and interior surfaces of jars are identical in color to the paste. Jar interiors are usually rough and unfinished, often with marks left from the smoothing of coils. As with Las Palmas Red-on-Beige, surfaces may have been "floated", treated with a wash of the same clay as that used for the paste, and stone burnished. With the exception of the vessel rim, no attempt was made to add color to the exterior of Mojica Impressed vessels, and less care seems to have been taken to produce vessels of a uniform hue, as was true with Las Palmas Red-on-Beige.

Just as the color of Mojica Impressed surface finishes varies widely, there is a fair amount of variability in the execution of the impressed decoration (Pl. 7.1:I-V). The impressions on the Mojica Variety (Pl. 7.1:I-J) are accomplished with a 2-4 pronged in-strument, possibly, but <u>not</u> definitely, with an implement made from the edge of a shell. It is possible that other objects with the requisite shape were utilized, and Richard Cooke (personal communication, 1984) has observed that some of the impressions may have been made with the tooth (possibly a premolar) of a small mammal. The typical mark has the shape of a semicolon with an extra dot on top (cf. Baudez 1967:Pl. 16C).

As indicated by the angle of impression, both right- and left-handed strokes are evident. These often push up a small, convex ridge of clay on one side of the the impression. The majority of the impressions appear to have been made with the right hand, working around the vessel in a counter-clockwise direction. The width of the impressed band varies from vessel to vessel, with a minimum of about 5 mm and a maximum of about 1.5 cm. The diameter of the individual depressions in each mark varies from 1-5 mm.

The amount of movement of the instrument in the soft clay varies from single, picked-up strokes to an actual "drag-and-jab." The Mojica Variety is used to designate examples which have large, clear, and deliberate marks, as opposed to examples with a rapid, almost blurred pattern of many small and tightly-placed impressions (Mojica Impressed: Corrida Variety) and coninuous dragging of the instrument across the vessel surface (Mojica Impressed: Arrastrada Variety). There is occasionally a tendency to slant the impressing implement about 30° to the left or right, thereby producing a design of oblique marks.

The only known painted decoration on Mojica Impressed: Mojica Variety appears on the vessel lip. Painting in a hard, red ocher pigment like that of Los Hermanos Beige extends on the exterior to the limits of lip convexity and terminates on the interior immediately inside the vessel lip.

<u>Form and Function</u>:

Mojica Impressed vessels appear to have been exclusively medium-sized to large, globular, necked jars. Unfortunately, very few vessel rim and shoulder fragments have been found with Mojica Impressed patterns. The few examples of Mojica Impressed: Mojica Variety rims found all demonstrated red painting on the vessel lip, and share rim forms with Los Hermanos Beige. Given the quantity of Mojica Impressed vessels recovered, it is likely that many Mojica Impressed rims have been classified as Los Hermanos Beige.

Mojica Impressed vessels were made in a large range of sizes, from small jars about 20 cm tall to enormous storage vessels. The largest example found was about 30% of a large, necked jar of Mojica Impressed: Arrastrada Variety, including portions of the rim, neck, and base. It was originally over 60 cm tall, and had a rim diameter of approximately 50 cm.

While many of the Mojica Impressed examples show evidence of fire-clouding and possibly smudging, no sherds known to be of this type were found with charcoal adhering to their inner surfaces. While some of these vessels may have been used for cooking, the smaller examples were probably used for serving liquids. The large size and necked-jar form typical of of the majority of Mojica Impressed: Mojica Variety suggests that vessels of this type may have been used primarily for storage.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Tronadora Vieja, two sherds of this type were found in "50's" strata and fragments of two vessels were found in an intrusive burial which probably originated in Unit 54. None were found in Unit 60 or underlying strata.

INTER-SITE LOCATIONS AND CONTEXTS:

The total sample of Mojica Impressed: Mojica Variety in the Arenal area consists of 127 sherds from 20 different sites. The largest collections come from Viboriana (27), where this type was prominent in the initial surface collection of the site, and Sitio Bolívar (24), where all but two of the sherds of came from surface collections (and may have been mistakenly labelled as belonging to this variety).

Baudez defined the type "Mojica à impressions de coquille" on the basis of a sample of 199 sherds, 97 from La Bocana, 97 from Ortega, and five from La Guinea (1967:57). The sherds he illustrates which are closest to Mojica Impressed: Mojica Variety (i.e. Baudez 1967:Pl.16A, C,F,H) come from the sites of Bocana and Ortega. Only two body sherds of the Mojica Impressed type are reported by

Sweeney from the site of Matapalo (1975:103), and this type appears to be completely absent from Rivas assemblages. According to Lange (personal communication, 1986), it is also rare or absent at sites on the Pacific coast of Guanacaste.

CULTURAL SIGNIFICANCE:

Impressed decoration, especially shell-stamping, is common in Tronadora Phase assemblages. It seems likely that the Mojica Impressed pattern has its origins in the Tronadora technique of using single, shell-edge impressions within horizontal bands delineated with groove incision. Baudez was able to reproduce impressions similar to those in Mojica Impressed decoration with a shell of *Purpura columellaris*, a Pacific coast species (Baudez 1967:58). The abundance of Mojica Impressed in the Cordillera region and its near absence on the coast suggests that the shell impression itself may have had a symbolic importance, perhaps because it was produced by an object which could be acquired only through trade or trips to the coast. Impressing implements other than shells may have been intended to imitate shells or adopted because of their own symbolic importance. While I have not found any ethnographic parallels for this, the use of a mammal tooth to decorate a storage jar might have been a way of "charming" the vessel to protect its intended contents from plunder by small mammals.

CHRONOLOGICAL POSITION:

Fragments of a Mojica Impressed: Mojica Variety jar were found within the "trench tomb" feature at the Tronadora Vieja site (G-163-W35). A charcoal sample from this feature yielded a radiocarbon date of 2010(597 BC)AD 660 [Tx-5280: 520 bc $\pm$ 560], which has so large a confidence interval as to be of minimal value. Baudez, who defines Mojica Impressed broadly and does not distinguish varieties with temporal significance, places this type in his Catalina Phase (300 BC -AD 300) in the Tempisque Valley. He also attributes its appearance in small quantities in the subsequent Ciruelas Phase (AD 300-500) to "accidents of stratigraphy" (Baudez 1967:58).

On the basis of its shared modes with Las Palmas Red-on Beige and its absence from assemblages containing "Linear Decorated" types and early polychromes at Sitio Bolívar (G-164), the Mojica Impressed: Mojica Variety is tentatively dated to the Early Arenal Phase (500 - 0 BC).

TYPE: Mojica Impressed

VARIETY: Laguna

COMPLEX: Arenal

SPHERE: Cordillera, Tempisque Valley (?)

DESCRIPTION:

Principal Identifying Modes:

1) Single or double rows of impressions made with fingernails or other single-pointed instruments on the shoulders of vessels with "natural" finishes.
2) Medium to large, necked jars.
3) Red-slipped rims.

Paste, Temper, Firing, Etc.:

Same as Mojica Immpressed: Mojica Variety.

Surface Finish And Decoration:

A few examples of Mojica Impressed: Laguna Variety have been noted as having a fine, well-polished, white finish which is lighter (Munsell 7.5YR 8/4) than has been noted on Mojica Impressed: Mojica Variety.

This variety is distinguished by single or double rows of impressions, usually made with instruments other than a shell (Pl. 7.1:K-O). The principal difference between this and the Mojica Impressed: Mojica Variety is the use of a fingernail or single-pointed instrument, rather than a multiple-pronged one, to produce the decoration. There is a wide variation in the nature of the impressions which appear on this variety, which may warrant further varietal distinctions if a larger sample is recovered in the future. To date, the most common impressions are fingernail and bar-shaped impressions. Some sherds included in this variety appeared to have "pinched" or cord-marked decoration, which Snarskis (1978:123) also reports from his Chaparrón Complex.

These impressions fill decorative bands on the vessel shoulder which are comparable in width (i.e. 5-10 mm) to those on Mojica Impressed: Mojica Variety. The majority appear to have been executed with the right hand, which worked around the vessel in a counterclockwise direction. In many examples, small ridges of clay were pulled up on the right-hand side of the individual impressions.

One unusual specimen worthy of mention had heavy triangular, pushed-up impressions in combination with a decoration similar to pattern-burnishing in the form of wiped vertical lines, spaced 1.5-2 cm apart, around the vessel neck. These were made when the paste was still fairly soft, and their appearance and placement is very similar to the painted decoration found on Zelaya Bichrome.

Form and Function:

Same as Mojica Impressed: Mojica Variety.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Tronadora Vieja, 12 sherds, or 67% of the total sample, came from "50's" strata. Only three were found in Unit 60 or below.

Only five sherds of this variety were identified at Sitio Bolívar, two from surface collections and three from Operation B. This sample is a tiny proportion of the total assemblage from the site.

INTER-SITE LOCATIONS AND CONTEXTS:

A total of 66 sherds from 11 different sites were classified as belonging to this variety of Mojica Impressed. The largest samples came from Tronadora Vieja (18), and surface collections at G-187 (15), and Viboriana (13).

Mojica Impressed: Laguna Variety is closely related to, and possibly identical with a type defined by Baudez (1967:61) as Congo Punctate, of which he reports a total of 50 sherds: 8 from La Bocana, 24 from Ortega, and 18 from La Guinea. Two vessels of this type are reported from Bolsón. Sweeney (1975:94), following Baudez' description, notes 10 body sherds of ths type from Matapalo.

However, given the great similarity in all aspects except the nature of the impression between Mojica Impressed and Congo Punctate, I feel that the sherds which are most similar to Congo Punctate in the Arenal Basin are in fact more usefully classified as a variety of Mojica Impressed. The tradition of impressed designs on the vessel shoulder is the same, and the use of an instrument to create jabbed impressions is clearly related. In addition, many of the decorations found on this type are shallow, impressed or stamped marks, rather than punctations.

CULTURAL SIGNIFICANCE:

Although its decoration most closely approximates punctation, the Mojica Impressed: Laguna Variety (and Congo Punctate) tradition stands apart from the Tronadora Phase type Tigra Grooved-Punctate and the Catalina Phase (Tempisque Valley) type Huila Zoned-Punctate. The decoration is used to highlight the otherwise plain exterior of a utilitarian vessel, rather being used as an element in a more complex motif. It was initially thought that this decoration might bridge the gap between the punctation diagnostic of the Tronadora Phase and Mojica Impressed: Mojica Variety. However, excavated assemblages revealed that Mojica Impressed: Laguna Variety was much more likely to be associated with Arenal types than Tronadora ones, confirming its chronological association with Mojica Impressed: Mojica Variety.

CHRONOLOGICAL POSITION:

Baudez (1967:62) reported that Congo Punctate was present in both Catalina (300 BC - AD 300) and Ciruelas (AD 300-500) assemblages, but that it was more characteristic of the former. The similarity between Mojica Impressed: Laguna Variety and certain Chaparrón ceramics, and its appearance in earlier assemblages leads me to place this variety in the Early facet of the Arenal Phase.

TYPE: Mojica Impressed

VARIETY: Congo

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Single or multiple rows of triangular impressions in a circumferential band on vessel shoulders.
2) Unslipped or "natural" finish.
3) Medium to large, necked jars.
4) Red-slipped rims.

Paste, Temper, Firing, Etc.:

Same as that of Mojica Impressed: Mojica Variety.

Surface Finish And Decoration:

The surface finish on this variety includes characteristics described for both Mojica Impressed: Mojica Variety and Mojica Impressed: Arrastrada Variety.

The principal decoration on this type is a band composed of triangular impressions, probably executed with a plant stem or flat, tabular instrument. The triangular impressions most commonly appear in 1-3 horizontal rows, but examples with 4 or 5 rows have been noted.

Form and Function:

Same as that of Mojica Impressed: Mojica Variety.

INTRA-SITE LOCATIONS AND CONTEXTS:

Mojica Impressed: Congo Variety sherds were found in surface collections and excavated contexts at Sitio Bolívar, where there was no discernable pattern to their distribution. No sherds of this variety were found at Tronadora Vieja

INTER-SITE LOCATIONS AND CONTEXTS:

The total sample of this variety consists of 85 sherds from two different sites, Sitio Bolívar (84) and G-182 (1).

This type is related to, and possibly homologous with, Baudez' type "Congo ponctué" (1967:61), defined on the basis of 50 sherds from sites in the Río Tempisque. These were found at La Bocana (8), Ortega (24), and La Guinea (18). Two vessels of this type are reported from Bolsón. Sweeney (1975:94) reports 10 body sherds of Congo Punctate from the site of Matapalo. However, it appears to be absent from Rivas assemblages (Healy 1980).

CULTURAL SIGNIFICANCE:

During the 1984 season, sherds with this type of decoration were classified as Mojica Impressed: Laguna Variety, conceived at that time as a variety which would include all Mojica Impressed-type decoration that was not accomplished with a multiple-pronged instrument. However, the abundance of sherds with triangular impressions recovered from excavations at Sitio Bolívar was thought to be great enough to warrant the separation of two distinct varieties.

The name of this variety is derived from Baudez' type "Congo ponctué" (1967:62;Pl.18F), which was defined as including vessels with triangular impressions. However, the variety and the type do not completely overlap. The Congo variety of Mojica is restricted to vessels decorated exclusively with triangular impressions, while Baudez' category includes would be a combination of the Laguna and Congo varieties defined here.

CHRONOLOGICAL POSITION:

While Baudez illustrated examples of pottery which corresponded to all five varieties of Mojica Impressed, he did not make any varietal distinctions or note temporal differences in the use of the different patterns. Mojica Impressed: Congo Variety was found in its most significant quantities at Sitio Bolívar, and it may belong in the Late Arenal Phase. However, the close similarity between some examples of this and the Laguna variety suggest that the Congo variety may have developed directly from Laguna, making it less useful as a temporal diagnostic than other varieties of Mojica Impressed.

TYPE: Mojica Impressed

VARIETY: Arrastrada

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Circumferential, scraped decoration on jar shoulders, appearing as a narrow band of parallel channels which are usually coarse in execution.
2) Unslipped or "natural" finishes.
3) Large, necked jars.

Paste, Temper, Firing, Etc.:

In general, Mojica Impressed: Arrastrada Variety sherds appear to be softer and more eroded than those of Mojica Impressed: Mojica Variety or Mojica Impressed: Laguna Variety. While these other varieties have a slightly burnished, sometimes "waxy" finish, Mojica Impressed: Arrastrada Variety sherds are usually gritty or sandy in texture. This may, however, be a factor of the depositional environment in which the largest sample of this variety was found (excavations at Sitio Bolívar). Pastes have a higher proportion of aplastic inclusions than either Mojica Impressed: Mojica Variety or Mojica Impressed: Laguna Variety. Of these, the most apparent to the naked eye are angular particles of quartz and plagioclase feldspar (clear or milky in color), and hornblende (black, sparkling tabular crystals).

The completeness of oxidation varies, but suggests a uniformity in firing times and conditions for all vessels. Thicker sherds have dark, reduced cores, and medium to thin sherds are often completely oxidized. Paste color ranges from a red orange to a dark buff. In general, Mojica Impressed: Arrastrada Variety and Mojica Impressed: Corrida Variety are more orange in color than either Mojica Impressed: Mojica Variety or Mojica Impressed: Laguna Variety. This may reflect modifications or improvements in firing technology, with a trend towards more complete oxidation, or may reflect changes in clay sources through the Arenal Phase. the paste of Mojica Impressed: Arrastrada Variety is softer than that of earlier varieties.

Surface Finish And Decoration:

The typical surface of Mojica Impressed: Arrastrada Variety is smoothed but pitted. It does not appear that any major attempt was made at achieving a polish or burnish. At most, vessels will have a dull, almost "waxy" luster. This may have been achieved by stone smoothing when the paste was not sufficiently dry to hold a brighter finish. In general, surface pits are less than 1 mm in diameter. They are thought to have occurred when coarse aplastic inclusions were pulled from the surface by smoothing or as a result of the burning off of organic inclusions during firing.

The principal decoration on this variety is a narrow, horizontal band of parallel channels, scraped onto the exterior surface of the vessel shoulder with a shell or multiple-pointed tool when the paste was relatively soft and pliable (Pl. 7.1:U-V). In most instances, it is clear that decoration preceded the smoothing of the vessel exterior, as evidenced by the flattening and wiping of the crests of the scraped channels. A finger or instrument was used to wipe away excess clay and press down the ridges, sometimes pushing clay back into the freshly-made marks. As a result, the channels are very coarse and irregular.

There is a clear relationship between Mojica Impressed: Arrastrada Variety, Mojica Impressed: Mojica Variety, and Mojica Impressed: Corrida Variety in that the instrument utilized to produce the scraped decorations was the same as that used to produce the individual impressed markings characteristic of other varieties. The scraped patterns consist of 3-8 horizontal channels, produced by dragging the same kind of instrument that was used to produce individual impressions on Mojica Impressed: Corrida Variety. The close relationship between Mojica Impressed: Corrida Variety and Mojica Impressed: Arrastrada Variety is especially clear in examples which show subtle indications of a rapid vacillation of the instrument in the execution of the design. This produced a series of small marks in the bottoms of the channels, whose appearance shows a slight overlap between Mojica Impressed: Arrastrada Variety and Mojica Impressed: Corrida Variety. Baudez (1967:58; Pl.17E,H) was able to replicate the scraped pattern using the edge of shell of the Pacific species Purpura columellaris.

The nature of the scraped pattern on Mojica Impressed: Arrastrada Variety may have resulted from a decrease in the time spent on the manufacture of these jars, hence a "hasty" (i.e. irregular or uneven) appearance to their execution. The design may have been produced by rotating the vessel on a bowl or lage sherd and lightly dragging the instrument against it. Vibration of the instrument during the execution of the design may have been intentional. It brings the pattern closer to that of Mojica Impressed: Corrida Variety.

Apart from the scraped decoration on vessel shoulders, the only other decoration noted on Mojica Impressed: Arrastrada Variety vessels is a red streaking on the vessel body and red-slipped rims, identical to that on Espinoza Red-Banded. It is very likely that many sherds classified as Espinoza Red-Banded in our collections are in fact from Mojica Impressed: Arrastrada Variety, and represent body sherds away from the decorated shoulder. On the best example, a large rim sherd with neck and body intact, the red-painted decoration consisted of three broad horizontal bands painted in a rough fashion; that is, with irregular edges and ragged ends. Most examples had only traces of red paint.

<u>Form and Function</u>:

Same as that of Mojica Impressed: Mojica Variety.

INTRA-SITE LOCATIONS AND CONTEXTS:

No sherds of this variety were identified at Tronadora Vieja. At Sitio Bolívar, Mojica Impressed: Arrastrada Variety appeared in both surface collections and excavations, with no pattern apparent in either horizontal or stratigraphic distribution.

INTER-SITE LOCATIONS AND CONTEXTS:

A total of 189 sherds of this variety were found in Arenal area assemblages. All but two of these, which come from G-187, were recovered from Sitio Bolívar.

Baudez (1967:Pl. 16L) illustrates one sherd of "Mojica à impressions de coquille" from the site of Ortega which is identical to the variety defined here.

CULTURAL SIGNIFICANCE:

While similar in appearance to incised decoration, the motif on Mojica Impressed: Arrastrada Variety does not appear to have any direct relationship to incised ceramic types. Guinea Incised, which is the chief contemporary incised type, is completely different in both form and execution. The grooving is also completely different from the smooth, rounded grooves on types like Schettel Incised and Tronadora Incised.

CHRONOLOGICAL POSITION:

The largest sample of Mojica Impressed: Arrastrada Variety came from excavated features at Sitio Bolívar, in assiciation with Mojica Impressed: Corrida Variety and a ceramic assemblage which was characterized by "Linear Decorated" types. A charcoal sample from the base of the large midden of ceramic and lithic debris in Operation B at this site yielded a date of 830(400 BC)AD 1 [Tx-5271: 390 bc ± 170], but on the basis of the ceramic assemblage it is believed that the main part of the feature dates to around AD 300-500.

TYPE: Mojica Impressed

VARIETY: Corrida

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Narrow band of small impressions executed with a multiple-pronged tool, often irregular in texture and giving the appearance of a hasty execution.
2) Unslipped or "natural" finish.
3) Large, necked jars.

Paste, Temper, Firing, Etc.:

Same as Mojica Impressed: Arrastrada Variety.

Surface Finish And Decoration:

The surface finish of this variety is the same as that of Mojica Impressed: Arrastrada Variety.

The decoration on this variety of Mojica Impressed is derived from that on Mojica Impressed: Mojica Variety. It consists of a series of multiple impressions, executed in strokes which are usually oblique to the horizontal line of the decorative band. The decorative motif on Mojica Impressed: Corrida Variety appears to have been accomplished with an instrument similar or identical to that used for decorating Mojica Impressed: Mojica Variety vessels (Pl. 7.1:P-T). The marks of this tool almost always slant towards the right (in a "/" form). The individual marks are most frequently made up of 3-5 small indentations, although examples have been noted with as many as eight. Unlike Mojica Impressed: Mojica Variety, strokes do not appear to have been careful and deliberate. As a rule, they are shallower, closer together, and small ridges pushed up by individual impressions of the implement are <u>not</u> evident. The designs gives the impression of having been produced by a very rapid movement of the impressing instrument, perhaps being executed while the vessel was being rotated on a bowl or sherd. The impressions were made when the clay was fairly soft, and on many sherds the design appears to have been partially smoothed over in the finishing of the vessel. The diameter of the individual components of each mark is 1-2 mm.

Although rapidly executed, the impressions on Mojica Impressed: Corrida Variety vessels are regular in size and spacing. The execution of the design technique appears to have been the work of a well-practiced, though relatively unsophisticated potter.

As in other varieties of Mojica Impressed, the surface finish is unslipped or "natural" -- that is, the clay on the surface of the vessel is the same as that of the paste. Vessel exteriors are smoothed, but vessel interiors are consistently rough and irregular. Horizontal marks resulting from wiping are left on the vessel interior. The inside of vessel necks, however, was smoothed and finished in the same way as the vessel exterior.

<u>Form and Function</u>:

Same as that of Mojica Impressed: Arrastrada Variety.

INTRA-SITE LOCATIONS AND CONTEXTS:

Sherds of Mojica Impressed: Congo Variety appeared in both surface collections and operations at Sitio Bolívar, showing little pattern in either horizontal or startigraphic distribution. No sherds of this variety were found at Tronadora Vieja.

INTER-SITE LOCATIONS AND CONTEXTS:

The total sample of this variety from the Arenal area consists of 318 sherds from six different sites. However, 299 (94%) of these came from Sitio Bolívar, where they constituted approximately 5% of the total diagnostic assemblage and The next largest assemblage, 15 sherds, came from G-187.

CULTURAL SIGNIFICANCE:

The decoration of Mojica Impressed: Corrida Variety vessels is unmistakably related to that of Mojica Impressed: Mojica Variety. Adding a temporal dimension, there appears to have been a marked decline in the attention paid to the decoration of individual vessels of Mojica Impressed through the Arenal Phase. Mojica Impressed: Corrida Variety, like Mojica Impressed: Arrastrada Variety, may be understood as a "decadent" form of Mojica Impressed: Mojica Variety. This may have resulted from a need for more rapid construction of vessels, perhaps due to manufacture on a larger scale by less-skilled potters. An overall decline in the quality of Mojica Impressed vessels is reflected in aspects of firing and surface finish. Mojica Impressed:

Mojica Variety sherds as a whole are harder, finer in texture, and have a smoother finish than Mojica Impressed: Corrida Variety. Another aspect of this trend is that the inferred symolic import of the original impressed pattern seems to have lost much of its original value. What had initially been a way of deliberately marking or distinguishing a vessel for a special use appears to have become simply another step in the manufacture of a class of utilitarian vessels.

CHRONOLOGICAL POSITION:

Same as Mojica Impressed: Arrastrada Variety. Mojica Impressed: Corrida Variety and Mojica Impressed: Arrastrada Variety appeared in significant quantities in the large assemblage of Late Arenal ceramics from Sitio Bolívar, where both Mojica and Laguna varieties were absent.

TYPE: Guinea Incised

VARIETY: Guinea

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Post-slip, incised geometric decorations on vessel lip and exterior.
2) Orange to red slipped vessels.
3) Tripod, complex-silhouette bowls.

Paste, Temper, Firing, Etc.:

The paste of Guinea Incised vessels is reddish-orange in color and generally has a fine, sandy texture. Aplastic inclusions are under 1 mm in diameter, with the exception of small, ferric balls. The percentage of temper in the paste may approach 50%, with the principal aplastic inclusions being clear grains of quartz and plagioclase feldspar, angular crystals of hornblende, and opaque white particles of weathered plagioclase (?) or pumice (??). The presence of a high percentage of hornblende crystals is consistent with pastes of other Arenal Basin types, and supports a local manufacture. Guinea Incised pastes are well oxidized at the surface, but about 50% of the sherds have dark, reduced cores. Paste fracture is regular, with sherds breaking along straight or curved lines. The paste appears to be always lighter in color than the overlying slip.

Surface Finish And Decoration:

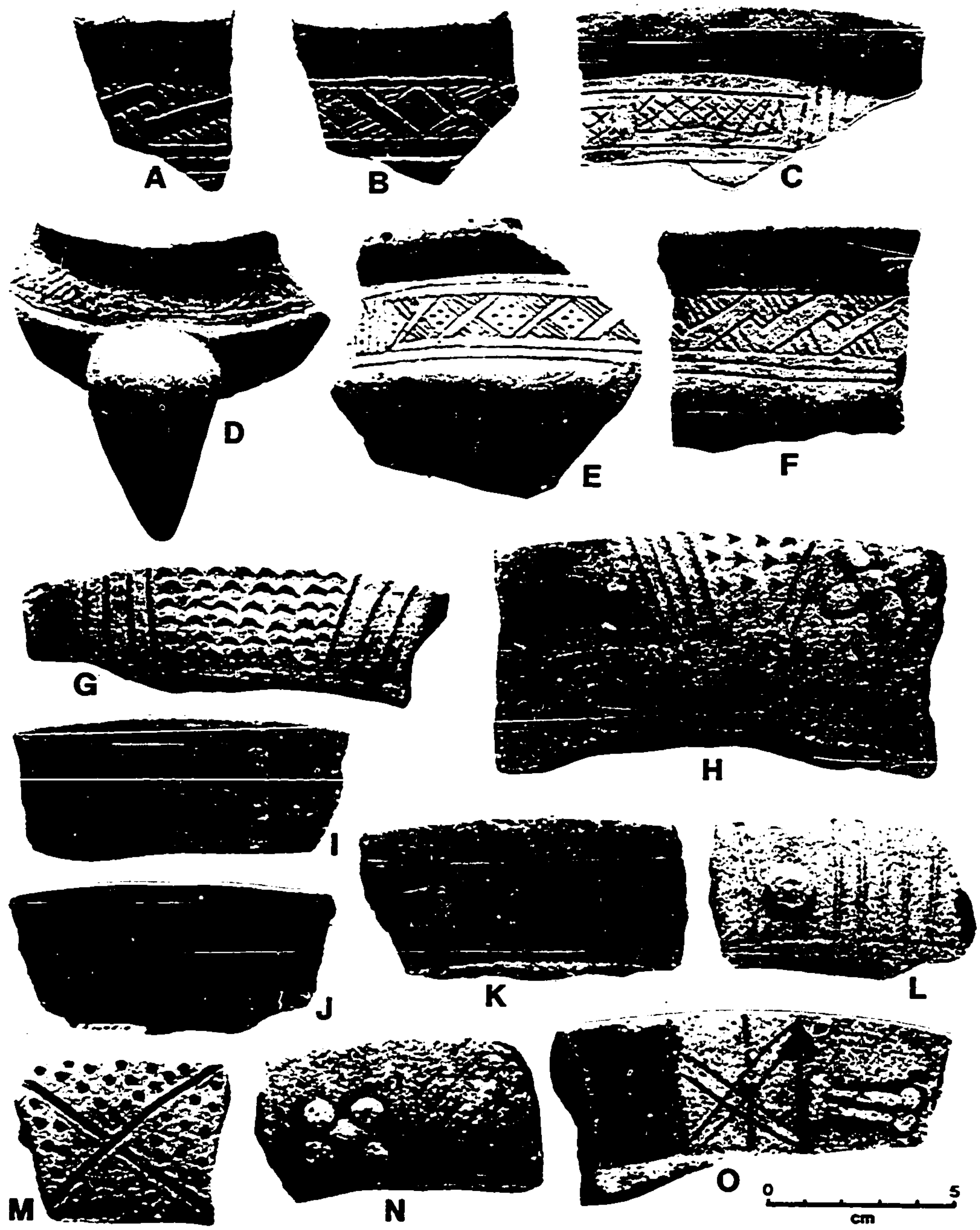
Guinea Incised sherds are characterized by an orange-red slip, used to finish the vessel on both interior and exterior. The slip is relatively hard, and has a shiny luster in well-preserved examples. Under a hand lens or microscope, its presence is marked by a slight crazing. Baudez (1967:74) describes the color of slips from this type in the Tempisque Valley as red to brown. It is believed that the sherds from the Cuenca de Arenal are on the whole lighter and more orange than those from sites to the west, but this remains to be tested through direct comparisons. In our assemblages, brown, beige, and tan examples were rare or absent.

Decoration on Guinea Incised vessels consists of primarily post-slip incision (only a few examples with apparent pre-slip incision were noted). The incision appears primarily on the vessel exterior in a frieze located between the vessel rim and a body angle which marks the juncture of the vertical vessel side and convex base (Pl. 7.2:A-F). The principal elements are horizontal and vertical lines, which usually form rectangular areas to enclose geometric motifs of hatched triangles, crosshatched rectangles, "guilloche" designs, and diamond patterns. One common design feature is an enclosed rectangular panel which extends only part of the way around the vessel circumference. Incised decoration also appears on the upper surfaces of the vessel rims and flanges. On rims, the most common decoration is a single groove which runs around the upper surface of the lip. On flanges, series of four short, radial lines intersecting a circumferential groove at the vessel body were most common. Wider rims and flanges can also have a series of crosshatched triangles, pointing outward. Curvilinear designs are rare or absent on this type, but there is a broad repertoire of incised designs combining geometric elements.

PLATE 7.2
Arenal Phase Ceramics

Guinea Incised (A-F); and Los Hermanos Beige: Cervantes Variety (G-O). All sherds are from Sition Boliívar. Proveniences: A (E23), B (B4), C (B6), D (E25), E and F (E21), G (?), H (E21), I (B6), J (E19), K-O (B6).

PLATE 7.2



Form and Function:

The most common vessel form of Guinea Incised in the Cuenca de Arenal is the tripod bowl. This form can display a great variety in height-to-diameter ratio and in complexity of the profile. Vessel profiles varied widely, with a strong emphasis on basal angles and carinations. In the sample from Sitio Bolívar (G-164), the typical shape was a complex-silhouette open bowl with a flattened, triangular cross-section rim. This form has vertical or inward-slanting walls and a convex base, with tripod legs most commonly attached at or just below the angle of wall and base. They give the appearance of being appended to the side, rather than the underside, of the vessel (cf. Baudez 1967:Pl. 31D). Supports are hollow rattles, conical on the bottom and rounded on the top (Pl. 7.2A). They are usually perforated on the sides with round holes or short, narrow slots.

Occasionally, the body angle below the decorated panel will appear as an actual flange on the side of the vessel, created by the addition of a thick strip of clay with a triangular cross-section. In some cases, this flange bears a strong similarity to the "Z-angle" characteristic of Protoclassic and Early Classic period vessels from the Maya Lowlands. As also happens on Maya vessels, this flange can be slightly scalloped.

Rim flanges are also an important characteristic of Guinea Incised vessels. These will appear as flattened, horizontal flanges along the edge of the rims of bowls. These can be round, and completely circumscribe the rim, or flare out in horizontal tabs, usually paired. As with body flanges, the upper surface of these lip flanges is often decorated with incision.

A great number of vessel fragments of Guinea Incised were found in the large sherd feature at Sitio Bolívar, including some vessels which appear to have been ritually smashed. The size and shape of Guinea Incised tripod bowls suggests that they were primarily serving vessels, perhaps used for "ritual" purposes. This inference is based on the fact that vessels of this type are typically open bowls, and that they are ornamented with elaborate incision, additions such as flanges, and large, rattle supports which have no clear utilitarian purpose. No vessel of this type were noted to have been burned or to have deposits of charred material. Whole vessels were rare, but no wear patterns were found on preserved vessel bottoms. Marked wear patterns were not noted on supports.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Sitio Bolívar, this type appeared in both surface collections and excavations, with little pattern apparent in either horizontal or stratigraphic distribution. At Tronadora Vieja, three of the Guinea Incised sherds come from "50's" contexts. None were found in Unit 60 or below.

INTER-SITE LOCATIONS AND CONTEXTS:

The total sample of this type from Arenal area assemblages consists of 198 sherds from six different sites. The largest assemblage, 172 sherds, comes from Sitio Bolívar, followed by a smaller sample of 18 sherds from the El Silencio site (G-150). Guinea Incised was also found at Tronadora Vieja (5 sherds), G-155, G-183, and G-191 (one each).

This type was initially defined by Baudez (1967:73) on the basis of a sample of 562 sherds: five from La Bocana, 437 from Ortega, and 120 from La Guinea. Baudez also reports 13 whole vessels of Guinea Incised from Bolsón. Sweeney (1975:204) reports a sample of 763 sherds from the site of Matapalo. Guinea Incised and analogous types are absent from contemporaneous assemblages in the Rivas region of Nicaragua (Healy 1980:313).

While side-by-side comparisons of assemblages have yet to be made, there is a strong resemblance between some examples of Guinea Incised from the Cordilleran region and vessels of Snarskis' Zoila Red Group (1978:201-202) from the

Atlantic Watershed region. Hollow, bulbous, rattle support forms (cf. Snarskis' modes S18 and S23; Ibid.:Figs 91-92) are common to both, as are the red surface color and the use of geometric incision. Incision and engraving on open tripod bowls was common to both Greater Nicoya and the Atlantic Watershed regions of Costa Rica at around AD 500, and these vessels were more common at inland sites than in coastal Guanacaste.

CULTURAL SIGNIFICANCE:

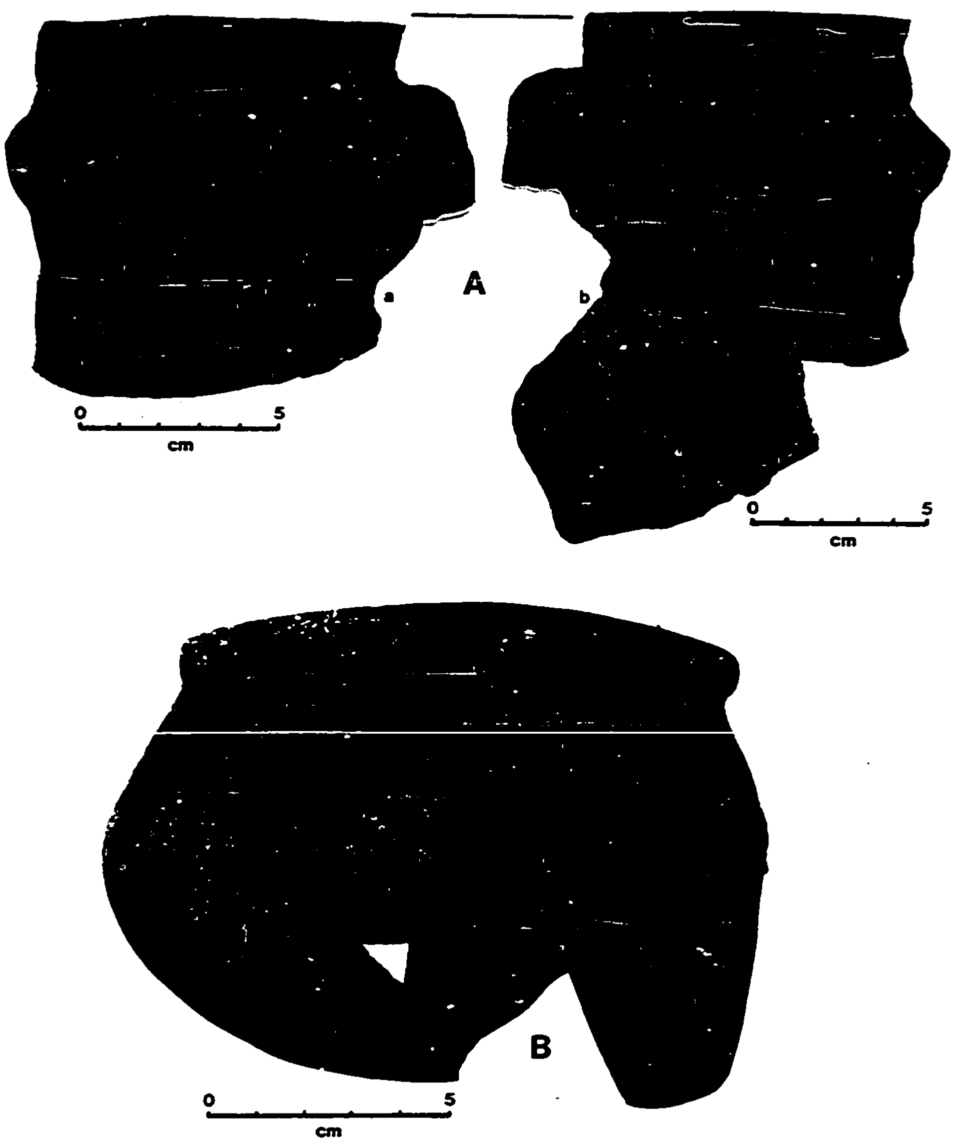
The geometric motifs and execution of the incised design in Guinea Incised bears direct relationships to later incised types such as Belén Incised. However, its relationship to earlier types is unclear. Tripod bowls are present in Bocana Incised Bichrome, but the decorated panel appears to be an innovation in the Late Arenal Phase. The form and decoration of Guinea Incised bowls is very close to that of vessels from the Atlantic Watershed region of Costa Rica.

The function or significance of hollow rattle feet has not been adequately studied. If the vessels were intended to be used as rattles, it seems unlikely that their function as containers or storage vessels was important. If the vessels were used for drinking, the rattle may have made a noise as the beverage was being consumed. Tall rattle feet first appear on Bocana Incised Bichrome or the poorly-defined type Santiago Appliqué.

PLATE 7.3
Arenal Phase Ceramics

Guinea Incised: Usulután Variety. Both vessels are from Sitio Bolívar, Lot E19. The uppermost vessel (A) has resist decoration on both the exterior and interior. The lower vessel (B) has resist decoration only on the exterior.

PLATE 7.3



Guinea Incised also has a "Usulután" variety, characterized by the use of resist techniques in the application of the slip. A particularly good example of this was found at Sitio Bolívar (Pl. 7.3). Resist areas included parts of the incised panel on the vessel exterior and free-form, curvilinear designs of parallel lines on the interior surface of bowls. Both the use of resist decoration and the carinated, tripod bowl form recall examples of Izalco Usulután from western El Salvador (Sharer 1978:39); however, the relationship seems distant.

CHRONOLOGICAL POSITION:

Baudez (1967:79) remarks that Guinea Incised dates to the Catalina (300 BC - AD 300) and Ciruelas (AD 300-500) Phases in the Tempisque Valley, but is most characteristic of the latter. At Matapalo, Sweeney (1975:212) found that this type was most characteristic of the Las Mina phase ("Linear Decorated Period"). This concurs with our interpretation of the Sitio Bolívar assemblage as dating to the latest portion of the Arenal Phase, contemporary with Baudez' "Linear Decorated" period, based on three dates of AD 79(245)410 [Tx-5272: 180 ad ± 60], AD 182(394)540 [Tx-5273: 290 ad ± 70], and AD 432 (642)770 [Tx-5270: 540 ad ± 80] from cultural features at the site. A single date of 830(400 BC)AD 1 [Tx-5271: 390 bc ± 170] from beneath the large midden of ceramic and lithic debris in Operation B at this site is believed to be slightly earlier than the principal occupation here.

TYPE: Los Hermanos Beige

VARIETY: Los Hermanos

COMPLEX: Tronadora?/Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Light orange, beige, or light brown paste and surface.
2) Red paint on vessel rim, sometimes extending to interior.
3) Large, necked jars and open bowls.

Paste, Temper, Firing, Etc.:

In the Arenal basin, the ceramics I have classified as Los Hermanos Beige demonstrate the full range of paste compositions noted for both Tronadora and Arenal ceramics. These include the "speckled" paste noted for Tonjibe Beige and teh hornblende-peppered paste identified in types such as Las Palmas Red-on-Beige. Because the specifics of paste differences for ceramics of the different phases were poorly understood at the time of sherd tabulation, and because Los Hermanos Beige sherds represented the single larges type category at virtually all sites samples, paste characteristics of the type were not recorded with sufficient detail to allow a quantified analysis of this type by stratigraphic or phase associations.

Suffice it to say that this classification was applied to a very large variety of red-rimmed beige sherds, which represented a tradition of long duration in the region. Red-painted rims classified as "Los Hermanos Beige" undoubtably included fragments of types such as Bocana Incised Bichrome, Mojica Impressed, and Los Hermanos Beige: Espinoza Variety. The strong possibility that red-rimmed, necked jars appeared in the Tronadora Phase and the evidence that they continued in use through the Silencio Phase (Hoopes 1984) indicates that this type will have a wide variety of forms and compositions. Until more and better evidence can be marshalled, it is impossible to characterize the paste of this type other than to note that it is generally compact, with very small aplastic inclusions. These range from small (<1 mm) white tephra particles to tabular hornblende crystals, plagioclase feldspar, and occasional ferric spherules.

The quality of firing of Los Hermanos Beige vessels varies widely. The assemblage from Tronadora Vieja, probably representing materials from either the Tronadora or Early Arenal Phases, was in general completely oxidized. Sherds of this type from Sitio Bolivar, on the other hand, showed a high percentage of dark, reduced cores. This would suggest that either temperature or firing time was reduced in the manufacture of ceramics later in the Arenal Phase, possibly because a greater quantity of vessels was being produced.

Surface Finish and Decoration:

As does paste composition, surface finish on Los Hermanos vessels varies widely within the confines of its two principal diagnostic attributes: 1) a "floated" or "self-slipped" surface of the same material as the vessel paste, and 2) the application of a red slip to the vessel rim. At one end of the scale are sherds of jars and open bowls which are of a very distinctive quality. These have a hard, brightly-polished slip on the rim, are heavily burnished, and well fired. A handful of specimens from Tronadora Vieja are virtually identical to Ocós Specular Red from La Victoria, Guatemala when the sherds are compared side by side. Many of these burnished sherds have horizontal marks on the exterior surface, probably made by the action of a burnishing stone applied with force to the leather-hard paste before the vessel was fired.

At the opposite end of the scale are examples -- especially from Sitio Bolívar -- where the red slip on the rim is soft, friable, and eroded. These sherds have a dull and grainy luster, and appear to have been fired at lower temperatures. While in the best quality sherds the red slip chips off in flakes, in the poorer examples it abrades unevenly. This differential in quality appears to be temporally diagnostic. The quality of the red slip on the examples from Tronadora Vieja is similar to that found on sherds of Tronadora Incised and Tajo Gouge-Incised, and its similarity to the technique used on sherds from La Victoria suggests a congruence of technology in the Early or Late Formative. Even if these sherds date to the Early Arenal Phase, the technology was probably closer to that used in earlier ceramics. By Late Arenal times, emphasis appears to have shifted from fine execution of the ceramic art to large-scale production of vessels. This would explain the poorer quality of surface finishes on sherds from Sitio Bolívar assemblages, although this difference may also be attributed in part to a different weathering environment (if the sherds on top of the mortuary features remained exposed to rain and sun for a long period of time).

Form and Function

The true range of forms of Los Hermanos Beige is described and illustrated by Baudez (1967:106), who first defined the type, and there is little point in repeating them here. The most common vessel form for Los Hermanos Beige was a large, necked jar with a rounded, exteriorly-thickened rim (Ibid.:Pl.7:17). The degree and shape of the rim thickening varied widely, but its most common form had a smooth curve along the interior edge of the lip and a slight angle on the exterior edge, created by the intersection of the convex curve of the rim and the concave curve of the vessel neck (Fig. 7.2:O-V). This angle was probably formed by the action of the potter's fingers coming over the top of the rim and the thumb sweeping upward from the neck, shaping the roll of clay which formed

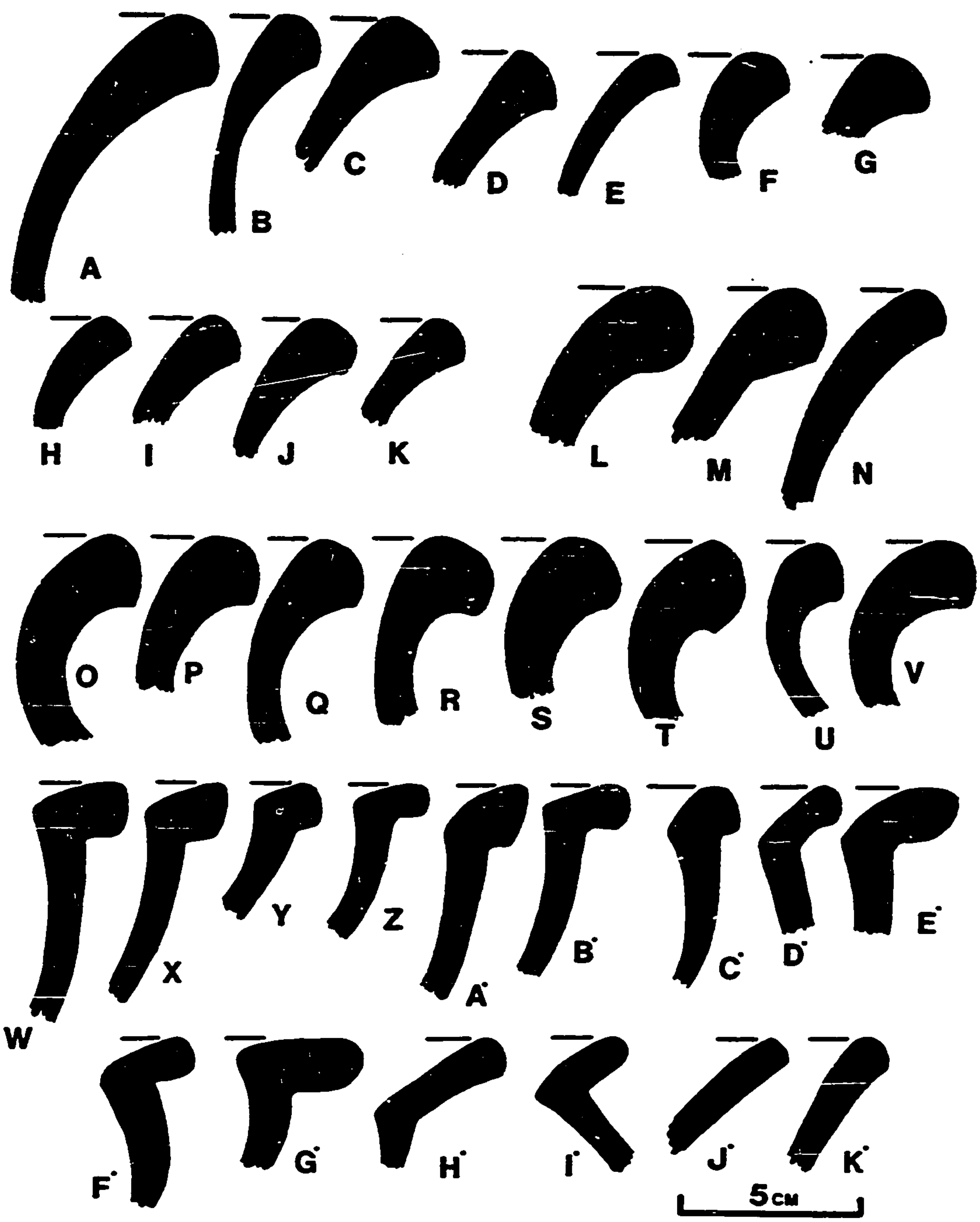


Fig. 7.2: Los Hermanos Beige rim profiles.
A-N: Jar and bowl profiles from Tronadora Vieja.
O-V: Jar profiles from Sitio Bolivar.
W-G': Open bowl profiles from Sitio Bolivar.
H'-I': Short-necked jars; J'-K': Direct-rim bowls.

the thickened rim. Other variations on the necked jar form included direct, outflaring rims from short-necked vessels.

While open bowl forms were noted in the assemblage from Tronadora Vieja, they were far more common at Sitio Bolívar. The most common form was a short, hemispherical bowl with a wide, outcurving or outflaring rim (Ibid.:Pl.8:1-2). The breadth of this rim surface presented a wide space for decoration, and examples where plastic decoration was applied have been placed in the Los Hermanos Beige: Cervantes Variety. While no intact examples were identified in our collections, Los Hermanos bowls with small, solid conical supports were recovered from excavations at Sitio Bolívar in association with the largest assemblage of Los Hermanos Beige bowl forms.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Sitio Bolívar, Los Hermanos Beige overwhelmed all other types in surface collections and excavations, and was equally ubiquitious in all deposits. At Tronadora Vieja, 38 sherds (or 49% of this type) came from "50's" strata, while 17 (22%) came from Unit 60 or below.

INTER-SITE LOCATIONS AND CONTEXTS:

The total collection of sherds classified as "Los Hermanos Beige: Los Hermanos Variety" from the Arenal area consists of 4519 sherds from 36 different sites. Virtually all of these were rim sherds, because plain, undecorated body sherds were not classified by type. The largest assemblage came from Sitio Bolívar, where 3849 sherds were counted. This was followed by samples from G-177 (93), Tronadora Vieja (78), G-166 (44), G-165 and G-170 (32 each), and G-168 (30).

After Monte Cristo Beige (which I could not distinguish from Los Hermanos) Los Hermanos Beige was the most abundant of Baudez' Zoned Bichrome period types. He reports a sample of 21,044 sherds of the former (including body sherds), with 4885 from La Bocana, 15,801 from Ortega, and 358 from La Guinea (1967:51). Of the latter, he noted a sample of 7332 sherds (including body sherds): 2442 from Ortega and 4904 from La Guinea. Three whole vessels were found at Bolsón. Sweeney, who could apparently make the distinction between the two (1975:105), reports 247 sherds of Monte Cristo Beige and 194 sherds of Los Hermanos Beige, all from the site of Matapalo (Ibid.:118). Both of these types may be related to Istmo Plain, a "broadly defined, catch-all type" defined by Healy (1980:130).

CULTURAL SIGNIFICANCE:

I was unable to distinguish Baudez' two red-rimmed Zoned Bichrome types, Monte Cristo Beige and Lost Hermanos Beige, from one another in any Arenal area assemblages. This is primarily due to their separation primarily on the grounds of paste, a distinction which has little use outside of the specific geological environment of the Tempisque Valley. Because it was deemed unwise to define a new type on the basis of paste distinctions alone, and because

Baudez' illustrated profiles of Los Hermanos Beige were closer to Arenal area examples than the Monte Cristo Beige profiles, "Los Hermanos Beige" was chosen to designate all red-rimmed necked jars and bowls in Tronadora and Arenal assemblages. An exception to this was a sample of sherds from Tronadora Vieja which were similar in form to Baudez' Monte Cristo Beige (cf. Baudez 1967:Pl. 7:1,11) but were left unclassified. Virtually all sherds classified as Los Hermanos Beige were rim sherds with red paint on a beige paste. This is somewhat at variance with the Río Tempisque and Matapalo samples, where red painting on rims appears to have been somewhat less frequent.

Los Hermanos Beige, the most common vessel type in the Arenal Basin, appears to have been the chief utilitarian ware during the Arenal Phase. As noted above, its use may well have begun during the Tronadora Phase. This is supported both by the appearance of sherds of this type with "speckled" pastes and by the frequency of Los Hermanos Beige sherds in stratified assemblages of predominantly Tronadora Phase ceramics. For this reason, Los Hermanos Beige does not appear to be an especially good temporal diagnostic in this region -- at least not for separating Tronadora and Arenal Phase components. However, while the use of red-rimmed beige vessels continues into the Silencio Phase, there appears to be a distinct change in the repertoire of rim forms (Hoopes 1984). On the basis of rim forms, the type Tres Esquinas Beige has been defined as the

Los Hermanos analog for the Silencio Phase. Unfortunately, given our small sample size, such a division has not been possible for the two earliest phases.

CHRONOLOGICAL POSITION:

While Baudez (1967:188) uses "Los Hermanos Beige" to designate red-rimmed ceramics of the Ciruelas, or "Linear Decorated" period (AD 300-500), my identification of this type has much greater time depth. In the Arenal area, this type probably appears in the latter half of the Tronadora Phase. It continues in use through the end of the Arenal Phase. Given the early appearance of red-painted rims in the Arenal area, it is possible that this tradition was older and stronger in the Cordillera, and that it does in fact appear later in the Tempisque Valley. However, it is not possible to determine this from the information Baudez presents.

TYPE: Los Hermanos Beige

VARIETY: Cervantes

COMPLEX: Arenal

SPHERE: Cordillera and Tempisque Valley

DESCRIPTION:

Principal Identifying Modes:

1) Large, open bowls with broad, outcurving rim surfaces.
2) Decorations with broad and fine incision, punctation, impression, and appliqué on the wide, upper rim surface.
3) Red slipping and zoning on the decorated rim.

Paste, Temper, Firing, Etc.:

Sherds are generally incompletely oxidized, with thick, dark cores. Otherwise, paste are identical to those of Los Hermanos Beige.

Surface Finish and Decoration:

Sherds of this variety are generally smoothed, with a range of surface textures comparable to that of Los Hermanos Beige. Unlike the designated variety, however, red slip is not always confined to the rim surface. It may also extend to zones on the interior or exterior, and there is an occasional appearance of the vertical streaks classified under the Espinoza Variety of Los Hermanos Beige.

The Cervantes Variety was initially defined as a type by Baudez (1967:109, "Cervantes incisé et ponctué"). However, Baudez notes that the paste, surface finish, and vessel forms correspond to those of Los Hermanos Beige, and the characteristic decoration was agreed to be a combination of modes which did not warrant a separate type designation by the consensus of the Denver Ceramic Conference (Lange et al. 1984). There is a great range in the decorative modes employed on the Cervantes variety, and incision, appliqué, punctation, and impression are more freely combined on this ceramic than on any other type in our assemblages. Sections of the broad rim surface are usually divided into segments. Incised decoration is executed before the application of red slip, and delineates slipped and unslipped zones, the latter of which are decorated. The most common motifs consist of: 1) sets of two to five parallel radial or oblique incisions; 2) rectangular zones of fine cross-hatchure; 3) zones of trangle impressions, probably done with the squared end of a tabular instrument; 4) crossed rectangular zones, sometimes in a "St. Andrew's cross" motif, with round punctation; 5) appliqué in possibly crude imitations of life forms. This last consists of pellets and short stips applied in compass-rose or "dog-bone" patterns (Pl. 7.2:G-O).

The width of incisions varies from < 1 mm in the fine-lined examples to as wide as 2 mm in broad-incised examples. In these latter, the quality of the incision approaches that noted in the "combed" style of the type Bocana Incised Bichrome, although it is believed to be much later in time.

Form and Function:

All Cervantes Variety vessels are large, open bowls (cf. Baudez 1967:Pl.8:Form V), and examples have been found to range in diameter from 15-50 cm. The rim itself is outflaring and exteriorly-thickened, having its greatest thickness at the outermost edge of the lip.

INTRA-SITE CONTEXTS:

This variety appeared in proportionate amounts in surface collections and excavated assemblages at Sitio Bolívar. It was not present at all at Tronadora Vieja.

INTER-SITE CONTEXTS:

The total collection of this variety from Arenal area assemblages consists of 165 sherds from nine different sites. The largest assemblage, 151 sherds, comes from Sitio Bolívar, with only very small amounts represented at other sites, including G-187 (4), G-168 (2), and G-180 (2). No sherds of this variety were found at Tronadora Vieja.

Baudez (1967:109) defined the type "Cervantes incisé et ponctué" from a sample of only 25 sherds: one from La Bocana, 21 from Ortega, and three from La Guinea. This type was not reported from sites in Rivas or on the Pacific Coast of Guanacaste, where Lange (personal communication, 1985) has confirmed that its occurrence is rare.

CULTURAL SIGNIFICANCE:

It is possible that the appliqué decoration found on Cervantes ceramics derives from El Bosque traditions of the Atlantic watershed region. This is suggested by its presence in the Cordillera region and its relative absence on the Pacific coast. However, the vessel forms and execution of design are markedly different from contemporaneous Atlantic patterns, and suggest a local development in inland Guanacaste.

Los Hermanos Beige: Cervantes Variety vessels were presumably used for serving large quantities of food or possibly for holding offerings. Because of the often complex rim decoration and the large average size of these vessels, it seems unlikely that they were used for drinking vessels. No examples were found with charred residues, but then very few sherds which preserved both rim and base were identified. Again, given the highly decorated rims, it seems unlikely that these vessels served as strictly utilitarian function as cooking.

CHRONOLOGICAL SIGNIFICANCE:

Baudez assigns the type Cervantes inci-sé et ponctué to the Ciruelas Phase, or his "Linear Decorated" period (AD 300-500). Among excavated Arenal Phase assemblages, this type clearly appeared with the greatest frequency at Sitio Bolívar, where its association with other Late Arenal ceramic types supports Baudez' chronological placement.

TYPE: Los Hermanos Beige

VARIETY: Espinoza

COMPLEX: Arenal

SPHERE: Cordillera

DESCRIPTION:

<u>Principal Identifying Modes</u>:

1) Wide, red elements painted on a light beige, grey, or brown unslipped surface.
2) Large, necked jars and large open bowls.

Paste, Temper, Firing, Etc.:

Paste color for Los Hermanos Beige: Espinoza Variety is identical to that for the designated variety (Los Hermanos). The majority of sherds ranges from a cream or beige color to a light grey or brown. Rare examples of orange pastes were also noted. As with the designated variety, Espinoza is relatively broadly defined, and paste composition varies widely. In general, sherds from Tronadora Vieja -- presumably from earlier in the Arenal Phase than examples from sites like Sitio Bolívar -- have a fine, well-oxidized paste with very small (< 0.5 mm) aplastic inclusions. While fine-paste sherds of this type were also found at Sitio Bolívar, the sample contained a much higher proportion of sherds with relatively coarse pastes. The average size of aplastic inclusions was higher (by definition) in coarse sherds, and many particles were larger than 1 mm in diameter. Coarse-paste sherds were less well-oxidized than the fine-paste ones, as demonstrated by dark, reduced cores. The most distinctive aplastic inclusions in the ocarse sherds included large particles of white pumice tephra with small hornblende phenocrysts. Round, ferric spherules were also present.

It is only fair to say that there was a high degree of variability in paste composition of sherds of this type, suggesting that the manufacturing procedure was probably decentralized and not highly standardized at the manufacturing stages of paste preparation and firing.

Surface Finish and Decoration:

As with Los Hermanos Beige, surface finish on this type varied widely. Some examples had a hard, smooth luster on the exterior, while others were soft and grainy. The Espinoza Variety also showed a differential in finish between its representation in Arenal Phase assemblages at Tronadora Vieja and Sitio Bolívar. At the former, sherds had a smoother surface finish, and there was a more deliberate quality to the red-painted decoration. At the latter, surface finish was softer and the red painting appears to have been very hastily applied. While the nature of the surface finish may well have been affected by the depositional environment, the quality of decoration must have been affected by cultural factors.

The principal decoration on Espinoza Variety sherds is red painting in wide (> 10 mm) parallel bands, usually in groups of three, on the exterior of large jars. These bands are usually vertical; however, examples were noted in which horizontal bands were used to encircle the vessel shoulder. At Sitio Bolívar, a large number of sherds placed in this category were decorated with large, horizontal bands. These appeared in sets of three or four, and were often very carelessly applied, almost wiped on as an afterthought. Quality of the red painted bands ranged from careful designs reminiscent of Las Palmas Red-on-Beige with the exception of the width of the painted elements to hastily wiped streaks with irregular margins. These latter were of such poor quality that several Los Hermanos-type sherds with red spotches on the exterior were included in this classification. These wide streaks were sometimes as much as 20 cm wide.

Another type of decoration which appeared on this variety was a shallow, vertical gadrooning, spaced at wide intervals and corresponding to the placement of wide bands. this gave the vessels a "calabash" shape, and may have been done in imitation of pumpkins or gourds. This gadrooning was always shallow and usually very subtle, and in no case approached what could be called a true squash effigy.

Form and Function:

While the majority of sherds of this variety appeared to be large, necked jars, a few fragments from open bowls were identified. Rim forms were identical to those of the designated variety of Los Hermanos Beige.

INTRA-SITE LOCATIONS AND CONTEXTS:

At Sitio Bolívar, this variety was present in both surface collections and excavations, with little pattern in its horizontal or stratigraphic distribution. At Tronadora Vieja, 31 sherds, or 66% of this variety at the site, come from "50's strata." Twelve sherds (26%) come from Unit 60 or below.

INTER-SITE LOCATIONS AND CONTEXTS:

A total of 312 Los Hermanos Beige: Espinoza Variety sherds were recovered from four different sites in the Arenal area. By far the largest collection comes from Sitio Bolívar (262 sherds), followed by Tronadora Vieja (47), Viboriana (2), and G-183 (1).

The Espinoza Red-Banded type has not been noted for assemblages in Costa Rica, with the exception of those in the Arenal Basin collected by Aguilar (1984) and the Proyecto Prehistórico Arenal.

Healy, who defines the type (1980:115) on the basis of a sample of 116 sherds, notes that there were "hundreds of Espinoza sherds" found in the Rivas excavations.

CULTURAL SIGNIFICANCE:

This variety is named after Healy's type "Espinoza Red-Banded" (1980:117) from the Rivas region of Nicaragua. Side-by-side comparison of sherds from the Arenal region and Healy's type collection at the Harvard's Peabody Museum revealed that while fragmentary sherds were virtually identical, the most complete examples showed subtle differences. In general, the "bands" on the Costa Rican sherds differ from those on the Nicaraguan type. For example, many of Healy's examples had decorations of spaced single wide vertical bands, rather than sets of three or four. Also, a number of Healy's examples had bands which flared at the uppermost end and tapered as they ran down the vessel side. This was not noted on any of the Arenal examples.

While the Costa Rican variety and Nicaraguan type are very similar, and may be representative of a unified tradition, I have kept the classification distinct. With the exception of Aguilar (1984), who is also describing sherds from the Arenal area, Espinoza Red-Banded has not been reported in other Costa Rican assemblages. The similarity of our sherds in paste, form, and surface finish is greater to the Los Hermanos type than to Espinoza Red-Banded, and for this reason I have chosen to designate the red-banded ceramics as a variety rather than a type.

CHRONOLOGICAL POSITION:

Healy identifies Espinoza Red-Banded as an important type in both the Aviles and San Jorge Phases of the Zoned Bichrome period in Rivas (1980:301), which he dates from 500/350 BC to AD 300/400 (Ibid.:307). Los Hermanos Beige: Espinoza Variety, unlike the Cervantes Variety, was important at both Tronadora Vieja and Sitio Bolívar. Its temporal duration is therefore very similar to that of Healy's type, and it is characteristic of both the Early and Late facets of the Arenal Phase.

Other Greater Nicoya Types in Arenal Assemblages:

Two types which appeared in ceramic assemblages from the Arenal basin appeared in forms which are virtually identical to those described by Baudez (1967), and do not warrant lengthy type descriptions here. These are Charco Black-on-Red, Zelaya Bichrome, and Zelaya Trichrome.

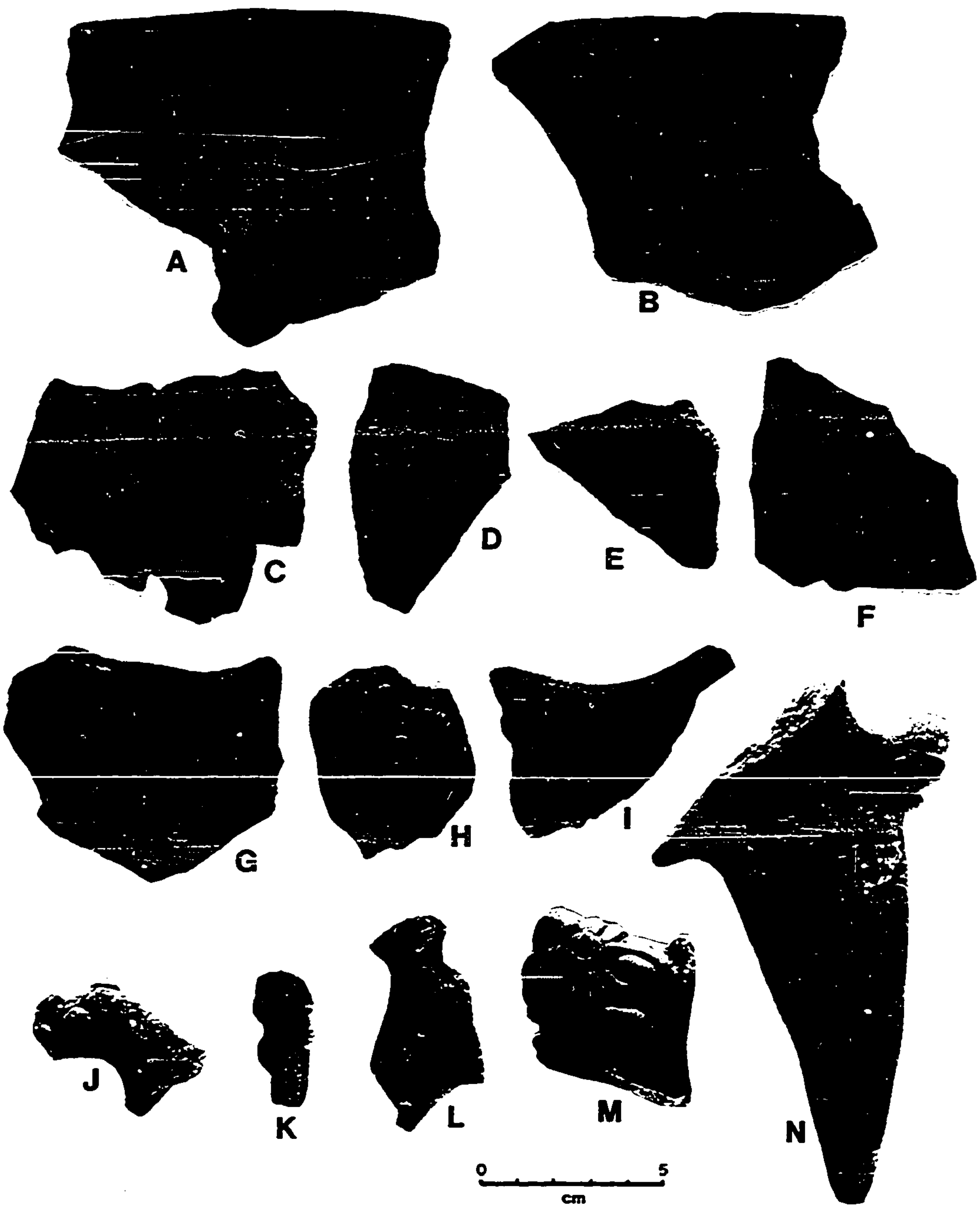
The designation "Charco Black-on-Red" corresponds to the Denver Ceramic Conference (Lange et. al 1984) usage, which combines Baudez' two "black-on-red" types, Charco and Cobano (1967:83-87) for a Charco Black-on-Red: Charco Variety type. A total of 555 Charco sherds were recovered from thirteen different sites in the Arenal area. The largest sample, 448 sherds, comes from Sitio Bolívar, where the type was common to surface collections and excavated deposits in all operations. Eleven sherds of this type were found at Tronadora Vieja, nine of which were from "50's" strata and none of which were from Unit 60 or below.

Baudez' descriptions of Charco and Cobano Black-on-Red is based on samples of 474 sherds (59 from La Bocana, 231 from Ortega, and 184 from La Guinea, together with 10 whole vessels from Bolsón), and 302 sherds of Cobano (277 from Ortega and 28 from La Guniea, with three whole vessels from Bolsón). Both Charco and Cobano were identified by Sweeney (1975:149-157), and the latter was divided into the name and Obando varieties. Charco was present at Matapalo (104 sherds) and Chahuite Escondido (one sherd),

PLATE 7.4
Arenal Phase Ceramics

Zelaya Painted: Trichrome Variety (A); Zelaya Painted: Bichrome Variety (B); Charco Black-on-Red (C-G); Atlantic-style appliqué (H-N). All examples are from Sitio Bolívar. Proveniences: A (E21), B (E23), C (E19), D (B21), E (E23), F (W27), G (E21), H (B18), I (E1), J and K (B6), L (E21), M (B6) N (E31). Of the appliqué examples, H is a small, anthropomorphic support fragment; I is a decorated loop handle on a small jar rim; J is a zoomorph; L is a bird form; M is an unusual piece which may be a shark effigy; and N is a support with an anthropomorphic adorno in a fine-paste ceramic from a bowl with maroon paint on the interior.

PLATE 7.4



as was Cobano, with 65 sherds at Matapalo and one sherd at Chahuite Escondido. 35 sherds of Cobano Black-on-Red: Obando Variety are reported from Matapalo. In Rivas, the types Obando Black-on-Red: Obando Variety and Puerto Black-on-Red (Healy 1980:201-205) are probably northern homologues, and the multiple- brush technique noted on the former was observed on several sherds collected at the Viboriana site (G-175).

In Arenal assemblages, the designation "Charco Black-on-Red" was applied to all red-slipped ceramics with linear decoration in black (Pl. 7.4:C-F). The most common decoration included horizontal and vertical lines, usually in sets of four on vessel exteriors. Motifs such as triangles and multiple wavy lines appeared on both jars and bowls. At times, the decoration was very similar to that on Las Palmas Red-on-Beige vessels, although lines were usually narrower and more hastily applied. One vessel of Charco Black-on-Red, reportedly excavated during the construction of a house in Tilarán, had an appliquéd human face and limbs. A small number of sherds from Tronadora Vieja had wide black lines on a red slip, almost like a black-on-red version of the more carefully executed examples of Los Hermanos Beige: Espinoza Variety, and possibly related to Healy's Obando Black-on-Red: Ubaldo Variety (1980:160). Charco vessels were often very fine, with some of the thinnest wall thicknesses (ca. 4 mm) encountered in the Arenal area. Most vessels pastes were incompletely oxidized, with black cores. The quality of the red slip varied from hard and polished to soft and friable, with the latter especially common at Sitio Bolívar. The inclusion of minerals common to Arenal ceramics, such as crystals of hornblende and plagioclase, suggests local manufacture.

Baudez assigns Charco Black-on-Red to his Catalina Phase, or the middle Zoned Bichrome period (300 BC - AD 300), but notes that it continues in use through the subsequent Ciruelas Phase (AD 300-500). Sweeney concurs (1975:152,160), and assigns Charco and Cobano to contemporaneous phases at Matapalo. Charco Black-on-Red appears to be of similarly long duration in the Arenal area, and probably begins in the latter part of the Early Arenal Phase, achieving maximum usage in the Late Arenal Phase.

A small number of sherds of both Zelaya Bichrome (Pl. 7.4:B) and Zelaya Trichrome (Pl. 7.4:A; Baudez 1967:97-99), current-ly designated "Zelaya Painted: Bichrome and Trichrome Varieties" (Lange et al. 1984) were noted in the assemblage at Sitio Bolí-var (32 and 2, respectively). These were virtually identical to the sherds illustrated by Baudez (1967:Pl.23A-D), who based his descriptions on samples of 464 sherds of Zelaya Bichrome (13 from La Bocana, 431 from Ortega, and 20 from La Guinea) and 264 sherds of Zelaya Trichrome (67 from Ortega and 197 from La Guinea). Zelaya Bichrome is noted at Matapalo (28 sherds) and Chahuite Escondido (5 sherds), while only eight sherds of Zelaya Trichrome are reported from Matapalo (Sweeney 1975: 82,161). Interestingly, both of these types/varieties are absent from assemblages in Rivas (Healy 1980:313).

The most common vessel form for Zelaya Painted in the Arenal area was a carinated bowl, 25-35 cm in diameter, slipped in red on the interior, the rim, and the exterior below the carination angle. Narrow (3-4 mm), vertical, black lines were used to decorate the space between the rim and the angle and the vessel exterior. One bowl had a Charco-like decoration of black lines on the interior. On some unusual examples, broad (ca. 8 mm) lines were used in a similar fashion on the necks of large jars. Pastes were beige to orange in color, and had fine inclusions of hornblende and plagioclase.

Baudez assigns Zelaya Bichrome to the Catalina Phase, while Zelaya Trichrome is said to be more typical of the Ciruelas Phase (1967:187-88). Sweeney (1975:162) was not able to discern this pattern. In the Arenal area, Zelaya Painted sherds appeared only in the Sitio Bolívar assemblage, and may be restricted to the Late Arenal Phase.

<u>Miscellaneous Arenal Phase Ceramics</u>:

A number of ceramics associated with Arenal assemblages were not present in high enough quantities to be positively identified as either new or existing types. However, they are valuable as chronological markers and indications of interregional ties during the Arenal Phase.

At Sitio Bolívar, a number of sherds were noted which were not typical of contemporaneous assemblages in Greater Nicoya, and suggested communication between the Cordilleran region and other parts of Costa Rica. Among these were four rim sherds from wide-mouthed tripod bowls, unslipped on the exterior but coated with a thick maroon slip on the interior. These were tentatively identified as belonging to the Anita Fine Purple Group of the La Selva Phase in the Atlantic Watershed, and appeared to have the same "powder-fine" paste noted at Linea Vieja sites (Snarskis 1978:208-209). Both the paste and the purple slip found on these few sherds are very different from those of local Arenal area pottery. Snarskis traces the origin of Anita Fine Purple ceramics to southeastern Costa Rica, and cites them as a possible evidence of trade between the Diquís and Atlantic Watershed regions. If these ceramics do have an origin in southeastern Costa Rica, their presence as foreign types at Cordilleran sites indicates very wide-ranging interregional interaction at this time.

Other ceramics at Sitio Bolívar signal important contact with the Atlantic Watershed region in the Late Arenal Phase. These included long, hollow conical supports with anthropomorphic adornos (Pl. 7.4:N; cf. Snarskis 1978: Fig. 90, S15); zoomorphic applique figures on vessel rims (Ibid.:Fig. 111, D23), and short vertical handles with appliqué (Pl. 7.4:I; Ibid.:Fig. 100,H12). All of these are diagnostic of late El Bosque and La Selva assemblages from the Atlantic Watershed region. These modes do not appear to have been combined on single vessels with Greater Nicoya characteristics, and they were not found in quantities anywhere near those of the local Arenal Phase ceramic types. It seems likely that they represent vessels brought from regions to the east of the Cordillera, rather than local imitations of Atlantic Watershed ceramics. They are far more common in the Arenal area than at contemporaneous sites to the west, and their presence suggests contact between peoples of the Cordilleran and Atlantic Watershed regions at around AD 500. These contacts may have been in the form of reciprocal exchange, down-the-line acquisition of materials from neighboring culture areas, or the actual colonization or settlement of sites in the Cordilleran region by peoples from the Atlantic Watershed region. To date, the evidence for any of these scenarios is scant. Ryder (1982-83a:107) reports El Bosque-style ceramics at the site of El Carmen, including whole vessels from primary mortuary contexts. Apart from these examples, no other Atlantic vessels are known from Guanacaste sites. Snarskis (1978:213) did not find any Greater Nicoya ceramics associated with El Bosque (Zoned Bichrome II) contexts at Atlantic Watershed sites, although some ceramics appear to have travelled east from Guanacaste in later phases (Snarskis and Blanco 1978).

Other ususual appliqué sherds from the Sitio Bolívar assemblage included an adorno which is probably the effigy of a shark (like those in Lake Nicaragua?), decorated with strip appliqué (Pl. 7.4:M), and a probable cayman or crocodile effigy decorated with pellet appliqué.

Finally, a few unusual sherds were noted from large, necked jars which had a Zelaya-like decoration of vertical black lines on the neck. However, the black lines alternated with lines of a friable white pigment, and the jar shoulder was marked with a wide, appliqué band with triangular impressions. No good analogies for these sherds have yet been found in the literature.

The Arenal Phase

While it is possible that Tronadora and Chaparrón-like assemblages provided the origin for early Zoned Bichrome types such as Bocana Incised Bichrome and Schettel Incised, the relationship between the Arenal area and Greater Nicoya becomes most clear with the appearance of Arenal Phase (Zoned Bichrome) types. It is probably fair to include the Cordilleran region within the boundaries of Greater Nicoya at this time. There is a dramatic increase in the number of sites in the Early Arenal Phase, from 20 sites with Tronadora ceramics (only 10 if sites with fewer than five diagnostic sherds are ignored) to 38 in the Arenal phase (cf. Fig. 5.9). Site size may also have increased, given that eroded artifact scatters at sites like Viboriana (G-175) and Sitio Bolívar were much greater than that at Tronadora Vieja, the only site from this phase which was extensively sampled. These factors, combined with the relative frequency of Arenal Phase ceramics at sites in the region, strongly suggest significant population growth during this phase. Specialized usage of distinct landforms, such as a possible Early Arenal cemetery at La Isla (G-166), a small island in Lake Arenal which was once high ground in the middle of a large, swampy area, may signal the appearance of social differentiation and specialized mortuary activity, further evidenced by stone mound construction later in the phase. The participation of the Arenal area in Greater Nicoya ceramic traditions suggests that processes of intra-regional social integration were occurring throughout the area, made possible by population growth and improved subsistence strategies. The large number of types common to the Rivas region of Nicaragua and western Guanacaste during the Zoned Bichrome period (Healy 1980:313) indicates the stylistic coherence of the "Greater Nicoya Archaeological Subarea" at this time.

Population growth may have resulted from changes in subsistence technology, such as the appearance of improved cultigens, and/or mechanisms of social integration which assisted in the intensification of existing strategies. Ground-stone implements such as manos and metates, and evidence for possible social differentiation in the form of craft objects and burial structures are characteristic of the Arenal Phase.

As noted above, Early Arenal ceramics, especially Bocana Incised Bichrome, are in many ways similar to the "scarified" pottery of the Aguas Buenas and Concepción complexes of western Panama (Haberland 1969, Linares 1980, Einhaus 1984), but sites from this period are still too rare to allow for a clear picture of what the nature of communication between the two regions might have been. Linares (1980:241) and Einhaus (1984:213) see Early Bugaba (AD 200-400) ceramics in the Chiriquí region of western Panama as evidence of the expansion of maize agriculturalists eastward from Costa Rica, made possible by the cultivation of races of maize adapted to higher altitudes. Unfortunately, we still have relatively little information to detail the possible interactions between Greater Nicoya, the Diquís region, and Chiriquí during the centuries before and after the time of Christ.

In terms of the volcanic stratigraphy of the Arenal area, the Early Arenal Phase appears to correspond stratigraphically to Units 55 and 54 (Appendix B). While it is not clear that violent eruptions of Volcán Arenal disrupted the occupation of individual sites, few sites have both Early and Late Arenal components. We have little data with which to address this pattern, but the evidence suggests that social, rather than geological factors may have been responsible for a degree of population relocation in the early centuries AD.

The Late Arenal Phase sees the continued use of ceramic types common to Greater Nicoya; however, the appearance of types and modes characteristic of assemblages in the Atlantic Watershed and other regions of Costa Rica but absent to the west indicates that the Arenal area became a true "transition zone" at this time. Sitio Bolívar, for example, yielded an assemblage of "Linear Decorated" types virtually identical to those described by Baudez (1967) for the Tempisque Valley. However, certain forms of vessel supports, zoomorphic appliqué and adornos, and sherds from the Atlantic Watershed indicate important eastern connections. Evidence for similar east-west connections has also been noted at El Carmen (Ryder 1982-83a:107), where El Bosque complex vessels were found in association with the same range of Zoned Bichrome types as those at Sitio Bolívar. Atlantic region influences may have had a major effect upon cultures in the Arenal area at the transition between the Arenal and Silencio Phases, but this hypothesis is supported primarily by negative evidence. Early Polychrome types which dominate Greater Nicoya assemblages from AD 500-800 are virtually absent from Cordilleran assemblages, as are sites with both Arenal and Silencio Phase components. The Silencio Phase is characterized by the appearance of localized types which demonstrate Atlantic as well as Greater Nicoya influence, and by distinctive Central Highland features such as stone cist tombs. Stratigraphically, the transition between Arenal and Silencio Phases may correspond to the Unit 52/53 horizon, but this is by far the least well defined of our stratigraphic correlations.

Although the number of sites appears to decrease in the Late Arenal Phase, evidence from Sitio Bolívar indicates that the sites that were occupied were large and heavily utilized, suggesting a greater degree of sociopolitical integration within villages at this time. An increased level of status differention in Late Arenal society is indicated at this site by the effort expended in the construction of stone funerary structures, the presence of luxury items such as greenstone pendants, and the ceremonial destruction of large quantities of ceramic vessels. A small number of polychrome vessels, probably manufactured in the Tempisque Valley or other regions to the west, appear at the very end of the Arenal Phase. These may have come to the Arenal area through ceremonial exchange or high-status trade.

CHAPTER EIGHT
Ceramics and Early Formative Chronology

The name of the "Intermediate Area" is derived from its geographical position between the centers of Mesoamerican and Central Andean development (Willey 1971). However, despite its origin, the term has also had unfortunate connotations for our conceptions of the archaeological cultures of the region. The increased research attention to Mesoamerica and the Central Andes has led to a widening gap in our knowledge of the intervening areas, contributing to the perception of Intermediate Area cultures as "peripheral." Our increasingly sophisticated understanding of cultures to the north and south is in distinct contrast to a still rudimentary understanding of parallel processes of development in the Intermediate Area. Until very recently, the Intermediate Area was considered to be "culturally intermediate," a kind of bridge between the territories of the major pre-Columbian civilizations. Its populations were understood as living on the peripheries of areas where the really important processes of development were occurring, and local art traditions and technologies were seen as resulting from the borrowing or imitation of advances made elsewhere. This has been especially true in Costa Rica, where there has been a tradition of dividing the country into regions of "Mesoamerican" and "South American" derived cultures (Ferrero 1977). Even archaeologists who have criticized this facile characterization find themselves relying on interpretations of "Mesoamerican" patterns and influence to explain processes of Costa Rican development (Snarskis 1978). However, as Creamer (1987:53) has recently pointed out, there is a trend in American archaeology to focus less on verifying "models of cultural unity" and more on defining the interrelationships between specific cultures. Concepts such as "Mesoamerica," initially defined on the basis of the distribution of certain language groups (Kirchhoff 1943) have decreasing utility as one goes farther back in time. Similarly, the notion of the lower Central American isthmus and northwestern South America as "intermediate" between areas of advanced cultural development loses all of its utility when one examines the evidence for early sedentism, village life, and ceramic technology.

Since the discovery and dating of early ceramic complexes at the sites of Valdivia and Puerto Hormiga, Intermediate Area cultures have been interpreted to have played a significant role in the origin and transmission of ceramic technology throughout the New World (Meggers, Evans and Estrada 1965;Ford 1969). However, the particulars of this development and diffusion are not completely clear, especially with reference to role subsistence technology may have played in its spread (Lathrap 1973). Part of this problem has stemmed from attempts to derive a particular geographical pattern from the distribution of sites and the characteristics of early ceramic styles.

One of the principal difficulties with the analysis of archaeological remains of the earliest pottery in the Intermediate Area has been the fact that sites and well-defined ceramic complexes are very few and far between. Radiocarbon dates are rare, and their contexts and reliability are usually far from ideal. This is partly due to the fact that a relatively small amount of systematic research has been conducted in the region. However, the small number and dispersed nature of early Formative period populations has also contributed to the difficulty of finding and dating early sites. Many of the factors responsible for population growth and the formation of nucleated settlements were in their incipient stages at this time, and features such as large public works which would help to make archaeological sites more readily recognizable are absent. The ephemeral visibility of early sites has also made them difficult to locate and investigate, and one wonders whether the identification of a number of early sites at coastal shell mounds has more to do with the nature of early subsistence practices or the ability to locate sites. Because of their age and frequent location in alluvial or volcanic environments, many early Formative sites are deeply buried and invisible to normal reconnaissance.

Additional problems are caused by the poor preservation of artifacts and other materials from early sites. Ceramics, especially when poorly fired, can be subject to heavy erosion or dissolve altogether. When very early Formative sites have been located, the archaeological samples obtained are often quite small. The fact that early ceramic complexes are frequently superimposed on preceramic cultural deposits introduces the possiblility of mixed cultural remains, especially flaked lithics and ground stone. As at Tronadora Vieja, radiocarbon associations from preceramic and ceramic occupations on the same surface can create serious problems for interpretation. A further complication is the very fragmentary nature of early data when it is located. Settlement and subsistence remains are often very poorly preserved, and whole ceramic vessels from the earliest periods are practically unknown.

One of the principal characteristics of early ceramic assemblages and sites is that at first appearance they tended to look relatively similar throughout the Americas. Ceramic decoration often consisted of no more than simple incision and punctation, with occasional touches of red pigment. With the discovery of several early ceramic complexes in the 1950's and 1960's, investigators found themselves stretching over great distances for comparative material. A disproportionate number of early ceramic-producing sites were identified at shell mounds in coastal and estuarine environments, fostering the perception that the early subsistence and settlement patterns associated with these early complexes were relatively homogeneous, in marked contrast to site locations occupied by later ranked societies.

Site placement and artifact form are the two variables which have received the most attention in initial research on Formative sites, and their apparent uniformity across large geographical regions was responsible for the notion of long-distance Formative diffusion as evidenced by the spread of ceramic technology. The most adamant proponents of this notion have been Meggers and Evans (1962; Meggers, Evans, and Estrada 1965), Coe (1960, 1961), and Ford (1969), but it has been tacitly accepted by a large number of scholars (c.f. Lathrap, Collier, and Chandra 1975; Lowe 1975; Myers 1978). In its simplest form, the model for the diffusion of Formative ceramic technology sees the earliest and most sophisticated pottery complexes appearing on the southern Ecuadorian coast, from whence they spread by sea to the Pacific coasts of Guatemala and western Mexico, linking the earliest Formative stages of the development of Nuclear American civilizations and largely excluding the intervening regions from the mainstream of cultural evolution. The early development of ceramic technology in Panama and on the Caribbean coast of Colombia is acknowledged, but considered largely peripheral to cultural evolution in the Andes and Mesoamerica.

It is clear that sociopolitical evolution in the Intermediate Area followed a significantly different pattern from that of regions in which high civilizations eventually appeared. However, a lag in cultural sophistication is not characteristic of this region throughout all of prehistory. In fact, social and technological development in Ecuador, Colombia, and Panama may have surpassed that of Mesoamerica during the much of the Early Formative period (4600-1000 BC). The evidence suggests that it was not until the appearance of Middle Formative period "civilizations", and their effects on regional identity and unification that the cultures of lower Central America and northwestern South America began to lose ground in the development of sociopolitical complexity. It is precisely because of the absence of development of complex, stratified societies that cultural development in the Intermediate Area becomes crucial to an understanding of processes responsible for the emergence of civilization in Nuclear America. In constrast to patterns in Mesoamerica and the Andean regions, prehistoric societies of lower Central America appear to have been characterized by long-term stability rather than change. Given the antiquity of sedentary village life in the Intermediate Area, important questions become: 1) Were early sedentary societies in lower Central America similar to those of areas which subsequently experienced high population growth and social complexity? 2) If so, do Formative societies in the Intermediate Area represent the "arrested" forms of social organization which preceded development in other areas? 3) What are the characteristics of Intermediate Area societies and/or environments which promoted long-term stability and inhibited the emergence of sociopolitical centralization?

Before we can address these questions, it is necessary to examine the chronology and nature of Early Formative development in detail. This is the aim of this chapter. While our discussion is focused primarily on the elucidation of patterns characteristic of lower Central America, its larger geographic context -- the Intermediate Area and neighboring regions -- must also be taken into account. Close attention to chronological detail is necessitated by the fact that most published studies have ignored the significance of calibration for the interpretation of radiocarbon dates (Appendix A). An uncritical examination of published sequences can be very misleading, and the chronology becomes meaningless when factors such as the relative lengths of phases and accuracy of dates and associations are not taken into account. For this reason, particular care is taken with respect to the interpretation of absolute chronology, and its significance for cross-cultural comparisons is referred to in the course of the discussion.

There is increasing evidence from the Intermediate Area that inland regions may have been even more significant than the coast in terms of Formative period sedentism and the appearance of ceramics, and that sea travel was not as important a mechanism for the transfer of cultural ideas as has been previously hypothesized. The antiquity of maize cultivation in both highland Mexico (MacNeish 1967) and on the Ecuadorian coast (Stothert 1985) suggests that agriculture may well have been practiced by preceramic populations. It is likely that there is not a close correlation between either maize or manioc agriculture and the use of pottery, and that the presence of ceramics is not a very good indicator of either the nature or the intensity of agricutural production.

However, ceramics are still our most important evidence for culture contact and patterns of the development and spread of ideas between ancient cutures in the Americas. As a class of artifact, ceramics preserve far better than subsistence or habitational remains. They are also thoroughly "cultural," in that the variables of their manufacture, form, and decoration are almost completely dependent on the ideas of the potter for their expression. Given the wide potential diversity in the forms and functions of ceramics artifacts, pottery objects are usually quite numerous in precolumbian assemblages. The plasticity of the medium and the "additive" aspects of ceramic decoration, together with the wide range of age and sex groups that can produce ceramic vessels within a given society, mean that pottery can be very informative with regard to cultural norms. Ceramics are therefore a rich source of information on patterns and changes in a given culture's technology and artistic styles, as well as modes of production, distribution, and communication. Because pottery is generally both heavy and brittle, it is rarely transported for great distances. In societies with without well-developed systems for large-scale ceramic production and distribution, pottery is far more likely to be manufactured on the spot than traded. The constituent elements of ceramics, unlike stone such as chert or obsidian for lithic implements, are ubiquitous in the environment. While resources such as specific tempering materials or pigments may move across the cultural landscape through exchange networks or patterns of long-distance procurement, pots themselves tend to "stay in place" better than other artifacts. The distribution of ceramics themselves is therefore far more likely to indicate local patterns or traditions at the early stages of village life than other classes of material, meaning that patterns of the distribution of ceramic concepts -- such as form or decoration -- can be more readily attributed to contacts between cultures and the transmission of ideas.

Contrary to models put forth by Ford (1969) and others, regional variation rather than widespread similarity was the rule throughout Nuclear America from the first appearance of decorated ceramic complexes. Rather than displaying a dendritic pattern, with a single point of origin and increasing numbers of successive branches and sub-branches as ideas spread across populations, the spread of ceramic technology and notions of decorative techniques throughout the New World appears to have been more of a latticework pattern. There appear to have been several regional "interaction spheres" where ideas originated whose spread and communication does not appear to have been regular or predictable. It becomes apparent that ideas pertaining to various aspects of ceramic production were not inextricably linked. Characteristics such as form, surface finish, and firing, whose production was more closely tied to technology, may have been less susceptible to externally-influenced change than decoration, which was more closely linked to symbolic systems.

While we still lack sufficient evidence to fill in the gaps in between, we will attempt to define several of these "interaction spheres" in the earliest ceramic traditions of Nuclear America -- the region between Mesoamerica and Peru. These interaction spheres do not necessarily correspond to expanding cultures or waves of stylistic influence, but relatively loose associations of contemporaneous phases and complexes whose association has merit for broad regional comparisons. It is likely that factors other than simple geography affected the spread of stylistic notions. Unfortunately, our current resolution of the details of cultural geography and development throughout this region is still too poor to adequately address them. Instead, this exercise is aimed at the elucidation of the broad, regional context of the Tronadora Phase and contemporaneous

Early Formative cultures in Costa Rica. While a great deal of this discussion is culture history, pure and simple, an understanding of the chronology of culture change is essential if we are to investigate the processes responsible for the specific constellation of local cultures at the "baseline" Formative stage in the Americas, when the first villages and ceramic-producing cultures began to emerge from among preceramic populations in the Intermediate Area. At this time, rather than serving as a conduit for ideas developed elsewhere, the Intermediate Area was itself the source of innovations which were to have profound effects on cultural development to the north and south.

The Earliest Ceramics in the New World, 4600-2500 BC

In spite of twenty years of intensive investigation and heated controversy, the debate as to the dating and identity of the first ceramics of the New World remains unresolved. One of the initial reasons for the intensity of the discussion was the assertion by Meggers, Evans, and Estrada (1965), later championed by Ford (1969), that the origin of Valdivia ceramics -- and of all pre-Columbian pottery in the New World -- was to be found in the early Jomon complex of Japan. This hypothesis has been substantially weakened through recent discoveries of ceramics in northern Colombia which may predate Valdivia ceramics by several centuries.

While the antiquity of ceramic technology in the New World is undoubtedly great, it is the distribution of specialized vessel forms and distinctive modes of decoration -- rather than the discovery of fired clay -- which reveals the most about unity or regional differences in Early Formative cultural traditions.

Monsú and Puerto Hormiga

The earliest ceramics in Colombia appear at the sites of Monsú and Puerto Hormiga, large shellmounds situated just a few kilometers apart on the Caribbean coast (Fig. 8.1), near the mouth of the Canal del Dique (Reichel-Dolmatoff 1965a, 1985). The earliest radiocarbon sample associated with ceramics at these sites, 4340(4124)3980 BC [UCLA-2149C: 3350 bc ± 80], comes from a sample of shell in deposits sealed beneath overlying cultural material by a caliche floor. It was associated with ceramic types Monsú Linear Incised and Turbana Broad Incised, and its context is considered to date material from the end of the Monsú Period (Reichel-Dolmatoff


MEXICO
(CHIAPAS)
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
COLOMBIA
PACIFIC OCEAN
1. Cuello
2. Chiapa de Corzo
3. Paso de la Amada
4. Aquiles Serdan
5. La Victoria
6. Altamira
7. Salinas la Blanca
8. Copán
9. Los Naranjos
10. Yarumela
11. Chalchuapa
12. Cuyamel Caves
13. Ometepe Island
14. Vidor
23. Barlovento
24. Canapote
25. Puerto Hormiga
26. Monsú
27. Machalilla
28. Salango
29. La Cabuya
30. Valdivia
31. Loma Alta
32. La Ponga
33. Real Alto

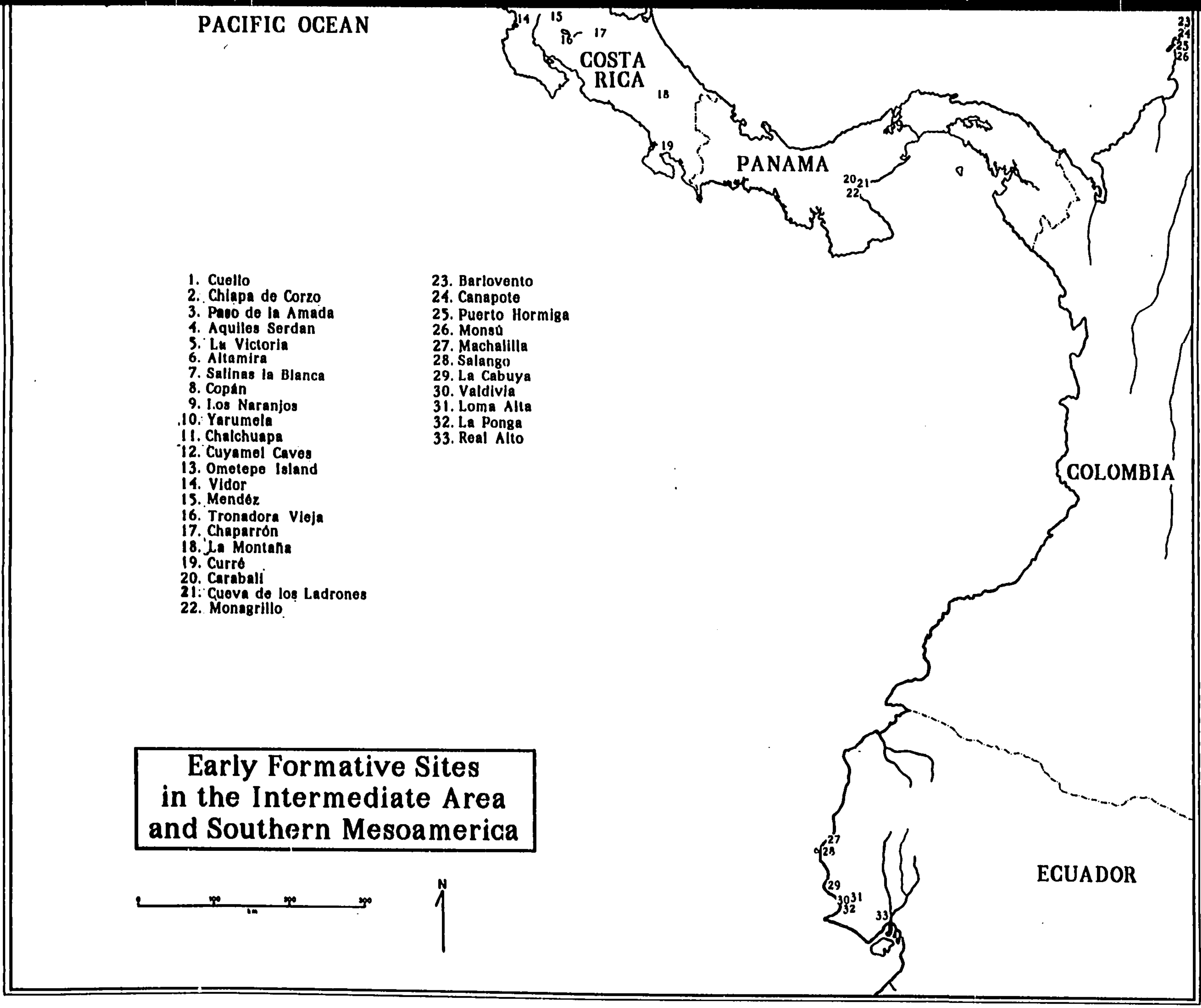

PACIFIC OCEAN
COSTA RICA
PANAMA
COLOMBIA
ECUADOR
1. Cuello
2. Chiapa de Corzo
3. Paso de la Amada
4. Aquiles Serdan
5. La Victoria
6. Altamira
7. Salinas la Blanca
8. Copán
9. Los Naranjos
10. Yarumela
11. Chalchuapa
12. Cuyamel Caves
13. Ometepe Island
14. Vidor
15. Mendéz
16. Tronadora Vieja
17. Chaparrón
18. La Montaña
19. Curré
20. Carabali
21. Cueva de los Ladrones
22. Monagrillo
23. Barlovento
24. Canapote
25. Puerto Hormiga
26. Monsú
27. Machalilla
28. Salango
29. La Cabuya
30. Valdivia
31. Loma Alta
32. La Ponga
33. Real Alto
Early Formative Sites
in the Intermediate Area
and Southern Mesoamerica
N

Fig. 8.1

1985:175). While this date is one of the earliest in clear association with ceramics in the New World, it is believed to post-date the two earliest ceramic phases at the site. Reichel-Dolmatoff reports that this sample comes from a deposit overlying over a meter's depth of even earlier cultural deposits. These contain ceramic material from the preceding Turbana and Monsú Periods, which he tentatively dates to approximately 4600-4200 BC (3800-3400 bc; 1985:175-176).

A second radiocarbon assay was run on a sample of bone in direct association with Turbana ceramic types in the lowest levels of Reichel-Dolmatoff's excavations, stratigraphically situated beneath the caliche floor and beneath the abovementioned sample (UCLA-2149C). This yielded a date of 3700(2775)1750 [UCLA-2568F: 2220 bc ± 360], which, in spite of its very large standard deviation, does not overlap UCLA-2149C at even the 2-sigma range. Reichel-Dolmatoff considers this date to be aberrant, based on a date of 3019(2820)2580 BC [UCLA-2149B: 2250 bc ± 80] from a shell artifact sttratigraphically situated above the caliche floor and associated with Pangola phase pottery, and on his acceptance of UCLA-2149C (Reichel-Dolmatoff 1985:175).

The series of radiocarbon dates used to support the antiquity of Turbana and Monsú ceramics is far from ideal, and it is probably wise to treat the very early interpretation of these ceramic complexes with caution until further dates can be obtained. The early placement of these sophisticated ceramics rests on the acceptance of a single date on shell, and despite Reichel-Dolmatoff's rejection of UCLA-2568F, its stratigraphic location below the older date casts some doubt on the latter's validity. Given a liberal interpretation of 2-sigma ranges, the stratigraphic reversal of UCLA-2568F and UCLA-2149B is not necessarily problematic. If, contrary to Reichel-Dolmatoff, we were to reject the early shell date (UCLA-2149C) and accept the date on bone (UCLA-2568F) instead, we could conceivably place both Turbana and Monsú ceramics after those from Puerto Hormiga. However, without being able to examine the ceramics themselves, it is difficult to assess whether such an ordering would be consistent with stylistic changes and their interpretation. For now, Reichel-Dolmatoff, who is intimately familiar with the early pottery from both Puerto Hormiga and Monsú, prefers to see Turbana and Monsú ceramics as the earliest in northern Colombia.

The earliest Turbana pottery consists of large "*tecomates*" or incurving-rim bowls, semi-globular open bowls, and broad plates (Reichel-Dolmatoff 1985:Fig. 62). The size of the Turbana and Monsú Period *tecomates* suggests an altogether different vessel from the earliest Mexican examples. The early Colombian examples are very large vessels, with an average rim diameter of 40 cm for the most common Turbana form and 50 cm for Monsú.

Plates (possibly used as budares) from both periods are also very large, ranging from 40-60 cm in diameter. Decoration on Turbana vessels included wide, deep, round-bottomed groove-incision and broad excision in curvilinear designs. Single rows of punctation zoned with grooving are also present. The design motifs on Turbana ceramics are very sophisticated for such early pottery, and include curvilinear patterns of multiple parallel grooves, circles, and spirals (Reichel-Dolmatoff 1985:Figs. 18-22). The basic decorative techniques found on these ceramics are apparently very long-lived, and appear on pottery from the much later Canapote (ca. 2300 BC) and Barlovento (ca. 1700-1000 BC) phases. The principal changes through time involve the depth and width of incision and the range of design elements (Ibid.:116-117). What is most unusual about the earliest ceramics from Monsú is the fact that they do not appear to represent "incipient" or experimental ceramics, but a well-developed technology with a clearly defined style, which Reichel-Dolmatoff interprets as evidence for a long prior tradition (Ibid.:117).

Although radiocarbon dates suggest some contemporaneity, the principal occupation of Puerto Hormiga is believed to have occurred during a hiatus at Monsú between about 4200-2800 BC (3350-2250 bc; Reichel-Dolmatoff 1985:177). A total of five dates -- three on shell and two on charcoal -- were associated with Puerto Hormiga ceramics (Reichel-Dolmatoff 1965:45). These dates come from two stratigraphic cuts, and range from a shell date of 3990 (3867)3700 BC [SI-153: 3090 bc ± 80] to a charcoal date of 3790(3203)2499 BC [I-1123: 2552 bc ± 250 bc], the latter of which was associated with hearths and burned shell on an apparent occupational floor (Reichel-Dolmatoff 1965:46). All samples were associated with assemblages containing both fiber-tempered and decorated, sand-tempered ceramics. They are acceptable in terms of stratigraphic relationships and internal consistency, the oldest and youngest overlapping for 90 years at the calibrated 2-sigma range (see Appendix B for details of the individual assays).

The pottery from Puerto Hormiga falls into three principal "wares" (Reichel-Dolmatoff 1965b). The largest group consisted of ceramics tempered with long, thin fibers with round cross-sections from a plant such as Spanish moss. These left tubular hollows, and gave the sherds a "sponge-like consistency" inimical to preservation. The second group consisted of somewhat stronger pottery, tempered with short, flat leaves that left imprints in the clay but did not produce hollow spaces. The third, and least abundant group of Puerto Hormiga pottery was sand-tempered. Of these three groups, only the sand-tempered pottery was constucted with coiling and decorated. Reichel-Dolmatoff characterized this latter group as "not the result of an initial stage" (1965b:56). As described by the excavator, both of the fiber-tempered wares were thick walled and poorly made. Fiber-tempered vessels were formed by modelling, not coiling, and were fired at low temperatures.

Decoration on the sand-tempered Puerto Hormiga pottery includes shallow grooving with a red ochre fill, dentate rocker-stamping, shell-edge stamping, and "crudely modelled zoomorphic appendages which represent frogs or small rodents in the attitude of climbing to the rim of the bowl" (Reichel-Dolmatoff 1965b:55). Curvilinear motifs are common, and design elements include the use of zoned areas of punctation, rocker stamping, or incised lines.

Valdivia

To date, the origins of Valdivia ceramics are still unclear. Bischof and Viteri (1972), during a re-excavation of the Valdivia type site, uncovered 27 sherds in strata below those containing Valdivia pottery. These were classified as a separate, pre-Valdivia ceramic complex called San Pedro. San Pedro sherds are described as "more primitive" than Valdivia pottery; however, they were also described as being of a high quality, and the authors report that the new complex "scarcely represents an incipient stage of ceramic manufacture" (Ibid.:549).

Hill (1975) has been able to identify an early facet of Valdivia ceramics (Valdivia I) based on both surface collections, excavated samples, and stylistic seriation which is characterized by simpler, unsophisticated forms. She concludes that the entire Valdivia sequence can be interpreted as a product of gradual, in situ culture change, and not one which was introduced from abroad (Ibid.:25). However, the relationship between the San Pedro ceramics and Hill's developmental sequence remains unclear. Hill notes that some Valdivia I sherds were found by Bischof and Viteri in levels above the San Pedro deposit (Ibid.:3). To date, San Pedro ceramics have not been identified at any other Valdivia period sites, and no radiocarbon dates have been reported in association with San Pedro ceramics. However, four dates are available from charcoal found associated with stone flakes and worked shell in levels <u>below</u> the San Pedro sherds. These range from 3370(3200)2939 BC [Hv-4839: 2585 bc ± 55] to 2910(2580)2290 BC [Hv-4675: 2125 bc ± 110], and are identified by Bischof as pertaining to the late preceramic period, possibly the Las Vegas phase (Bischof 1972:272), but it does not appear that the associated artifacts were highly diagnostic. Stothert's (1985) proposed chronology for the Las Vegas culture would place the end of the Vegas period well before the dates from Bischof and Viteri's aceramic levels.

The dating of the appearance of ceramics at the Valdivia site is not clear. Bischof and Viteri (1972:550) report a very complex stratigraphy at the site, characterized by erosional and cultural intrusions into underlying aceramic (and possibly preceramic) deposits. They also suggest that the presence of "large, solid charcoal chunks" (Bischof 1972:271) in these deposits introduces the possiblility of contamination of the overlying, ceramic-bearing levels. Problems have long been noted with the oldest date of 4333(3970)3640 BC [M-1320: 3200 bc ± 150] from the original excavations at Valdivia (G-31), principally because it is out of line with the rest of the determinations from the site both stratigraphically and temporally (Bischof 1972:269, Hill 1975:7). The remaining 17 dates from Meggers, Evans, and Estrada's (1965) excavations at the site, with only small deviations with regard to stratigraphic placement, range from 3690(3356)2920 BC [M-1322: 2670 bc ± 140] to 2868(2538)2403 BC[W-630: 2100 bc ± 55] -- virtually identical to the range of Bischof and Viteri's "aceramic" dates. It is therefore necessary to examine dates for Valdivia from other sites.

Interestingly, the earliest dates for Valdivia ceramics do not come from the coast, but from an inland site. The earliest dates for Valdivia ceramics come from early assemblages at the sites of Real Alto, in the Chanduy Valley, and Loma Alta, in the Valdivia Valley. However, not all of these are acceptable. Two dates on charcoal, 5490(5170)4586 BC [GX-5269: 4145 ± 215 bc] and 4780 (4344)3819 BC [GX-5267: 3545 ± 200 bc], were associated with Valdivia materials at Real Alto. The first is out of stratigraphic sequence and much too early (Damp 1984:574). Although the second was obtained from a midden deposit adjacent to a Valdivia I house feature at the site, Damp has doubts about its validity as well (Damp et al. 1981:811). A third early date from Real Alto, 5048(4426)3824 BC [ISGS-448: 3670 ± 250 bc], comes from an aceramic level underlying the earliest Valdivia occupation (Lathrap et al. 1977) and probably indicates the presence of charcoal at the site which predates the ceramic occupation.

What is probably the earliest acceptable date for Valdivia ceramics comes from Loma Alta, a site approximately 15 km inland from the Valdivia type site. Here, a date on charcoal of 4460(4020)3700 BC [GX-7704: 3325 ± 175 bc] was associated with a Valdivia I household cluster. This sample comes from "a hearth at the very base of cultural deposits" at Loma Alta, which precedes "a cluster of eight [unpublished] dates between 3100 and 2800 B.C. [calibrated to 3900-3500 BC] and marks a well established Valdivia I occupation" (Damp 1984:574). Five additional dates on charcoal obtained from Norton's 1972 excavations in stone cairns containing Valdivia pottery at Loma Alta range from 4034(3781)3517 BC [I-7076: 3060 bc ± 120] to 3630(3344)2920 BC [ISGS-192: 2640 bc ± 120 bc] (Hill 1975:Fig. 3). Placing emphasis on the Loma Alta dates, Damp estimates that Valdivia I lasted from about 3300-2700 bc (Damp 1984:573), or 4000-3400 BC (see Appendix B for documentation of all Valdivia dates).

The cultural origins for Valdivia are still unclear. Stothert interprets the preceramic Las Vegas culture as a coastal variant of Lathrap's (1970, 1975) Tropical Forest culture, and suggests that "a generalized preceramic culture of lowland Ecuador, which included Las Vegas as a local variant, provided the context for the development of Valdivia" (1985:634). Las Vegas is seen to have first appeared on the Ecuadorian coast as early as 10,000 B.P., and is believed to have been characterized by broad-spectrum hunters and gatherers, exploiting a range of game animals, shellfish, and marine resources. Based on an analysis of phytoliths from soils associated with Las Vegas materials, Stothert proposes that this preceramic group began cultivating a primitive form of maize between 7000 and 8000 B.P. (Ibid.:621). Continuities between Las Vegas and Valdivia are found in common flaking technologies, shell spoons, similarities in early house construction, and burial patterns. However, Stothert notes an "apparent gap" in the archaeological sequence between Las Vegas and Valdivia. The terminal date for Las Vegas is suggested as 6600 B.P, or ca. 4650 bc (Ibid.:618).

<u>Monagrillo</u>

There are a total of 18 dates pertaining to contexts with Monagrillo ceramics. The earliest of these, a date on charcoal of 4456(4242)4000 BC [SI-2841: 3435 bc ± 95], was associated with Monagrillo ceramics at the type site of Monagrillo on Parita Bay. The date on this sample is stratigraphically consistent with four other dates from the same excavation unit, but is interpreted by its excavators as "inexplicably early" (Ranere and Hansell 1978). A later date of 3790(3578)3360 BC [TEM-119: 2850 bc ± 100], from shells associated with an occupational midden containing 383 sherds at the site of Cueva de los Ladrones, inland from Parita Bay in central Panama, is believed to be the earliest acceptable date for Monagrillo ceramics (Cooke 1984). At the base of the feature which provided this shell date, a sample of charcoal from a possible preceramic hearth dates to 3510(3208)2920 BC [TEM-124: 2570 bc ± 100]. These two dates suggest a perceramic/ceramic transition at the site at around 3500 BC. Three other dates from ceramic-bearing deposits at this site are a charcoal date of 2580(2425)2140 BC [TEM-122: 1930 bc ± 80], and two dates on shell: 2580(2343)2041 BC [TEM-121: 1910 bc ± 90] and 2470(2205)1962 BC [TEM-120: 1820 bc ± 80]. In addition to the early date cited above, nine other dates have been obtained from ceramic-bearing levels at the type site of Monagrillo on the coast. The earliest acceptable assays from this site are: 3340(3036)2900 BC [SI-2842: 2455 bc ± 75] on charcoal (Ranere and Hansell 1978), 3499(2981)2506 BC [TEM-208: 2400 bc ± 165] on shell (Cooke 1984), 2910(2740)2490 BC [SI-2844: 2185 bc ± 80] on charcoal (Ranere and Hansell 1978), and 2889(2719)2470 BC [Y-585: 2140 bc ± 70] on charcoal (Deevey et al. 1959). These are followed at Monagrillo by five later dates on charcoal for Monagrillo contexts, ranging from 2271(1992)1740 BC [SI-2840: 1665 bc ± 80] to

1750(1520)1318 BC [SI-2843: 1295 bc ± 100] (Ranere and Hansell 1978). Together, these suggest dates of about 3500-1500 BC for the Monagrillo phase at Cueva de Ladrones and Monagrillo. Three dates, ranging from ca. 1200-700 BC and associated with "Monagrillo-type" ceramics at the Aguadulce rockshelter, may indicate that Monagrillo traditions may have lasted even longer. However, these samples were collected from a "highly compressed" stratigraphic context, and may not reliably date the associated materials (Ranere and Hansell 1978).

There is a significant overlap between the earliest portion of the Monagrillo phase and the great majority of dates for Valdivia ceramics. However, the technological and stylistic similarities between the two complexes are not as close as one would expect, given their proximity in time and space. From Valdivia II on, the execution of design and technical quality of Valdivia ceramics give one the impression of a high level of sophistication. Monagrillo pottery lacks this quality. "It is only fairly well made, and, on the whole, could be considered 'simple' pottery" (Willey and McGimsey 1954:58). This characterization is based upon a notably small range of vessel forms -- mostly globular, subglobular, or open bowls --and the nature of their decoration. Rim forms are predominantly simple and direct, with only occasional thickening, and the necked jars abundant in Valdivia are absent in Monagrillo. All decoration is rare (Willey and McGimsey's initial sample of Monagrillo Incised consisted of only 70 sherds), and its most common manifestation consisted of red-painted bowl rims. Bray (1984:321) notes that Monagrillo shares incised lines ending in punctations, excised areas where lines meet, and spiral motifs with Puerto Hormiga ceramics, but also remarks that it lacks the latter's modelled, stamped, punctate, and hatched designs. Painted decoration like that of Monagrillo is absent on early Colombian ceramics. In terms of undecorated wares, no fiber-tempered stage has been recognized for Monagrillo. All Monagrillo pottery was shaped by coiling.

Pox and Purrón

To date, only two ceramic complexes outside of the Intermediate Area may date as early as 3000 BC These are the "Pox" ceramics from Puerto Marquéz and Zanja on the Pacific coast of Guerrero, Mexico (Brush 1965) and the Purrón phase of the Tehuacán Valley (MacNeish et al. 1970). Both are characterized by coarse, undecorated wares and a predominance of the tecomate form.

The archaeological site of Puerto Marquéz is located next to a fresh-water stream on a small cove facing the ocean, and Zanja is located on a narrow branch of a large lagoon, in environments surprisingly similar to those of early ceramic sites in Colombia. Three dates were run on samples of shell from deep test excavations at Puerto Marquéz. Two of 3990(3700)3370 BC [H-1263: 2950 bc ± 130] and 3291(2820)2460 BC [H-1264: 2250 bc

± 135] come from artificial 20 cm excavation levels (740-760 cm and 680-700 cm, respectively) containing lithic debris, including small chunks of obsidian, and interpreted as preceramic cultural debris. The first of these represents the bottom 20 cm of a meter of deposits completely devoid of ceramic artifacts. The third date, at 3499(3034)2626 [H-1258: 2450 bc ± 140] comes from the 640-660 cm level. This was the deepest level which yielded ceramics, and pottery was abundant in this and all superimposed levels (Brush 1965:194, Johnson and MacNeish 1972). The dates H-1264 and H-1258 overlap at the 2-sigma range, and suggest a possible preceramic/ceramic transition at the site around 3000-2800 BC. Pox pottery is undecorated, with the exception of occasional traces of red slip. Its most diagnostic feature is its rough, pitted surface, caused by the wiping and removal of large aplastic inclusions from the paste before it had completely dried. Although the sample of sherds diagnostic as to form was poor, Pox vessels appear to have been "either sharply incurving neckless pots or vessels with high, straight necks" (Ibid.).

Purrón ceramics were identified in levels in Purrón Cave, in the Tehuacán Valley of southern Mexico. Six radiocarbon dates on charcoal from the two stratigraphic units in which Purrón sherds appeared range from 2900(2457)1890 BC [I-762: 1950 bc ± 180] to 2269(1663)1135 BC [I-666: 1425 bc ±

200], overlapping from 2270-1890 BC, or 380 years, at the 2-sigma range. The excavators have suggested a beginning date for the phase of 2900 BC based on their strong similarity to the Pox pottery from Puerto Marquêz and two dates from the estimated end of the preceding Abejas phase (Johnson and MacNeish 1972:25). Calibrated, the Abejas dates from Purrôn Cave overlap at the 2-sigma range from 3945-2910.

Given the overlap of the associated radiocarbon dates, the charcoal samples may reasonably have resulted from contemporaneous activities. However, the excavators prefer a liberal interpretation of the dates to accomodate a continuous sequence, and suggest that the Purrôn phase was about 1200 years long, ending around 1700 BC (1500 bc; Mac Neish 1970:21).

Like the Pox ceramics, Purrôn sherds are undecorated. The predominant vessel forms are plain tecomates, tall- and short-necked jars, and both flaring-wall and incurving-rim bowls. Pastes are friable and poorly fired. According to MacNeish, there is a clear continuity in non-ceramic artifactual assemblages from Abejas to Purrôn. This suggests that there was a continuity both in populations and subsistence strategies (Ibid.:25). As in Panama and northwestern South America, the introduction of ceramics was not accompanied by dramatic cultural change.

Discussion

There is an enormous range of variability in the quality of the ceramics identified as the earliest complexes in Colombia, Ecuador, Panama and Mexico, and while details of chronology remain to be refined, it is apparent that no uniform tradition of ceramic technology can be identified even for the very earliest technologies in the period between 4600-2500 BC. There is no question but that the earliest ceramics from both Puerto Hormiga and Monagrillo have a far more "primitive" appearance that contemporaneous pottery from Valdivia contexts, but radiocarbon associations suggest that both of these are more recent than sophisticated industries in both Colombia and Ecuador. Reichel-Dolmatoff (1985:175) sees the decorated Puerto Hormiga ceramics as undoubtedly more recent than the early complexes from Monsú, and Bischof (1972) would have them even later than the associated radiocarbon dates suggest.While the Puerto Hormiga complex -- especially the fiber-tempered wares -- could credibly be interpreted as an "incipient" industry, Turbana and Monsú, which are believed to predate it by a thousand years, are not. Pox and Purrón ceramics are also sufficiently crude to be credible examples of an incipient or experimental industry, and the appearance of stone vessels foreshadows ceramic forms in the immediately preceding preceramic period. However, both Pox and Purrón are associated with later dates than all of the other phases under discussion. Their simplicity itself might argue for independent invention on chronological grounds alone. Ceramic technology was presumably at a sufficiently developed level in northwestern South America that by the time Pox and Purrón appear they can be seen only as crude imitations of southern wares.

In spite of their partial temporal overlap, Valdivia, Puerto Hormiga, and Monagrillo ceramics are perhaps more distinguished by their differences than by their similarities. This is in direct contradiction to Willey's (1971: 275) assertion that "such early ceramic phases as Valdivia, Puerto Hormiga, Canapote, Tesca, Barlovento, San Jacinto, and Monagrillo can together be related to a single pottery tradition." The common denominators of these phases do not stand up well to close examination. Even if the earliest northern Colombian phases are 1000 years more recent than the associated charcoal samples, there is no question that they are very different from apparently contemporaneous Valdivia pottery. There is no evidence that modelling or fiber-tempering, such as appear in Puerto Hormiga ceramics, were ever utilized as a manufacturing technique in early Valdivia ceramics (or in the early Monagrillo complex). As noted above, Turbana and Monsú ceramics are primarily large, incurving-rim bowls and large, open plates. The principal vessel shapes of Puerto Hormiga pottery are "bowl-shaped or slightly ovate containers", often with incurving, direct rims (Reichel-Dolmatoff 1965a, 1965b:55).

In contrast, the very earliest Valdivia pottery described by Hill consists of "thick-walled pots, some with everted necks" and plain bowls. Early decorative modes are also very distinct. While wide-bottomed groove-incision and channelling on unslipped vessels are common to all of the early Colombian phases, the earliest decoration on Valdivia I ceramics is simple "combing", standardized fine-line patterns, and incising on everted necks or the upper side walls of bowls. Valdivia II sees the appearance of lobed, beveled, and folded rims, "shoulder bosses", and "Valdivia Fine Line Incised" -- characterized by cross-hatched zones of thin lines "engraved" into a red slip. The chief markers of the next Valdivia phase (Valdivia III) are "piecrust" rims and the appearance of pottery figurines (Hill 1975:4).

With the possible exception of a general characterization such as "plain bowls with incision on their exteriors", relatively few Valdivia diagnostics are shared with Turbana, Monsú, Puerto Hormiga, or Monagrillo ceramics. Two of the most distinctive features of the Valdivia complex, stylized figurines and necked jars with a variety of elaborate rim forms are absent from both Puerto Hormiga and Monagrillo assemblages. Attempts to correlate stylistic changes between the Ecuadorian and Colombian sequences reveals a number of major disjunctions. While it is possible that some of the incised, curvilinear designs in the latter two complexes were inspired by the deeply incised motifs of Valdivia IV pottery, they are not really the same. In fact, the deep, wide, parallel and curvilinear grooving from much earlier Turbana and Monsú times apparently fades from the Colombian sequence well before analogous decoration becomes popular in Ecuador during Valdivia IV times (ca. 2600 BC). Furthermore, modes which are strongly diagnostic of both Puerto Hormiga and Monagrillo ceramics -- zoomorphic modelling on the former and red painted bowl rims on the latter -- are absent from the Valdivia sequence. The large, open plates such as those noted through several phases at the site of Monsú are also completely unknown in the Valdivia sequence.

It seems appropriate here to address what was once a truism, especially in Mesoamerica: "It is perhaps significant that the earliest pottery form in Colombia, Peru, and Ecuador is...a <u>tecomate</u>" (MacNeish et al. 1970:29). As noted above, the earliest Valdivia vessels are necked jars and shallow bowls, and in fact the round, gourd-shaped <u>tecomate</u> form which distinguishes Mesoamerican complexes is <u>not</u> found in Valdivia ceramics. It is possible that the early Turbana and Monsú ceramic forms described by Reichel-Dolmatoff are in fact <u>tecomates</u>. However, no whole vessels were recovered. As noted above, the enormous rim diameters of 40-50 cm make these vessels very distinct, and suggest that if they were not in fact incurving-rim bowls (height < rim diameter), they must have been some of the largest <u>tecomates</u> ever manufactured. At Puerto Hormiga, both fiber-tempered and sand-tempered vessels are described as "bowl-shaped or slightly ovate containers" (Reichel-Dolmatoff 1965:55), and true _tecomate_-like vessels may not appear in northern Colombia until the Barlovento phase. As noted above, typical Monagrillo ceramics were not gourd-shaped _tecomates_ either, but deep, straight-walled or short, incurving rim bowls. At any rate, a marked divergence between the use of necked and neckless jars (or _tecomates_) indicates a multilinear evolution of Early Formative vessel shapes beginning as early as Valdivia I. From a technological point of view, Valdivia ceramics are much more sophisticated in terms of slipping and firing techniques than either Puerto Hormiga or Monagrillo ceramics, suggesting that even technological information was not shared by these early complexes. These major divergences in form and technology suggest that coastal Ecuador in fact played a fairly minor role in the diffusion of ceramic styles in the New World.

In addressing the question of a "_Tecomate_ Tradition", Bray (1984:321) notes: "The overall impression is of a generalized family relationship, perhaps with sporadic contacts but with no systematic interaction or migration." The differences in ceramic forms and technology between the earliest pottery complexes in Ecuador, Colombia, and Panama and the broad range of dates (ca. 4600-3000 BC, or 1600 years) for the first appearance of ceramics in all three areas suggest that it was the _idea_ of fired-clay pottery, rather than a specific ceramic complex, that was communicated between cultures in this part of the world at an early date. It is likely that pottery itself may have first appeared somewhere in the Intermediate Area as early as 5000 BC; however, it also seems likely that this earliest pottery was extremely simple, and that the process of its manufacture was not explicity linked with a specific repertoire of formal or decorative modes. In terms of vessel shape, it appears that no vessel form, except perhaps large, direct-rim bowls, was common to Valdivia, Puerto Hormiga, and Monagrillo. As has been suggested elsewhere (Lathrap 1977, for example), early shapes may have been in imitation of non-ceramic objects, such as gourds, whose functions were partly replaced by pottery vessels. Unfortunately, unbaked or poorly-fired clay artifacts and vessels which may represent the origins of an initial technology are not likely to have been well preserved in the archaeological record.

It is not until around 2600 BC that the ceramics of the Ecuadorian coast begin to resemble stylistic assemblages from northern Colombia. According to Hill (1975:17), "semicircular, rectangular, or free form zones outlined by incision and filled with small punctation are found exclusively in Valdivia VI", a phase dated to approximately 2600-2500 BC (2150-2000 bc; Ibid.:21). Elaborate zoned punctation is an important diagnostic of decorated Puerto Hormiga sherds as well as those of Barlovento, and appears in more northern assemblages such as Tronadora, Dinarte, and Barra around or shortly after 2000 BC.

Two vessel forms which have important precedence in the Tehuacan Valley are the tecomate and flat-based, flaring-wall bowl. Ground stone prototypes of these forms, later to become the most common vessel shapes of the Mesoamerican Formative, appear in Tehuacan sequence at around 6000 BC, and it is possible that these (which may in turn have imitated gourds) influenced the models for later ceramic forms. Flat-based, flaring-wall bowls -- ubiquitous in virtually all early Mesoamerican assemblages -- are absent from Monagrillo, Valdivia, and the Colombian assemblages. While flat-based cylinders are a characteristic of the Tronadora Complex, flat-based, flaring-wall bowls do not appear in any of the early Costa Rican phases. It seems clear that this vessel form is a Mesoamerican innovation with a fairly limited geographical distribution, and that it was characteristic of Mesoamerican ceramic assemblages from the inception of this Formative technology.

As MacNeish puts it, "The source of Purrón pottery and, for that matter, of Mesoamerican pottery in general, is one of archaeology's $64,000 questions" (Ibid.). The possiblility of a trans-Pacific inspiration for early Mexican pottery can be ruled out without much discussion, given the very simple forms and technologies involved. Two other options remain: independent invention or diffusion from ceramic-producing cultures to the south. The overwhelming majority of scholars who have investigated the problem of the earliest ceramics in the New World have favored the second explanation. Of these, perhaps the most fervent has been Ford (1969), who assembled a massive body of data to trace the spread of ceramic technology and Formative culture from an origin in Japan to Florida and the Mississippi Valley. A problem with the model of ceramic diffusion as often conceived is that it tends to consider the spread of the idea of ceramic vessels in toto, that is, the technology, form, and certain decorative ideas transferred together as a package, rather than each considered separately.

While it is possible that the idea of fired-clay ceramics reached Mesoamerica from central Panama sometime between 4000 and 3500 BC, it seems more likely that knowledge of the technology was widely diffused throughout the Intermediate Area, and that knowledge of forming and firing vessels did not arrive as a unified technology. In spite of their apparent contemporaneity, Pox and Purrón as ceramic complexes are not closely related to Monagrillo, Puerto Hormiga, or Valdivia in terms of either form or decoration. Both Purrón and the succeeding Early Ajalpan ceramics lack any incised decoration similar to that of southern complexes, further suggesting that southern ceramic decorative traditions were not simply "late in arriving," but did not accompany the technology at all.

Regional Early Formative Florescence, 2500 - 1000 BC

The period from 4600-2500 BC was most crucial for the appearance and development of regional ceramic complexes in core areas of Ecuador, Colombia, and Panama; however, it was the suceeding period of 2500-1000 BC which saw the spread of ceramic technology and the emergence of diverse ceramic traditions at several loci in Mesoamerica, the Intermediate Area, and the Central Andes. At this time, there is a notable regionalization of ceramic styles throughout Nuclear America and the development of what may be interpreted as incipient Formative ceramic interaction spheres. These spheres are by no means sharply defined, and intersect and overlap each other in several places. They do not correspond to strict culture areas, and are of very limited time depth. Each is characterized by a great deal of internal variety from the earliest dated complexes, and these spheres are defined to facilitate broad inter-regional comparisons, rather than to imply the existence of unified culture areas. The nature of Early Formative interaction within Mesoamerica and South American regions is beyond the scope of this thesis, and is assumed to have been at least as complex as that noted within the Intermediate Area itself.

At least two interaction spheres may be defined for the southern portion of Mesoamerica. The most northern of these roughly encompasses the southern Mexican highlands, the Isthmus of Tehuantepec, and southern Guatemala (both coast and highlands). Its initial complexes include Purrón and Ajalpan (Tehuacan); Barra, Locona, Navaríjo, Ocós, and Cuadros (Chiapas), Ojochi, Bajío, Chicharras, San Lorenzo, and La Venta I (Veracrúz); Pellicer, Molina, and Palacios (Tabasco); and the recently-defined Xox phase from Baja Verapáz (Sharer and Sedat 1987). While the definition of what constitutes "Olmec" culture still leaves a great deal to be desired (Demarest, in press), this northern sphere may correspond to the distribution of the roots of the Olmec culture. This is perceived as a broad cultural substrate from which centers of regionalized development emerged.

The second Mesoamerican sphere of influence is somewhat more geographically restricted, and is defined largely by the early Swasey ceramics, Maní Cenote pottery (Brainerd 1958), and what were probably the roots of later phases such as Xe, Real, Eb, Mamom, and Lopez. The geographical extent of this sphere corresponds roughly to the Maya Lowlands in Yucatán and the Petén, although it may overlap with the first sphere in eastern Yucatán.

In Central Panama to the south, a separate interaction sphere appears to have been characterized by late Monagrillo and Sarigua ceramics. Both vessel form and decorative traditions remain relatively distinct, with the exception of individual shared modes such as grooving, shell-stamping, and occasional applique. Mesoamerican characteristics are virtually absent.

In South America, the coastal estuaries and broad river valleys of northern Colombia constitute yet another important interaction sphere with enormous time depth. In the period from 2500-1000 BC, this is characterized by Pangola, Macaví, Canapote, Tesca, and Barlovento ceramics.

The coasts of Guayas and Manabí in Ecuador, together with parts of the northern highlands of Peru, comprise another sphere with great time depth, represented by Valdivia, Machalilla, and possibly Cerro Narrio ceramics from Ecuador, and Pandanche, Monte Grande and possibly Guañape ceramics from northern and central Peru. Another early interaction sphere includes highland cultures of central Peru and the western limits of the Amazon Basin, characterized by ceramic phases such as Waira-jirca and Tutishcayno.

The "Central American" interaction sphere, with which we are primarily concerned, is the least unified and the most poorly defined. This may be due in part to a lack of regional integration on the level of that which characterizes the other spheres we have defined, but it is also readily attributed to the paucity of available evidence. The region between Guatemala and central Costa Rica probably was comprised of several small, localized , largely independent interaction zones in the period prior to 1000

BC. The best known is centered on the volcanic cordillera and inland alluvial plains of Costa Rica. As noted above, the Tronadora and Chaparrón complexes show some specific modal similarities to early Mesoamerican ceramics, especially those of coastal Chiapas and Guatemala. However, as a whole, the early Costa Rican assemblages are very distinct. There are significant differences in vessel forms, primarily in the use of rim bolstering, and types of decorations between the two regions. The characteristics shared with Mesoamerican ceramics by the more northern Costa Rican complexes, (Tronadora and Chaparrón, rather than the Atlantic complex of La Montaña), may indicate greater casual contacts with the north. However, important characteristics of the Early Formative cultures on the Pacific, such as a vigorous and expressive figurine tradition, have no counterpart in Costa Rica. It seems more likely that ceramic traditions and stylistic notions were filtered through numerous Early Formative cultures in the intervening regions between northern Costa Rica and coastal Guatemala. Unfortunately, these cultures remain completely unknown.

While the dating of Dinarte, Chaparrón, La Montaña, and the recently discovered Curre complex in the Diquís region of southeast Costa Rica (Corrales 1985) remains unclear, all share important features with Tronadora ceramics and help to define the characteristics of the Early Formative interaction sphere in Costa

Rica and southwest Nicaragua. These include the predominance of bolstered-rim olla-tecomates, incurving-rim bowls with thickened and grooved rims, horizontal, wide-bottomed groove-incision, zones of heavy punctation, and (especially in the north) the use of red paint to accentuate rims and zoned areas.

A second interaction "sub-sphere" may be centered on the poorly-known Early Formative cultures of central Honduras, where the earliest ceramics belong to the Yarumela I complex (Canby 1949, 1951), long supposed to pertain to the second millennium BC, although a recent assay may place them closer to 1000 BC (Joesink-Mandeville, personal communication 1987). Yarumela I ceramics are distinct in form and decoration from the ceramic phases which follow, with an emphasis on simple, unslipped vessels and plastic decoration. It is possible that these represent an early tradition of local or southern derivation. The Middle Formative ceramics from the Jaral and Zanjos phases at Los Naranjos (Baudez and Becquelin 1973) and Playa de los Muertos (Kennedy 1981) appear to be much closer to Mesoamerican traditions than the early Yarumela ceramics, and may represent an "outwash" of the northern interaction spheres around 1000 BC. Joesink-Mandeville (1985) sees important stylistic resemblances between Yarumela I and the earliest known ceramics in Nicaragua and Costa Rica. However, these consist primarily of decorative modes such as groove-incision, punctation, and types of strip-appliqué. There are important differences between Tronadora and Yarumela I in terms of vessel form. Many Yarumela I vessels are large, shallow bowls (possibly comales) (Canby 1949). While thickened-rim budare fragments have been noted for La Montaña (Snarskis 1978:87), they appear to be completely distinct from Yarumela I vessel forms.

The "Proto-Olmec" Mesoamerican Sphere

While Pox and Purrón represent the earliest introduction of ceramic technology to the Mesoamerican region, the Early Formative period sees a veritable explosion of ceramic styles throughout southern Mesoamerica. Several ceramic phases have been identified as representing Early Formative traditions on the Pacific coast of Chiapas and Guatemala between 2000 and 1000 BC. There is a great deal of variety between individual complexes within this sphere; however, a few general characteristics help to unite them. These include: 1) an emphasis on plastic decoration, such as deep incision, grooved zoning, rocker-stamping, punctation, and fingernail impression; 2) a selective use of red pigment, often specular hematite, to decorate rims or zoned areas; 3) careful control of firing, often used to produce characteristic patterns of variable oxidation (such as white-rimmed blackwares), and 4) true tecomates, flat-based, flaring-wall bowls, and cylinders.

The earliest appearance of a decorative tradition in this region occurs during the Barra Phase. Three dates are available for Barra ceramics from excavations by Ceja

(1985) and the New World Archaeological Foundation (Clark et al. 1987) at the site of Paso de la Amada, although the nature and contexts of dates from the latter project remain unpublished. These are: 2293(1760)1410 BC [B-16238: 1510 bc ± 180], 2290(1660)1055 BC [I-8161: 1410 bc ± 225], and 2027(1600)1135 BC [I-8162: 1350 bc ± 160]. Barra is followed by a newly-defined Locona phase, dated by five samples ranging from 2202(1710)1324 BC [B-14244: 1470 bc ± 170] to 1580(1350)943 BC [B-14243: 1090 bc ± 110]. The subsequent Ocós dates are 1691(1480)1135 BC [B-13838: 1230 bc ± 100] and 1500(1290)943 BC [B-16239: 1070 bc ± 100]. While a critical evaluation is impossible withouth further information on the nature and contexts of these samples, the dates suggest that while internal phase divisions (attempted by the excavators) may be unclear, the Barra/Locona/Ocós series may date from approximately 1800-1300 BC. It is followed by two phases, Cherla and Cuadros, the latter of which probably terminates around 900 BC.

Green and Lowe (1967:74) feel that Barra had "principally a southern inspiration", but they remark that "Barra pottery shapes are nearly identical to just those forms known in the ground stone prototypes: flat-bottom bowls, hemispherical or 'round-side' bowls, and _tecomates_." Grooving and fluting are attributed to imitation of natural forms such as the gourd and squash, and they suggest that "what may have diffused from the south was skill and little else except a few rather close decorative design similarities" (Ibid.:62). Lowe makes much of the congruity between Barra forms and decorations and complexes from the Louisiana Gulf Coast to northern Colombia and Ecuador, but claims, "the Barra complex seems too well developed and too distinctive to be explained by direct diffusion from any other known pottery complex in the New World" (1975:9). Coe (1960, 1961) is far more emphatic about long-distance connections, and goes so far as to attribute the appearance of shared attributes between Ocós and Conchas and Chorrera to a direct sea trade between La Victoria and the coast of Ecuador. This trade is seen as responsible for the introduction of modes such as iridescent painting, plain rocker-stamping, and "pinching" (Coe 1961:135), as well as a "Chavinoid" plastic decoration within curvilinear zones (Coe 1960:372). However, Coe also notes a sharing between the Sarigua complex of Panama and Ocós of "shell-stamping, zoned punctation, and the use of surface indentation or depression, combined with raised ridges for zoning purposes" (Ibid.:383).

The most recent investigators of the Chiapan coast (Clark et al. 1987) note that the short period of time between the preceding Chantuto occupation and the appearance of sophisticated Barra ceramics suggest the introduction of ceramic technology from outside the area. However, they do not attribute Barra's origins to any identifiable source, citing a significant lack of information for this period. Neither Coe nor Green and Lowe point to direct contact with South America for the origin of Mesoamerican ceramic decorative traditions, and there is increasing evidence for the existence of an early, inland ceramic interaction sphere in Costa Rica which may have had casual relationships with cultures such as those of Pacific Guatemala.

The "Proto-Maya" Mesoamerican Sphere

The best evidence for early ceramics in the southeastern Mesoamerican sphere is the Swasey complex, which may date as early as 2500 BC at the site of Cuello, Belize (Hammond et al. 1979). A total of 20 dates on carbonized wood have been reported in association with Swasey ceramics at this site. The two earliest assays, 4340(3979)3640 BC [UCLA-2012c: 3190 bc ± 145] and 3776(3569)3194 BC [UCLA 2102b: 2790 bc ± 100], both from structural fill and possibly representing redeposited charcoal, have been rejected as "too early" (Hammond et al. 1977). The earliest accepted date, 2920(2535)2044 BC [UCLA-1985e: 2050 bc ± 155], comes from a 25-30 cm thick occupational midden representing "the debris from a substantial and sedentary occupation" on an ancient ground surface. A similar date, 2577(2457)2149 BC [Q-1571: 1950 bc ± 65], is reported as the earliest in terms of stratigraphy (Hammond et al. 1977). Eleven succeeding "acceptable" dates range from 2470(2166)1924 BC [Q-1572: 1810 bc ± 85] to 1601(1202)810 BC [Q-1476: 1020 bc ± 160], although not all are stratigraphically consistent. The accepted dates for Swasey ceramics all come from the UCLA and Cambridge radiocarbon laboratories (Hammond et al. 1977,1979). However, a set of four samples associated with Swasey material dated by the La Jolla laboratory and ranging from 1187(869)800 BC [LJ-4918: 790 ± 70 BC] to 800(652)400 BC [LJ-4919: 540 bc ± 70] are all believed to be too late (Radiocarbon 26:1:93-94), as (more obviously) are two UCLA dates at around AD 300 and 900 (see Appendix B for detailed listings of cited assays). Based on the approximate central dates of the accepted assays, Swasey ceramics appear to date to between 2500-1200 BC.

In terms of both form and decoration, Swasey ceramics are very different from any of the western or southern Early Formative ceramic traditions. Necked *ollas*, necked jars with handles, elongated bottles, and spouted jars are more characteristic of the assemblage than the *tecomate* and flat-based, flaring-wall bowl. There is a marked lack of emphasis on plastic decoration, which sets Swasey apart from practically all New World ceramic complexes at this time, and the sophistication of slipping techniques is also in distinct contrast to other contemporary assemblages. Pring (1977:366) admits that the origins of Swasey ceramics are unknown, and cites a suggestion by Lathrap of a South American origin for the complex. Pring draws specific comparisons to the Ecuadorian Machalilla complex. However, given the great differences in the emphasis on plastic decoration between Swasey and the ceramics of northern Colombia and coastal Ecuador, such a derivation seems unlikely.

Swasey and related ceramics are distinguished from the other Early Formative ceramic traditions both on the basis of surface treatment and vessel form. Distinctive surface finishes on Swasey include well-controlled slipping in red, buff, orange, and black, as well as sophisticated "double-slipping" techniques. Swasey vessel forms include typical Mesoamerican <u>tecomates</u> and flaring-wall, flat-based bowls. However, distinctive forms such as "squared lips," monopod bottles, spouted jars, and jars with handles distinguish this complex from Early Formative ceramic assemblages farther to the south. While round-bottomed grooving is shared by Swasey and all other early ceramic complexes, pattern-burnishing appears to be far more common in Swasey and central Yucatan Maní complexes than anywhere else (Pring 1977:45).

As Pring notes:

> Swasey material is now known to be present in a fairly wide area incorporating much of northern Belize and extending at least as far as Becán. Maní, too, seems to have some shared types. Apart from this, and a few odd and not very significant modes, a thorough search of early ceramic complexes throughout the Americas has revealed no comparable material (1977:46).

The sophistication of Swasey ceramics indicates that it does not represent an incipient or experimental industry. The origins of Swasey ceramics are unknown, but they are sufficiently different from the earliest ceramics in Colombia, Ecuador, and Panama to suggest either independent derivation or emergence from a northern substrate of as great an antiquity as the earliest Colombian ceramics, perhaps dating as early as 5000 BC.

The Central Panamanian Sphere

To date, the ceramic sequence for Panama between the appearance of Monagrillo in the fourth millennium BC and the time of Christ remains poorly understood. The period with which we are concerned, 2500-1000 BC, is not an exception. Seven dates from 2580(2430)2140 BC [TEM-122: 1930 bc $\pm$ 80] to 1429(1190)933 BC [TEM-126: 1010 bc $\pm$ 80] indicate that the principal Monagrillo phase occupation of sites such as Monagrillo, Cueva de Ladrones, and the Aguadulce rockshelter occurred at this time. Decorated Monagrillo Incised sherds from this period show strong similarities to Colombian complexes such as Barlovento, but the apperance of red paint on rims distinguishes the Panamanian complex from those to the south. Decoration in general seems less common in Monagrillo, where the most common vessel forms were deep bowls with almost vertical sides rather than sharply incurving walls. A large number of Monagrillo ceramics were poorly fired and friable, in contrast to the hard, well-preserved pottery from sites like Monsú and Canapote.

According to Cooke (1984:283), the site of Monagrillo was abandoned sometime between 1400-1100 BC (1200-950 bc). The only other Early Formative Panamanian ceramic complex is Sarigua, known from a small shell midden not far from the type site of Monagrillo. Sarigua ceramics are not remarkable either in terms of technical quality or the execution of design. The pottery is thin and unslipped, and decoration consists of incision, shell-edge stamping, punctation, and appliqué ridges. Willey (1971:283) notes that Sarigua bears "a general resemblance to other early Nuclear American wares"; however, it seems clearly outside of the development of more sophisticated ceramics from the same time period in Ecuador, Colombia, Peru, and Meso-america. No dates are available for Sarigua, although a best estimate would put it around 1700-1100 BC (1500-1000 bc). The Costa Rican La Montaña complex is tenuously linked to Sarigua by the use of zoned shell-edge stamping and the use of punctation and appliqué.

The Northern Colombian Sphere

Excavations at Monsú have yielded the first dates for phases between Puerto Hormiga and Canapote, making some progress towards filling a long-standing chronological gap. A date of 3019(2820)2580 BC [UCLA-2149B: 2250 bc ± 80] comes from a "shell object" associated with pottery from the Pangola phase in deposits stratigraphically separated by a caliche floor from earlier Turbana and Monsú levels (Reichel-Dolmatoff 1985:175). It is succeeded by an almost identical date on shell of 2920(2775)2503 BC [UCLA-2568A: 2225 bc ± 80] from a higher stratigraphic level. This second date is said to have been associated with Barlovento pottery, and although it is much earlier than other dates for Barlovento ceramics, it is not rejected by Reichel-Dolmatoff. Acceptance of this date would place Barlovento phase ceramics closer in time to Puerto Hormiga pottery, which Bischof claims is very similar (1972). However, interpretation is complicated by the fact that Barlovento ceramics are found stratified <u>above</u> levels containing Canapote and Tesca ceramics at the site of Canapote, both of which are associated with dates later than UCLA-2568A and earlier than seven other dates for Barlovento contexts. For now, it seems wise to treat this date with caution. A third date, 3700(2775)1750 BC [UCLA-2568F: 2220 bc ± 360], was run on a sample of bone associated with the lowest excavated levels (below the caliche floor) and early Turbana phase pottery. It is rejected by Reichel-Dolmatoff as being too late for the associated ceramics on the basis of his acceptance of an early date (UCLA-2149C) for Monsú phase contexts.

There are several problems with ceramic chronology in northern Colombia stemming from the fact that although radiocarbon dates place Canapote and Tesca ceramics chronologically between Puerto Hormiga and the majority of Barlovento assays, Canapote and Tesca complexes are not thought by their excavator to be stylistically intermediate between Puerto Hormiga and Barlovento (Bischof 1972). The Canapote and Tesca phases are dated by two radiocarbon dates, both aggregate samples of charcoal fragments, believed to date the earliest ceramic phases at the site of Canapote. The first, at 2853(2425)2044 BC [Y-1317: 1940 bc ± 100], comes from a refuse layer overling 60 cm of Canapote deposits. Its context is considered by Bischof to be late in the Canapote phase. The second, 2480(2140)1782 BC [Y-1760: 1780 bc ± 120], overlies Canapote deposits, and is assigned to the succeeding early Tesca phase (Bischof 1972: 278). Bischof (1972:273) proposes a beginning date for Canapote around 2850 BC, which would make it roughly coeval with Reichel-Dolmatoff's Pangola phase at Monsú (1985:175).

Canapote ceramics have been identified at the site of the same name, a shellmound in the suburbs of Cartagena, where three successive phases were identified: Canapote, Tesca, and Barlovento. Canapote pottery is described as unpolished and hard, with sand and occasional shell temper. Decoration consists of "curvilinear or rectilinear elements, often combined in one pattern, executed in sharply incised narrow lines... the style is characterized by its orderly but somewhat dry quality" (Bischof 1966: 487). Forms are exclusively globular, round-bottomed vessels.

Early Tesca pottery is decorated with broad incised lines, and most designs are curvilinear. Modelled decoration (of the type which figures prominently in Puerto Hormiga ceramics) first appears in the Tesca phase at Canapote. Bischof also attributes the first use of zoned hatchure, both cross-hatchure and parallel, to Tesca (1972:277). Reichel-Dolmatoff (1965:59) identifies fiber-tempered ware and elaborately decorated sherds with spouts and handles from the site of Bucarelia, some 150 km inland, as Puerto Hormiga ceramics. However, Bischof believes that the Bucarelia style "conforms to a late version of the Tesca A-style, and even more clearly to the subsequent Tesca B-style" (1972:278).

Bischof feels that Puerto Hormiga and Canpote ceramics are not closely related, and does not see the latter as having developed from the former, in spite of the implications of the radiocarbon chronology. He remarks that "no specific relationships can be detected between Puerto Hormiga and the Canapote pottery that should be nearer in time and is found only some 40 kms to the north" (1972:273), and argues for a late placement of Puerto Hormiga ceramics on stylistic grounds, claiming Puerto Hormiga's closest stylistic affinities are with Barlovento ceramics. He finds the quality of sand-tempered Puerto Hormiga and Barlovento wares to be very similar, and notes a common usage of decoration to the point where "it can be stated with confidence that the Puerto Hormiga art style...has its only close counterpart...in the Barlovento styles of the Early and Middle Barlovento periods" (Ibid.:274). Bischof's revised interpretation of the northern Colombian sequence would identify two phases of occupation at Puerto Hormiga, and would place both Canapote and Tesca ceramics earlier than the decorated, sand-tempered Puerto Hormiga ware. Canapote and Tesca ceramics, dating ca. 2400-2000 BC, either precede both decorated Puerto Hormiga ceramics and Barlovento pottery (as Bischof would have it, rejecting the radiocarbon dates' association with decorated pottery at Puerto Hormiga) or represent an intermediate, short-lived phenomenon during which local styles and wares diverged from a Puerto Hormiga-Barlovento continuum.

It is evident that there has been little concensus on the chronology of the earliest northern Colombian ceramic complexes, and it seems likely that this problem will not be resolved until further research can be directed at an analysis of the several early complexes together. The problem is compounded by the small number of sites that have been excavated and a lack of continuous occupations. Reichel-Dolmatoff believes that the Monsú shellmound was abandoned during the occupation of nearby Puerto Hormiga, making it even more difficult to assess relationships between the successive occupations of each. If we accept his interpretation of the early date (UCLA-2149C: 4340-3980 BC) for late Monsú pottery and its implications about even earlier dates for decorated Turbana ceramics, Bischof's identification of Canapote ceramics as the earliest decorated complex in northern Colombia must be rejected. However, assigning temporal priority to the relatively sophisticated Turbana and Monsú ceramics rather than the relatively crude, fiber-tempered Puerto Hormiga pottery is also intuitively problematic. If we consider the possibility that a number of divergent ceramic traditions were occurring within a small geographical area over a period which may have lasted over 2500 years between the end of Turbana and the beginning of Barlovento, the complexity of the problem of the earliest Formative cultures in northern Colombia becomes apparent.

The Barlovento phase is somewhat better understood than the preceding phases. Barlovento ceramics are known from a number of sites, most notably the Barlovento type site, Canapote, and Monsú. At Canapote, Barlovento phase material is found stratigraphically above levels with Tesca ceramics (Bischof 1966). At Monsú, Barlovento ceramics appear above what Reichel-Dolmatoff has labelled Pangola phase levels. If we exclude the early date cited above (UCLA-2568A), Barlovento ceramics are dated by a total of seven radiocarbon samples. The earliest acceptable date for Barlovento is a date on charcoal of 2138(1851)1600 BC [Y-1318: 1560 bc $\pm$ 100]. This sample was retrieved by Bischof in 1962 from deposits exposed by the collapse of a profile from Reichel-Dolmatoff's 1957 excavations at the Barlovento type site, a group of six shellmounds in the swamps to the north of Cartagena. It was initially thought to be too early for the phase, but subsequently deemed acceptable (Bischof 1972). Three other dates for the Barlovento phase are on shell collected by Reichel-Dolmatoff from Barlovento, and are stratigraphically consistent at 2138(1779)1500 BC [W-739: 1520 bc ± 120], 1691(1425)1054 BC [W-743: 1190 bc ± 120], and 1500(1216)843 BC [W-741: 1030 bc ± 120]. These are supported by two more stratified shell dates from Barlovento contexts at Monsú. These are 1689(1518)1410 BC [TK-625a: 1290 bc ± 60] -- from the same excavation level as the sample rejected as too early (UCLA-2568A) --and 1734(1502)1319 BC [TK-625b: 1280 bc ± 90]. The latest assay, run on a shell disk from a Barlovento phase burial assemblage at Monsú, dates to 1242(956)800 BC [UCLA-2149D: 850 bc ± 80 bc] (Reichel-Dolmatoff 1985:175-76). It is almost completely overlapped by the most recent Barlovento date from the type site (W-741) at the 2-sigma range; taken together, the two suggest a terminal date for Barlovento around 1000 BC. These dates indicate that Barlovento is roughly contemporaneous with Barra, Locona, Ocós, and Early Tronadora, dating from approximately 1800-1000 BC. The Colombian and Central American complexes share a large number of specific decorative modes. However, the vessel forms and decorations of the northern and southern complexes remain very distinct.

Barlovento is interpreted as signalling an important stylistic change in the local sequence. Polished ceramics appear for the first time, and decoration includes curvilinear designs with narrow, deeply incised lines, comma-shaped punctation, and circular stamped marks. The Monsú assemblage contains a wide variety of exuberant curvilinear volutes and sigmoids with zoned incision and punctation (Reichel-Dolmatoff 1985:Figs. 45-54). Shallow incisions are often filled with red ochre (Ibid.:58). Vessel lips on wide, open plates are broad and decorated with incised and punctate designs (Reichel-Dolmatoff 1985:Figs. 55-56). Bimorphic modelled lugs are also considered an important decorative mode. Modelled decoration -- considered to be an important mode of Puerto Hormiga ceramics -- is reported as absent in Canapote, rare in Tesca, but "flourishing" in early and middle Barlovento. Vessel forms consist primarily of very large (40 cm diameter) incurving-rim bowls with direct, tapered, or interior-thickened rims, deep, vertical-walled bowls, and open plates or possible _budares_.

Bolstered rims, grooved rims, cylinders, and squat jars are absent from Barlovento assemblages, making Barlovento very different from Tronadora. The complete absence of red slipping or painting and any type of figurine tradition readily distinguishes this complex from contemporaneous ones in Pacific Chiapas, despite Lowe's (1975) long-distance comparisons. Reichel-Dolmatoff notes that "a complex related to Barlovento is found as far south as the Isla de los Indios, a small islet in the lagoon of Zapatera, at the confluence of the Magdalena and César rivers" (1965:59), suggesting that the manifestation of these styles was not exclusively a coastal phenomenon, and may have extended well inland along large river valleys.

Overlapping late Barlovento in time is the Malambo phase, defined from a site on a lagoon of the lower Magdalena. The earliest radiocarbon date for Malambo is a charcoal date of 1597(1344)830 BC [M-1176: 1120 bc ± 100], although this phase may continue into the first century AD (Reichel-Dolmatoff 1965:66). There is a continuation of earlier pottery forms, but budares make their first appearance in this complex, and Reichel-Dolmatoff feels there is a sufficient change in decorative styles to suggest that Malambo represents the intrusion of the Venezuelan Barrancoid tradition into northern Colombia (Ibid.).

The dating of Momil, which most likely follows Malambo, is at least as controversial as that of Machalilla, making arguments for relationsips between the two difficult to support. Foster and Lathrap (1973) draw stylistic parallels between Momil I and both Valdivia and Machalilla, implying contemporaneity (ca. 2000-1500 BC) on the basis of some shared vessel styles and decorative techniques. Bray (1984:323) cites Momil sherds from a post-Barlovento context, and suggests that Momil began sometime after 1000 BC. He notes that there are two dates for Momil Ib, 390(269 BC)AD 3 [TK-131: 200 bc ± 60] and 353(147)72 BC [GrN-6908: 175 bc ± 35], which are "about halfway through the first period" (Ibid.). As with Machalilla, Momil has been recognized as a major departure from the preceding stylistic sequence in its respective area (Reichel-Dolmatoff and Reichel-Dolmatoff 1956). Carinated bowls, flaring-rim jars, and pots with overhanging collars succeed a tradition of direct-rim, incurving bowls, although plastic decorative techniques of stamping, punctation, and broad incision continue. However, the Momil pattern shows radical departures from other sylistic sequences. Decoration such as red-on white painting, negative painting, and bichroming appear in Momil 1b, while "true rocker-stamping is confined to early Momil II" (Bray 1984:322). The most distinctive characteristic of the Momil sequence is the restriction of <u>budares</u> to Momil I and <u>metates</u> to Momil II -- taken to represent a transition from root-crop to maize agriculture (Reichel-Dolmatoff 1965: 72). This transition is attributed to a full site-unit intrusion from "Mesoamerica," which also brought mammiform supports, tripod vessels, and flanged bowls (Ibid.:73).

The appearance of maize during the Tronadora Phase in Costa Rica and the subsequent appearance of tripod vessels, mammiform supports, and flanged bowls (Guinea Incised) in the Arenal Phase indicates that Reichel-Dolmatoff may have been looking too far afield for northern influence during Momil II. Snarskis (1978:151) sees important similarities between the El Bosque ceramics of the Atlantic Watershed of Costa Rica, also associated with a maize economy (Snarskis 1984:211), and Momil. The nature of possibly direct contact between Atlantic Costa Rican and Colombian cultures around the time of Christ is still unclear. However, it is apparent that arguments which cite Momil as evidence for Colombian/Mesoamerican contacts in the Early Formative period must be fallacious. The Momil ceramic traits cited as "Mesoamerican" are in fact more characteristic of Costa Rican than Mesoamerican assemblages at the time, suggesting that possible external "influence" on Momil may have had a more southern, Isthmian origin.

The Ecuadorian Sphere

In Ecuador, there are several radiocarbon samples associated with late Valdivia pottery which can be used to date the end of the phase. Hill sees the Valdivia period ending sometime after 2300 BC (1900 bc), based on two dates of 2872(2400)1920 BC [L-1232H: 1950 bc ± 150] and 2573(2140)1740 BC [L-1232I: 1800 bc ± 150] associated with Valdivia 7 assemblages at site OGSE-46B-1 (1975: 21). The latest date from the Valdivia type site is 2650 (2466)2280 BC [SI-78: 2020 bc ± 65], a date on shell associated with early "Valdivia C" ceramics (Meggers, Evans, and Estrada 1965:149). At Loma Alta, a date on charcoal of 2460(2161)1910 BC [ISGS-190: 1815 bc ± 85] associated with Valdivia 6 ceramics (Hill 1975:Fig. 3) overlaps the two dates from OGSE-46B-1 at the 2-sigma range. A date on shell of 1884(1700)1600 BC [SI-69: 1500 bc ± 50], associated with "Valivia C" diagnostics from the Buena Vista site (Meggers, Evans, and Estrada 1965:149), suggests a possible terminal date for Valdivia as late as 1700 BC. The two most recent dates associated with Valdivia ceramics, 2187(1658)1110 BC [SI-112: 1400 bc ± 200] and 1289(952)790 BC [SI-20: 855 bc ± 105], can probably be rejected. The first is on shell associated with the earliest Valdivia levels at the type site, stratified below several earlier dates, and described as a small, "finely-divided" sample. The second was run on a sample of a "fine ash, dust-type charcoal," and is much too recent (Ibid.).

A total of six radiocarbon dates are available for the succeeding Machalilla phase. Three come from the site of La Cabuya. One, at 1188(960)832 BC [SI-67: 880 bc ± 45], is on shell associated with Machalilla pottery. The two others, 2029(1570)1114 BC [SI-107: 1370 bc ± 170] and 1597(1160)800 BC [SI-108: 1030 bc ± 160], are both from scrapings of a charred residue adhering to sherds of the same Machalilla phase vessel in adjacent excavated strata (Meggers, Evans, and Estrada 1965:149). SI-107 and SI-108 overlap from 1570-1114 BC at the 2-sigma range, with a midpoint of 1342 BC. However, the excavators consider the earliest of the three samples to accurately date the site. In the interest of a continuous chronological sequence, they force an early interpretation and place Machalilla at approximately 2500-1700 BC (2000-1500 bc; Ibid.:174).

The most recent published assessment of Machalilla chronology, based on three dates from the site of La Ponga in the Valdivia Valley and a more literal interpretation of the dates from La Cabuya, places the Machalilla phase somewhat later. The La Ponga dates, 1374(1113)836 BC [WIS-1125: 970 bc $\pm$ 80], 1311(1035)830 BC [WIS-1141: 930 bc $\pm$ 80], and 1210(946)800 BC [WIS-1140: 840 bc $\pm$ 80], are all on charcoal from stratified midden deposits. Machalilla deposits at the site were overlain by Chorrera/Engoroy and Guangala ceramics, and the earliest date was recovered from a mixed context. However, the other two appear to have been clearly associated with Machalilla ceramics. While not in stratigraphic order, the three dates are very close to each other, and overlap from 1210-836 BC at the 2-sigma range. The excavators' interpretation of these samples and the associated materials dates the Machalilla phase to 1400-900 BC (1200-800 bc), and they propose a terminal date for Valdivia ceramics at around 1700 BC (Lippi, Bird, and Stemper 1984:118).

Evidence for dating the Valdivia/Machalilla transition is less than ideal, and it is questionable whether assigning a date to this "event" is even a worthwhile exercise. However, understanding the chronology of the two is essential to an evaluation of their possible relationships with ceramic complexes outside of coastal Ecuador. According to interpretations of the existing radiocarbon samples, Valdivia ceramics probably date no later than about 1700 BC. Although the existing dates argue most strongly for placing them later than 1500 BC, Machalilla ceramics may in fact date as early as 1600 BC. The dates for the Machalilla phase are slightly later than those for Barra and Locona, the earliest ceramic complexes on the coast of Chiapas in Mesoamerica. However, in general, Machalilla appears to be and roughly contemporaneous with the Pacific coastal Mesoamerican sequence between Barra and Jocotal, the early Costa Rican phases, the latter half of Monagrillo, and with the middle and latter portions of Barlovento. For this reason, Machalilla ceramics play a key role in defining southern stylistic regionalization at this time.

Although somewhat more restricted in distribution than Valdivia sites, Machalilla sites are found over a relatively broad area between the type site of Machalilla in southern Manabí and San Pablo on the coast of Guayas. Machalilla sherds are reported from such disparate locations as the Isla de la Plata, some 45 km offshore (Marcos and Norton 1981) and the Cueva de los Tayos, at the base of the eastern slopes of the Ecuadorian Andes (Porras 1978). At the site of Salango, Norton (1983:49) reports beads of turquoise and lapis lazuli (posiibly from Chile or the eastern Andes), as well as trade sherds from the eastern Andes, and the presence of obsidian in Machalilla deposits

(Meggers and Evans 1962:191) supports the appearance of coastal-highland communication during this phase.

Despite contemporaneity during the Early Formative period, Machalilla ceramics are altogether different and distinct from those in either Mesoamerica or Central America. While the northern complexes are distinguished by smoothed, round-bottomed groove-incision, Machalilla ceramics are typically decorated with fine, sharp incisions "often done when the surface was hard enough to leave ragged, 'chipped' margins" (Meggers and Evans 1962:187). Two distinctive ceramic innovations appear in the Machalilla complex. One is the stirrup-spout vessel and the other is the carinated bowl. The former may represent the earliest appearance of this form in the New World. The latter has been assigned cultural significance in both northern Colombia and the Amazonian region.

Carinated, or complex-silhouette bowls with a marked incurving angle at the shoulder, appear to have their origin in Valdivia VI, dating to ca 2500 BC (Hill 1975:21), but they do not become a dominant form until Machalilla times. However, they do not appear in any of the early complexes of northern Colombia until Momil, and are not prominent in either Lower Central American or Mesoamerican assemblages until after 1000 BC. The importance of this vessel form over that of the _tecomate_ or incurving-rim bowl sharply distinguishes Machalilla from other contemporaneous complexes, and points out its regionalized nature.

Lippi, Bird, and Stemper (1984) have assembled impressive evidence for the cultivation of maize during Machalilla times at the inland site of La Ponga in the Valdivia Valley. This consists of macrobotanical remains of 80 fragments of maize kernels and 50 cupule fragments. According to the excavator, "A significant portion of the Machalilla maize samples was associated with the earliest Machalilla pottery recognized to date", which is not believed to date earlier than 1200 bc (Ibid.:122). While a later dating of Machalilla would help to relate the Ecuadorian carinated bowl tradition to that of the first phase of Momil, the association of these ceramics with a definite maize agriculture contradicts Reichel-Dolmatoff's interpretation of the Momil sequence. If Machalilla ceramics did influence later styles of northern Colombia, this influence was purely stylistic, with few implications for change in basic social or subsistence patterns.

A revised dating for Machalilla (1600-900 BC) also reduces the implications for Ecuadorian influence on both Peruvian and Mesoamerican sequences. Given Meggers and Evans' early termination date of around 1700 BC (1500 bc) for Machalilla, there is a significant disjunction between the use of stirrup-spouts on the coast of Ecuador and their florescence during the Early Horizon Cupisnique and Chavín in the Central Andes. However, given the revised dating, the disappearance of the stirrup-spout from the Ecuadorian sequence with the end of the Machalilla phase strongly suggests that, rather than being an innovation, it may have been a mode characteristic of an early style with broad distribution along both Ecuadorian and Peruvian coasts. Its disappearance may have been due to a rupture in this continuity with the start of the Peruvian Early Horizon. The later placement of Machalilla would also throw the subsequent Chorerra complex out of line with Coe's estimate for South American influence on Ocós (Coe 1960, 1961). Ocós has recently been suggested as dating from around 1500-1400 BC (1300-1150 bc; Clark et al. 1987), but probably dates as late as 1100 BC.

Chorrera, with which Coe noted the most similarities for Ocós, has been dated by Lippi, Bird, and Stemper to 900-100 BC (800-100 bc; 1984:120), bringing it more in line with the Middle and Late Formative periods in Mesoamerica. Much has been made of the similarity between "iridescent-painted" ceramics in both Chorerra and Ocós (cf. Lathrap, Collier, and Chandra 1975:53). However, another major Chorerra characteristic is bichrome zoning in black and red paint outlined with fine incision. While the former is reported from Ocós, the latter does not appear in Lower Central American assemblages until around the time of Christ, when it is a major diagnostic of the middle Zoned Bichome Period -- most notably the type Rosales Zoned Engraved (Baudez 1967:68) -- in northwestern Costa Rica.

To date, there is not enough contextual or chronological evidence to demonstrate clear relationships between Machalilla and cultures either to the north or south. In fact, although there are a number of modes which could be selected for close comparisons, the differences between Ecuadorian and northern complexes are overwhelming. Both Machalilla and Chorrera have shown a number of major disjunctions when an attempt is made to cross-date decorative modes or vessel forms with sequences outside of Ecuador. This is true even for comparisons between coastal Ecuador and northern Colombia. The small, polished, fine-line engraved, carinated bowls of Machalilla are very different from the contemporaneous large, unslipped, wide-grooved, incurving-rim bowls typical of Barlovento, and bespeak vast stylistic differences between cultures in northwestern South America as early as the period from 2000-1000 BC.

<u>The Peruvian Sphere</u>

The relations between the ceramics of the Ecuadorian coast and the earliest pottery in Peru are not entirely clear. It seems likely that ceramic technology diffused south from the southern Intermediate Area sometime prior to 2500 BC; however, the patterns for this diffusion are not entirely clear. To date, the earliest ceramics in Peru have been reported from the northern highlands, in the Dept. of Cajamarca. Kaulicke (1981) reports two dates of 2876(2537)2340 BC [ZK-333: 2068 bc ± 80] and 2430(1692)1056 BC [ZK-334: 1443 bc ± 240] (weighted averages of two pairs of dates presented by Kaulicke) from charcoal samples at the site of Pandanche. Both were associated with apparent hearths, delineated by small stones, and with pottery. Kaulicke calls the earliest ceramic complex at this site "Pandanche A." This complex is characterized by both fine and coarse vessels. The former include _tecomate_-like vessels, small, globular _ollas_, flat-based, convex-wall bowls, and carinated bowls with rounded bases. The latter are ollas with convex walls and rounded bases and vessels with "S"-shaped profiles. Decorations include horizontal and crosshatch incision, finger-impressed fillets, fingernail impressions, shell-stamping, zoned punctation, and punctate button appliqué. Similar ceramics have been reported from the sites of Pacopamapa, also in the Cajamarca Valley, and Monte Grande, in the upper Jequetepeuqe Valley, but without associated radiocarbon dates (Tellenbach 1981).

Kaulicke finds stylistic parallels between Pandanche A, Late Valdivia, and Machalilla ceramics, suggesting that the earliest ceramic traditions in Peru may derive from southern Ecuador. The relative lack of research in the highlands of northern Peru and Ecuador makes the nature of the relationships between the Valdivia-related cultures and the Cajamarca region difficult to assess. However, a date of 2580(2463)2280 BC [BM-896: 1978 bc ± 60] has been obtained from a sample of charcoal from stratified deposits at Cerro Narrio. It was associated with a collapsed mudbrick building and fine pottery (cf. Collier and Murra 1943), and is seen as possible evidence for sedentary agricultural communities in the Paute and Cañar basins of Ecuador in the third millennium BC (Hammond and Bruhns 1987). Given the similarity between this date and the earliest of the two from Pandanche (Kaulicke 1981), Pandanche A phase similarities with Ecuadorian Early Formative cultures may well represent contact or influence which took place in or across highland valleys in northern Peru and southern Ecuador, and may not indicate direct interaction between the Peruvian highlands and the Ecuadorian coast.

Early Formative ceramics are also present on the central and north-central coast of Peru, between Lima and Las Haldas. However, north coast pottery may not predate 1900 BC, and Lanning (1967:84) suggested a date of 1700-1600 BC (1400-1500 bc) -- contemporaneous with the Valdivia/Machalilla transition -- for the earliest pottery on the south coast. The relatively late date of ceramic technology on the north coast remains puzzling, given the early dates for pottery in the northern highlands, the early Ecuadorian dates and the presence at Huaca Prieta of carved gourds with distinctly Valdivia motifs (Lathrap, Collier, and Chandra 1975: Fig.16), and suggests that mechanisms for the introduction of ceramic technology were not strictly linked to geography. The earliest Initial Period pottery on the coast appears as largely undecorated neckless jars (elongated, rather than <u>tecomate</u>-shaped) --distinctly different from the necked jars and carinated bowls of late Valdivia and Machalilla. In the Virú Valley, early decoration on Guañape ceramics consists of appliquéd "ribs" or strips of clay with finger-punching or short incisions, modelling, and some zoned punctation near vessel rims (Strong and Evans 1952). While the former is very similar to decorations on Kaulicke's Pandanche ceramics, only the latter bears vague relationships with Ecuadorian techniques, and the similarity is probably coincidental.

In the highlands, the earliest ceramics are known from the Kotosh Waira-jirca phase at the site of Kotosh. Waira-jirca has five associated radiocarbon dates on charcoal from construction fill, ranging from 2490(2210)1890 BC [Gak-262: 1850 bc ± 110] to 1431(1200)937 BC [TK-108: 1050 bc ± 80], but has been tentatively placed at 1700-1100 BC (1500-1000 bc; Izumi and Terada 1972:307). Recent excavations have defined roughly contemporaneous phases at the sites of La Pampa (Terada 1979) and Huacaloma (Terada and Onuki 1982), both in the northern highlands. The earliest ceramics at the latter site, from the Early Huacaloma phase, are dated by three assays on aggregate samples of charcoal: 1492(1348)1054 BC [TK-341a: 1130 bc ± 70], 1291(973)800 BC [TK-409: 890 bc ± 90], and 1450(831)214 BC [TK-341b: 770 bc ± 240], the last of which was calculated on alkalai-soluble components of the first sample (Ibid.:258). At all of these sites, the earliest ceramics are large tecomates, short-necked jars, and carinated bowls. In Waira-jirca, decorative techniques include incision, punctation, burnishing, and plain rocker-stamping. The most distinctive type of decoration for this phase consists of a highly stylized geometric zoning, infilled with fine cross hatchure. While this type of decoration seems directly ancestral to zoned decoration in Chavín ceramics, its sources of origin are unclear. It is possible that it is related to early zoned decoration in northern Colombia, but distance and distinct differences in vessel types suggest that the two areas are not directly related. At La Pampa and Huacaloma, early decoration includes appliqué fillets and ribs, suggesting possible relations with the ceramics of Las Haldas and Guañape (Terada 1979:176).

A ceramic complex which shows a large degree of similarity to Waira-jirca is from the Early Tutishcayno phase at the site of Yarinacocha, at the western edge of the Amazonian Basin. Connections between the two included zoned hatchure with after-firing pigments, carinated bowls, double-spouted jars with a bridged handle, the use of close-hatched lines, and decorated expanded rims (Izumi and Terada 1972:307). Despite the absence of dates for the early lowland complex, Lathrap believes that "decorated Waira-jirca vessels derive from a ceramic tradition much like and very closely related to Early Tutishcayno, a

Tropical Forest ceramic tradition" (1970:107). Lathrap also suggests that Late Tutishcayno is related to Machalilla on the basis of a predominance of carinated bowls in both complexes (1963:239, 1970:92). The grounds for this argument are the same as those presented by Foster and Lathrap (1973) for a far earlier dating of Momil, namely that there was a widespread carinated bowl tradition associated with a Tropical Forest culture of root-crop agriculture. However, recent documentation of maize cultivation during the Machalilla period (Lippi, Bird, and Stemper 1984) indicate that, if a carinated bowl tradition did spread outward from the Amazon lowlands, it did so independent of a particular agricultural orientation.

On the basis of chronology, vessel form, and decoration, it appears that the emergence of ceramic traditions in North Highland Peru may have been closely related to Ecuadorian styles. However, given our current dearth of knowledge of relevant geographic areas, it is unclear whether Peruvian ceramics are directly related to late Valdivia/Machalilla traditions or were more closely related to as yet poorly understood complexes in the Ecuadorian highlands. Vessel forms and decorative traditions of early pottery on the Peruvian coast -- which may have evolved from highland traditions -- appear to have been even farther removed from stylistic development either on the Ecuadorian coast or in northern Colombia. While general similarities are present, important differences cannot be overlooked. Large, elongated, incurving-rim bowls and <u>tecomates</u> have no good precedents in the Ecuadorian sequence, and both forms might easily have been derived from gourds or basketry used by a long tradition of preceramic cultures on the Peruvian coast. A direct diffusion of styles from the coastal lagoons of northern Colombia seems improbable, and it is likely that the repertoire of Peruvian ceramic decoration developed independently of any Intermediate Area style. The only exception to this might be the stirrup-spout jar. This distinct form probably has only one source of origin in South America. Unfortunately, the chronology of the Machalilla phase is not clear enough for us to assign it certain priority.

<u>The Central American Sphere</u>

Two dates are available for the Tronadora Complex: 2470(2170)1830 BC [Tx-5277: 1780 bc ± 100] and 2860(1820)1000 BC [Tx-5279: 1530 bc ± 320], making its appearance slightly earlier than Barra and contemporaneous with Swasey in the north and Monagrillo, Barlovento, Canapote, and the last phase of Valdivia to the south. As noted in the detailed discussion of Tronadora ceramics above, of all of these phases, the complex's closest stylistic ties are with the northern Early Formative assemblages. However, the diagnostic characteristics of Tronadora and related Costa Rican complexes indicate that it represents a distinct and independent sphere of vessel forms and decorations which may extend northward into Nicaragua and possibly Honduras. There are strong similarities between Tronadora pottery and a small sample comprising the Dinarte phase from Ometepe Island in Lake Nicaragua (Haberland 1966), and Haberland (personal communication, 1985) finds it likely that the two complexes are one and the same. Dinarte was initially estimated to date to around 1700 BC (1500 bc), and both Tronadora and Dinarte have been identified by Joesink-Mandeville (1985) as possibly related to Yarumela I. Schettel Incised, an early type whose distribution includes Pacific Guanacaste and Rivas (Healy 1980: 226), may also represent part of this sphere.

The specific similarities between Tronadora and its contemporaneous phases in Pacific Chiapas and Guatemala (i.e. Barra through the Jocotal and Conchas phases) include red-rimmed tecomates and outflaring-wall bowls, the use of round-bottomed incision executed when the paste was relatively hard, grooved rims, punctation, and dentate rocker-stamping. This latter feature is reportedly absent in Barra, and may not appear until after 1500 BC. A congruence is most readily apparent when Ocós and Tronadora sherds are compared side by side, particularly with respect to characteristics such as texture, red pigment on thickened rims, rocker-stamping, and grooving (including lip-grooving). However, there are distinct differences between the two complexes as well. Ocós tecomates are sharply incurving and typically have tapered rims. A handful of these were found in the lowest levels (Unit 64) at Tronadora Vieja. However, more typically Costa Rican examples are either heavily bolstered on the exterior or comma-shaped. Snarskis (1984:206) notes that comma-shaped rims are more typical of later Conchas than Ocós, and these may in fact represent ceramics from the middle and late portions of the Tronadora Phase. Tall, shell-stamped cylindrical vessels such as those of Tronadora, La Montaña, and Dinarte are not typical of Barra and Ocós, and are of unknown derivation. MacNeish et al. (1970:Fig.27) illustrate a rocker-dentate sherd from Late Ajalpan (ca. 1400-900 BC) contexts which is very similar to Costa Rican examples. However, it is identified as a trade sherd from Trapiche I in Veracruz! Cylindrical vessels of similar shape have been noted in Zoned Bichrome contexts in Costa Rica (Hartman 1907:Pl. II:1) and in Chiriquí (MacCurdy 1911:Pls. XXVIa and XXVIe -- the latter of which had apparent textile impressions), but appear to have been associated with later contexts. Perhaps the greatest difference between the Costa Rican and Chiapan ceramic traditions is the complete absence in the former of the rich figurine assemblages associated with Barra, Locona, Ocós, and later complexes. Solid figurines are unknown in any of the early Costa Rican assemblages, and hollow figurines do not appear until around the middle of the Zoned Bichrome Period (ca. 300 BC).

While both the dating and comparisons of Tronadora and related complexes are in need of further investigation, it is clear from the evidence assembled to date that Tronadora, Dinarte, Chaparrón, and La Montaña ceramics represent an important regional tradition of some antiquity which was not strongly influenced by cultures to the north or south. While Tronadora and Chaparrón especially are more similar to Mesoamerican complexes than to any early complexes from Panama, they are also significantly distinct. La Montaña, with less of an emphasis on _tecomate_ forms and red zoning, may be remotely related to Sarigua in Panama. The presence of _budare_ fragments in La Montaña suggests a root-crop orientation, which Snarskis believes may be evidence of a South American-derived subsistence tradition (1984:204). However, _budares_ are unknown in Panama, and suggest a possibly distant relationship with Barlovento or Malambo in Colombia.

Without more secure dating, it is difficult to say which appeared first, Barra or Tronadora. While some might find it tempting to trace "stylistic influence" moving from south to north, this is a specious argument. Given the comparable dates between Pox, Purrón, and Monagrillo, there was plenty of time for a northern decorative tradition to appear, independent of Costa Rican, Panamanian, Colombian, or Ecuadorian influence. Swasey may prove to be just such a case of independent generation. Looking at the distribution of vessel forms, we might even attribute an emphasis on the "pumpkin-shaped" tecomate form to the northern Mesoamerican interaction sphere, given its historical precedence there.

A second tradition within the Central American Early Formative interaction sphere may be represented by the earliest ceramics at the site of Yarumela in central Honduras. Canby's (1949) initial report describes a complex of shallow bowls and griddle-like plates, which Lowe (1978: 362) believes might be indicative of a root-crop subsistence pattern with its origins in lower Central America. In recent excavations at the site, Joesink-Mandeville (personal communication, 1985) has begun to define a ceramic complex characterized by unslipped ceramics decorated with appliqué fillets and impressed strips. This pottery seems very different from any other Early Formative styles of the region. It may prove to be distantly related to the unusual red-painted strip appliqué on Tronadora ceramics (Tajo Gouge-Incised), but appears to be restricted to unslipped, monochrome vessels. Yarumela I ceramics (Canby 1949) are very different from Early Formative pottery to either the north of south, and are probably best understood as an independent, local tradition. Until further data is available, interpretations of the age, geographical extent, or origins of this tradition are highly speculative. The roots of the Siteoid tradition on the Caribbean coast of Nicaragua (Magnus 1975, 1976) are also poorly known. Although they are attributed to a possible migration from Venezuela around the time of Christ, an alternative interpretation is that they also developed from an unknown local expression of a widespread Early Formative substrate of ceramic-producing cultures.

Conclusion

As close examination reveals, the earliest ceramics in Nuclear America are characterized by regionalized diversity in form, decoration, and manufacturing techniques, probably from their very inception. It seems likely that there is in fact no linear relationship between the earliest known pottery in northern Colombia and coastal Ecuador, but that both emerged from an even earlier knowledge of fired-clay technology, possibly expressed in an initial low-fired ceramic technology which has not been preserved. There appears to have been a significant division between the well-developed necked-jar tradition throughout the Valdivia sequence and the neckless bowl tradition in northern Colombia. This division is emphasized by characteristics such as the thick, red slip which appears in a highly-sophisticated form as early as Valdivia II and is completely absent from early Colombian complexes.

Similarly, there is no evidence of a strong connection between Valdivia and Monagrillo, the latter of which may now be dated as early as 3200 BC. While curvilinear incisions appear on a small percentage of Monagrillo ceramics (ca. 1% of the total assemblage; Willey and McGimsey

1954:50), their style and execution is relatively unique, and not directly related to that of either Colombia or Ecuador. The technical quality of Monagrillo ceramics is nowhere near that of Valdivia pottery, and distinctive necked jar forms are not present. Further differences are found between Monagrillo ceramics and early Colombian pottery. While coastal shellmound subsistence orientations are common to both Parita Bay and the Colombian coast, fiber-tempered pottery and large vessels decorated with exuberant excision such as those common to Monsú and Puerto Hormiga do not have major counterparts in Panama. It is possible that the incised Monagrillo designs were originally inspired by traditions across the isthmus in Colombia, but it is apparent that they were at best half-hearted imitations made by a culture of a somewhat different ilk.

After 2500 BC, there is a great increase in the number of identified Early Formative ceramic complexes, both in Mesoamerica and the Central Andes. While most of these drew a general inspiration from earlier ceramics in the Intermediate Area, discernable differences between the several regionalized interaction spheres suggest a process of multilinear evolution throughout Nuclear America during this time period. Ecuador remains prominent in terms of stylistic and formal innovation, but it is difficult to trace the effects of developments such as Machalilla phase carinated bowls or stirrup-spouts as coherent complexes of traits on any other areas. This is complicated by the fact that phases such as Machalilla and Chorerra are still poorly dated, making difficult cross-dating between regions on the basis of ceramic styles.

A point which merits emphasis in any discussion of Early Formative ceramics is the fact that ceramic technology itself, and possibly decorative modal complexes as well, do not always have a strong correlation with other aspects of cultural adaptation. There is an increasing body of evidence to suggest that a number of preceramic populations were familiar with agriculture, possibly even maize agriculture, and that several early ceramic-using cultures made very little use of agriculture. In regions such as central Panama and the coast of Peru, the introduction of ceramics had no apparent effect on either settlement or subsistence patterns. The fact that ceramics are not a requisite component of highly complex (perhaps approaching chiefdom-level) societies is readily apparent at sites such as El Paraiso, on the central coast of Peru. Likewise, the presence of highly sophisticated ceramic technologies does not guarantee the emergence of even low-level chiefdoms, as indicated on the Ecuadorian coast.

An examination of the range of earliest Formative ceramics indicates that cultural development was far from uniform across Nuclear America between 4600-1000 BC. While the Intermediate Area was clearly precocious in the development of decorated ceramic complexes, it is still unclear whether this also represented priority in cultural adaptations which made possible the evolution of New World civilizations. Before this problem can be properly addressed, it is necessary to improve our data base concerning specific regional chronologies as well as the processes involved in the development of specific subsistence and settlement strategies and accompanying socio-political adaptations.

The earliest ceramics in Costa Rica play an important role in the above model for Early Formative cultural geography in the New World. The discovery of early ceramic-producing cultures on the Pacific coasts of Chiapas and Guatemala, Panama, and Ecuador just thirty years ago prompted a great deal of speculation as to how ceramic technology and "Formative" culture might have spread across large geographical regions within what was seen as a relatively short period of time. The absence of information for early cultures in intervening regions along the Central American isthmus made for a number of elaborate, yet, in retrospect, somewhat simplistic explanations. Long-distance diffusion, naturally invoking coastwise travel, was frequently cited. Our improved understanding of absolute chronology and the amount of detail which has come to light for an increasing number of local phases is helping to paint a more complicated, but probably more realistic picture of cultural development in the New World. If anything, the evidence indicates that a clear understanding of the nature of cultural processes affecting cultural development will only be achieved through detailed investigations of highly circumscribed regions.

The dating and unique regional expression of the Tronadora Phase reveals the true complexity of the Early Formative stage. If local variation can be detected even within the small confines of Costa Rican geography, there was probably an even greater degree of contemporaneous regionalization throughout Central America, Mesoamerica, and South America. It is likely that the variety in ceramic stylistic traditions was also echoed in subsistence strategies and settlement patterns. Rather than emerging simultaneously from some kind of uniform cultural substrate, the earliest sedentary ceramic-producing villages seem to have appeared over a period of at least 2000 years in response to a variety of local situations. The varied expression of these numerous traditions emphasizes the importance of multilinear adaptations to cultural geography. There was undoubtably a great variety in types of early societies, and the degree to which these remained relatively autonomous through later periods played a significant role in the definition of regional identity and the nature of interregional contacts throughout the occupational sequence. Although ceramics alone remain skimpy evidence, it becomes clear that the types of societies which produced dynamic, centralized societies may have been fundamentally different from those which remained relatively stable and decentralized from their inception. If we acknowledge that their origins were separate and distinct, it becomes difficult to explain societies of the Intermediate Area as "arrested" or "retarded" stages of civilizations to the north and south. Rather, they are characterized by alternative strategies from their inception, and by contrast may shed further light on the processes responsible for the emergence of New World civilizations.

CHAPTER NINE
Conclusions

From the its earliest appearance, the pottery of the Arenal area is distinguished by a mixture of stylistic characteristics which have important continuities in both Greater Nicoya and Atlantic Watershed traditions, and which suggest generic relationships with pottery traditions much farther afield. Ceramic styles reflect a combination of shifting cultural affinities and strong local traditions, suggesting that the region has had an important character of its own for several thousand years in spite of occasional contact and influence from other regions. Local populations and cultural traditions appear to have been largely autochthonous and of significant antiquity.

Both the temporal depth of the ceramic sequence and the nature of ceramic styles have important implications for the interpretation of both Costa Rican and wider Central American culture history. They argue strongly that the prehistory of Costa Rica, and of the Intermediate Area in general, cannot be readily explained in terms of migrations or "waves of influence" from either Mesoamerica or South America, or as the reactions of a "periphery" to a "core," but that this part of Nuclear America was home to an enormous variety of local cultures from a very early date which no doubt played important roles in the development and transmission of technologies and traditions throughout this part of the New World. Costa Rican prehistory also argues against a unilinear diffusion of "Formative" culture from north to south or vice versa. Instead, subsistence and settlement strategies, and accompanying technologies and stylistic traditions, appear to have developed at varying rates in a variety of regions in Costa Rica, the Intermediate Area, and Nuclear America as a whole, creating a complex latticework of communication and interaction whose characteristics are best revealed through a detailed and systematic investigation of the wide range of variation in regional sequences.

Snarskis' definition of the La Montaña and Chaparrón ceramic complexes (1978) laid the groundwork for our understanding of the Early and Middle Formative periods in eastern Costa Rica. However, Lange, in his most recent summary of Greater Nicoya archaeology (1984b:169) noted that "There are no known sites in Greater Nicoya dating from Period III (Ca. 4000-1000 B.C.)." Happily, this situation has now changed. The Proyecto Prehistórico Arenal has provided us with fragmentary but valuable information concerning this very period, with new data on early sedentism, agriculture, and ceramic technology in western Guanacaste. The new data has permitted us to formulate a more comprehensive picture of Archaic, Early Formative, and Zoned Bichrome period societies in Costa Rica, and to revise our interpretations of social process and culture history in the Intermediate Area and in Nuclear America as a whole.

Early Subsistence and Sedentism in Lower Central America

Although many of the early models for early sedentary societies in the Intermediate Area emphasized the importance of coastal and estuarine environments, there is increasing evidence that inland regions may have played a very significant role in the processes responsible for the origins of village life and incipient agriculture. The appearance of virtually all of the earliest ceramic complexes in Costa Rica in inland, intermontane valleys emphasizes this pattern.

While it is true that settlement and subsistence data for early societies in Costa Rica are extremely limited, it is clear that there may be a significant antiquity to the occupation of fertile, volcanic soils well inland by sedentary populations. The fact that the initial appearance of ceramics and cultigens at early sites is not accompanied by noticeable changes in settlement pattern for thousands of years suggests that subsistence patterns were characterized more by long-term stability than by dramatic changes. This pattern does not suggest the introduction of new domesticates in the context of a predominantly agricultural economy by expanding Formative populations from either the north or the south. Instead, Early Formative Isthmian populations may have been experimenting with early forms of cultigens such as maize in the context of an existing mixed economy of garden-plot cultivation, arboriculture, and hunting -- a lifestyle which persisted throughout much of prehistory in Costa Rica.

This pattern emphasizes the presence of early populations in inland valleys and implies that they must have played an important role in the emergence of Formative patterns. I agree with Cooke, who remarks:

> "What future investigations must clarify is whether marine resources were the <u>sine qua non</u> of early developments in Parita Bay or a vital adjunct to a primarily agricultural, and even maize-using, settlement pattern centered on the piedmont and coastal plains, which is considerably older than much of what the existing field data suggest (1984:283)

Inland regions should be considered as important loci for the development of cultigens such as Pollo, or Pollo-like races of maize, which appear to be adapted to cool and wet environments such as are found in higher, inland valleys of the Isthmian region (Galinat 1980). The possiblility that Formative technologies, such as pottery manufacture and maize agriculture, may well have appeared on the coast only <u>after</u> their development in inland regions merits further consideration.

Recent investigations in Ecuador have yielded substantial data on Valdivia period occupations away from the coast. Since the initial research on the Valdivia culture by Meggers, Evans, and Estrada in the late 1950's, a large number of inland Valdivia period sites have been identified. The best documented of these are Real Alto, (Marcos et al. 1976, Lathrap et al. 1977) and Loma Alta (Norton 1971, Damp 1984, Raymond 1985). An important characteristic of each of these sites is a subsistence pattern oriented towards inland, rather than coastal resources. Zevallos (1971), Pearsall (1978), and Damp (1981), among others, have marshalled a considerable body of data from macrobotanical remains and phytoliths which strongly suggests the presence of maize and beans at some Valdivia sites. Raymond (1985) reports that preliminary analyses of marine fauna indicate the presence of estuarine fish, shallow and deep water fish, and shellfish at Loma Alta. However, he also notes the remains of mammals such as tapir, white-tailed deer, peccary, armadillo, and rabbit associated with the early Valdivia occupation, and concludes that Loma Alta did not have a primarily maritime economic focus. Of nine Valdivia period sites in the Valdivia Valley, only Loma Alta, situated at a location near prime agricultural land, and the Valdivia type site have Valdivia I-II occupations. Of these two, Loma Alta appears to have been the principal settlement. If we accept the early dates for Valdivia I ceramics at Loma Alta, the earliest ceramics in Ecuador may well have been associated with a sedentary, inland economy, rather than one heavily dependent upon marine resources. This is in direct contrast to the shellmounds of Monsú and Puerto Homiga in Colombia (where, admittedly, far less regionally-oriented research has been conducted), suggesting that the correlation between the earliest appearance of ceramics and a particular subsistence adaptation may be relatively weak.

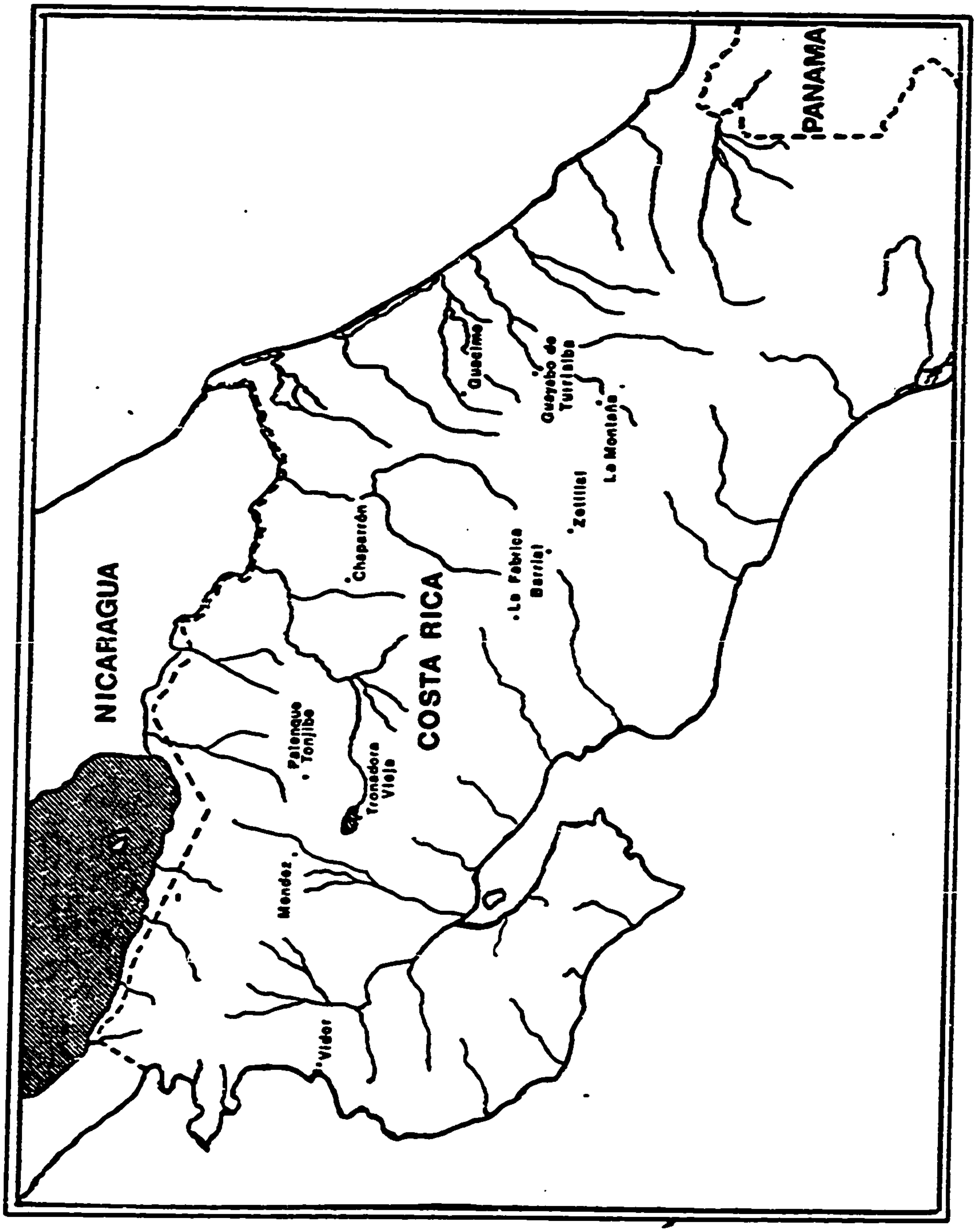


Fig. 9.1: Sites in Costa Rica with early ceramics.

In Costa Rica, the inland valleys of the northwestern cordillera, central highlands, and northern llanuras may have had a head start over coastal regions with regard to the appearance of sedentism and ceramic technology (Fig. 9.1). Sherds related to Chaparrón and La Montaña have been reported from "Guácimo, Línea Vieja, Guayabo de Turrialba, Tatisco, near Cartago, Pavas, Barrial de Heredia, and four other sites within 30 kilometers of Chaparrón in San Carlos" (Snarskis 1984:206). Similar materials have also appeared in the inland Terraba/Coto Brus Valley in the Diquís region of southwestern Costa Rica (Corrales 1985). With the exception of a few sherds from Loma B levels at the Vidor Site (Lange, personal communication 1985), no Early Formative ceramic complex has been clearly defined in western Guanacaste.

There is increasing evidence from the Isthmian region that maritime adaptations were but one facet of early subsistence patterns, hinting at the existence of a significant inland population which may have played an active role in the development of early subsistence technology. In Panama, the earliest dates for Monagrillo pottery do not come from coastal shellmounds, but from the Cueva de los Ladrones rockshelter approximately 25 km inland (Cooke 1984:277). Although no dates are yet available from this site, early Monagrillo pottery has also been found at the Carabalí Rockshelter, over 100 km inland from Parita

Bay (Valerio 1985; Cooke, personal communication 1986). Phytolith evidence from the Aguadulce Rockshelter, 18 km inland (although the shoreline was somewhat closer in prehistoric times), suggests that Monagrillo peoples were cultivating maize prior to 1500 BC (Cooke 1984:277). However, the appearance of maize and ceramics on the coast, where preceramic patterns of shellfish exploitation date to 6000 BC, is not accompanied by a major change in settlement patterns or population size. Monagrillo sites include both shellmounds and rockshelters, and in each ceramic levels are often found superimposed on Preceramic ones. The occurrence of Monagrillo ceramics at inland rockshelters, where species such as white-tailed deer dominated the faunal assemblages (Ranere and Hansell 1978:52), suggests that hunting was as important a supplement to incipient agriculture as the exploitation of coastal resources.

In Mesoamerica, the Barra and Ocós complexes were both initially defined at coastal shell middens. However, sites dating to these and the intermediate Locona phase have now been reported near inland marshes and <u>bajos</u> (Clark et al. 1987). Shellfishing was the apparent subsistence base at La Victoria (Coe 1961:114), but recent investigations have revealed charred macrobotanical remains of corn and beans in Locona and Ocós times (Clark et al. 1987:6). For both the earliest Chiapan cultures, like those of inland Costa Rica, subsistence economies appear to have been mixed, and populations probably relied upon a versatile combination of garden-plot agriculture, tree-cropping, gathering, hunting, and fishing.

Sanders, in his introduction to Stark and Voorhies' (1978) volume on coastal adaptations, remarks that available data do not support the notion that coastal dwellers invented agriculture as a result of population growth and pressure. Instead, he believes that much of the early coastal sedentism was "underwritten" by agricultural surpluses produced by inland groups. Intuitively, conditions which promoted experimentation with early cultigens, such as familiarity with a wide range of plant resources and seasonal variablility in gathered foodstuffs, were more likely to have prevailed in inland areas than on the coast.

Given the antiquity and success of maritime exploitation on Parita Bay, the addition of maize to the diet appears more as an afterthought to the local economy than a critical new development. The appearance of maize and pottery in central Panama does not appear to herald the arrival of rapidly expanding Formative populations or radically new subsistence technologies. Monagrillo ground stone tools show a continuity of Preceramic styles, including a variety of plant processing equipment. Settlement patterns change slowly, and there is no good evidence for population increase and agricultural villages in alluvial floodplains and highland valleys in central Panama until

300 BC. As Cooke remarks:

> ...if the Monagrillo pottery was being made as far back as 3000 BC... fully sedentary villages employing the entire range of sixteenth-century cultigens might not have been developed until as many as 3000 years after clay utensils began to be used along the Parita Bay littoral" (Cooke 1984:272).

In Costa Rica, the patterns of early sedentism, agriculture, and ceramics are very different from those of Panama. In a pattern markedly distinct from that in central Panama, shellfishing and other distinctly coastal adaptations are not apparent in northwestern Costa Rica until the Early Polychrome period (Lange 1978), suggesting that the first sedentary communities in Costa Rica had inland-oriented economies. Evidence for Early Formative maritime adaptations has not been identified on either the Pacific or the Caribbean coasts. So far, the oldest radiocarbon dates for ceramics suggest that Tronadora Vieja ceramics are approximately contemporaneous with Mesoamerican complexes such as Barra and Swasey. While subsistence data from the site is admittedly limited, maize phytoliths, pollen, and the charred remains of maize kernels suggest an incipient agricultural economy during the Tronadora Phase.

Elsewhere in Costa Rica, the presence of flat <u>budare</u> fragments with raised rims in the La Montaña complex has been tentatively interpreted as evidence for the processing of bitter manioc (Snarskis 1984:204). Acuña (1985) has even suggested that assemblages of microlithic artifacts from the Turrialba Valley represent "grater chips" -- small sharpened stones used to stud manioc processing equipment. However, no evidence of budare fragments has been found at Tronadora Vieja, and no grater chips have been identified from the site. Snarskis (Ibid.) theorized that La Montaña represented the last vestiges of a root crop economy which had preceded that of maize. It now seems likely that both maize and manioc were under cultivation at the same time in different parts of Costa Rica, indicating the simultaneous presence of cultures with distinct regional adaptations during the Early Formative period.

Site distribution suggests that the pattern of subsistence adaptations in Greater Nicoya may have been very different from that defined so far for central Panama. Radiocarbon dates for ceramics are fully a thousand years earlier in the Cordillera of western Guanacaste than they are on the coast. Moreover, shellfishing is distinctly absent from coastal sites in Guanacaste until around AD 500. As Lange remarks, "The earliest currently known occupations appear to have been based on procurement activities that excluded collection of mollusks, a subsistence practice that emerged slowly over time as populations increased (Lange 1978:107). The pattern is similar in western Nicaragua, where the earliest pottery (also similar to Tronadora) appears on islands in Lake Nicaragua rather than on the Pacific Coast (Haberland 1966).

Period IV, which corresponds to the Zoned Bichrome Period in Costa Rica (Stone 1984), has been defined as beginning with the "sedentary farming threshold" and ending with "full-fledged Formative communities" and "the rise of ranked societies" (Ibid.:Fig. 1.2). It dates to approximately 1000 BC to AD 500, and is represented by the Late Tronadora Phase through the end of the Late Arenal Phase in the Arenal basin. While our information for the beginning of the Arenal Phase indicates that sedentary villages which were utilizing cultigens such as maize dated approximately 1000 years earlier than the suggested beginning of Period IV, the transition from what were probably small, scattered hamlets to large villages occurred sometime during the time period in question. Period IV saw the emergence of recurring assemblages of characteristic "Zoned Bichrome" ceramic types across Greater Nicoya, the appearance of a specific iconography in decorative traditions of pottery and stone, apparent long-distance exchange of exotic materials and artifacts, complex belief and ritual systems associated with death and burial, and the manufacture of "elite" artifacts of ceramics, ground stone, and jade. The evidence for centralized political systems and patterns of social organization at the level of "chiefdoms" -- characterized by evidence for centralized political authority and hierarchical settlement patterns (Peebles and Kus 1977) -- is extremely limited. However, the Zoned Bichrome Period does appear to have seen the emergence of social rank and the development of regional inter-community interaction. The patterns of social complexity which appeared at this time had a distinctly regional character, and helped to define the cultural landscape of Greater Nicoya as a distinct culture area in lower Central America.

Due primarily to the limited evidence, the nature of subsistence adaptations and the role of agriculture in the Zoned Bicrome period remains a heavily debated topic. Milling bins in volcanic bedrock and associated mullers suggested to Lange that wild nuts were an important component of the diet in the San Dimâs region (1971:265), but he notes a significant shift to the exploitation of marine resources at the end of the period (1984:173). In Pacific Nicaragua, Healy sees populations were reliant upon subsistence farming complemented with fishing, hunting, and other gathering practices (1980:332). Stone believes that Zoned Bichrome agriculture "was probably limited to root crops" (1977:30). However, macrobotanical evidence of maize was associated with Tronadora Phase remains at Tronadora Vieja, indicates that this crop may have been known and cultivated in the Cordillera region at a very early date, and did not appear as a late addition to an earlier root crop tradition sometime during the Zone Bichrome period. Charred maize kernels found with Arenal Phase ceramics at Sitio Bolívar, along with a large collection of metates and manos (Chenault n.d.). leave little doubt that maize was cultivated during the Zoned Bichrome period in the upland valleys of eastern Guanacaste. However, the relative importance of maize in the diet remains unclear. As noted above, although maize appears at an early date, it appears to have been accompanied by relatively few changes in site location. In a pattern distinctly different from that in Mesoamerica and the Central Andes, maize never played a very important role in the iconography of Greater Nicoya. While there is a vivid tradition of naturalistic anthropomorphic and zoomorphic motifs, maize (or any phytomorphic) symbolism has not been identified in ground stone, ceramic, or jade artifacts from the Zoned Bichrome period. Evidence for the symbolic importance of maize may exist in the elaborately carved metates and manos which appear in Greater Nicoya at this time (Mason 1954, Graham 1981). However, Lange has suggested that the metates were actually ceremonial thrones, downplaying their possible association with maize rituals (1984:175).

For the Atlantic Watersherd region, Snarskis (1984: 218) has suggested that jade and the "axe-god cult" in particular were introduced to eastern Costa Rica by Olmec from Mesoamerica, who also brought knowledge of maize cultivation. He bases this interpretation on evidence for rectangular house construction -- believed to represent an important change from "South American" round house forms -- during the early El Bosque phase (ca. AD 0-500, or possibly in the early centuries BC). However, our present understanding of Costa Rican and Olmec chronology does not support this model. Evidence from Tronadora Vieja suggests that maize was known in the Arenal area several hundred years prior to the earliest dated jade artifacts in the Atlantic Watershed. The remains of a small, circular dwelling at Tronadora Vieja are also inconsistent with Snarskis' model.

To date, there is no good evidence for significant population movement into northern Costa Rica from Mesoamerica during the Early Formative period, and early ceramics do not reflect especially close ties between eastern Guanacaste and centers of "Olmec" culture. The apparent continuity in the occupation of sites such as Tronadora Vieja from the Archaic through the Early Formative periods suggests that new cultigens were adopted by existing populations. Our data for earlier, Fortuna Phase settlement patterns are very poor. However, Tronadora Phase sites are rare, and the superimposition of a Tronadora Phase occupation on Fortuna Phase levels at Tronadora Vieja suggests that the appearance of maize may not have been accompanied by radical changes in settlement patterns or population growth. It remains to be demonstrated for Greater Nicoya that there was any significant clustering of Zoned Bichrome sites on or near lands of high agricultural potential. While it is possible that evidence for agricutural intensification in the Arenal Basin has been submerged by Lake Arenal, there is no evidence to date from elsewhere in the region for canals, raised fields, or terraces. This negative evidence suggests that maize may have been cultivated as an adjunct to existing repertoires of wild or cultivated foods, and not as a crucial dietary staple.

The importance of maize may have been very different in the Atlantic Watershed and Central Highlands regions of Costa Rica, where there is good macrobotanical evidence for maize in El Bosque and Pavas phase contexts (Snarskis 1976:348), which are roughly contemporaneous with the Zoned Bichrome period in Greater Nicoya. Large and often elaborate metates are ubiquitous at El Bosque phase sites, as well as manos, pestles, and other ground stone tools. At the site of Barrial de Heredia, bottle-shaped storage pits associated with Pavas phase remains were found to contain thousands of carbonized maize kernels, cob fragments, carbonized remains of two varieties of Phaseolus vulgaris, and the charred remains of seeds (Ipomoea sp.) and nuts (Ibid.: 161).

It is fair to say that to date there is far better evidence for the importance of maize in early Atlantic contexts than in Greater Nicoya. There is also better evidence for maize cultivation at this time in the highlands of western Panama, where macrobotanical evidence includes a large number of cobs of a Pollo-like race of maize (Linares 1979:35). However, it should be noted that the significance of maize and other cultigens in prehistoric diet in the Arenal area was a key research concern from the inception of the Proyecto Prehistórico Arenal, and a great deal of effort was expended in an attempt to obtain samples of human bone for isotopic analysis in addition to macrobotanical remains, pollen, and phytoliths. Unfortunately, due to the poor preservation of human skeletal remains, we were unable to obtain any samples of human bone collagen dating earlier than the Silencio Phase (AD 600-1300). These samples were small, but suggest to Sheets (1984:212) that "maize clearly was a minor fraction of the diet" of the individuals tested from the El Silencio cemetery.

As with the Atlantic Watershed and regions of central Costa Rica, no faunal remains were preserved in the wet, tropical environments of sites in the Arenal area. Unfortunately, there is also very little in the way of lithic, bone, or shell artifacts to provide much information on hunting or fishing. This is not the case on the Pacific coast, where Zoned Bichrome subsistence patterns show a shift towards intensive shellfishing in the Mata de Uva phase (ca. AD 300-600), which Lange believes was accompanied by population growth in coastal regions of Guanacaste and Rivas (1984:173).

Relatively little is known about village size or regional settlement patterns during the Zoned Bichrome Period. On the Pacific coast of Costa Rica, "Some of the population lived in permanent, year-round settlements, while others appear to have practiced a 'restricted wandering' pattern" (Lange 1984:173). A survey of the

Río Sapoá region near the Costa Rican-Nicaraguan border yielded only "small, single component sites" which "suggest dispersed settlements, possibly resulting from a subsistence pattern that was not conducive to clustered populations" (Lange 1971:253). Coastal villages are evidenced primarily by shell middens arranged loosely around open plaza areas (Lange 1984:173), and no real architectural remains have yet been identified in this region. The small remains of circular structures found at Sitio Bolívar are to date our only evidence for Zoned Bichrome period dwellings apart from occasional fragments of bajareque, or wattle-impressed clay. The evidence from Sitio Bolívar suggests that Tronadora Phase patterns of round house construction, probably of materials such as wattle-and-daub, were continued in the Late Arenal Phase. The high sherd density along the lakeshore at this site as well as the relatively short period of time (ca. 300 years) indicated by the major occupation of the site suggest a medium to large village (possibly 100-200 persons). However, given our poor data on the site size due to its partial inundation by Lake Arenal, these population estimates are purely speculative.

By comparison, in Atlantic Costa Rica, the earliest habitational remains date to the El Bosque phase (ca. AD 0-500) at the site of Severo Ledesma, where rounded river cobbles were used for the foundations of large, rectangular dwellings (Snarskis 1978, 1984b). The use of large stones and river cobbles in house or mortuary construction appears to be an important characteristic of late Period IV society in both the Atlantic Watershed and the Cordillera regions of Costa Rica, and Snarskis believes there are strong similarities between the Severo Ledesma dwellings and the features excavated by Ryder (1982-83a) at Sitio El Carmen. However, our relatively limited data suggests that patterns of house construction in the two areas may have been very distinct.

Early Social Complexity in Greater Nicoya

To date, discussion of sociopolitical organization during the Zoned Bichrome Period has been largely limited to speculations in excavation reports and summary articles. Among those who have addressed the topic, Stone (1977) envisions a series of local chiefdoms emerging in northwestern Costa Rica early in this period. With reference to a broader region, Willey places the emergence of chiefdom-type societies in the early centuries AD, and writes that, "Certainly by A.D. 500, or the close of this period, this type of society was characteristic of much of lower Central America" (1984:362).

The strongest evidence for developing complexity in sociopolitical organization during the Zoned Bichrome period has been the appearance of elaborate jades, carved metates, mace heads, and fine ceramics in burials. The level of workmanship demonstrated by many of these items has led to speculation about craft specialization in the service of an elite group who owned and used luxury items. Lange has interpreted graves containing fine ceramics, ornamental metates, and jades as reflecting "stratification," defined by Fried (1967) as institutionalized differential access to basic subsistence resources, and concludes that, "The social stratification reflected in the mortuary patterns indicates that at least low-level chiefdoms had evolved at this time" (1984:173). The fancy metates have been interpreted as "ceremonial stools, thrones, seats, or 'seats of power,' rather than utilitarian items", largely on the basis of ceramic figurines depicting persons seated on metates and the fact that decorated manos in burials are rarely found together with manos (Lange 1984:175). Maceheads are interpreted to be symbols of rank, clans, or status, and Lange sees the recurrence of macehead styles over much of Costa Rica as indicative of "social and hereditary ties among geographically dispersed upper classes" (1984:176).

The bulk of our information on social rank during the Zoned Bichrome period in Greater Nicoya comes from mortuary features and assemblages. The forms of burials range from small cemeteries within the "plazas" between shell middens at coastal sites (Lange 1984:173) to the stone mounds noted in the Cordillera de Guancaste, and it is clear that different mortuary traditions existed in separated parts of the region. Ryder (1982-83a:114) cites evidence of "cemeteries marked by basalt pillar tombs" which ring the Bay of

Culebra on the Pacific coast; however, none of these have yet been tested through controlled excavation. The stone burial mounds, as noted in Chapter Four, are somewhat better known. Local informants report finding jades, ornamental metates, and painted ceramics in association with burials in the mounds (Ryder 1982-83a:114). However, stone mounds which have been excavated have been found to contain no grave goods other than painted ceramic vessels. While the size and effort involved in the construction of these mounds certainly indicates the expenditure of a great deal of energy, there is as yet no evidence that any of these mounds was constructed around or intended for the use of a single individual. On the contrary, they appear to have been repositories for large numbers of individuals. Ryder estimates that one mound at the site of Guayabo de Bagaces was built in a single effort and may have contained as many as 100 separate tombs. He concludes:

> ... the society responsible for building the burial mounds was capable of mounting an extensive time, resource, and energy consuming effort, possibly directed by an individual or group of special stat-us... the existence of the mounds and the <u>possibility</u> of marked differentiation in the presence and quality of the associated grave goods, suggests the existence of a social hierarchy (1982-83b:126-27; emphasis mine).

However, excavation of another stone mound at Sitio Méndez in the Río Naranjo region revealed that its stone cap was actually a cluster of several tombs. Ten individual stone features within the mound cap were found to cover burial pits. However, the only artifact noted in any of the tombs was a single ceramic jar.

According to the excavator, "This construction feature suggests the mound was not the result of a single effort by organized labor, but probably a continuous, family or community effort as individuals were added to the cemetery throughout the occupation of the site" (Norr 1986:139).

The interpretation of the nature and social context of the construction of the two mounds varies greatly. The former model sees some degree of formal organization, which may have been orchestrated by a chiefly individual. However, the latter sees mound construction as a process of accretion, which may have taken place in the absence of a centralized authority. I believe that the latter is more in keeping with the apparent nature of the stone mortuary features at Sitio Bolívar, and I remain skeptical about the importance of centralized authority in Greater Nicoya during the zoned Bichrome period.

To date, there is no evidence for restricted access to <u>basic</u> resources along the lines of social classes in Zoned Bichrome times. "Elite" items may have been acquired by individuals through trade or warfare, and their appearance in a society does not necessarily imply centralized political control. Unfortunately, the vast majority of these objects have come from looted contexts. One exception is Las Huacas (Hartman 1907), where fifteen burials, several containing more than one individual, were all accompanied by elaborate metates and jades. This is in distinct contrast to the burials in stone mounds from central and eastern Guanacaste, which are distuinguished by special construction, but have been found to contain relatively little in terms of grave goods or "elite" items.

The evidence to either support or refute notions that the late Zoned Bichrome period in Greater Nicoya saw the emergence of elite social groups or chiefdoms remains limited and ambiguous. Specialized artifacts and "elite" mortuary features are principal characteristics of this period, and probably indicate the presence of some degree of social ranking. However, there is very little evidence for political centralization. To date, evidence for "chiefly" individuals, either in residences or burials, is absent from the archaeological record for the Zoned Bichrome period in Greater Nicoya. There is also little evidence for settlement hierarchy or social units which may have incorporated populations from more than one small village. Until better evidence is available, I feel that the identification of Zoned Bichrome societies as "chiefdoms" goes well beyond the present data. It is possible that northwestern Costa Rica may have been characterized by an alternative form of social organization at this time. One possibility is the "complex tribe" (Habicht-Mauche et al. 1987) -- an organization in which some "status" positions existed, but in which desicion-making was vested in corporate and/or lineage structures rather than centralized authority. Ethnographic parallels would include African societies which "lack centralized authority, administrative machinery, and constituted judicial institutions... and in which there are no sharp divisions of rank, status, or wealth" (Fortes and Evans-Pritchard 1940:5), of which the Nuer would be one example.

Nuer society is described by Evans-Pritchard as "acephalous", and is characterized by the "absence of centralized government and beaurocracy in the nation, in the tribe, and in tribal segments" (1940b:293). Authority is not vested in any individual, even at the village level. Disputes are resolved by a "leopard-skin chief," who can be asked to intervene in social confilicts but is not a true chief and has no real political authority. However, the Nuer carry on occasional trade with neighboring groups, exchanging ivory for iron tools and ornaments (Evans Pritchard 1940a:87). They were also capable of erecting significant religious monuments, such as a fifty to sixty foot high earth-fill pyramid surrounded by ivory tusks (Ibid.:Pl. XXV), under the direction of temporary leadership.

While there are many significant differences between the Nuer and Zoned Bichrome peoples of northwestern Costa Rica, I believe that further exploration of tribal models for early Costa Rican societies will prove more fruitful than their identification as incipient archaeological chiefdoms. Delineating the characteristics of complex tribes in the archaeological record and defining their role in sociopolitical processes of prehistoric Lower Central America will be an important task for future research.

Ceramic Chronology and Culture History

The Arenal area was one of a range of environmental niches in Costa Rica whose cultures contributed jointly to prehistoric development in Lower Central America. Its shifting cultural affinities evidence the close and continuing ties which existed between individual culture areas throughout the occupational sequence. The early cultures of Costa Rica mirror the complexity of the prehistoric social landscape of lower Central America. However, before processual questions can be properly addressed, it is necessary to understand the chronological framework of cultural adaptations. The Proyecto Prehistórico Arenal's work in the Arenal area has emphasized the necessity of refining local chronologies in the formulation of models for cultural development. It is hoped that my own contribution to our understanding of Formative period cultures in the region will assist with the establishment of a theoretical foundation for future research on the origins of Lower Central American societies and their role in cultural systems of Nuclear America as a whole.

The evidence from the entire regional ceramic sequence in the Arenal basin, from 2000 BC through AD 1400, indicates that this region had a very dynamic and complex prehistory, characterized by fluctuating populations with changing regional contacts and affiliations (Hoopes 1984). The study region is not easily classified within a defined culture area, and is instead a textbook example of how cultural boundaries and population densities shift through time. Tronadora Phase ceramics have their closest parallels in the San Carlos (Atlantic Watershed) and Central Highlands. During the Arenal Phase, the majority of the ceramic types are shared with the western regions of Greater Nicoya. In the succeeding Silencio Phase, Greater Nicoya polychromes appear as probable trade items in stone-lined tombs like those which appear in the Central Highlands to the southeast, while distinct, local ceramic styles flourish. By the Tilarán Phase, virtually all ceramic ties to Greater Nicoya have disappeared, and the local monochrome pottery tradition more closely resembles that of the Central Highlands and Atlantic Watershed regions.

While the Arenal area may be understood as a transition zone between Greater Nicoya and the Atlantic Watershed regions, it is hardly marginal or peripheral to cultural development in the two regions during the early part of the sequence. Evidence from the Tronadora and Arenal Phases indicates that the local environments of the volcanic cordilleras of northwestern Costa Rica supported populations which probably played a significant role in the development of Formative economies in Costa Rica. It is also clear that the region supported significant activity during the later Silencio and Tilarán Phases.

The current archaeological evidence from the Arenal area suggests that it was essentially self-sufficient during the Formative period (ca. 2000 BC - AD 600). While basic knowledge of technologies such as ceramic manufacture and maize cultivation were shared with regions to the north and south, their introduction was not accompanied by identifiable incursions of populations from either Mesoamerica or South America. To date, it has not been possible to trace patterns of diffusion from either the north or south. Rather, the apparent antiquity of both Archaic and Formative cultures in the region suggests that a complex latticework of early village cultures may have existed in fertile inland valleys of Costa Rica, Honduras, El Salvador, and Nicaragua, as well as Colombia, Ecuador, and Peru during the Early Formative period. We still know extremely little about these cultures. However, they comprised an important component of the social context for the emergence of village life, agriculture, ceramics, and other basic technologies in Nuclear America.

Thirty years ago, Willey and Phillips predicted, "It is a practical certainty that the origins of Formative stage cultures will be found to be extremely complex and diverse." (Willey and Phillips 1958:146). Archaeologists working in the Intermediate Area, and especially in Costa Rica, have become increasingly resistant to models which see the region as a conduit for technological advances made in Mesoamerica or South America, a cultural "backwater" which received marginal populations as density increased to the north and south, or an area bypassed by coastwise travellers on their way to more important places. Current research makes it clear that "Formative" cultures in lower Central America have significant antiquity, and that distinct local patterns were being established in inland regions as early as the second millenium BC.

Early Formative societies of the Intermediate Area may have been an important source of technological innovations which became fundamental to more highly developed societies to the north and south. Furthermore, as in Costa Rica, many of these Intermediate Area cultures may have followed independent, highly localized trajectories of socio-political development. Given the timespan involved, cultural development in this portion of Nuclear America appears to have been qualitatively different in many ways from areas to the north and south. Local patterns cannot be readily explained as "arrested" stages in a trajectory of unilinear cultural evolution in Nuclear America. Nor can they be adequately addressed in terms of broad, regional models for cultural diffusion or core/periphery interaction. Rather, the local cultures of lower Central America must be understood on their own terms. The possibility that this region did not simply receive innovations from outside, but made distinct contributions to neighboring regions during both the Formative and later periods in Nuclear America should be an important consideration of future research.

Understanding the differences between cultural processes in the Intermediate Area and regions to the north and south, especially during the Formative period, can only enhance our knowledge of both. It is my hope that further inquiry into problems of cultural development in the poorly known regions between Mesoamerica and the Central Andes will generate fruitful hypotheses and make positive contributions to our understanding of the archaeology of the Americas as a whole.

APPENDIX A
Radiocarbon Date Calibration and Interpretation

Radiocarbon Dating and Ceramic Sequences

A great deal of confusion has been introduced to the definition of temporal divisions by the convention of defining phase and period temporal boundaries on the basis of uncalibrated radiocarbon years (i.e. radiocarbon age before present minus 1950) rather than calibrated calendar years. The dates chosen are frequently best estimates of the central dates or 2-sigma overlaps of available radiocarbon assays, rounded to the nearest hundred years. Because these dates are in uncalibrated radiocarbon years, they are relatively meaningless for interpretive purposes. Variations in the amount of carbon isotopes in the atmosphere over time have had a major effect on the correspondence between radiocarbon years and actual calendar years. The "radiocarbon year" does not represent a uniform measure of time, and the degree of precision (and inferred "accuracy") with which radiocarbon years are counted decreases as one goes farther back in time.

For this reason, I have made extensive use of calibrated dates in this thesis, relying upon the calibration curves presented in a special issue of Radiccarbon (Stuiver and Kra 1986) and a calibration program for the IBM-PC provided by the Quaternary Isotopes Laboratory at the University of Washington, Seattle (cf. Stuiver and Reimer 1986). The tables which accompany this appendix present available radiocarbon assays and "high-precision" calibrated dates from the Proyecto Prehistórico Arenal, Costa Rica as a whole, and various relevant areas of Mesoamerica and South America.

To date, very few authors of published cultural sequences in Costa Rica and other regions of significance to Nuclear American prehistory have been thorough in their presentation of radiocarbon dates or completely explicit in detailing the logic behind temporal divisions. Because of the lack of standardization or agreement in the calibration of radiocarbon dates, virtually all have based their chronologies on interpretations of uncalibrated radiocarbon dates, treating radiocarbon years as "real" prehistoric time.

While this methodology is acceptable if the only concerns are internal consistency and comparability with other similarly-constructed sequences, it is fundamentally flawed. The conversion of a C14 date into a calibrated AD/BC date is a non-linear transformation. The calibration curve does not have a predictable shape, but is characterized by a number of short-term "wiggles," with amplitudes of up to about 200 years and divergences from calendrical ages by as much as 900 years (Pearson 1987). The temporal boundaries of phases and periods defined on the basis of uncalibrated dates are therefore subject to the vagaries of atmospheric chemistry, and as such are not "real time" representations. According to calibration tables recently adopted as the international standard by the 12th International Radiocarbon Conference (Stuiver and Kra 1986, Stuiver and Pearson 1986, Pearson and Stuiver 1986) the correspondence between uncalibrated dates (years bc or ad) frequently suggested as period boundaries and actual calendar dates (years BC or AD -- the intersection of uncalibrated years BP with the calibration curve) would be:

Uncalibrated	Intersections with Curve	Average
4000 bc	4894 BC, 4883 BC, 4845 BC	4874 BC
2000 bc	2468 BC	2468 BC
1000 bc	1211 BC, 1180 BC, 1165 BC	1185 BC
500 bc	752 BC, 709 BC, 530 BC	663 BC
300 bc	374 BC	374 BC
0 bc	AD 58	AD 58
ad 300	AD 405	AD 405
ad 500	AD 609	AD 609
ad 800	AD 889	AD 889
ad 1000	AD 1035	AD 1035
ad 1200	AD 1264, AD 1268, AD 1276	AD 1269
ad 1500	AD 1440	AD 1440

It can be seen from this chart that date ranges suggested on the basis of "ballpark" interpretations of uncalibrated radiocarbon dates have a variable correspondence with real calendar years -- those actually lived by the cultures responsible for creating archaeological remains. For example, a suggested date range for the Middle Formative period of 1000 - 500 bc in uncalibrated radiocarbon years could represent a time period of as many as 681 or as few as 413 years. Using the average calendar dates for the upper and lower intersections, the range would be 1185-663 BC, a timespan of 522 years -- close in terms of actual length, but averaging about 175 years earlier than the suggested period. A suggested range for the Zoned Bichrome period of 500 bc to ad 500 in uncalibrated radiocarbon years could correspond to a calendar year period from 752 BC to AD 609, or 1361 years instead of 1000.

Some of this may seem to be overly picky in view of the fact that we have no access to alternative dates or records in Central America prior to the appearance of inscribed dates. However, the practice of citing sequences and phases in terms of uncalibrated radiocarbon years has become pervasive in the literature. It makes for a number of problems when interregional comparisons are attempted, particularly in cases where absolute chronology is the only constant. There are many cases where phase boundaries fall at or near dates when calibration curves show rapid fluctuations in levels of atmospheric carbon. For example, high precision (decadal) calibration ranges for dates from 490-530 bc are over 300 calendar years long even before laboratory errors are taken into account, markedly reducing the accuracy of C14 dates from this interval. A radiocarbon date of 500 bc $\pm$ 50 has a calibrated 2-sigma (95%) confidence interval of 790-400 BC, or 390 years (Stuiver and Becker 1986).

Problems also arise where short phases (300 years or less) have been defined in terms of radiocarbon years. One example of this is the San Lorenzo Phase, defined by Coe and Diehl (1980) as lasting from "1150-900 B.C." (in radiocarbon years). While the authors may have envisioned a 250-year phase, this range calibrates to a length of between 362 and 396 years (ca. 1400-1000 BC; Tolstoy 1978). On the other hand, the preceding Chicharras Phase, dated "1250-1150 B.C.", would calibrate to between 83 and 54 years long, rather than 100 years.

Calendar dates are preferable to uncalibrated dates for comparisons between regions with phases dated by means of radiocarbon assays and Maya sites of the Classic period, where dates from inscriptions are often favored over radiocarbon determinations. The date of ad 500 (uncalibrated), suggested by Lange (1980) as the terminus of the Zoned Bichrome period, calibrates to around AD 630 (Stuiver and Becker 1986). This places it firmly within the Late Classic period (Thompson 1966), with important implications for cultural interaction. However, a date of AD 500 (calibrated), corresponding to the late Early Classic period, might have a very different cultural significance.

With the advent of bristlecone pine, Irish oak, Douglas fir, and Sequoia calibrations and the ready availability of calibration tables that have been adopted as international standards and easy-to-use calibration programs written for the personal computer (Stuiver and Pearson 1986, Pearson and Stuiver 1986, Stuiver and Becker 1986, Stuiver and Reimer 1986), there is no good reason for using uncalibrated radiocarbon years as opposed to calibrated calendar years to define the temporal boundaries of archaeological phases and periods. The calibration curves cited will no doubt be subjected to future revisions, but they are not expected to change significantly (Pearson 1987:99). It is also hoped that further excavation and analysis will refine the accuracy of phase definitions.

In this thesis, individual dates and chronological sequences will be presented in terms of calibrated calendar dates, avoiding "ballpark" estimates of uncalibrated radiocarbon years. Although it is expected that this may result in some initial confusion, especially where comparisons with existing sequences in radiocarbon years are necessary, I have faith that the use of calibrated dates, calendar years, and "real time" phases will ultimately become standard practice.

Where I refer to regional periodizations and sequences in other regions, an attempt will be made to base temporal divisions on those radiocarbon assays which were considered to be most reliable for the original phase definitions. Where new data suggests revisions, these will be made explicit. To avoid confusion, I have elected to use the journal Antiquity's convention of using lower case (bc and ad) to designate uncalibrated radiocarbon dates and upper case (BC and AD) to designate calibrated calendar dates will be strictly applied. This is not the method recommended by the 12th International Radiocarbon Conference, which prefers the designations "BC/AD" and "Cal BC/AD." However, because this terminology is still the subject of some debate, I have chosen to use the method which I find easiest to follow in print (spoken presentations being yet another matter). The calibration method employed here is that suggested by Stuiver and Pearson (1986:808) and Pearson (1987), and makes use of a computer program (CALIB, rev 1.3; cf. Stuiver and Reimer 1986) and data files obtained from the Quaternary Isotope Laboratory at the University of Washington, Seattle for use on an IBM-compatible personal computer. The dates assume a 5568 half-life for C14 (Stuiver and Polach 1977), and dates calculated with a 5730 half-life have been divided by a correction factor of 1.029 prior to calibration.

Other factors which affect date calibration are geographic location and sample material. Calibration tables to date have been based on tree-ring samples from long-lived species only in the northern hemisphere. Until species of comparable value for dendro-correction south of the Equator can be identified and sampled, calibrated dates from the southern hemisphere may have unknown factors of error due to possible variabilities in atmospheric carbon. Stuiver and Pearson (1986) have suggested that 30 years be subtracted from southern hemisphere dates prior to calibration, and I have applied this correction to dates in the following tables. Corrections are also available for dates from marine samples. However, although a number of the dates cited, especially from Panama, Colombia, Ecuador, are dates on shell, I have not included this factor in my calibrations for two reasons: 1) the suggested correction factors for shell from northwestern South America are very small, and 2) most of the shell species used for dates are from shallow or brackish water, and available marine sample corrections may not apply to estuarine environments.

All radiocarbon dates presented have been calibrated with the most accurate method available for the time period in question. For dates younger than about 1500 bc I have used a decadal calibration curve (Stuiver and Becker 1986), which allows for more detailed comparisons than the bidecadal one (Stuiver and Pearson 1986). However, the differences in dates calibrated by the two curves are at most in terms of 5-10 years, and are probably not significant for the level at which archaeologists are currently able to resolve chronological phenomena.

For date citations, I have decided upon a method which differs slightly from that recommended by the authors of the CALIB program. The suggested method for citation of calibrated dates is to present the date's intersection of calibration curves in parentheses along with maximum and minimum values of either 1-sigma or 2-sigma confidence intervals. However, many dates intersect the curve at a number of points, making the complete citation very cumbersome.

<u>Example</u>: 2980 ± 100 BP or 1030 ± 100 bc
calibrates to 2-sigma cal BC 1489 (1287, 1286, 1258, 1230, 1216, 1198, 1195, 1138, 1135) 923

Technically, this form of citation is the most accurate, because each of the individual dates within the parentheses (the intersections with the calibration curve) has an equal chance of being correct. For this reason, all of the dates cited in the text can be found in their complete form in the subsections of this appendix. However, lengthy date citations are awkward to include in a body of text, especially where there can be several in the same sentence. One option would have been to cite only the upper and lower dates of a calibrated interval. However, I feel that even a very rough central date can have greater conceptual value for provisional interpretations than "bandwidths" of calendar years, which are often several hundred years wide. For this reason, I have chosen to include the calculated numerical average of all curve intersections for a given date. This should <u>not</u> be understood as a central date for a calibrated probability curve, and it has absolutely <u>no</u> statistical validity insofar as the date's accuracy. It is no more than an average of several possible dates, all of which have <u>equal</u> probabilities of being correct (assuming the central radiocarbon year date had the highest probability within <u>its</u> range of error). It should not be understood as a calibrated equivalent of the central date in radiocarbon years.

For the sake of accuracy, I have chosen to use the maximum and minimum dates of the 2-sigma (95%) confidence interval. To facilitate comparisons with the more common citations of dates in radiocarbon years, the date's initial citation in the text will be accompanied in brackets by the laboratory number and date in radiocarbon years (bc/ad) with its 1-sigma (67%) confidence interval.

Ex.: 1489(1216)923 BC [Y-1934: 1030 bc ± 100]

Occasionally (according to context), subsequent citations will be abbreviated to the calibrated 2-sigma range, central date, and laboratory number.

Where possible, I have tried to interpret radiocarbon dates as calibrated band-widths rather than as individual dates. However, while these represent the most accurate interpretations of assays, they often represent periods of time which are too wide for the purposes of archaeological chronology. In cases where only one date is available for a given phase or context, I have relied primarily upon a reasonable approximation of the calibrated intersections. Where more than one date is available, there are several options for interpretation (Ottaway 1987:136). One is to use a statistical algorithm to combine the several dates for a single weighted, calibrated date (an option available in the current CALIB program). However, this method assumes that all of the dates are equivalent in terms of context, material, and laboratory treatment, which is rarely the case. A second method is to view the separate dates as band-widths of statistical probabilities, each of which takes laboratory errors into account individually, and to assume that the overlap of 95% confidence intervals represents the most likely "band-width" of dates for several samples from a given phase or context. Using this second method, "bad" dates (unless rejected as being grossly inaccurate) -- which can seriously skew weighted averages -- only lengthen the interpreted range rather than shifting it forward or backward in time. For this reason, I have chosen to utilize the latter, and cite weighted averages only in cases where more than one date has been obtained from the same radiocarbon sample.

In the following subsections, I present dates obtained by the Proyecto Prehistórico Arenal, a complete listing of calibrated dates from Costa Rica, and a list of calibrated dates from the late Archaic and Early Formative periods in Nuclear America. Dates in each subsection are listed in order by laboratory number for easy reference. I have also provided charts of dates in graphic form (Tables A.1 - A.9) to summarize the radiocarbon profiles of relevant geographic regions. For each date, I have attempted to present the documentary information which is available from a reasonable search of the published literature on sample material, context, associations, and acceptability (question marks in the listings indicate problems with the validity of the date or its associations). However, the information available on each date is far from uniform. Blanks have been omitted from the printed date listings. These present only the information available for each sample, and missing categories indicate missing data.

Although extensive, the listings are not comprehensive. They are offered only as documentation for the numerous radiocarbon dates cited in the text.

Table A.1: Proyecto Prehistórico Arenal
Radiocarbon Dates

4000 BC — AD 1600

Tx-5079	AD 1300	AD 1422
Tx-5083	AD 990	AD 1640
Tx-5077	AD 1208	AD 1384
Tx-5269	AD 770	AD 1000
Tx-5080	AD 560	AD 861
Tx-5270	AD 432	AD 770
Tx-5082	AD 230	AD 768
Tx-5273	AD 182	AD 540
Tx-5078	AD 79	AD 410
Tx-5272	AD 79	AD 410
Tx-5081	800 BC	AD 640
Tx-5280	2010 BC	AD 660
Tx-5279	2860 BC	1000 BC
SI-?	2450 BC	1753 BC
Tx-5277	2470 BC	1834 BC
Tx-5274	3014 BC	2590 BC
Tx-5276	3360 BC	2920 BC
Tx-5278	3609 BC	3040 BC
Tx-5275	3609 BC	3050 BC
Tx-5286	3950 BC	3381 BC

Appendix A.1
Proyecto Prehistórico Arenal Radiocarbon Dates

Laboratory No.: Tx-5077 Project Cat.: Carbon #2
Provenience: El Silencio (G-150) Op/Lot: C2
Excavator: J. Bradley Submitted by: P. Sheets
Date Collected: 2/1/84 Date Submitted: 6/18/84
Material: Wood charcoal Lab Run No.: 2041b
Years bp and 1-sigma Range: 740 ± 50
C-14: -87.7 ± 4.4% C-13: Unknown
Radiocarbon Date: ad 1210
2-sigma Cal BC and Intercepts: AD 1208(1277)1384
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Collected from the El Silencio site, 6 km east of Tilarán on the Continental Divide (10°28'N, 84°55'W).

Nature of Sample:

"Small" sample. Some rootlet contamination noted prior to submission.

Context and Associations:

Recovered from secondary deposit with a very high density of Silencio Phase ceramics overlying *laja* tombs (Burials 6-11; Bradley 1984:102). Ceramics the included Greater Nicoya types Mora Polychrome (39), Papagayo Polychrome (32), Altiplano Polychrome (12), as well as locally defined types (Hoopes 1984a) Tilarán Beige (108), Jiménez Polychrome (91), and Belén Incised: Ayotes Variety (41). All of these are considered to be diagnostic of the Middle Polychrome period and the Silencio Phase in the Arenal area.

Interpretation:

This date is consistent with a large number of dates from Middle Polychrome period deposits throughout Greater Nicoya, and is considered to accurately date the associated ceramics.

Laboratory No.: Tx-5078 Project Cat.: Carbon #4
Provenience: El Silencio (G-150) Op/Lot: B5
Excavator: M. Chenault Submitted by: P. Sheets
Date Collected: 2/15/84 Date Submitted: 6/18/84
Material: Wood charcoal Lab Run No.: 2364a
Years bp and 1-sigma Range: 1770 ± 60
C-14: -197.9 ± 2.8% C-13: Unknown
Radiocarbon Date: ad 180
2-sigma Cal BC and Intercepts: AD79(245)410
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Collected from the El Silencio site, 6 km east of Tilarán on the Continental Divide (10°28'N, 84°55' W). Stratigraphically located in Unit 50, which is overlain by a horizon of Units 40 and 41.

Nature of Sample:

Possible mixing with earlier charcoal during tomb construction noted at time of excavation.

Context and Associations:

Sample was situated in a stone-lined tomb (Burial 2; Bradley 1984:97) in association with human skeletal remains, Silencio Phase ceramics, and a gold avian pendant. Ceramics associated with this burial included three miniature jars of the type Cabuyal Polychrome. All of the ceramics from excavated levels above and beneath the tomb were diagnostic of the Silencio Phase (Hoopes 1984a). No Arenal Phase ceramics were recovered from the operation where this sample was collected. However, a fragmentary vessel of Charco Black-on-Red from Operation J suggests the possibility of a small Arenal phase occupation which preceded the Silencio Phase funerary activity.

Interpretation:

This date is too early for the associated ceramics, and several hundred years earlier than the supposed (albeit poorly-dated) beginnings of gold metallurgy in Costa Rica. It is believed to represent charcoal from earlier deposits which were disturbed by tomb construction.

Laboratory No.: Tx-5079 Project Cat.: Carbon #15
Provenience: Dos Armadillos (G-154) Op/Lot: A2
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 3/19/84 Date Submitted: 6/18/84
Material: Wood charcoal Lab Run No.: 2044b
Years bp and 1-sigma Range: 570 ± 30
C-14: -69.0 ± 3.1% C-13: Unknown
Radiocarbon Date: ad 1380
2-sigma Cal BC and Intercepts: AD 1300(1332,1343,1394)1422
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Collected at the Dos Armadillos site (G-154), located approximately 6 km west of Tilarán (10°28'N, 84°55' W), on a small terrace at 815 m elevation, immediately south of the Río Santa Rosa.

Nature of Sample:

Large aggregate sample of medium-sized chunks of charcoal from 20 cm excavation level. Rootlet contamination of sample noted prior to submission.

Context and Associations:

Stratigraphically situated in the upper portion of Unit 30, underlying Unit 20 at a depth of 40 cm below present ground surface. Associated with a Tilarán Phase ceramic assemblage and possible remains of prehistoric habitations. Ceramic types include Silencio Appliqué, San Luís Coarse, Malekos Red, and fragments of an unidentified incised type.

Interpretation:

This date is considered to accurately date the associated artifactual assemblage, and it assists in the dating of the cultural occupation of the region immediately prior to the deposition of Unit 20.

Laboratory No.: Tx-5080   Project Cat.: Carbon #38
Provenience: Tronadorcita (G-161) Op/Lot: B4
Excavator: J. Bradley   Submitted by: P. Sheets
Date Collected: 4/4/84   Date Submitted: 6/18/84
Material: Wood charcoal   Lab Run No.: 3495
Years bp and 1-sigma Range: 1340 ± 70
C-14: -153.4 ± 3.3% C-13: Unknown
Radiocarbon Date: ad 610
2-sigma Cal BC and Intercepts: AD 560(665)861
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, northwest of the present mouth of the Quebrada Tronadorcita and 4 km east of the Río Tronadora (10°30'N, 84°53' W). Test excavations at site discussed in preliminary report (Bradley, Hoopes, and Sheets 1984:78-81).

Nature of Sample:

Unknown.

Context and Associations:

Sample comes from a 2 X 2 m test excavation with evidence for later intrusive activities. It was associated with Arenal Phase ceramics, a mano fragment, and a thermally-fractured flake. Arenal Phase ceramics were noted in all lots between surface and Unit 50. Stratigraphic context noted to be below Unit 30, and "probably" at the top of Unit 50. Tilarán Phase ceramics dominated the surface assemblage, although very small amounts of sherds from the Silencio, Arenal, and possibly Tronadora Phases were present.

Interpretation:

The charcoal may date to the early Silencio Phase. Silencio Phase ceramics and features were situated in Unit 50 at the El Silencio site (G-150), and ceramics from this phase appeared in surface assemblages at the Tronadorcita site. However, given the disturbed nature of the deposit and the uncertain stratigraphic association of the sample, it is unclear exactly what is dated by it.

Laboratory No.: Tx-5081   Project Cat.: Carbon #31/55
Provenience: Tronadora Vieja (G-163) Op/Lot: C2/D1
Excavator: J. Bradley   Submitted by: P. Sheets
Date Collected: 4/6/84   Date Submitted: 6/18/84
Material: Wood charcoal   Lab Run No.: 2367a
Years bp and 1-sigma Range: 2030 ± 300
C-14: -223 ± 12.8% C-13: Unknown
Radiocarbon Date: 80 bc
2-sigma Cal BC and Intercepts: 800(90,80,70,58,44,6,
4 BC)AD 640
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W). It was first tested in 1984 (Bradley, Hoopes, and Sheets 1984) and then extensively sampled in 1985.

Nature of Sample:

Aggregate of small fragments from samples collected in two separate operations (G-163-C2 and G-163-D1) during test excavations in 1984.

Context and Associations:

Both samples combined for this date consisted of charcoal fragments from Unit 60 and below. Cutural materials from associated levels included Tronadora Phase ceramics, the remains of an apparent hearth, and a charred cupule of *Zea mays*. Associated diagnostic ceramics consisted of sherds of Tonjibe Beige and Tronadora Incised as well as other groove-incised and punctate sherds.

Interpretation:

The fact that this sample is derived from aggregate fragments from thick excavation levels in two separate operations makes its utility definitely suspect. As an aggregate sample from a site with components both earlier and later than the Tronadora Phase, it may have been contaminated by younger or older charcoal. Its large 2-sigma range also limits its usefulness for dating the associated materials.

Despite its association with Tronadora Phase ceramics and stratigraphic units which have been found to contain Tronadora Phase ceramics elsewhere at the site, this date does not overlap either of the other two dates accepted for this phase (Tx-5277 and Tx-5279) at the calibrated 2-sigma range. Given its possible range, this date does not support or refute the proposed chronology.

Laboratory No.: Tx-5082   Project Cat.: Carbon #34/43
Provenience: Viboriana (G-175)   Op/Lot: B1/B6
Excavator: J. Hoopes   Submitted by: P. Sheets
Date Collected: 5/84   Date Submitted: 6/18/84
Material: Charcoal   Lab Run No.: 2369a
Years bp and 1-sigma Range: 1530 ± 130
C-14: -173.8 ± 6.2%   C-13: Unknown
Radiocarbon Date: ad 420 ± 130
2-sigma Cal BC and Intercepts: AD 230(539)768
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Collected during test excavations in 1984 at the site of Viboriana (G-175), located approximately 9.5 km east of the Río Tronadora on the south shore of Lake Arenal, at 10°28'N, 84°51'W (Bradley, Hoopes, and Sheets 1984).

Nature of Sample:

Combination of small samples from two different excavation levels in the same operation, one representing the uppermost 20 cm of Unit 50 and the other representing the bottommost 20 cm of the "50's" strata. Samples were separated by one meter's depth of deposits.

Context and Associations:

Sherd density was relatively low in this excavation, especially in Lot B6. Ceramics from Lot B1 and from excavated level between the two samples were a mixture of early and late Arenal Phase types, including Los Hemanos Beige, Los Hermanos Beige: Cervantes Var., Mojica Impressed: Mojica Variety, Las Palmas Red-on-Beige, and Bocana Incised Bichrome.

Interpretation:

While the nature and provenience of this sample are far from ideal, the date yielded by it is in line with our chronology for the Arenal Phase. It is slightly later than would be expected for the early Arenal types, but is in keeping with acceptable dates from Sitio Bolívar (i.e. Tx-5270, Tx-5271, Tx-5272, Tx-5273

Laboratory No.: Tx-5083 Project Cat.: Carbon #51
Provenience: Viboriana (G-175) Op/Lot: B7
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 5/20/84 Date Submitted: 6/18/84
Material: Wood charcoal Lab Run No.: 2366a
Years bp and 1-sigma Range: 670 ± 190
C-14: -80.0 ± 11.1% C-13: Unknown
Radiocarbon Date: ad 1280
2-sigma Cal BC and Intercepts: AD 990(1283)1640
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Collected during test excavations in 1984 at the Viboriana site (G-175; Bradley, Hoopes, and Sheets 1984). This site is situated on the south shore of Lake Arenal at 10°28'N, 84°51'W.

Nature of Sample:

Unknown.

Context and Associations:

Situated in the matrix of an intrusive pit feature which apparently originated in the "Upper 50's" strata and penetrated Aguacate. The only artifact recovered from this feature was an Arenal Phase diagnostic sherd.

Interpretation:

Although it was unclear precisely where in the "50's" strata the pit feature originated, it was interpretated at the time of its excavation as dating to the Arenal Phase. This date is completely different from what was expected, and opens the possibility that the pit was excavated anywhere between the Silencio Phase (although no artifacts from this or the subsequent Tilarán Phase were found at the site) and modern times.

Laboratory No.: Tx-5269 Project Cat.: Carbon #87
Provenience: Sitio Bolivar (G-164)
Op/Lot: A9
Excavator: M. Mueller Submitted by: P. Sheets
Date Collected: Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2194b
Years bp and 1-sigma Range: 1130 ± 50
C-14: -131.3 ± 3.9% C-13: Unknown
Radiocarbon Date: ad 820
2-sigma Cal BC and Intercepts: AD 770(895,922,939)1000
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, approximately 1 km east of Tronadora, at 10°31'N, 84°55'W.

Nature of Sample:

Large sample of charcoal from a prehistoric hearth. This feature was situated less than 10 m from the edge of Lake Arenal, and may have been subject to inundation and periodic leaching. Agricultural burning occurs frequently in the Arenal area, and in fact a portion of the site was burned during our excavations, representing a significant source of modern charcoal. The hearth feature was partly exposed to modern weathering at the time of its discovery. A layer of charcoal, approximately 1-2 cm thick, was removed from the exterior of this sample prior to its submission for dating.

Context and Associations:

Collected from large hearth in an area of apparent prehistoric habitation on the shore of Lake Arenal consisting of another hearth and the remains of two circular structures. The lakeshore where these features were found was covered with a heavy scatter of Arenal Phase ceramics and other artifacts.

Interpretation:

The date for this sample is later than the estimated date for the associated ceramics by several hundred years. It corresponds chronologically to the Silencio Phase, and although a very small amount of ceramics from this phase were identified in the large surface collection from this site, the feature itself is virtually identical in shape, location, and apparent stratigraphic position to that which yielded Tx-5272. It is also a "better" sample, in that it came from a single piece of charcoal, rather than an aggregate collection. Two interpretations for the discrepancy between two dates from apparently contemporaneous features are: 1) Both features date to the Silencio Phase, despite its virtual absence in the ceramic assemblage, or 2) Tx-5269 was somehow contaminated. Given the large, Late Arenal component at the site and the fact that this date does not overlap any of the other four dates from this site at even the calibrated 2-sigma range, I prefer the latter explanation.

A second date (but on an aggregate sample), Tx-5272, is associated with a very similar, hearth-like feature near on the shoreline near the one from which this date was obtained.

Laboratory No.: Tx-5270   Project Cat.: Carbon #102
Provenience: Sitio Bolívar (G-164)
Op/Lot: E18
Excavator: M. Chenault   Submitted by: P. Sheets
Date Collected: Date Submitted: 7/10/85
Material: Wood charcoal   Lab Run No.: 2496a
Years bp and 1-sigma Range: 1410 ± 80
C-14: -160.2 ± 4.4%   C-13: Unknown
Radiocarbon Date: ad 540
2-sigma Cal BC and Intercepts: AD 432(642)770
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, approximately 1 km east of Tronadora, at 10°31'N, 84°55'W.

Nature of Sample:

Unknown. Slight rootlet contamination noted prior to submission.

Context and Associations:

Collected from mortuary features at the top of a small ridge. Associated excavation lot corresponds to cultural materials between modern ground surface and concentration of ceramics overlaying stone mortuary features. Associated with late Arenal Phase ceramics and lithics. Ceramics consist primarily of Los Hermanos Beige jars and bowls, but include the decorated types Guinea Incised, Los Hermanos Beige: Espinoza Variety, and Zelaya Bichrome. Overlying and underlying lots include large quantities of both Corrida and Arrastrada varieties of Mojica Impressed.

Interpretation:

This date is consistent with the interpretation of the associated artifacts and features as dating to the end of the Zoned Bichrome period. It is considered to accurately date the deposit.

Laboratory No.: Tx-5271 Project Cat.: Carbon #98
Provenience: Sitio Bolívar (G-164)
Op/Lot: B17
Excavator: J. Bradley Submitted by: P. Sheets
Date Collected: Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 12
Years bp and 1-sigma Range: 2340 ± 170
C-14: -252.24 ± 6.7% C-13: Unknown
Radiocarbon Date: 390 bc
2-sigma Cal BC and Intercepts: 830(400 BC)AD 1
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, approximately 1 km east of Tronadora, at 10°31'N, 84°55'W.

Nature of Sample:

Unknown.

Context and Associations:

Site located approximately 1 km east of Tronadora, at 10°31'N, 84°55'W. Sample was stratigraphically situated in a possible hearth on the surface of the Aguacate Formation, at the base of a large midden feature (minimum depth of around 80 cm below the modern ground surface) in Operation B at the top of a small ridge at Sitio Bolívar. The feature consisted of a large, dense concentration of fragments of pottery, lithic artifacts, and subsistence remains. Despite heavy disturbance of the stratigraphy over this feature, the cultural remains appear to have been associated with activity postdating the deposition of Unit 54. The ceramic types most heavily represented in this feature were Los Hermanos Beige, Charco Black-on-Red, Guinea Incised, and Los Hermanos Beige: Cervantes Variety.

Interpretation:

The portion of the site from which this date was obtained had been somewhat disturbed by looting activities. Periodic agricutural burning at the site is a possible source of modern charcoal. However, modern activities do not appear to have affected the cultural deposits from which this sample was obtained.

While this date is within the estimated range for the Arenal Phase, it is somewhat earlier than expected for the associated ceramics, which are believed to date to approximately AD 300-500 on the basis of comparisons with assemblages in Greater Nicoya. The vast majority of ceramic types from the overlying assemblage are considered to be Late Arenal types. However, a small sample of Las Palmas Red-on-Beige, a supposed Early Arenal type, was recovered from the deposit. Three Tronadora Phase sherds from surface collections at the site also suggest the existence of a small, early component. Given the location of this sample on the surface of Aguacate, above which stratigraphic units had been disturbed by later activities, it may represent virtually any period of occupation. If the date is accurate, it most likely pertains to a small, poorly represented Early Arenal phase component at the site.

Laboratory No.: Tx-5272 Project Cat.: Carbon #85
Provenience: Sitio Bolívar (G-164)
Op/Lot: A8
Excavator: M. Mueller Submitted by: P. Sheets
Date Collected: Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2506a
Years bp and 1-sigma Range: 1770 ± 60
C-14: -197.4 ± 3.3% C-13: Unknown
Radiocarbon Date: ad 180
2-sigma Cal BC and Intercepts: AD 79(245)410
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, approximately 1 km east of Tronadora, at 10°31'N, 84°55'W.

Nature of Sample:

Large, aggregate sample from a concentration of wood charcoal in a prehistoric hearth or cooking pit on the eroding shoreline of Lake Arenal. This feature was situated less than 10 m from the edge of the lake, and may have been subject to inundation and periodic leaching. Agricultural burning occurs frequently in the Arenal area, and in fact a portion of the site was burned during our excavations, representing a significant source of modern charcoal. The hearth feature was partly exposed to modern weathering at the time of its discovery.

Context and Associations:

Collected from large hearth in an area of apparent prehistoric habitation on the shore of Lake Arenal consisting of another hearth and the remains of two circular structures. Stratigraphic position is difficult to assess, due to the eroded nature of the shoreline. However, a hard, unidentified tephra layer was noted to overlie the stone in the feature. The charcoal was distributed around fire-cracked rocks in a shallow pit. The lower margin of this pit was a dark-red oxidized layer overlain by a layer of black, brittle, fine-grained and consarent habitation on the shore of Lake Arenal. The charcoal was distributed in and around fire-cracked rocks in a shallow pit excavated into Aguacate. The lower margin of this pit was marked by a dark red, oxidized layer overlain by a black, brittle, fine-grained, consolidated layer (identified by the excavator as a "prepared" surface). The rocks and charcoal were situated on this black layer of consolidated material. The lakeshore where these features were found was heavily scattered with Arenal Phase ceramics and other artifacts.

A level plan and photographs of the feature and associated charcoal are on file at the University of Colorado, Boulder.

Interpretation:

This date is very close to one (Tx-5273) obtained from the large sherd scatter in Operation B in the ridgetop portion of Sitio Bolívar, and is also in line with a number of other dates from late Zoned Bichrome contexts in Greater Nicoya. A second date, Tx-5269, was recovered from a similar hearth-like feature on the lakeshore. Despite the similarity of the two features in terms of form, depositional environment, and associated cultural materials, samples from the two separate hearths yielded markedly different dates. This discrepancy is difficult to explain. However, Tx-5272 is more in keeping with the estimated chronological placement of the principal artifactual assemblages from Sitio Bolívar. The associated surface collection from the lakeshore and sherd deposits from the ridgetop portion of the site are believed to date to the last two centuries of the Arenal Phase (AD 300-500).

Laboratory No.: Tx-5273 Project Cat.: Carbon #84
Provenience: Sitio Bolívar (G-164)
Op/Lot: B6
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 4/16/84 Date Submitted: 7/10/85
Material: Charcoal Lab Run No.: 2186b
Years bp and 1-sigma Range: 1660 ± 70
C-14: Unknown C-13: Unknown
Radiocarbon Date: ad 290
2-sigma Cal BC and Intercepts: AD 182(394)540
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site located on the south shore of Lake Arenal, approximately 1 km east of Tronadora, at 10°31'N, 84°55'W.

Nature of Sample:

Single, "large" sample of wood charcoal.

Context and Associations:

Sample was collected from a 40 cm thick midden feature in the ridgetop portion of Sitio Bolívar. It was located at a depth of 125 cm below the modern ground surface in the northwest portion of Operation B, in direct association with broken pottery. The feature consisted of a large, dense concentration of fragments of pottery, lithic artifacts, and subsistence remains (including *Zea mays*) which had been deposited over the remains of possible burial pits into the Aguacate substrate. Despite heavy disturbance of the stratigraphy over this feature, the cultural remains appear to have been associated with activity postdating the deposition of Unit 54. The sample itself was situated in an unidentified stratum 12 cm below the black horizon identified as Unit 50. The ceramic types most heavily represented in the associated feature were Los Hermanos Beige, Charco Black-on-Red, Guinea Incised, and Los Hermanos Beige: Cervantes Variety.

The portion of the site from which this date was obtained had been somewhat disturbed by looting activities. Periodic agricutural burning at the site is a possible source of modern charcoal. However, modern activities did not penetrate to the depth from which this sample was obtained. This sample was identified at the time of its excavation as ideal for dating because of both its size and context. The clear association of the charcoal with cultural remains and the absence of evidence for significant occupations pre-dating or post-dating the principal Late Arenal occupation helps support the interpretation of this sample as securely dating the associated cultural assemblage.

Interpretation:

This date is very close to one (Tx-5272) obtained from a hearth or cooking pit in the lakeshore portion of Sitio Bolívar. It is also in line with a number of other dates from late Zoned Bichrome contexts in Greater Nicoya. This date is in keeping with the estimated chronological placement of the principal artifactual assemblages from Sitio Bolívar (Chapter Seven), and is therefore considered to be an acceptable date for its associations. Stylistically, the ceramic assemblage appears to be closely related to material from Baudez' (1967) Ciruelas Phase in the Tempisque Valley, and is believed to date to the last two centuries of the Arenal Phase (AD 300-500).

Laboratory No.: Tx-5274   Project Cat.: Carbon #13
Provenience: Tronadora Vieja (G-163)   Op/Lot: I6
Excavator: M. Mueller   Submitted by: P. Sheets
Date Collected: 2/15/85   Date Submitted: 7/10/85
Material: Wood charcoal   Lab Run No.: 15
Years bp and 1-sigma Range: 4210 ± 70
C-14: -402.5 ± 4.2%   C-13: Unknown
Radiocarbon Date: 2260 bc
2-sigma Cal BC and Intercepts: 3014(2883,2796,2784)2590 BC
Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

"Very large" lump sample of charred wood (with well-preserved internal structure) from dense concentration of large and small fragments. Appeared to be the remains of a large cooking fire.

Context and Associations:

Stratigraphically situated 5-10 cm below the surface of the Aguacate Formation (ca. 155-165 cm below modern ground surface) in a location where this clay substrate had apparently been disturbed. Associated with Fortuna Phase lithic debitage consisting of chalcedony flakes.

Interpretation:

Pre-dates tephra deposits by Cerro Chato. Dates Fortuna Phase activity during late Archaic period at Tronadora Vieja. This sample was split for this assay and SI-?, and comes from the same feature as Tx-5275; however, none of the three dates overlaps at even the 2-sigma range. It is possible that the charcoal samples come from a fire in which logs of varying ages were burned. Other than laboratory error, this is one of the only acceptable explanations for this discrepancy. Level plan, black-and-white negatives and color slides of sample and context on file at the University of Colorado, Boulder.

Laboratory No.: Tx-5275 Project Cat.: Carbon #14
Provenience: Tronadora Vieja (G-163) Op/Lot: I6
Excavator: M. Mueller Submitted by: P. Sheets
Date Collected: 2/15/85 Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2185b
Years bp and 1-sigma Range: 4600 ± 70

C-14: -436.2 $\pm$ 3.2%   C-13: Unknown
Radiocarbon Date: 2650 bc
2-sigma Cal BC and Intercepts: 3609(3360)3050 BC
Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

"Very large" sample of charred wood (with well-preserved internal structure) from dense concentration of large and small fragments. Appeared to be the remains of a large cooking fire.

Context and Associations:

Stratigraphically situated 5-10 cm below the upper surface of Aguacate (155-165 cm below modern ground surface) in Operation I. Associated with Fortuna Phase lithic debitage consisting of chipped chalcedony flakes.

Interpretation:

Pre-dates tephra deposits from Cerro Chato. Dates Fortuna Phase activity during late Archaic period at Tronadora Vieja. This sample comes from the same feature as Tx-5274 and SI-? (lab no. unreported); however, none of the three dates overlaps at even the 2-sigma range. It is possible that the charcoal samples come from a fire in which logs of varying ages were burned. Other than laboratory error, this is one of the only acceptable explanations for this discrepancy. Level plan, black-and-white negatives and color slides of sample and context on file at the University of Colorado, Boulder.

Laboratory No.: Tx-5276 Project Cat.: Carbon #27
Provenience: Tronadora Vieja (G-163) Op/Lot: L10
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 3/5/85 Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2181b
Years bp and 1-sigma Range: 4450 ± 70
C-14: -425.4 ± 2.6% C-13: Unknown
Radiocarbon Date: 2500 bc
2-sigma Cal BC and Intercepts: 3360(3096,3053,3048)2920 BC
Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

Site is stuated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

"Large" aggregate sample of fragments from a 50 X 50 cm area on an apparent occupational surface in soil stratum overlying Aguacate. Some root activity noted 100 cm SE of feature.

Context and Associations:

Stratigraphically located in lowermost culture-bearing deposit on the surface of the Aguacate Formation (ca. 140 cm below the modern ground surface). Sample was situated in soil beneath Unit 60 but partially overlying feature of consolidated tephra interpreted as Unit 61. Associated with Fortuna Phase lithics and Tronadora Phase ceramics. The lithics are characterized by Sheets as two, "broad, expanding, thin, Archaic-style chalcedony flakes." The ceramics include one sherd with a charcoal residue adhering to its interior. A total of 63 sherds from the associated stratigraphic level include the types Tonjibe Beige, Tigra Grooved-Punctate, Tajo Gouge-Incised, Zetilial Shell-Stamped, and Los Hermanos Beige. Other charcoal from the same level includes a carbonized fragment of a maize kernel, a charred peduncle of a leaf or fruit, and an unidentified seed.

Interpretation:

Despite its association with a sherd with charcoal residue, a feature interpreted in the field as "possible remains of a cooking fire," and Tronadora Phase ceramics, I am hesitant to accept this date as valid for the ceramic occupation. Even though I predicted at the time of the sample's collection that it would provide a secure date for Tronadora activity, this date does not overlap either of the two acceptable dates (Tx-5277 and Tx-5279) at the calibrated 2-sigma range. It is also considered to be too early for the Tronadora Phase.

Sheets has interpreted the chalcedony flakes associated with this sample as bifacial thinning flakes from a Fortuna Phase lithic industry. The date overlaps other assays associated with Fortuna Phase material, and the sample is therefore believed to have derived from late Archaic period activity at the site. However, this interpretation remains highly subjective, and is largely influenced by a relatively conservative attitude towards the interpretation of ceramic associations.

Laboratory No.: Tx-5277 Project Cat.: Carbon #30
Provenience: Tronadora Vieja (G-163) Op/Lot: V9
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 3/11/85 Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2184b
Years bp and 1-sigma Range: 3730 ± 100
C-14: -371.6 ± 4.2% C-13: Unknown
Radiocarbon Date: 1780 bc
2-sigma Cal BC and Intercepts: 2470(2192,2165,2140)1834 BC
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

Single, large chunk, estimated at time of collection to represent about 20 gms of charred wood. Field notes emphasize both size of sample, consolidated nature, and its association with "the earliest occupation on the surface of Aguacate." Possible rootlet contamination noted prior to submission of sample to laboratory.

Context and Associations:

Recovered from a shallow (5 cm) excavation level representing a possible occupational surface in a 2 X 4 m extension of Operation V. This level corresponded to the uppermost surface of the Aguacate Formation clays. The sample was directly associated with potsherds, one of which had charred material adhering to its interior, and three

Archaic-style biface trimming flakes. All of the ceramics from this excavation level were small, undecorated body sherds. However, the level from which the sample was recovered was immediately overlain by a level with a maximum depth of 10 cm which yielded 42 sherds. Of these, all of the decorated ceramics are considered to be diagnostic of the Tronadora Phase. These include the types Tronadora Incised, Tigra Grooved-Punctate, Tonjibe Beige, and characteristic shell-stamped sherds. Two body sherds from the level overlying the charcoal sample had charred material adhering to their interiors.

Interpretation:

The quality of this sample with regard to size, consolidation, and provenience was noted at the time of its collection, and was the principal reason for its selection for dating. The stratigraphic position of this sample was very clear. Unfortunately, as with sample Tx-5276, artifactual associations included both Fortuna Phase lithics and Tronadora Phase ceramics. This mixture is believed to have resulted from sequential occupations of the surface of Aguacate at this site by both Archaic and Formative peoples prior to the deposition of tephras from Cerro Chato.

This sample is interpreted as an acceptable date for the earliest part of the Tronadora Phase. It does not overlap any of the dates considered to be clearly associated with Fortuna Phase materials even at the calibrated 2-sigma range, and is comparable to dates for Early Formative ceramics in Chiapas and Panama. The calibrated 2-sigma range of this date is completely overlapped by that of Tx-5279, which was associated with the floor of a Tronadora Phase habitation. This sample was situated in the upper surface of Aguacate, and is therefore believed to pre-date the deposition of tephras from Cerro Chato.

Laboratory No.: Tx-5278 Project Cat.: Carbon #37
Provenience: Tronadora Vieja (G-163) Op/Lot: I14
Excavator: J. Hoopes Submitted by: P. Sheets
Date Collected: 3/14/85 Date Submitted: 7/10/85
Material: Wood charcoal Lab Run No.: 2495a
Years bp and 1-sigma Range: 4580 ± 80
C-14: -435.0 ± 2.9% C-13: Unknown
Radiocarbon Date: 2630 ± 80
2-sigma Cal BC and Intercepts: 3609(3351)3040 BC
Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

Single, large sample of wood charcoal collected by worker under Hoopes' supervision.

Context and Associations:

Stratigraphically situated in the uppermost 10 cm of the Aguacate Formation in a 2 X 2 m extension of Operation I. The artifact lot associated with this sample included two small, undecorated body sherds. Several large charcoal samples were collected from this stratigraphic level in Operation I. These include samples Tx-5275 and Tx-5276.

Interpretation:

The stratigraphic position of this sample and its close proximity to samples Tx-5275 and Tx-5276 strongly suggests that all three derive from contemporaneous activity.

This sample, along with Tx-5275 and Tx-5276, is believed to date preceramic Fortuna Phase activity at the site. It probably pre-dates the first deposition of tephras from Cerro Chato.

Laboratory No.: Tx-5279 Project Cat.: Carbon #61
Provenience: Tronadora Vieja (G-163) Op/Lot: W18
Excavator: J. Bradley Submitted by: P. Sheets
Date Collected: 3/18/85 Date Submitted: 7/10/85
Material: Charcoal Lab Run No.: 2193b
Years bp and 1-sigma Range: 3480 ± 320
C-14: -351.4 ± 12.5% C-13: Unknown
Radiocarbon Date: 1530 bc
2-sigma Cal BC and Intercepts: 2860(1872,1842,1813, 1807,1777)1000 BC
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

No specific information available in field notes. Possible rootlet contamination was noted prior to the date's submission.

Context and Associations:

Stratigraphically situated at the contact between Unit 61 and the underlying Unit 64, on an occupational surface interpreted as a Tronadora Phase habitation. Associated with circular pattern of postholes, artifact scatter, and remains of "hearths" with large quantities of fire-cracked and heat-spalled rock. Some of these postholes yielded sherds and fragments of charcoal. Associated artifacts include a small metate support, a mano fragment, a chalcedony core and flake, and a total of 76 sherds. All of the diagnostic ceramics from the associated assemblage pertain to the Tronadora Phase, and include the types Tonjibe Beige, Tigra Grooved-Punctate, and Tronadora Incised. Several additional sherds wre decorated with shell-stamping and groove-incision. Immediately overlying and adjacent lots also contained clear Tronadora diagnostics.

Interpretation:

Unfortunately, this sample is not described in detail in either the field notes or laboratory record. There is an oblique reference to charcoal on the floor of the habitation feature in Bradley's notes. However, it is very likely that the sample represents an aggregation of charcoal fragments from the apparent house floor and occupational area. A routine methodology at the site consisted of maintaining a running sample of charcoal fragments from each excavation lot. This sample probably represents the cumulative collection from Lot W18, which designates materials from the occupational feature at the interface of Units 61 and 64. Because we have evidence for earlier Fortuna Phase activity at the site and because this date may come from an aggregate sample, it is possible that the sample may have been contaminated by earlier charcoal. However, no clear Fortuna Phase artifacts were recovered from this portion of the site.

Based its close association with a variety of cultural features and diagnostic artifacts, this date is considered acceptable for Tronadora Phase activity at the site. It overlaps the entire calibrated 2-sigma range of Tx-5277, but does not overlap Tx-5274, Tx-5276, or Tx-5278, which are considered to date Fortuna Phase material.

Laboratory No.: Tx-5280 Project Cat.: Carbon #76
Provenience: Tronadora Vieja (G-163) Op/Lot: W35
Excavator: J. Bradley Submitted by: P. Sheets
Date Collected: 3/85 Date Submitted: 7/10/85
Material: Charcoal Lab Run No.: 2498a
Years bp and 1-sigma Range: 2470 + 560
C-14: -265.3 ± 21.9% C-13: Unknown
Radiocarbon Date: 520 bc
2-sigma Cal BC and Intercepts: 2010(757,689,656,645,590, 577,545,458,452 BC)AD 660
Calibration Reference(s): Stuiver and Becker 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

No specific information available in field notes. Possible rootlet contamination was noted prior to the date's submission.

Context and Associations:

Sample was obtained from the interior of a tomb or burial feature which originated in Unit 54 and penetrated Aguacate to a depth of 175 cm. Within this feature were fragments of two Mojica Impressed: Mojica Variety necked jars and four fragments of carbonized cobs of *Zea mays*.

Interpretation:

Unfortunately, this sample is not described in detail in either the field notes or laboratory record. It most likely represents an aggregation of charcoal fragments, in which case the fact that it comes from a feature intrusive into earlier occupational levels indicates the possibility of contamination by earlier charcoal.

Given the stratigraphic origin of the feature and the presence of Mojica Impressed ceramics, this sample is clearly associated with Arenal Phase activity at the site. However, its central date is somewhat older than expected, and its large 2-sigma range limits its utility for dating the associated feature and materials.

Laboratory No.: Tx-5286 Project Cat.: A1-186-A2
Provenience: Piedras del Sol (A1-186) Op/Lot: A2
Excavator: M. Mueller Submitted by: P. Sheets
Date Collected: 6/85 Date Submitted: 8/5/85
Material: Charcoal Lab Run No.: 2509a
Years bp and 1-sigma Range: 4890 ± 100

C-14: -455 ± 3.1% C-13: Unknown
Radiocarbon Date: 2940 bc
2-sigma Cal BC and Intercepts: 2336(2030,1989,1979) 1740 BC
Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

This is the only dated sample from the only identified aceramic site in the Arenal basin. Pre-dates the deposition of tephra from Cerro Chato.

Nature of Sample:

Unknown.

Context and Associations:

Recovered from a test pit at an aceramic site, 2.25 km southwest of La Tigra on the north shore of Lake Arenal (10°32'N, 85°48'W). In unweathered Aguacate Formation matrix, 3 m below present ground surface. Associated with possible hearth, chipped stone artifacts, and "cooking stones." Associated lithics have been interpreted by Sheets as the remains of a late Fortuna Phase chipped stone workshop.

Interpretation:

Dates late Archaic period in the Arenal Basin.

Laboratory No.: SI-? Project Cat.: Carbon #14
Provenience: Tronadora Vieja (G-163) Op/Lot: I6
Excavator: M. Mueller Submitted by: P. Sheets
Date Collected: 2/15/85 Date Submitted: 1985
Material: Wood charcoal Lab Run No.: Unknown
Years bp and 1-sigma Range: 3675 ± 100
C-14: Unknown C-13: Unknown
Radiocarbon Date: 1725 bc
2-sigma Cal BC and Intercepts: 2450(2129,2122,2114,2098, 2095,2083,2069,2063,2037) 1753 BC

Calibration Reference(s): Stuiver and Pearson 1986

Provenience:

Site is situated on the south shore of Lake Arenal, approximately 400 m west of the now submerged town of Old Tronadora (10°30'N, 84°54'W).

Nature of Sample:

"Very large" sample of charred wood (with well-preserved internal structure) from dense concentration of large and small fragments. Appeared to be the remains of a large cooking fire.

Context and Associations:

Stratigraphically situated 5-10 cm below the upper surface of Aguacate (155-165 cm below modern ground surface) in Operation I. Associated with Fortuna Phase lithic debitage consisting of chipped chalcedony flakes.

Interpretation:

Pre-dates tephra deposits by Cerro Chato. Dates Fortuna Phase activity during late Archaic period at Tronadora Vieja.

This sample was split for this assay and Tx-5274, and comes from the same feature as Tx-5275; however, none of the three dates overlaps at even the 2-sigma range. It is possible that the charcoal samples come from a fire in which logs of varying ages were burned. Other than laboratory error, this is one of the only acceptable explanations for this discrepancy. Level plan, black-and-white negatives and color slides of sample and context on file at the University of Colorado, Boulder.

Table A.2: Calibrated Radiocarbon Dates from Costa Rica

4000 BC — AD 1600

UCLA-2167D	AD 1410	AD 1953
SI-577	AD 1432	AD 1622
SI-576	AD 1414	AD 1479
GsY-98 (1)	AD 1280	AD 1636
SI-145	AD 1280	AD 1640
Hv-2692	AD 1330	AD 1441
GsY-98	AD 1299	AD 1457
GsY-98 (2)	AD 1280	AD 1470
Tx-5079	AD 1300	AD 1422
?	AD 1315	AD 1407
UCLA-2113G	AD 1280	AD 1430
Hv-2691	AD 1260	AD 1410
Tx-5083	AD 990	AD 1640
Hv-2690	AD 1258	AD 1395
I-8915	AD 1030	AD 1450
Sh-28-5592A	AD 890	AD 1635
UCLA-2113I	AD 1192	AD 1389
Tx-5077	AD 1208	AD 1384
WSU-?	AD 1000	AD 1430
I-8914	AD 775	AD 1440
Sh-8-5475A	AD 410	AD 1955
SI-144	AD 1037	AD 1191

4000 BC — AD 1600

ISGS-1134	AD 990	AD 1260
UCLA-2175I	AD 980	AD 1139
Beta-15100	AD 901	AD 1260
LSU-70-173	AD 611	AD 1430
?	AD 1005	AD 1151
Sh-6-5475A	AD 175	AD 1955
Sh-45-5211A	AD 670	AD 1381
Beta-15103	AD 890	AD 1220
UCLA-2175H	AD 896	AD 1187
ISGS-1087	AD 779	AD 1256
GsY-99	AD 781	AD 1220
I-8913	AD 780	AD 1220
Sh-29-5592A	AD 430	AD 1440
Sh-7-5475A	AD 540	AD 1394
Beta-2802	AD 889	AD 1025
UCLA-2175F	AD 770	AD 1153
Tx-5269	AD 770	AD 1000
Sh-50-5592A	AD 431	AD 1280
UCLA-2113F	AD 670	AD 980
UCLA-2113E	AD 609	AD 898
I-8010	AD 560	AD 890
SI-146	AD 432	AD 980

4000 BC	AD 1600
Tx-5080	AD 560 – AD 861
SI-147	AD 540 – AD 872
Y-1122	AD 540 – AD 796
Y-1124	AD 430 – AD 866
Tx-5270	AD 432 – AD 770
Beta-15102	AD 410 – AD 650
UCLA-2167B	AD 344 – AD 660
UCLA-2175G	AD 263 – AD 670
I-7721	AD 80 – AD 890
Sh-5-5475A	AD 31 – AD 976
Tx-5082	AD 230 – AD 768
UCLA-2175C	AD 260 – AD 597
I-7514	AD 34 – AD 766
ISGS-1132	AD 130 – AD 637
Tx-5273	AD 182 – AD 540
Beta-15101	AD 230 – AD 540
Haber B2	AD 70 – AD 637
Y-850	AD 132 – AD 533
UCLA-2113C	AD 130 – AD 430
Tx-5078	AD 79 – AD 410
Tx-5272	AD 79 – AD 410
DIC-2668	AD 33 – AD 430

4000 BC — AD 1600

UCLA-2113H	AD 70	AD 388
Haber B1	167 BC	AD 540
ISGS-1086	93 BC	AD 529
I-10804	86 BC	AD 390
UCLA-2175D	348 BC	218 BC
Tx-5081	800 BC	AD 640
GsY-100 (2)	410 BC	AD 48
SI-3459	390 BC	45 BC
GsY-100	754 BC	60 BC
GsY-100 (1)	511 BC	2 BC
UCLA-2113M	400 BC	122 BC
UCLA-2163	410 BC	132 BC
UCLA-2113B	800 BC	AD 52
Tx-5280	2010 BC	AD 660
UCLA-2113D	800 BC	596 BC
UCLA-2113N	800 BC	596 BC
?	1079 BC	414 BC
?	1490 BC	800 BC
UCLA-2167F	1427 BC	833 BC
?	1681 BC	835 BC
?	2012 BC	1606 BC
UCLA-2113A	2271 BC	1430 BC

4000 BC — AD 1600

Tx-5279	2860 BC	1000 BC
UCLA-2167A	2028 BC	1645 BC
?	2013 BC	1665 BC
?	2200 BC	1527 BC
SI-?	2450 BC	1753 BC
Tx-5277	2470 BC	1834 BC
Tx-5274	3014 BC	2590 BC
Tx-5276	3360 BC	2920 BC
Tx-5278	3609 BC	3040 BC
Tx-5275	3609 BC	3050 BC
Tx-5286	3950 BC	3381 BC

APPENDIX A.2
Calibrated Radiocarbon Dates from Costa Rica

? 960 ± 0 bp (ad 990 ± 0) Material: Charcoal
Site: Retes Region: Atl. Watershed
Phase: Early Cartago Period: Stone Cist
Calibrated 2σ range: AD 1005 - 1151 (146 years)
Intercept(s): AD 1028 1145 1146
Intercept mean: AD 1106
Calibration reference: Stuiver and Becker 1986

? 586 ± 0 bp (ad 1364 ± 0) Material: Charcoal
Site: La Maquina Region: Atl. Watershed
Phase: La Cabaña Period: Stone Cist
Collected by M. Stirling.
Comments: Associated with La Cabaña ceramics, jaguar metate, gold artifacts.
Reference(s): Stirling 1969, Lange & Stone 1984
Calibrated 2σ range: AD 1315 - 1407 (92 years)
Intercept(s): AD 1329 1349 1392
Intercept mean: AD 1357
Calibration reference: Stuiver and Becker 1986

? 3025 ± 150 bp (1075 ± 150 bc) Material: Paleosol
Site: Quebrada Guillermina Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic sample from paleosol beneath ET9 near Volcán Arenal.
Interpreted as predating first eruption of Volcán Arenal.
Reference(s): Borgia et al. n.d.
Calibrated 2σ range: 1681 - 835 BC (846 years)
Intercept(s): 1367 1366 1316 1267 BC
Intercept mean: 1329 BC
Calibration reference: Stuiver and Becker 1986

? 2895 ± 145 bp (945 ± 145 bc) Material: Paleosol
Site: Quebrada La Palma Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic date from paleosol beneath ET9 near Volcán Arenal.
Interpreted as predating first eruption of Volcán Arenal.
Reference(s): Borgia et al. n.d.
Calibrated 2σ range: 1490 - 800 BC (690 years)
Intercept(s): 1187 1185 1127 1126 1081 1060 1054 BC
Intercept mean: 1117 BC
Calibration reference: Stuiver and Becker 1986

? 2650 ± 115 bp (700 ± 115 bc) Material: Paleosol
Site: Sangregado Dam Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic date from paleosol beneath ET9 near Volcán Arenal.

Interpreted as predating first eruption of Volcán Arenal.
Reference(s): Borgia et al. n.d.
Calibrated 2σ range: 1079 - 414 BC (665 years)
Intercept(s): 811 BC
Intercept mean: 811 BC
Calibration reference: Stuiver and Becker 1986

? 3510 ± 120 bp (1560 ± 120 bc) Material: Charcoal
Site: Cerro Chato Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic date from carbonized organic matter beneath pyroclastic flow.
Dates eruptive activity of Cerro Chato volcano.
Reference(s): Borgia et al. n.d.
Calibrated 2σ range: 2200 - 1527 BC (673 years)
Intercept(s): 1880 1841 1832 BC
Intercept mean: 1851 BC
Calibration reference: Stuiver and Becker 1986

? 3500 ± 50 bp (1550 ± 50 bc) Material: Charcoal
Site: Cerro Chato Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic date on carbonized organic matter from pyroclastic flow.
Associated with eruptive activity of Cerro Chato volcano.
Reference(s): Borgia et al n.d.
Calibrated 2σ range: 2013 - 1665 BC (348 years)
Intercept(s): 1878 1842 1830 1789 1785 BC
Intercept mean: 1825 BC
Calibration reference: Stuiver and Becker 1986

? 3460 ± 70 bp (1510 ± 70 bc) Material: Charcoal
Site: Cerro Chato Region: Cordillera
Collected by A. Borgia. Submitted by A. Borgia.
Comments: Geologic date on carbonized organic matter from pyroclastic flow.
Associated with eruptive activity of Cerro Chato volcano.
Reference(s): Borgia et al n.d.
Calibrated 2σ range: 2012 - 1606 BC (406 years)
Intercept(s): 1768 1765 1749 BC
Intercept mean: 1761 BC
Calibration reference: Stuiver and Becker 1986

Beta-2802 1060 ± 40 bp (ad 890 ± 40) Material: Charcoal
Site: Barrial de Heredia Region: Atl. Watershed
Phase: Curridabat Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: From hearth in largest ellipsoidal structure at site.
Associated with Central Highland ceramics and Greater Nicoya polychromes.
Reference(s): Snarskis 1984b:158
Calibrated 2σ range: AD 889 - 1025 (136 years)
Intercept(s): AD 985
Intercept mean: AD 985
Calibration reference: Stuiver and Becker 1986

DIC-2668 1770 ± 85 bp (ad 180 ± 85) Material: Charcoal
Site: H-43-SE Region: Atl. Watershed

Phase: Pavas Period: Zoned Bichrome
Reference(s): Snarskis 1984b:162
Calibrated 2σ range: AD 33 - 430 (397 years)
Intercept(s): AD
Intercept mean: AD 245
Calibration reference: Stuiver and Becker 1986

Beta-15100 950 ± 80 bp (ad 1000 ± 80) Material: Charcoal
Site: La Ceiba Region: Tempisque
Phase: Palo Blanco Period: Middle Polychrome
Collected by J. Guerrero.
Comments: From sample of over 1 kg of charcoal from long oven feature.
Associated with abundant quantities of Middle Polychrome ceramics.
Reference(s): Guerrero n.d.
Intercept mean: AD 1108
Calibration reference: Stuiver and Becker 1986

Beta-15101 1660 ± 60 bp (ad 290 ± 60) Material: Charcoal
Site: La Ceiba Region: Tempisque
Phase: Catalina Period: Zoned Bichrome
Collected by J. Guerrero.
Comments: Large sample of charcoal from hearth.
Associated with Zoned Bichrome ceramics.
Reference(s): Guerrero n.d.
Calibrated 2σ range: AD 230 - 540 (310 years)
Intercept(s): AD 394
Intercept mean: AD 394
Calibration reference: Stuiver and Becker 1986

Beta-15102 1500 ± 60 bp (ad 450 ± 60) Material: Charcoal
Site: La Ceiba Region: Tempisque
Phase: Catalina Period: Zoned Bichrome
Collected by J. Guerrero.
Comments: Large sample of charcoal from hearth.
Zoned Bichrome ceramics present in lowest levels of site.
Reference(s): Guerrero n.d.
Calibrated 2σ range: AD 410 - 650 (240 years)
Intercept(s): AD 558
Intercept mean: AD 558
Calibration reference: Stuiver and Becker 1986

Beta-15103 980 ± 80 bp (ad 970 ± 80) Material: Charcoal
Site: La Ceiba Region: Tempisque
Phase: Palo Blanco Period: Middle Polychrome
Collected by J. Guerrero.
Comments: From surface of fired clay floor.
Associated with abundant quantities of Middle Polychrome ceramics.
Reference(s): Guerrero n.d.
Calibrated 2σ range: AD 890 - 1220 (330 years)
Intercept(s): AD 1023
Intercept mean: AD 1023
Calibration reference: Stuiver and Becker 1986

GsY-98   515 ± 150 bp   (ad 1435 ± 150)   Material: Wood charcoal
Site: La Bocana   Region: Tempisque   (10°19'N, 85°16'W)
Unit: G   Level: 1 (0-20 cm)   Cat.: 1/G1
Phase: Bebedero   Period: Late Polychrome
Collected 1960 by C. Baudez.   Submitted by C. Baudez.
Comments: Dates late occupation of cave.
Calibrated date based on weighted average of GsY-98 (1) and GsY-98 (2).
Total of 1105 sherds, 25 flakes, and one mano fragment from level.
Published in Radiocarbon 1966 8:140.
Reference(s):   Baudez 1967:24
Calibrated 2σ range: AD 1299 - 1457   (158 years)
Intercept(s):   AD 1416
Intercept mean: AD 1416
Calibration reference: Stuiver and Becker 1986

GsY-98 (1)   478 ± 85 bp   (ad 1472 ± 85)   Material: Wood charcoal
Site: La Bocana   Region: Tempisque   (10°19'N, 85°16'W)
Unit: G   Level: 1 (0-20cm)   Cat.: 1/G1
Phase: Bebedero   Period: Late Polychrome
Collected 1960 by C. Baudez.   Submitted by C. Baudez.
Comments: One of two dates run on same sample (250 g?). Dates late occupation of cave.
Late Polychrome (Bebedero) sherds recovered from surface of deposits.
Total of 1104 sherds, 25 flakes, and mano fragment from level.
Published in Radiocarbon 1966 8:140.
Reference(s):   Baudez 1967:24
Calibrated 2σ range: AD 1280 - 1636   (356 years)
Intercept(s):   AD 1429
Intercept mean: AD 1429
Calibration reference: Stuiver and Becker 1986

GsY-98 (2)   554 ± 85 bp   (ad 1396 ± 85)   Material: Wood charcoal
Site: La Bocana   Region: Tempisque   (10°19'N, 85°16'W)
Unit: G   Level: 1 (0-20 cm)   Cat.: 1/G1
Phase: Bebedero   Period: Late Polychrome
Collected 1960 by C. Baudez.   Submitted by C. Baudez.
Comments: One of two dates run on same sample (250 g?). Dates late occupation of cave.
Late Polychrome (Bebedero) sherds recovered from surface of deposits.
Total of 1104 sherds, 25 flakes, and one mano fragment from this level.
Published in Radiocarbon 1966 8:140.
Reference(s):   Baudez 1967:24
Calibrated 2σ range: AD 1280 - 1470   (190 years)
Intercept(s):   AD 1335
Intercept mean: AD 1335
Calibration reference: Stuiver and Becker 1986

GsY-99   1005 ± 90 bp   (ad 945 ± 90)   Material: Wood charcoal
Site: La Bocana   Region: Tempisque   (10°19'N, 85°16'W)
Unit: M   Level: 3 (40-60 cm)   Cat.: 1/M3
Phase: Catalina?   Period: Zoned Bichrome?
Collected 1960 by C. Baudez.   Submitted by C. Baudez.
Comments: Sample from one of two hearths with abundance of subsistence remains at level.
Subisistence remains, 694 sherds, mano, and 14 flakes recovered from level.
Associated with Catalina phase ceramics, but rejected as much too recent.
Published in Radiocarbon 1966 8:140.

Reference(s): Baudez 1967:24
Calibrated 2σ range: AD 781 - 1220 (439 years)
Intercept(s): AD 1002 1010 1018
Intercept mean: AD 1009
Calibration reference: Stuiver and Becker 1986

GsY-100 2195 ± 130 bp (245 ± 130 bc) Material: Wood charcoal
Site: Ortega Region: Tempisque (10°22'N, 85°29'W)
Unit: L Level: 6 Cat.: 3/L6
Phase: Catalina Period: Zoned Bichrome
Collected 1960 by C. Baudez. Submitted 1961 by C. Baudez.
Comments: From large, oval oven or hearth, bottom situated in Level 7. Mixing of 5,6,7.
Calibration is weighted average based on GsY-100 (1) and GsY-100 (2).
Associated with ceramics from Catalina Phase (sample of 3509 sherds).
Published in Radiocarbon 1966 8:139.
Reference(s): Baudez 1967:26-27
Calibrated 2σ range: 754 - 60 BC (694 years)
Intercept(s): 351 316 297 230 220 211 BC
Intercept mean: 270 BC
Calibration reference: Stuiver and Becker 1986

GsY-100 (1) 2221 ± 100 bp (271 ± 100 bc) Material: Wood charcoal
Site: Ortega Region: Tempisque (10°22'N, 85°29'W)
Unit: L Level: 6 Cat.: 3/L6
Phase: Catalina Period: Zoned Bichrome
Collected 1960 by C. Baudez. Submitted 1961 by C. Baudez.
Comments: From large, oval oven or hearth. One of two assays run on same sample.
Bottom of oven feature situated in Level 7 (130 cm). Some mixing of 5, 6, & 7.
Associated with ceramics from Catalina Phase (sample of 3509 sherds).
Published in Radiocarbon 1966 8:139.
Reference(s): Baudez 1967:26-27
Calibrated 2σ range: 511 - 2 BC (509 years)
Intercept(s): 346 289 279 274 259 248 233 BC
Intercept mean: 275 BC
Calibration reference: Stuiver and Becker 1986

GsY-100 (2) 2168 ± 98 bp (218 ± 98 bc) Material: Wood charcoal
Site: Ortega Region: Tempisque (10°22'N, 85°29'W)
Unit: L Level: 6 Cat.: 3/L6
Phase: Catalina Period: Zoned Bichrome
Collected 1960 by C. Baudez. Submitted 1961 by C. Baudez.
Comments: From large, oval oven or hearth. One of two assays run on same sample.
Bottom of oven feature situated in Level 7 (130 cm). Some mixing of 5, 6, & 7.
Associated with ceramics of the Catalina Phase (sample of 3509 sherds).
Published in Radiocarbon 1966 8:139.
Reference(s): Baudez 1967:26-27
Calibrated 2σ range: 410 BC - AD 48 (458 years)
Intercept mean: 350 BC
Calibration reference: Stuiver and Becker 1986

HAR-2513 1310 ± 40 bp (ad 640 ± 40) Material: Charcoal
Site: Vidor Region: Pacific
Period: Early Polychrome
Calibrated 2σ range: AD 643 - 799 (156 years)

Intercept(s): AD 677
Intercept mean: AD 677
Calibration reference: Stuiver and Becker 1986

Haber B1* 1820 ± 140 bp (ad 130 ± 140) Material: Charcoal
Site: Mercocha Region: Atl. Watershed
Phase: El Bosque Period: Zoned Bichrome II
Calibrated 2σ range: 167 BC - AD 540 (707 years)
Intercept(s): AD 175 198 216
Intercept mean: 196 BC
Calibration reference: Stuiver and Becker 1986

Haber B2* 1685 ± 120 bp (ad 265 ± 120) Material: Charcoal
Site: Porvenir Region: Atl. Watershed
Phase: El Bosque Period: Zoned Bichrome II
Calibrated 2σ range: AD 70 - 637 (567 years)
Intercept(s): AD 356 370 382
Intercept mean: AD 369
Calibration reference: Stuiver and Becker 1986

Hv-2690 675 ± 50 bp (ad 1275 ± 50) Material: Unknown
Site: La Paloma Region: Rivas Unit: 4-F Level: 100-120 cm
Period: Middle Polychrome
Collected by W. Haberland.
Reference(s): Haberland 1978:405
Calibrated 2σ range: AD 1258 - 1395 (137 years)
Intercept(s): AD 1283
Intercept mean: AD 1283
Calibration reference: Stuiver and Becker 1986

Hv-2691 660 ± 50 bp (ad 1290 ± 50) Material: Unknown
Site: La Paloma Region: Rivas
Period: Middle Polychrome
Collected by W. Haberland.
Reference(s): Haberland 1978:405
Calibrated 2σ range: AD 1260 - 1410 (150 years)
Intercept(s): AD 1284
Intercept mean: AD 1284
Calibration reference: Stuiver and Becker 1986

Hv-2692 505 ± 30 bp (ad 1445 ± 30) Material: Unknown
Site: San Lazaro Region: Rivas
Phase: San Lazaro Period: Late Polychrome
Collected by W. Haberland.
Reference(s): Haberland 1978:405
Calibrated 2σ range: AD 1330 - 1441 (111 years)
Intercept(s): AD 1420
Intercept mean: AD 1420
Calibration reference: Stuiver and Becker 1986

I-7514 1605 ± 165 bp (ad 345 ± 165) Material: Charcoal
Site: Severo Ledesma (7-SL) Region: Atl. Watershed Unit: Pit 5-7
Level: 5-8 (80-160 cm)
Phase: El Bosque Period: Zoned Bichrome II

Collected 1977 by M. Snarskis. Submitted by M. Snarskis.
Comments: Dispersed charcoal from several excavation levels (80 cm deep).
Upper levels of pit yielded Transitional Period ceramics.
Associated with El Bosque Complex sherds.
Reference(s): Snarskis 1978:176
Calibrated 2σ range: AD 34 - 766 (732 years)
Intercept(s): AD 427
Intercept mean: AD 427
Calibration reference: Stuiver and Becker 1986

I-7721 1525 ± 185 bp (ad 425 ± 185) Material: Charcoal
Site: Finca Patricia (41-FP) Region: Atl. Watershed Unit: Pit 41-1
Level: 3 (40-60 cm)
Phase: El Bosque Period: Zoned Bichrome II
Collected 1977 by M. Snarskis. Submitted by M. Snarskis.
Comments: Dispersed charcoal from shallow stratigraphic pit.
Single component, El Bosque site.
Associated with El Bosque Complex pottery.
Reference(s): Snarskis 1978:177
Calibrated 2σ range: AD 80 - 890 (810 years)
Intercept(s): AD 540
Intercept mean: AD 540
Calibration reference: Stuiver and Becker 1986

I-8010 1325 ± 80 bp (ad 625 ± 80) Material: Charcoal
Site: (Meseta) Region: Atl. Watershed
Phase: Pavas/Curridabat?
Calibrated 2σ range: AD 560 - 890 (330 years)
Intercept(s): AD 670
Intercept mean: AD 670
Calibration reference: Stuiver and Becker 1986

I-8913 1010 ± 90 bp (ad 940 ± 90) Material: Charcoal
Site: La Isabel (4-IT) Region: Atl. Watershed Unit: Tomb 3b
Phase: La Selva (Late B) Period: Transitional
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Charcoal from inside of late La Selva vessel placed as an offering in tomb.
Tomb also contained small incised vessel of later type Tayutic Brown Incised.
Earlier Zoned Bichrome II material found at this site.
Reference(s): Snarskis 1978:240
Calibrated 2σ range: AD 780 - 1220 (440 years)
Intercept(s): AD 1001 1012 1017
Intercept mean: AD 1010
Calibration reference: Stuiver and Becker 1986

I-8914 840 ± 195 bp (ad 1110 ± 195) Material: Charcoal
Site: La Isabel (4-IT) Region: Atl. Watershed Unit: Feature 4
Phase: La Selva? Period: Transitional?
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Charcoal dispersed in a lens between walls outside a looted Stone Cist tomb.
Walls ran perpendicular to later tomb in style of "accessory tombs."
Associated with sherds of Tuis Negative and Mercedes White Line pottery.
Reference(s): Snarskis 1978:240
Calibrated 2σ range: AD 775 - 1440 (665 years)
Intercept(s): AD 1212

Intercept mean: AD 1212
Calibration reference: Stuiver and Becker 1986

I-8915 680 ± 140 bp (ad 1270 ± 140) Material: Charcoal
Site: La Zoila (5-ZT) Region: Atl. Watershed Unit: Mound M1
Phase: La Cabaña Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Single charcoal fragment from the base of Stone Cist period burial mound. Associated with Stone Cist Period ceramics.
Reference(s): Snarskis 1978:289
Calibrated 2σ range: AD 1030 - 1450 (420 years)
Intercept(s): AD 1282
Intercept mean: AD 1282
Calibration reference: Stuiver and Becker 1986

I-9866 985 ± 165 bp (ad 965 ± 165) Material: Charcoal
Site: Vidor Region: Pacific
Phase: "Mound B"?
Calibrated 2σ range: AD 670 - 1280 (610 years)
Intercept(s): AD 1022
Intercept mean: AD 1022
Calibration reference: Stuiver and Becker 1986

I-10804 1830 ± 80 bp (ad 120 ± 80) Material: Charcoal
Site: El Tajo Region: Cordillera (10°27'N, 84°46'W)
Unit: Cuad.7S-6W Level: ET 8 (top)
Phase: Arenal Period: Zoned Bichrome
Collected by C. Aguilar.
Comments: From humus-rich paleosol developed on top of volcanic tephra. Associated with Zoned Bichrome (Arenal Phase) ceramics.
Reference(s): Aguilar 1984:74
Calibrated 2σ range: 86 BC - AD 390 (476 years)
Intercept(s): AD 134 152 169 200 211
Intercept mean: 173 BC
Calibration reference: Stuiver and Becker 1986

ISGS-1086 1820 ± 120 bp (ad 130 ± 120) Material: Charcoal
Site: Sitio Ramirez Region: Cordillera Unit: Test 1 Cat.: 4
Phase: Catalina/Ciruelas Period: Zoned Bichrome
Collected 1978-79 by L. Norr. Submitted by L. Norr.
Comments: Stratigraphically situated at interface of burned area and sterile subsoil. Associated with middle and late Zoned Bichrome ceramics. Polychromes absent. Later tombs found in same 2 X 2 m excavation unit.
Reference(s): Norr 1982-83:140
Calibrated 2σ range: 93 BC - AD 529 (622 years)
Intercept(s): AD 175 198 216
Intercept mean: AD 195
Calibration reference: Stuiver and Becker 1986

ISGS-1087 1000 ± 100 bp (ad 950 ± 100) Material: Charcoal
Site: Sitio Ramirez Region: Cordillera Unit: Test 1 Cat.: 2
Phase: Silencio? Period: Middle Polychrome?
Collected 1978-79 by L. Norr. Submitted by L. Norr.
Comments: From fill of Tomb 2, which was covered with stone slabs.

No polychrome ceramics noted at site, which dates primarily to Zoned Bichrome.
Reference(s): Norr 1982-83:140
Calibrated 2σ range: AD 779 - 1256 (477 years)
Intercept(s): AD 1004 1008 1019
Intercept mean: AD 1009
Calibration reference: Stuiver and Becker 1986

ISGS-1132 1650 ± 100 bp (ad 300 ± 100) Material: Charcoal
Site: Sitio Ramirez Region: Cordillera Unit: Test 1 Cat.: 3
Phase: Catalina/Ciruelas Period: Zoned Bichrome
Collected 1978-79 by L. Norr. Submitted by L. Norr.
Comments: Stratigraphically situated in soil level above sterile subsoil.
Associated with middle and late Zoned Bichrome ceramics. Polychromes absent.
Later tombs found in same 2 X 2 m excavation unit.
Reference(s): Norr 1982-83:140
Calibrated 2σ range: AD 130 - 637 (507 years)
Intercept(s): AD 408
Intercept mean: AD 408
Calibration reference: Stuiver and Becker 1986

ISGS-1134 910 ± 70 bp (ad 1040 ± 70) Material: Charcoal
Site: Sitio Ramirez Region: Cordillera Unit: Test 1 Cat.: 1
Phase: Silencio? Period: Middle Polychrome?
Collected 1978-79 by L. Norr. Submitted by L. Norr.
Comments: Associated with the marker of stone-lined Tomb 1.
No polychrome ceramics noted at site, which dates primarily to Zoned Bichrome.
Reference(s): Norr 1982-83:141
Calibrated 2σ range: AD 990 - 1260 (270 years)
Intercept(s): AD 1070 1085 1127 1137 1154
Intercept mean: AD 1114
Calibration reference: Stuiver and Becker 1986

LSU-70-173 953 ± 241 bp (ad 997 ± 241) Material: Charcoal
Site: Guayabo Region: Atl. Watershed
Phase: La Cabaña Period: Stone Cist
Calibrated 2σ range: AD 611 - 1430 (819 years)
Intercept(s): AD 1031 1144 1147
Intercept mean: AD 1107
Calibration reference: Stuiver and Becker 1986

M-1172 920 ± 75 bp (ad 1030 ± 75) Material: Charcoal
Site: Chahuite Escondido Region: Pacific
Phase: Matapalo? Period: Early Polychrome?
Comments: Burial context.
Contaminated through mixing.
Reference(s): Haberland 1978:406
Calibrated 2σ range: AD 980 - 1260 (280 years)
Intercept(s): AD 1044 1090 1122 1139 1152
Intercept mean: AD 1109
Calibration reference: Stuiver and Becker 1986

M-1173 1270 ± 75 bp (ad 680 ± 75) Material: Charcoal
Site: Matapalo Region: Pacific Unit: Cut 1 Level: 60-75 cm
Phase: Matapalo Period: Early Polychrome

Collected by M. Coe. Submitted by M. Coe.
Reference(s): Lange & Stone 1984
Calibrated 2σ range: AD 640 - 943 (303 years)
Intercept(s): AD 692 699 712 748 767
Intercept mean: AD 724
Calibration reference: Stuiver and Becker 1986

P-2168 1070 ± 50 bp (ad 880 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 60-90 cm Cat.: B1/1C
Phase: La Cruz Period: Late Polychrome?
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Comments: B1 cut 1 (B1/1) was in deepest part of midden.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:394
Calibrated 2σ range: AD 783 - 1145 (362 years)
Intercept(s): AD 983
Intercept mean: AD 983
Calibration reference: Stuiver and Becker 1986

P-2169 870 ± 40 bp (ad 1080 ± 40) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 90-120 cm Cat.: B1/1D
Phase: La Cruz Period: Late Polychrome?
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:394
Calibrated 2σ range: AD 1028 - 1259 (231 years)
Intercept(s): AD 1163 1174 1188
Intercept mean: AD 1175
Calibration reference: Stuiver and Becker 1986

P-2170 1030 ± 50 bp (ad 920 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 150-180 cm Cat.: B1/1F
Phase: Doscientos Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 892 - 1152 (260 years)
Intercept(s): AD 997
Intercept mean: AD 997
Calibration reference: Stuiver and Becker 1986

P-2171 720 ± 50 bp (ad 1230 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 180-210 cm Cat.: B1/1G
Phase: Doscientos Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1220 - 1388 (168 years)
Intercept(s): AD 1279
Intercept mean: AD 1279
Calibration reference: Stuiver and Becker 1986

P-2172 950 ± 40 bp (ad 1000 ± 40) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 240-270 cm Cat.: B1/1I
Phase: Doscientos Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 996 - 1191 (195 years)
Intercept(s): AD 1033 1143 1147
Intercept mean: AD 1108
Calibration reference: Stuiver and Becker 1986

P-2173 880 ± 50 bp (ad 1070 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 270-300 cm Cat.: B1/1J
Phase: Doscientos Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1020 - 1260 (240 years)
Intercept(s): AD 1161 1185
Intercept mean: AD 1173
Calibration reference: Stuiver and Becker 1986

P-2174 1110 ± 40 bp (ad 840 ± 40) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 330-360 cm Cat.: B1/1L
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:35
Calibrated 2σ range: AD 780 - 1015 (235 years)
Intercept(s): AD 902 918 955 972 975
Intercept mean: AD 944
Calibration reference: Stuiver and Becker 1986

P-2175 740 ± 40 bp (ad 1210 ± 40) Material: Charcoal
Site: Matapalo (G-11) Region: Pacific (10°20' N, 85°50' W)
Unit: Cut 1 Level: 30-40 cm Cat.: G11/1C
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1215 - 1376 (161 years)
Intercept(s): AD 1277
Intercept mean: AD 1277
Calibration reference: Stuiver and Becker 1986

P-2176 1040 ± 50 bp (ad 910 ± 50) Material: Charcoal
Site: Matapalo (G-11) Region: Pacific (10°20' N, 85°50' W)
Unit: Cut 1 Level: 45-60 cm Cat.: G11/1D
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.

Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 890 - 1150 (260 years)
Intercept(s): AD 995
Intercept mean: AD 995
Calibration reference: Stuiver and Becker 1986

P-2177 1330 ± 50 bp (ad 620 ± 50) Material: Charcoal
Site: Matapalo (G-11) Region: Pacific (10°20' N, 85°50' W)
Unit: Cut 1 Level: 45-60 and 60-75 cm Cat.: G11/2D G11/2E
Phase: Matapalo Period: Early Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:35
Calibrated 2σ range: AD 606 - 799 (193 years)
Intercept(s): AD 668
Intercept mean: AD 668
Calibration reference: Stuiver and Becker 1986

P-2178 810 ± 40 bp (ad 1140 ± 40) Material: Charcoal
Site: Huerta del Aguacate Region: Pacific (10°15' N, 85°50' W)
Unit: Cut 1 Level: 30-45 cm Cat.: G2/1C
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1133 - 1279 (146 years)
Intercept(s): AD 1223
Intercept mean: AD 1223
Calibration reference: Stuiver and Becker 1986

P-2179 930 ± 40 bp (ad 1020 ± 40) Material: Charcoal
Site: Huerta del Aguacate Region: Pacific (10°15' N, 85°50' W)
Unit: Cut 2 Level: 45-60 cm Cat.: G2/1D
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1000 - 1210 (210 years)
Intercept(s): AD 1040 1095 1119 1140 1151
Intercept mean: AD 1109
Calibration reference: Stuiver and Becker 1986

P-2180 760 ± 50 bp (ad 1190 ± 50) Material: Charcoal
Site: Huerta del Aguacate Region: Pacific (10°15' N, 85°50' W)
Unit: Cut 2 Level: 75-90 cm Cat.: G2/2F
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 1163 - 1300 (137 years)
Intercept(s): AD 1263
Intercept mean: AD 1263
Calibration reference: Stuiver and Becker 1986

P-2181 1130 ± 40 bp (ad 820 ± 40) Material: Charcoal
Site: Huerta del Aguacate Region: Pacific (10°15' N, 85°50' W)
Unit: Cut 2 Level: 90-105 cm Cat.: G2/2G
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:219.
Reference(s): Sweeney 1975:380
Calibrated 2σ range: AD 777 - 996 (219 years)
Intercept(s): AD 895 922 939
Intercept mean: AD 919
Calibration reference: Stuiver and Becker 1986

P-2282 1030 ± 50 bp (ad 920 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 120-150 cm Cat.: B1/1E
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:35
Calibrated 2σ range: AD 892 - 1152 (260 years)
Intercept(s): AD 997
Intercept mean: AD 997
Calibration reference: Stuiver and Becker 1986

P-2283 1040 ± 50 bp (ad 910 ± 50) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 210-240 cm Cat.: B1/1H
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:35
Calibrated 2σ range: AD 890 - 1150 (260 years)
Intercept(s): AD 995
Intercept mean: AD 995
Calibration reference: Stuiver and Becker 1986

P-2284 1120 ± 40 bp (ad 830 ± 40) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55' N, 85°40' W)
Unit: Cut 1 Level: 300-330 cm Cat.: B1/1K
Phase: Tamarindo Period: Middle Polychrome
Collected 1960 by M. Coe. Submitted 1974 by J. Sweeney.
Published in Radiocarbon 1977 2:218.
Reference(s): Sweeney 1975:35
Calibrated 2σ range: AD 778 - 998 (220 years)
Intercept(s): AD 898 920 942
Intercept mean: AD 920
Calibration reference: Stuiver and Becker 1986

SI-? 3675 ± 100 bp (1725 ± 100 bc) Material: Charcoal
Site: Tronadora Vieja G-163 Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. I Level: Unit 65 Lot: I6 Cat.: 13
Phase: Fortuna Period: Late Archaic
Collected 5/12/85 by M. Mueller. Submitted by P. Sheets.
Comments: "Very large" sample with well-preserved morphology from concentration of frags.

Situated 5-10 cm below the surface of Aquacate in disturbed clay substrate. Split with Tx-5274. Associated with chalcedony flakes and lithic debitage.
Calibrated 2σ range: 2450 - 1753 BC (697 years)
Intercept(s): 2129 2122 2114 2098 2095 2083 2069 2063 BC 2037 BC
Intercept mean: 2090 BC
Calibration reference: Stuiver and Becker 1986

SI-144 900 ± 0 bp (ad 1050 ± 0) Material: Charcoal
Site: Marin Region: Atl. Watershed (10°10'N, 83°36'W)
Unit: Grave 7 Level: 3.5 ft Cat.: W-4
Phase: La Selva? Period: Transitional?
Collected 1964 by M. Stirling. Submitted by M. Stirling.
Published in Radiocarbon 1966 8:417.
Calibrated 2σ range: AD 1037 - 1191 (154 years)
Intercept(s): AD 1133 1136 1156
Intercept mean: AD 1142
Calibration reference: Stuiver and Becker 1986

SI-145 480 ± 90 bp (ad 1470 ± 90) Material: Charcoal
Site: Marin Region: Atl. Watershed (10°10'N, 83°36'W)
Unit: Grave 2 Level: 3.0 ft Cat.: W-6
Phase: La Cabaña Period: Stone Cist
Collected 1964 by M. Stirling. Submitted by M. Stirling.
Comments: Site located near Williamsburg, Linea Vieja. Associated with La Cabaña ceramics.
Published in Radiocarbon 1966 8:417.
Reference(s): Stirling 1969, Lange & Stone 1984
Calibrated 2σ range: AD 1280 - 1640 (360 years)
Intercept(s): AD 1429
Intercept mean: AD 1429
Calibration reference: Stuiver and Becker 1986

SI-146 1330 ± 120 bp (ad 620 ± 120) Material: Charcoal
Site: Marin Region: Atl. Watershed (10°10'N, 83°36'W)
Unit: Grave 4 Level: 3.0 ft Cat.: W-1
Phase: La Selva Period: Transitional
Collected 1964 by M. Stirling. Submitted by M. Stirling.
Comments: Site located near Williamsburg, Linea Vieja.
Published in Radiocarbon 1966 8:417.
Reference(s): Stirling 1969, Lange & Stone 1984
Calibrated 2σ range: AD 432 - 980 (548 years)
Intercept(s): AD 668
Intercept mean: AD 668
Calibration reference: Stuiver and Becker 1986

SI-147 1360 ± 90 bp (ad 590 ± 90) Material: Charcoal
Site: Marin Region: Atl. Watershed (10°10'N, 83°36'W)
Unit: Grave 11 Level: 4.0 ft Cat.: W-2
Phase: La Selva Period: Transitional
Collected 1964 by M. Stirling. Submitted by M. Stirling.
Comments: Site located near Williamsburg, Linea Vieja.
Published in Radiocarbon 1966 8:417.
Reference(s): Stirling 1969, Lange & Stone 1984

Calibrated 2σ range: AD 540 - 872 (332 years)
Intercept(s): AD 657
Intercept mean: AD 657
Calibration reference: Stuiver and Becker 1986

SI-576 450 ± 30 bp (ad 1500 ± 30) Material: Tree bark and wood
Site: Volcán Arenal Region: Cordillera Level: 15' below surface
Cat.: 11126-1
Phase: Tilarán Period: Late
Collected 11/13/68 by W. Melson. Submitted 11/22/68 by W. Melson.
Comments: Bark and wood of tree buried by prehistoric nueé ardente from Volcán Arenal.
Outermost charred portion of sample removed for pretreatment and dating.
No direct cultural associations; some Tilarán Phase sherds from nearby hill.
Calibrated 2σ range: AD 1414 - 1479 (65 years)
Intercept(s): AD 1437
Intercept mean: AD 1437
Calibration reference: Stuiver and Becker 1986

SI-577 400 ± 30 bp (ad 1550 ± 30) Material: Tree bark and wood
Site: Volcán Arenal Region: Cordillera Level: 15' below surface
Cat.: 111216-1
Phase: Tilarán Period: Late
Collected 11/13/68 by W. Melson. Submitted 11/22/68 by W. Melson.
Comments: Bark and wood of tree buried by prehistoric nueé ardente from Volcán Arenal.
Outermost charred portion of sample removed for pretreatment and dating.
No direct cultural associations; some Tilarán Phase sherds from a nearby hill.
Reference(s): Melson 1984
Calibrated 2σ range: AD 1432 - 1622 (190 years)
Intercept(s): AD 1450
Intercept mean: AD 1450
Calibration reference: Stuiver and Becker 1986

SI-3459 2170 ± 65 bp (220 ± 65 bc) Material: Wood charcoal
Site: El Tajo Region: Cordillera (10°27'N, 84°46'W)
Unit: Cd. 2S-13W Level: Unit 8 (top)
Phase: Arenal Period: Zoned Bichrome
Collected 12/2/77 by C. Aguilar. Submitted 12/77 by W. Melson.
Comments: From humus-rich paleosol developed on fine tephra layer from Volcán Arenal.
Paleosol from which sample comes was buried catastrophically by Unit 7.
Associated with Zoned Bichrome (Arenal Phase) ceramics.
Reference(s): Aguilar 1984:74, Melson 1984
Calibrated 2σ range: 390 - 45 BC (345 years)
Intercept(s): 346 322 226 225 207 BC
Intercept mean: 265 BC
Calibration reference: Stuiver and Becker 1986

Sh-28-5592A 730 ± 210 bp (ad 1220 ± 210) Material: Charcoal
Site: Guayabo Region: Atl. Watershed
Phase: La Cabaña Period: Stone Cist
Calibrated 2σ range: AD 890 - 1635 (745 years)
Intercept(s): AD 1278
Intercept mean: AD 1278
Calibration reference: Stuiver and Becker 1986

Sh-29-5592A 1030 ± 290 bp (ad 920 ± 290) Material: Charcoal
Site: Aquiares Region: Atl. Watershed
Phase: Bosque/Cabana?
Calibrated 2σ range: AD 430 - 1440 (1010 years)
Intercept(s): AD 997
Intercept mean: AD 997
Calibration reference: Stuiver and Becker 1986

Sh-45-5211A 980 ± 170 bp (ad 970 ± 170) Material: Charcoal
Site: Rosa Maria Region: Atl. Watershed
Phase: Bosque/Cabana?
Calibrated 2σ range: AD 670 - 1381 (711 years)
Intercept(s): AD 1023
Intercept mean: AD 1023
Calibration reference: Stuiver and Becker 1986

Sh-5-5475A 1530 ± 210 bp (ad 420 ± 210) Material: Charcoal
Site: El Cardel Region: Atl. Watershed
Phase: El Bosque Period: Zoned Bichrome II
Calibrated 2σ range: AD 31 - 976 (945 years)
Intercept(s): AD 539
Intercept mean: AD 539
Calibration reference: Stuiver and Becker 1986

Sh-50-5592A 1140 ± 220 bp (ad 810 ± 220) Material: Charcoal
Site: Platanillo Region: Atl. Watershed
Phase: Bosque/Cabana?
Calibrated 2σ range: AD 431 - 1280 (849 years)
Intercept(s): AD 892 925 936
Intercept mean: AD 918
Calibration reference: Stuiver and Becker 1986

Sh-6-5475A 960 ± 430 bp (ad 990 ± 430) Material: Charcoal
Site: Monte Cristo Region: Atl. Watershed
Phase: La Selva/La Cabana
Calibrated 2σ range: AD 175 - 1955 (1780 years)
Intercept(s): AD 1028 1145 1146
Intercept mean: AD 1106
Calibration reference: Stuiver and Becker 1986

Sh-7-5475A 1050 ± 240 bp (ad 900 ± 240) Material: Charcoal
Site: Aquiares Region: Atl. Watershed
Phase: La Selva/La Cabana
Calibrated 2σ range: AD 540 - 1394 (854 years)
Intercept(s): AD 990
Intercept mean: AD 990
Calibration reference: Stuiver and Becker 1986

Sh-8-5475A 870 ± 390 bp (ad 1080 ± 390) Material: Charcoal
Site: Descanso Region: Atl. Watershed
Phase: La Selva/La Cabana
Calibrated 2σ range: AD 410 - 1955 (1545 years)
Intercept(s): AD 1163 1174 1188
Intercept mean: AD 1175

Calibration reference: Stuiver and Becker 1986

Tx-5077 740 ± 50 bp (ad 1210 ± 50) Material: Wood charcoal
Site: El Silencio (G-150) Region: Cordillera (10°28' N, 84°55'W)
Unit: Op. C Lot: C2 Cat.: 2
Phase: Silencio Period: Middle Polychrome
Collected 2/1/84 by J. Bradley. Submitted 6/18/84 by P. Sheets.
Comments: From deposit with high density of sherds overlying slab-built tombs.
"Small" sample. Some rootlet contamination noted.
Considered to accurately date associated artifactual assemblage.
Reference(s): Sheets 1984, Bradley 1984
Fractionation: σC_4 = -87.7±4.4%%
Calibrated 2σ range: AD 1208 - 1384 (176 years)
Intercept(s): AD 1277
Intercept mean: AD 1277
Calibration reference: Stuiver and Becker 1986

Tx-5078 1770 ± 60 bp (ad 180 ± 60) Material: Wood charcoal
Site: El Silencio (G-150) Region: Cordillera (10°28'N, 84°55'W)
Unit: Op. B Level: Unit 50 Lot: B5 Cat.: 4
Phase: Silencio? Period: Middle Polychrome?
Collected 2/15/84 by M. Chenault. Submitted 6/18/84 by P. Sheets.
Comments: Sample from a slab-built tomb in Silencio Phase cemetery.
Date considered to be too early for associations. May have been redeposited.
Associated with human remains, Cabuyal Polychrome vessels, gold avian pendant.
Reference(s): Sheets 1984, Bradley 1984:97
Fractionation: σC_4 = -197.9±2.8%
Calibrated 2σ range: AD 79 - 410 (331 years)
Intercept(s): AD 245
Intercept mean: AD 245
Calibration reference: Stuiver and Becker 1986

Tx-5079 570 ± 30 bp (ad 1380 ± 30) Material: Wood charcoal
Site: Dos Armadillos (G-154) Region: Cordillera (10°28'N, 84°55'W)
Unit: Op. A Level: Unit 30 (40 cm) Lot: A2 Cat.: 15
Phase: Tilaran Period: Late
Collected 3/19/84 by J. Hoopes. Submitted 6/18/84 by P. Sheets.
Comments: Aggregate sample (?) situated in upper portion of Unit 30, underlying Unit 20.
Considered to accurately date the associated artifactual assemblage.
Associated with types Silencio Appliqué, San Luis Coarse, and Malekos Red.
Reference(s): Sheets 1984, Hoopes 1984b
Fractionation: σC_4 = -69.0±3.1%%
Calibrated 2σ range: AD 1300 - 1422 (122 years)
Intercept(s): AD 1332 1343 1394
Intercept mean: AD 1356
Calibration reference: Stuiver and Becker 1986

Tx-5080 1340 ± 70 bp (ad 610 ± 70) Material: Wood charcoal
Site: Tronadorcita (G-161) Region: Cordillera (10°30'N, 84°53'W)
Unit: Op. B Level: Unit 50? Lot: B4 Cat.: 38
Phase: Arenal? Period: Zoned Bichrome?
Collected 4/4/84 by J. Bradley. Submitted 6/18/84 by P. Sheets.
Comments: In 2 X 2 m test pit, below Unit 30 and "probably" at the top of Unit 50.
Most likely dates Arenal Phase ceramics, but some Silencio materials present.

Arenal Phase ceramics mixed with later phases in this and overlying levels.
Reference(s): Sheets 1984, Bradley et al. 1984
Fractionation: σC₄ = -153.4±3.3%
Calibrated 2σ range: AD 560 - 861 (301 years)
Intercept(s): AD 665
Intercept mean: AD 665
Calibration reference: Stuiver and Becker 1986

Tx-5081 2030 ± 300 bp (80 ± 300 bc) Material: Wood charcoal
Site: Tronadora Vieja(G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Ops. C & D Level: Unit 60 Lot: C2/D1 Cat.: 31/55
Phase: Tronadora? Period: Middle Formative?
Collected 4/6/84 by J. Bradley. Submitted 6/18/84 by P. Sheets.
Comments: Aggregate sample of small fragments from Unit 60 in two separate operations.
Date is believed to be much too late, possibly the result of contamination.
Associated with Tronadora Phase samples, cupule of Zea mays.
Reference(s): Sheets 1984, Bradley et al. 1984
Calibrated 2σ range: 800 BC - AD 640 (1440 years)
Intercept mean: 50 BC
Calibration reference: Stuiver and Becker 1986

Tx-5082 1530 ± 130 bp (ad 420 ± 130) Material: Wood charcoal
Site: Viboriana (G-175) Region: Cordillera (10°28'N, 84°51'W)
Unit: Op. B Level: Unit 50 Lot: B1/B6 Cat.: 34/43
Phase: Arenal Period: Zoned Bichrome
Collected 5/84 by J. Hoopes. Submitted 6/18/84 by P. Sheets.
Comments: Samples from widely separated levels in Unit 50 combined for datable sample.
Very low sherd density, but site is single-component Arenal Phase occupation.
Reference(s): Sheets 1984, Bradley et al. 1984
Fractionation: σC₄ = -173.8±6.2%
Calibrated 2σ range: AD 230 - 768 (538 years)
Intercept(s): AD 539
Intercept mean: AD 539
Calibration reference: Stuiver and Becker 1986

Tx-5083 670 ± 190 bp (ad 1280 ± 190) Material: Wood charcoal
Site: Viboriana (G-175) Region: Cordillera (10°28'N, 84°51'W)
Unit: Op. B Level: Intrusive pit Lot: B7 Cat.: 51
Phase: Arenal? Period: Zoned Bichrome?
Collected 5/20/84 by J. Hoopes. Submitted 6/18/84 by P. Sheets.
Comments: From deep intrusive pit with uncertain stratigraphic origin.
Date is much too recent for Arenal Phase. Suggests late cultural intrusion.
The only artifact recovered from this feature was a single Arenal Phase sherd.
Reference(s): Sheets 1984, Bradley et al. 1984
Calibrated 2σ range: AD 990 - 1640 (650 years)
Intercept(s): AD 1283
Intercept mean: AD 1283
Calibration reference: Stuiver and Becker 1986

Tx-5269 1130 ± 50 bp (ad 820 ± 50) Material: Wood charcoal
Site: Sitio Bolivar (G-164) Region: Cordillera (10°31'N, 84°55'W)
Level: Surface Lot: A9 Cat.: 87
Phase: Arenal? Period: Zoned Bichrome?
Collected 3/85 by M. Mueller. Submitted 7/10/85 by P. Sheets.

Comments: Large sample from prehistoric hearth or firepit on shore of Lake Arenal.
Possibly subject to inundation, periodic leaching, or recent contamination.
Associated with large Arenal Phase surface assemblage. Date too recent.
Calibrated 2σ range: AD 770 - 1000 (230 years)
Intercept(s): AD 895 922 939
Intercept mean: AD 919
Calibration reference: Stuiver and Becker 1986

Tx-5270 1410 ± 80 bp (ad 540 ± 80) Material: Wood charcoal
Site: Sitio Bolivar (G-164) Region: Cordillera (10°31'N, 84°55'W)
Unit: Op. E Lot: E18 Cat.: 102
Phase: Arenal Period: Zoned Bichrome
Collected 3/85 by M. Chenault. Submitted 7/10/85 by P. Sheets.
Comments: Sample from matrix of sherds and artifacts overlying stone mortuary features.
Slight rootlet contamination. Otherwise acceptable date for late Arenal Phase.
Associated with wide variety and large quantity of late Arenal Phase material.
Calibrated 2σ range: AD 432 - 770 (338 years)
Intercept(s): AD 642
Intercept mean: AD 642
Calibration reference: Stuiver and Becker 1986

Tx-5272 1770 ± 60 bp (ad 180 ± 60) Material: Wood charcoal
Site: Sitio Bolivar (G-164) Region: Cordillera (10°31'N, 84°55'W)
Level: Surface Lot: A8 Cat.: 85
Phase: Arenal Period: Zoned Bichrome
Collected 3/85 by M. Mueller. Submitted 7/10/85 by P. Sheets.
Comments: Large, aggregate sample from concentration in hearth on shore of Lake Arenal.
Partly exposed to modern weathering and charcoal from agricultural burning.
Considered to be an acceptable date for associated Late Arenal ceramics.
Calibrated 2σ range: AD 79 - 410 (331 years)
Intercept(s): AD 245
Intercept mean: AD 245
Calibration reference: Stuiver and Becker 1986

Tx-5273 1660 ± 70 bp (ad 290 ± 70) Material: Wood charcoal
Site: Sitio Bolivar (G-164) Region: Cordillera (10°31'N, 84°55'W)
Unit: Op. B Level: 125 cm Lot: B6 Cat.: 84
Phase: Arenal Period: Zoned Bichrome
Collected by M. Mueller. Submitted 7/10/85 by P. Sheets.
Comments: Single, "large" sample in direct association with midden deposit of sherds.
Sample is acceptable, and consistent with other late Zoned Bichrome dates.
Associated with large quantity of late Arenal Phase ceramics and debris.
Calibrated 2σ range: AD 182 - 540 (358 years)
Intercept(s): AD 394
Intercept mean: AD 394
Calibration reference: Stuiver and Becker 1986

Tx-5274 4210 ± 70 bp (2260 ± 70 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. I Level: Unit 65 Lot: I6 Cat.: 13
Phase: Fortuna Period: Late Archaic
Collected 2/15/85 by M. Mueller. Submitted 7/10/85 by P. Sheets.
Comments: "Very large" sample with well-preserved morphology from concentration of frags.
Situated 5-10 cm below the surface of Aguacate in disturbed clay substrate.

Split with Tx-5275 & SI-?. Associated with chalcedony flakes, lithic debitage.
Fractionation: σC_4 = -402.5±4.2%
Calibrated 2σ range: 3014 - 2590 BC (424 years)
Intercept(s): 2883 2796 2784 BC
Intercept mean: 2821 BC
Calibration reference: Stuiver and Pearson 1986

Tx-5275 4600 ± 70 bp (2650 ± 70 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. I Level: Unit 65 Lot: I6 Cat.: 14
Phase: Fortuna Period: Late Archaic
Collected 2/15/85 by M. Mueller. Submitted 7/10/85 by P. Sheets.
Comments: "Very large" sample with well-preserved morphology from concentration of frags.
Situated 5-10 cm below the surface of Aguacate in disturbed clay substrate.
Split with Tx-5274. Associated with chalcedony flakes and lithic debitage.
Fractionation: σC_4 = -436.2±3.2%
Calibrated 2σ range: 3609 - 3050 BC (559 years)
Intercept(s): 3360 BC
Intercept mean: 3360 BC
Calibration reference: Stuiver and Pearson 1986

Tx-5276 4450 ± 70 bp (2500 ± 70 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. L Level: 140 cm Lot: L10 Cat.: 27
Phase: Tronadora? Period: Early Formative?
Collected 3/5/85 by J. Hoopes. Submitted 7/10/85 by P. Sheets.
Comments: Large, aggregate sample from 50 X 50 cm area on occupational surface.
Stratigraphically situated in lowermost soil level on Aguacate.
Associated with Tronadora Phase ceramics, maize kernel — considered too early.
Fractionation: σC_4 = -425.4±2.6%
Calibrated 2σ range: 3360 - 2920 BC (440 years)
Intercept(s): 3096 3053 3048 BC
Intercept mean: 3066 BC
Calibration reference: Stuiver and Pearson 1986

Tx-5277 3730 ± 100 bp (1780 ± 100 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. V Lot: V9 Cat.: 30
Phase: Tronadora Period: Early Formative
Collected 3/11/85 by J. Hoopes. Submitted 7/10/85 by P. Sheets.
Comments: Single, large chunk of charcoal (ca. 20 g) associated with occupational floor.
From level corresponding to uppermost surface of Aguacate clay substrate.
Associated with 42 sherds, of which decorated examples are Tronadora Phase.
Fractionation: σC_4 = -371.6±4.2%
Calibrated 2σ range: 2470 - 1834 BC (636 years)
Intercept(s): 2192 2165 2140 BC
Intercept mean: 2166 BC
Calibration reference: Stuiver and Becker 1986

Tx-5278 4580 ± 80 bp (2630 ± 80 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. I Lot: I14 Cat.: 37
Phase: Fortuna Period: Late Archaic
Collected 3/14/85 by J. Hoopes. Submitted 7/10/85 by P. Sheets.

Comments: Single, large chunk of charcoal in uppermost 10 cm of Aguacate clay substrate.
Level with large amount of charcoal, including samples Tx-5274 and Tx-5275.
Associated with Fortuna Phase lithic debitage and two undecorated body sherds.
Fractionation: σC_4 = -435.0±2.9%
Calibrated 2σ range: 3609 - 3040 BC (569 years)
Intercept(s): 3351 BC
Intercept mean: 3351 BC
Calibration reference: Stuiver and Pearson 1986

Tx-5279 3480 ± 320 bp (1530 ± 320 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. W Lot: W18 Cat.: 61
Phase: Tronadora Period: Early Formative
Collected 3/18/85 by J. Bradley. Submitted 7/10/85 by P. Sheets.
Comments: From occupational surface associated with circular habitational feature.
Stratigraphically situated at the contact between Unit 61 and Unit 64.
Associated with postholes, Tronadora sherds, lithic debris, and hearth stones.
Fractionation: σC_4 = 351.4±12.5%
Calibrated 2σ range: 2860 - 1000 BC (1860 years)
Intercept(s): 1872 1842 1813 1807 1777 BC
Intercept mean: 1822 BC
Calibration reference: Stuiver and Becker 1986

Tx-5280 2470 ± 560 bp (520 ± 560 bc) Material: Wood charcoal
Site: Tronadora Vieja (G-163) Region: Cordillera (10°30'N, 84°54'W)
Unit: Op. W Lot: W35 Cat.: 76
Phase: Arenal Period: Zoned Bichrome
Collected 3/85 by J. Bradley. Submitted 7/10/85 by P. Sheets.
Comments: From interior of deep, narrow burial feature originating in Unit 54.
Feature penetrated Aguacate substrate to depth of 175 cm.
Burial feature contained early Arenal Phase ceramics and four maize cob frags.
Fractionation: σC_4 = 265.3±21.9%
Calibrated 2σ range: 2010 BC - AD 660 (2670 years)
Intercept mean: 597 BC
Calibration reference: Stuiver and Becker 1986

Tx-5286 4890 ± 100 bp (2940 ± 100 bc) Material: Charcoal
Site: Piedras del Sol AL-186 Region: Cordillera (10°32'N, 85°48'W)
Unit: Op. A Level: 300 cm Lot: A2
Phase: Fortuna Period: Late Archaic
Collected 6/85 by M. Mueller. Submitted 8/5/85 by P. Sheets.
Comments: From unweathered Aguacate matrix in test pit at aceramic site.
Associated lithics interpreted by Sheets as remains of Fortuna Phase workshop.
Associated with possible hearth, chipped stone artifacts, and hearth stones.
Calibrated 2σ range: 3950 - 3381 BC (569 years)
Intercept(s): 3695 BC
Intercept mean: 3695 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2113A 3465 ± 160 bp (1515 ± 160 bc) Material: Charcoal
Site: La Montaña (18-LM) Region: Atl. Watershed Unit: 2,3,3N,4
Level: Layer D
Phase: La Montaña Period: Middle Formative
Collected 12/76-3/77 by M. Snarskis. Submitted by M. Snarskis.

Comments: Dispersed charcoal fragments over several square meters were combined for date. Presence of charcoal without radioactivity in Layer D makes this date suspect. Associated with level containing La Montaña ceramics and other artifacts.
Reference(s): Snarskis 1978:105
Calibrated 2σ range: 2271 - 1430 BC (841 years)
Intercept(s): 1807 1806 1770 1762 1752 BC
Intercept mean: 1779 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2113B 2275 ± 160 bp (325 ± 160 bc) **Material:** Charcoal
Site: La Montaña (18-LM) **Region:** Atl. Watershed **Unit:** 2,3,3N **Level:** Layer D
Phase: La Montaña **Period:** Middle Formative?
Collected 12/76-3/77 by M. Snarskis. **Submitted** by M. Snarskis.
Comments: Dispersed charcoal fragments over several square meters were combined for date. Possible contamination from gopher tunnels and overlying prehistoric cemetery. Associated with level containing La Montaña ceramics and other artifacts.
Reference(s): Snarskis 1978:106
Calibrated 2σ range: 800 BC - AD 52 (852 years)
Intercept mean: 65 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2113C 1730 ± 60 bp (ad 220 ± 60) **Material:** Charcoal
Site: La Montaña (18-LM) **Region:** Atl. Watershed **Unit:** 8
Phase: La Selva? **Period:** Transitional?
Collected 12/76-3/77 by M. Snarskis. **Submitted** by M. Snarskis.
Comments: Charcoal from inside a vessel placed as a burial offering. Earlier charcoal noted at site, although this context seems secure. Associated with La Selva Complex ceramics in prehistoric cemetery.
Reference(s): Snarskis 1978:240
Calibrated 2σ range: AD 130 - 430 (300 years)
Intercept(s): AD 260 281 291 298 324
Intercept mean: AD 291
Calibration reference: Stuiver and Becker 1986

UCLA-2113D 2500 ± 60 bp (550 ± 60 bc) **Material:** Charcoal
Site: La Montaña (18-LM) **Region:** Atl. Watershed **Unit:** Sector 2 **Level:** Layer D
Phase: La Montaña **Period:** Middle Formative
Collected 2-3/76 by M. Snarskis. **Submitted** by M. Snarskis.
Comments: Concentrated charcoal fragments from top of Layer D. Collected one year prior to principal excavations at site. Associated with level containing La Montaña ceramics and other artifacts.
Reference(s): Snarskis 1978:106
Calibrated 2σ range: 800 - 596 BC (204 years)
Intercept(s): 763 680 660 629 623 609 BC
Intercept mean: 661 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2113E 1310 ± 60 bp (ad 640 ± 60) **Material:** Charcoal
Site: La Montaña (18-LM) **Region:** Atl. Watershed **Unit:** 7
Phase: La Selva **Period:** Transitional
Collected 12/76-3/77 by M. Snarskis.
Comments: Charcoal from inside a vessel placed as a burial offering.

Earlier material present at site, although context seems secure.
Associated with La Selva Complex ceramics in prehistoric cemetery.
Reference(s): Snarskis 1978:240
Calibrated 2σ range: AD 609 - 898 (289 years)
Intercept(s): AD 677
Intercept mean: AD 677
Calibration reference: Stuiver and Becker 1986

UCLA-2113F 1210 ± 60 bp (ad 740 ± 60) Material: Charcoal
Site: La Cabaña (20-CB) Region: Atl. Watershed Unit: Tomb 2
Phase: El Bosque? Period: Zoned Bichrome II?
Collected 1977 by M. Snarskis. Submitted by M. Snarskis.
Comments: Dispersed charcoal fragments from fill of long, corridor-shaped tomb.
Transitional Period sherds in fill suggest possible prehistoric contamination.
Associated with broken El Bosque pottery and jade. Transitional Phase sherds.
Reference(s): Snarskis 1978:177
Calibrated 2σ range: AD 670 - 980 (310 years)
Intercept(s): AD 778 792 800
Intercept mean: AD 790
Calibration reference: Stuiver and Becker 1986

UCLA-2113G 590 ± 60 bp (ad 1360 ± 60) Material: Charcoal
Site: La Cabaña (20-3) Region: Atl. Watershed Level: 1
Phase: La Cabaña Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Scattered charcoal from midden deposit in southern arm of walled enclosure.
Associated with Stone Cist Period ceramics and habitations.
Reference(s): Snarskis 1978:290
Calibrated 2σ range: AD 1280 - 1430 (150 years)
Intercept(s): AD 1328 1350 1391
Intercept mean: AD 1356
Calibration reference: Stuiver and Becker 1986

UCLA-2113H 1800 ± 60 bp (ad 150 ± 60) Material: Charcoal
Site: La Cabaña (20-CB) Region: Atl. Watershed Unit: Tomb 1
Phase: El Bosque Period: Zoned Bichrome II
Collected 1977 by M. Snarskis. Submitted by M. Snarskis.
Comments: Charcoal dispersed in the fill of corridor-shaped tomb complex.
Associated with El Bosque pottery, jade beads, metate and mano fragments.
Reference(s): Snarskis 1978:176
Calibrated 2σ range: AD 70 - 388 (318 years)
Intercept(s): AD 185 186 228
Intercept mean: AD 200
Calibration reference: Stuiver and Becker 1986

UCLA-2113I 730 ± 60 bp (ad 1220 ± 60) Material: Charcoal
Site: La Cabaña (20.1-CB) Region: Atl. Watershed Unit: Tomb 3
Phase: La Cabaña Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Charcoal from inside a vessel placed as a burial offering in a stone cist tomb.
Tomb is part of a large Stone Cist Period cemetery.
Reference(s): Snarskis 1978:289
Calibrated 2σ range: AD 1192 - 1389 (197 years)
Intercept(s): AD 1278

Intercept mean: AD 1278
Calibration reference: Stuiver and Becker 1986

UCLA-2113M 2230 ± 60 bp (280 ± 60 bc) Material: Charcoal
Site: La Montaña (18-LM) Region: Atl. Watershed Unit: 11
Level: Layer D
Phase: La Montaña Period: Middle Formative?
Collected 12/76-3/77 by M. Snarskis. Submitted by M. Snarskis.
Comments: Single large piece of charcoal.
Possible contamination by gopher tunnels and overlying prehistoric cemetery.
Associated with level containing La Montaña ceramics and other artifacts
Reference(s): Snarskis 1978:106
Calibrated 2σ range: 400 - 122 BC (278 years)
Intercept(s): 359 286 284 271 261 241 235 BC
Intercept mean: 277 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2113N 2500 ± 60 bp (550 ± 60 bc) Material: Charcoal
Site: La Montaña (18-LM) Region: Atl. Watershed Unit: 5
Level: Layer D
Phase: La Montaña Period: Middle Formative
Collected 12/76-3/77 by M. Snarskis. Submitted by M. Snarskis.
Comments: Single large piece of charcoal.
Associated with level containing La Montaña ceramics and other artifacts.
Reference(s): Snarskis 1978:106
Calibrated 2σ range: 800 - 596 BC (204 years)
Intercept(s): 763 680 660 629 623 609 BC
Intercept mean: 661 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2113O >50,000 bp Material: Charcoal
Site: La Montaña (18-LM) Region: Atl. Watershed Unit: 4
Level: Layer D
Phase: La Montaña? Period: Middle Formative?
Collected 12/76-3/77 by M. Snarskis. Submitted by M. Snarskis.
Comments: Single large piece of charcoal.
"Unable to be dated; without radioactivity."
Reference(s): Snarskis 1978:106

UCLA-2129 1295 ± 60 bp (ad 655 ± 60) Material: Charcoal
Site: Vidor Region: Pacific
Phase: Culebra? Period: Early Polychrome?
Calibrated 2σ range: AD 640 - 882 (242 years)
Intercept(s): AD 685
Intercept mean: AD 685
Calibration reference: Stuiver and Becker 1986

UCLA-2151 660 ± 80 bp (ad 1290 ± 80) Material: Charcoal
Site: Mojica Region: Pacific
Period: Zoned Bichrome?
Calibrated 2σ range: AD 1220 - 1420 (200 years)
Intercept(s): AD 1284
Intercept mean: AD 1284
Calibration reference: Stuiver and Becker 1986

UCLA-2163 2250 ± 60 bp (300 ± 60 bc) Material: Charcoal
Site: Mendez Region: Cordillera Lot: 129
Phase: Naranjo/Catalina Period: Zoned Bichrome
Collected 1978-79 by L. Norr.
Comments: Recovered from black silt stratum benath Mound I.
Stratum interpreted as ground surface at time of mound construction.
Associated with Middle and Late Zoned Bichrome ceramics.
Reference(s): Norr 1982-83:140, Lange & Stone 1984
Calibrated 2σ range: 410 - 132 BC (278 years)
Intercept(s): 377 370 365 266 265 BC
Intercept mean: 329 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2164 1285 ± 60 bp (ad 665 ± 60) Material: Charcoal
Site: Vidor Region: Pacific
Phase: Culebra Period: Early Polychrome
Calibrated 2σ range: AD 640 - 890 (250 years)
Intercept(s): AD 688 704 706 752 760
Intercept mean: AD 722
Calibration reference: Stuiver and Becker 1986

UCLA-2167A 3500 ± 60 bp (1550 ± 60 bc) Material: Wood charcoal
Site: Mendez Region: Cordillera Unit: TR-4, N6W1 Level: 200 cm belo
w datum
Phase: Tronadora? Period: Early Formative?
Collected 1978-79 by L. Norr.
Comments: Recovered from culturally sterile stratum under Mound I (level 4).
Immediately overlain by occupational level (level 3).
Naranjo Phase ceramics from overlying level contain Tronadora-like sherds.
Reference(s): Norr 1982-83:140, Lange & Stone 1984
Calibrated 2σ range: 2028 - 1645 BC (383 years)
Intercept(s): 1878 1842 1830 1789 1785 BC
Intercept mean: 1825 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2167B 1525 ± 80 bp (ad 425 ± 80) Material: Charcoal
Site: La Fábrica Region: Atl. Watershed
Calibrated 2σ range: AD 344 - 660 (316 years)
Intercept(s): AD 540
Intercept mean: AD 540
Calibration reference: Stuiver and Becker 1986

UCLA-2167D 360 ± 80 bp (ad 1590 ± 80) Material: Charcoal
Site: Grecia Region: Atl. Watershed
Phase: Art. #233?
Calibrated 2σ range: AD 1410 - 1953 (543 years)
Intercept(s): AD 1490
Intercept mean: AD 1490
Calibration reference: Stuiver and Becker 1986

UCLA-2167E 2110 ± 80 bp (160 ± 80 bc) Material: Charcoal
Site: El Carmen Region: Pacific Unit: Square 12 Cat.: RC #3-4
Phase: Catalina/Arenal Period: Zoned Bichrome
Collected 1977-78 by P. Rydar.
Comments: "Fist sized" sample from Cache 7 in Mound 2. Primarily Zoned Bichrome pottery. Described as "in clear relation" to Las Palmas Red-on-Beige vessel and metates. In association with linear "walls" and stone mortuary features.
Reference(s): Ryder 1982-83a:109, Lange & Stone 1984
Calibrated 2σ range: 390 BC - AD 54 (444 years)
Intercept mean: 144 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2167F 2910 ± 100 bp (960 ± 100 bc) Material: Charcoal
Site: La Fábrica Region: Atl. Watershed
Calibrated 2σ range: 1427 - 833 BC (594 years)
Intercept(s): 1207 1206 1189 1181 1147 1146 1128 1124 BC
1108 1091 1085 1058 1056 BC
Intercept mean: 1133 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2175C 1600 ± 60 bp (ad 350 ± 60) Material: Charcoal
Site: Severo Ledesma(7.1-SL) Region: Atl. Watershed Unit: 7.5
Level: 5-8
Phase: El Bosque Period: Zoned Bichrome II
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Charcoal from stratigraphic pit.
Reference(s): Lange & Stone 1984
Calibrated 2σ range: AD 260 - 597 (337 years)
Intercept(s): AD 428
Intercept mean: AD 428
Calibration reference: Stuiver and Becker 1986

UCLA-2175D 2000 ± 90 bp (50 ± 90 bc) Material: Charcoal
Site: Severo Ledesma(7.1-SL) Region: Atl. Watershed Unit: M-1
Phase: El Bosque Period: Zoned Bichrome II
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Sample from fill of rectangular El Bosque phase house.
Reference(s): Lange & Stone 1984
Calibrated 2σ range: 348 - 218 BC (130 years)
Intercept(s): 86 84 65 36 34 19 13 1 BC
Intercept mean: 42 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2175F 1080 ± 80 bp (ad 870 ± 80) Material: Charcoal
Site: Barrial de Heredia Region: Atl. Watershed
Phase: Curridabat Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: From charcoal within a rock-filled oven inside largest ellipsoidal structure.
Reference(s): Snarskis 1984b:158
Calibrated 2σ range: AD 770 - 1153 (383 years)
Intercept(s): AD 981
Intercept mean: AD 981
Calibration reference: Stuiver and Becker 1986

UCLA-2175G 1525 ± 90 bp (ad 425 ± 90) Material: Charcoal
Site: Barrial de Heredia Region: Atl. Watershed Unit: 26-M.2
Level: 3
Phase: Curridabat Period: Transitional
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Late Curridabat Phase ceramics mixed with Pavas Phase materials.
Snarskis says this date is "too early."
Reference(s): Lange & Stone 1984
Calibrated 2σ range: AD 263 - 670 (407 years)
Intercept(s): AD 540
Intercept mean: AD 540
Calibration reference: Stuiver and Becker 1986

UCLA-2175H 1000 ± 60 bp (ad 950 ± 60) Material: Charcoal
Site: Barrial de Heredia Region: Atl. Watershed Unit: 26-M.1
Level: 2
Phase: Cartago Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: From just below house floor at site.
Associated with Central Highlands ceramics and Greater Nicoya polychromes.
Reference(s): Snarskis & Blanco 1978, Snarskis 1984b:158
Calibrated 2σ range: AD 896 - 1187 (291 years)
Intercept(s): AD 1004 1008 1019
Intercept mean: AD 1010
Calibration reference: Stuiver and Becker 1986

UCLA-2175I 920 ± 80 bp (ad 1030 ± 80) Material: Charcoal
Site: Guacimo Region: Atl. Watershed Unit: 7-Tomb VII
Phase: La Cabaña Period: Stone Cist
Collected by M. Snarskis. Submitted by M. Snarskis.
Comments: Possibly mixed with El Bosque ceramics (date considered too early for Luna).
Associated with La Cabaña pottery, Luna Polychrome vessel from Greater Nicoya.
Reference(s): Lange & Stone 1984
Calibrated 2σ range: AD 980 - 1139 (159 years)
Intercept(s): AD 1044 1090 1122 1152 1275
Intercept mean: AD 1137
Calibration reference: Stuiver and Becker 1986

UCLA-2177A 2830 ± 80 bp (880 ± 80 bc) Material: Charcoal
Site: Vidor Region: Pacific Unit: Feature 13 Lot: N45-47,W13-14
Cat.: RC #22
Phase: Loma B Period: Zoned Bichrome
Collected by L. Norr. Submitted by F. Lange.
Comments: Associated with Toya Zoned Incised ceramics.
Reference(s): Lange 1980, Lange & Stone 1984
Calibrated 2σ range: 1291 - 830 BC (461 years)
Intercept(s): 1007 982 976 BC
Intercept mean: 988 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2177B 2200 ± 60 bp (250 ± 60 bc) Material: Charcoal
Site: Vidor Region: Pacific Level: 3 Lot: N 56.5-57.5
Cat.: RC #30
Phase: Orso Period: Zoned Bichrome

Collected by F. Lange. Submitted by F. Lange.
Reference(s): Lange 1980, Lange & Stone 1984
Calibrated 2σ range: 400 - 90 BC (310 years)
Intercept(s): 352 295 230 219 212 BC
Intercept mean: 262 BC
Calibration reference: Stuiver and Becker 1986

WSU-? 747 ± 135 bp (ad 1203 ± 135) Material: Turtle carapace
Site: San Francisco Region: Rivas
Period: Late Polychrome
Collected by L. Wyckoff.
Comments: Date from turtle carapace at site north of Rivas.
Healy says date "appears to be a good sample."
Reference(s): Wyckoff 1973, Healy 1980:309
Calibrated 2σ range: AD 1000 - 1430 (430 years)
Intercept(s): AD 1265 1266 1276
Intercept mean: AD 1269
Calibration reference: Stuiver and Becker 1986

Y-809 1530 ± 280 bp (ad 420 ± 280) Material: Charcoal
Site: Matapalo Region: Pacific (10°22'N, 85°49'W)
Unit: Cut 1 Level: 150-165 cm Cat.: G11/1K (No. 1)
Phase: Monte Fresco Period: Zoned Bichrome
Collected 1959 by M. Coe. Submitted by M. Coe.
Comments: From stratified midden with Zoned Bichrome pottery underlying Early Polychrome.
Possible contamination by air during preparation process.
Coe interprets date as "a little late, though not impossibly so."
Published in Radiocarbon 1961 3:132.
Reference(s): Baudez & Coe 1962, Sweeney 1975
Calibrated 2σ range: AD 163 - 1030 (867 years)
Intercept(s): AD 539
Intercept mean: AD 539
Calibration reference: Stuiver and Becker 1986

Y-810 1870 ± 200 bp (ad 80 ± 200) Material: Charcoal
Site: Matapalo Region: Pacific (10°22'N, 85°49'W)
Unit: Cut 2 Level: 135-150 cm Cat.: G11/2J (No. 2)
Phase: Monte Fresco Period: Zoned Bichrome
Collected 1959 by M. Coe. Submitted by M. Coe.
Comments: From stratified midden with Zoned Bichrome pottery underlying Early Polychrome.
Coe believes this date is somewhat more reliable than Y-809.
Published in Radiocarbon 1961 3:132.
Reference(s): Baudez & Coe 1962, Sweeney 1975
Calibrated 2σ range: 390 BC - AD 598 (988 years)
Intercept(s): AD 129
Intercept mean: AD 129
Calibration reference: Stuiver and Becker 1986

Y-811 1395 ± 90 bp (ad 555 ± 90) Material: Charcoal
Site: Matapalo Region: Pacific (10°22'N, 85°49'W)
Unit: Cut 1 Level: 60-75 cm Cat.: G11/1E (No. 3)
Phase: Matapalo Period: Early Polychrome B
Collected 1959 by M. Coe. Submitted by M. Coe.
Comments: From stratified midden with Early Polychrome overlying Zoned Bichrome pottery.

Stratigraphically higher than Y-809 and Y-810.
Date believed to confirm alignment of period with Early/Late Classic Maya.
Published in Radiocarbon 1961 3:132.
Reference(s): Baudez & Coe 1962, Sweeney 1975
Calibrated 2σ range: AD 431 - 800 (369 years)
Intercept(s): AD 644
Intercept mean: AD 644
Calibration reference: Stuiver and Becker 1986

Y-814 220 ± 100 bp (ad 1730 ± 100) Material: Charcoal
Site: Miramar Region: Pacific (10°17'N, 85°50'W)
Unit: Cut 3 Level: 30-45 cm Cat.: G10/3C (No. 6)
Phase: Matapalo/Tamarindo Period: Late Polychrome?
Collected 1959 by M. Coe. Submitted 1959 by M. Coe.
Comments: Sample lay close to the surface, and may be contaminated or intrusive.
Associated with extremely thick, crude pottery. Site lacks polychromes.
Possibly associated with salt-making station of Conquest or post-Conquest age.
Published in Radiocarbon 1961 3:132.
Calibrated 2σ range: AD 1440 - 1950 (510 years)
Intercept(s): AD 1659
Intercept mean: AD 1659
Calibration reference: Stuiver and Becker 1986

Y-815 990 ± 70 bp (ad 960 ± 70) Material: Charcoal
Site: Huerta del Aguacate Region: Pacific (10°19'N, 85°49'W)
Unit: Cut 2 Level: 60-75 cm Cat.: G2/2E (No. 7)
Phase: Tamarindo Period: Middle Polychrome
Collected 1959 by M. Coe. Submitted 1959 by M. Coe.
Comments: Site is a single component shell midden.
According to Coe, associated ceramics are "Nicoya Polychromes."
Date seen as confirming chronological estimates based on external correlations.
Published in Radiocarbon 1961 3:132.
Reference(s): Baudez & Coe 1962, Sweeney 1975
Calibrated 2σ renge: AD 893 - 1210 (317 years)
Intercept(s): AD 1021
Intercept mean: AD 1021
Calibration reference: Stuiver and Becker 1986

Y-816 840 ± 70 bp (ad 1110 ± 70) Material: Charcoal
Site: Chahuite Escondido Region: Pacific (10°55'N, 85°43'W)
Unit: Cut 1 Level: 15-30 cm Cat.: B1/1B (No. 8)
Phase: La Cruz Period: Late Polychrome
Collected 1959 by M. Coe. Submitted 1959 by M. Coe.
Comments: Excavations in large shell midden.
Associated with Luna Polychrome, which dates from Conquest or shortly before.
Coe notes date is "a little older than expected." Baudez rejects at too early.
Published in Radiocarbon 1961 3:133.
Reference(s): Baudez & Coe 1962
Calibrated 2σ range: AD 1020 - 1280 (260 years)
Intercept(s): AD 1212
Intercept mean: AD 1212
Calibration reference: Stuiver and Becker 1986

Y-850 1700 ± 70 bp (ad 250 ± 70) Material: Charcoal

Site: Ortega Region: Tempisque (10°22'N, 85°28'W)
Unit: L Level: 6
Phase: Catalina Period: Zoned Bichrome
Collected 1960 by C. Baudez. Submitted by M. Coe.
Comments: Collected from large, oval oven or hearth. Some mixing in levels 5, 6, and 7.
Bottom of oven feature reported to be in Level 7, at a depth of 130 cm.
Associated ceramics believed to be coeval with Monte Fresco phase (Y-810).
Published in Radiocarbon 1961 3:132.
Reference(s): Baudez & Coe 1962, Baudez 1967:26-27
Calibrated 2σ range: AD 132 - 533 (401 years)
Intercept(s): AD 264 269 342 374 376
Intercept mean: AD 325
Calibration reference: Stuiver and Becker 1986

Y-1122 1380 ± 70 bp (ad 570 ± 70) Material: Charcoal
Site: Ayala (J-GR-5) Region: Granada (11°30'N, 85°30'W)
Unit: Cut 2 Level: 195 cm
Phase: Santa Isabel Period: Early Polychrome
Collected 1961 by A. Norweb. Submitted by G. Willey.
Comments: Site unpublished, materials examined and referred to by Healy (1980:306).
Willey places sample on line between Early Polychrome A and B.
Predominant associated type was Chavez White-on-Red.
Published in Radiocarbon 1963 5:334.
Reference(s): Healy 1980:306, Norweb 1964
Calibrated 2σ range: AD 540 - 796 (256 years)
Intercept(s): AD 648
Intercept mean: AD 648
Calibration reference: Stuiver and Becker 1986

Y-1124 1390 ± 100 bp (ad 560 ± 100) Material: Charcoal
Site: Ayala (J-GR-5) Region: Granada (11°30'N, 85°30'W)
Unit: Cut 2 Level: 285 cm
Phase: San Jorge Period: Zoned Bichrome
Collected 1961 by A. Norweb. Submitted by G. Willey.
Comments: Site unpublished, materials examined and referred to by Healy (1980:307).
Willey says should be earlier than Y-1122, in upper range of Zoned Bichrome.
Predominant associated type was Chavez White-on-Red.
Published in Radiocarbon 1963 5:334.
Reference(s): Healy 1980:306, Norweb 1964
Calibrated 2σ range: AD 430 - 866 (436 years)
Intercept(s): AD 644
Intercept mean: AD 644
Calibration reference: Stuiver and Becker 1986

Table A.3: Calibrated Radiocarbon Dates from Colombia

6000 BC — 1000 BC

UCLA-2149D	1242 BC	800 BC
W-741	1500 BC	843 BC
M-1176	1597 BC	1019 BC
W-743	1691 BC	1054 BC
TK-625b	1734 BC	1319 BC
TK-625a	1689 BC	1410 BC
W-739	2138 BC	1500 BC
Y-1318	2138 BC	1600 BC
Y-1760	2480 BC	1782 BC
Y-1317	2853 BC	2044 BC
UCLA-2568F	3700 BC	1750 BC
UCLA-2568A	2920 BC	2503 BC
UCLA-2149B	3019 BC	2580 BC
I-1123	3790 BC	2499 BC
SI-151	3899 BC	3370 BC
I-445	4033 BC	3149 BC
SI-152	3970 BC	3640 BC
SI-153	3990 BC	3700 BC
UCLA-2149C	4340 BC	3980 BC

Table A.4: Calibrated Radiocarbon Dates from Ecuador

6000 BC — 500 BC

WIS-1140	1210 BC	800 BC
SI-20	1289 BC	790 BC
SI-67	1188 BC	832 BC
WIS-1141	1311 BC	830 BC
WIS-1125	1374 BC	836 BC
SI-108	1597 BC	800 BC
SI-107	2029 BC	1114 BC
SI-112	2187 BC	1110 BC
SI-69	1884 BC	1600 BC
L-1232I	2573 BC	1740 BC
ISGS-190	2460 BC	1910 BC
L-1232H	2872 BC	1920 BC
BM-896	2580 BC	2280 BC
SI-78	2650 BC	2280 BC
SI-71	2861 BC	2409 BC
W-630	2868 BC	2403 BC
Hv-4837	2900 BC	2400 BC
M-1321	3014 BC	2205 BC
ISGS-439	2890 BC	2460 BC
SI-82	2886 BC	2470 BC
SI-80	2889 BC	2494 BC
ISGS-467	3302 BC	2140 BC

6000 BC — 500 BC

ISGS-385	2910 BC – 2480 BC
M-1318	3072 BC – 2340 BC
SI-85	2910 BC – 2501 BC
W-632	3340 BC – 2147 BC
SI-16	3032 BC – 2494 BC
SI-18	3040 BC – 2498 BC
L-1232	3076 BC – 2505 BC
Hv-4838	3092 BC – 2509 BC
SI-81	3019 BC – 2625 BC
ISGS-446	3040 BC – 2614 BC
Hv-4673	3314 BC – 2620 BC
SI-1055	3292 BC – 2784 BC
SI-84	3298 BC – 2790 BC
ISGS-466	3330 BC – 2710 BC
L-1042C	3370 BC – 2786 BC
SI-22	3360 BC – 2890 BC
W-631	3640 BC – 2506 BC
I-7167	3370 BC – 2900 BC
M-1317	3596 BC – 2703 BC
GX-9962	3700 BC – 2590 BC
SI-83	3370 BC – 2933 BC
SI-84 R	3370 BC – 3044 BC

6000 BC 500 BC

ISGS-274	3510 BC	2936 BC
ISGS-192	3630 BC	2920 BC
M-1322	3690 BC	2920 BC
GX-7699	3772 BC	2910 BC
GX-8964	3939 BC	2910 BC
I-7069	3650 BC	3100 BC
L-1042D	3690 BC	3100 BC
ISGS-275	3640 BC	3136 BC
ISGS-452	4213 BC	2590 BC
ISGS-146	3779 BC	3100 BC
ISGS-468	3780 BC	3106 BC
GX-5268	4032 BC	3147 BC
I-7075	3980 BC	3370 BC
ISGS-142	4233 BC	3350 BC
I-7076	4034 BC	3517 BC
M-1320	4333 BC	3640 BC
GX-7704	4460 BC	3700 BC
GX-5267	4780 BC	3819 BC
ISGS-448	5048 BC	3824 BC
GX-5269	5490 BC	4586 BC

Table A.5: Calibrated Radiocarbon Dates from Panama

7000 BC — 500 BC

TEM-125	830 BC	410 BC
TEM-107	968 BC	410 BC
TEM-127	1309 BC	790 BC
TEM-126	1429 BC	933 BC
SI-2843	1750 BC	1318 BC
I-9384	1879 BC	1430 BC
SI-2838	1890 BC	1500 BC
SI-2839	2133 BC	1532 BC
TEM-110	2269 BC	1600 BC
Beta-1218	2201 BC	1639 BC
SI-2840	2271 BC	1740 BC
TEM-108	2307 BC	1740 BC
TEM-128	2470 BC	1782 BC
TEM-120	2470 BC	1962 BC
Beta-5870	2580 BC	1910 BC
TEM-121	2580 BC	2041 BC
TEM-122	2580 BC	2140 BC
Y-585	2889 BC	2470 BC
SI-2844	2910 BC	2490 BC
TEM-130	3032 BC	2509 BC
TEM-208	3499 BC	2506 BC
SI-2842	3340 BC	2900 BC

7000 BC — 500 BC

TEM-124	3510 BC	2920 BC
TEM-119	3790 BC	3360 BC
TEM-207	4240 BC	3520 BC
TEM-175	4240 BC	3700 BC
SI-2841	4456 BC	4000 BC
TEM-176	4573 BC	3990 BC
TEM-109	4571 BC	4047 BC
TEM-106	4940 BC	4490 BC
TEM-174	5318 BC	4470 BC
TEM-131	5350 BC	4808 BC
Beta-1219	5980 BC	5230 BC
TEM-206	5690 BC	5248 BC
Y-458-d	5957 BC	5490 BC
TEM-123	5960 BC	5566 BC

Table A.6: Calibrated Radiocarbon Dates from Belize

5000 BC — AD 1000

UCLA-1985bc	AD 660	AD 1150
UCLA-1985d	AD 135	AD 529
LJ-4919	800 BC	400 BC
LJ-4923	810 BC	410 BC
LJ-4922	830 BC	410 BC
LJ-4918	1187 BC	800 BC
Q-1476	1601 BC	810 BC
UCLA-1985a	1680 BC	830 BC
I-7877A	1882 BC	800 BC
UCLA-1985g	1920 BC	931 BC
Q-1575	2013 BC	931 BC
Q-1579	1740 BC	1395 BC
Q-1578	1862 BC	1463 BC
Q-1577	2190 BC	1646 BC
Q-1573	2192 BC	1740 BC
Q-1576	2470 BC	1641 BC
Q-1574	2288 BC	1835 BC
UCLA-2102d	2855 BC	1543 BC
Q-1572	2470 BC	1924 BC
Q-1571	2577 BC	2149 BC
UCLA-1985e	2920 BC	2044 BC
UCLA-2102b	3776 BC	3194 BC
UCLA-2102c	4340 BC	3640 BC

Table A.7: Calibrated Radiocarbon Dates from Chiapas

4000 BC — 500 BC

N-1595	166 BC	AD 341
GrN-1525	390 BC	74 BC
GrN-1056	762 BC	264 BC
Y-1151	1210 BC	595 BC
L-427	1368 BC	432 BC
Y-1166	1212 BC	790 BC
I-1832	1689 BC	264 BC
Y-1154	1407 BC	820 BC
GrN-1172	1310 BC	900 BC
Y-1150	1430 BC	834 BC
B-13836	1430 BC	900 BC
GrN-1512	1429 BC	1054 BC
GrN-774	1677 BC	833 BC
B-16239	1500 BC	943 BC
B-14243	1580 BC	943 BC
B-14242	1597 BC	1055 BC
B-14241	1685 BC	1054 BC
UM-101	1690 BC	1053 BC
B-13838	1691 BC	1135 BC
B-13837	1861 BC	1325 BC
M-978	2131 BC	1051 BC
B-13835	1877 BC	1410 BC

	4000 BC	500 BC
B-16236	1807 BC	1416 BC
I-8162	2027 BC	1135 BC
I-8161	2290 BC	1055 BC
B-14244	2202 BC	1324 BC
B-16238	2293 BC	1410 BC
N-1891-2	2464 BC	1834 BC
N-1594	2470 BC	1926 BC
N-1601	2590 BC	2140 BC
1866-A	2590 BC	2142 BC
1866-B	2851 BC	2147 BC
N-1598	2600 BC	2205 BC
N-1891-1	2865 BC	2200 BC
N-1600	2868 BC	2280 BC
N-1597	2878 BC	2330 BC
N-1599	2886 BC	2397 BC
1866-D	3019 BC	2580 BC
N-1889	3309 BC	2667 BC
N-1887	3340 BC	2703 BC
N-1888	3370 BC	2910 BC
N-1596	3613 BC	3047 BC

Table A.8: Calibrated Radiocarbon Dates from Veracruz

3000 BC — AD 500

Y-1907	AD 130	AD 650
UCLA-1280B	100 BC	AD 660
UCLA-1281B	90 BC	AD 637
UCLA-1284B	830 BC	415 BC
M-531	1440 BC	AD 51
M-529	1769 BC	380 BC
Y-1802	1430 BC	790 BC
UCLA-902	1410 BC	922 BC
Y-1908	1493 BC	835 BC
Y-1934	1489 BC	923 BC
Y-1936	1430 BC	942 BC
Y-1937	1432 BC	1010 BC
UCLA-1286	1430 BC	1023 BC
Y-1797	1487 BC	1010 BC
Y-1800	1520 BC	1010 BC
UCLA-1253	1520 BC	1018 BC
Y-1912	1520 BC	1055 BC
Y-1801	1520 BC	1111 BC
Y-1911	1520 BC	1111 BC
Y-1939	1682 BC	1012 BC
Y-1798	1691 BC	944 BC
M-535	2138 BC	603 BC

3000 BC — AD 500

Y-2379 1723 BC ├──┤ 1266 BC

Y-1933 1879 BC ├──┤ 1265 BC

Y-1799 2900 BC ├──┤ 2470 BC

Y-1931 3040 BC ├──┤ 2502 BC

Table A.9 : Calibrated Radiocarbon Dates from the Tehuacán Valley

4000 BC — 500 BC

I-916	1078 BC	410 BC
I-908	1188 BC	410 BC
I-915	1211 BC	447 BC
I-914	1211 BC	447 BC
I-931	1379 BC	665 BC
I-901	1373 BC	790 BC
I-767	1500 BC	451 BC
I-923	1430 BC	800 BC
I-566	1690 BC	790 BC
I-935	1520 BC	835 BC
I-934	1691 BC	944 BC
I-929	1866 BC	1116 BC
I-565	2128 BC	1136 BC
I-666	2269 BC	1135 BC
I-670	2139 BC	1317 BC
I-570	2287 BC	1410 BC
I-895	2457 BC	1440 BC
I-753	2852 BC	1680 BC
I-757	2888 BC	1772 BC
I-762	2900 BC	1890 BC
I-760	3505 BC	2460 BC
I-755	3945 BC	2910 BC
I-572	3690 BC	2920 BC

APPENDIX A.3
Calibrated Late Archaic and Early Formative Dates

1866-A* 3900 ± 80 bp (1950 ± 80 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Chantuto Period: Late Archaic
Collected by B. Voorhies.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 2590 - 2142 BC (448 years)
Intercept(s): 2457 BC
Intercept mean: 2457 BC
Calibration reference: Stuiver and Becker 1986

1866-B* 3920 ± 80 bp (1970 ± 80 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Chantuto Period: Late Archaic
Collected by B. Voorhies.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 2851 - 2147 BC (704 years)
Intercept(s): 2462 BC
Intercept mean: 2462 BC
Calibration reference: Stuiver and Becker 1986

1866-D* 4200 ± 80 bp (2250 ± 80 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Chantuto Period: Late Archaic
Collected by B. Voorhies.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 3019 - 2580 BC (439 years)
Intercept(s): 2880 2798 2782 BC
Intercept mean: 2820 BC
Calibration reference: Stuiver and Pearson 1986

B-13835 3300 ± 95 bp (1350 ± 95 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Ocos/Cherla Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1877 - 1410 BC (467 years)
Intercept(s): 1603 BC
Intercept mean: 1603 BC
Calibration reference: Stuiver and Becker 1986

B-13836 2950 ± 100 bp (1000 ± 100 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Ocos/Cherla Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987

Calibrated 2σ range: 1430 - 900 BC (530 years)
Intercept(s): 1212 1202 1192 1141 1132 1118 1115 BC
Intercept mean: 1159 BC
Calibration reference: Stuiver and Becker 1986

B-13837 3280 ± 95 bp (1330 ± 95 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Locona Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1861 - 1325 BC (536 years)
Intercept(s): 1598 1569 1533 BC
Intercept mean: 1567 BC
Calibration reference: Stuiver and Becker 1986

B-13838 3180 ± 100 bp (1230 ± 100 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Ocos Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1691 - 1135 BC (556 years)
Intercept(s): 1488 1485 1452 BC
Intercept mean: 1475 BC
Calibration reference: Stuiver and Becker 1986

B-14241 3120 ± 110 bp (1170 ± 110 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Locona Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1685 - 1054 BC (631 years)
Intercept(s): 1428 1424 1413 BC
Intercept mean: 1422 BC
Calibration reference: Stuiver and Becker 1986

B-14242 3090 ± 90 bp (1140 ± 90 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Locona Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1597 - 1055 BC (542 years)
Intercept(s): 1407 1394 1327 1326 BC
Intercept mean: 1364 BC
Calibration reference: Stuiver and Becker 1986

B-14243 3040 ± 110 bp (1090 ± 110 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Locona Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1580 - 943 BC (637 years)
Intercept(s): 1370 1362 1351 1342 1319 BC
Intercept mean: 1349 BC
Calibration reference: Stuiver and Becker 1986

B-14244 3420 ± 170 bp (1470 ± 170 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Locona Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 2202 - 1324 BC (878 years)
Intercept(s): 1735 1697 1696 BC
Intercept mean: 1709 BC
Calibration reference: Stuiver and Becker 1986

B-16236 3300 ± 80 bp (1350 ± 80 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Ocos/Cherla Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1807 - 1416 BC (391 years)
Intercept(s): 1603 BC
Intercept mean: 1603 BC
Calibration reference: Stuiver and Becker 1986

B-16238 3460 ± 180 bp (1510 ± 180 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Barra Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 2293 - 1410 BC (883 years)
Intercept(s): 1768 1765 1749 BC
Intercept mean: 1761 BC
Calibration reference: Stuiver and Becker 1986

B-16239 3020 ± 100 bp (1070 ± 100 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Ocos Period: Early Formative
Collected 1985-87.
Reference(s): Clark et al. 1987
Calibrated 2σ range: 1500 - 943 BC (557 years)
Intercept(s): 1313 1298 1296 1277 1266 BC
Intercept mean: 1290 BC
Calibration reference: Stuiver and Becker 1986

BM-896 3928 ± 60 bp (1978 ± 60 bc) Material: Charcoal
Site: Cerro Narrio Region: Ecuador (3° S, 80° W)
Cat.: 12B1
Period: Early Formative
Collected 1972 by E. Carmichael. Submitted by E. Carmichael.
Published in Radiocarbon 1977 19:2:149.
Reference(s): Hammond & Bruhns 1987
Calibrated 2σ range: 2580 - 2280 BC (300 years)
Intercept(s): 2463 BC
Intercept mean: 2463 BC
Calibration reference: Stuiver and Becker 1986

Beta-1218 3555 ± 100 bp (1605 ± 100 bc) Material: Charcoal

Site: Cerro Mangote (AG-1) Region: Central Panama Unit: Pothole 1
Phase: Preceramic Period: Late Archaic
Collected 1979 by R. Cooke. Submitted by R. Cooke.
Comments: From same context as TEM-174, TEM-175, and TEM-206.
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 2201 - 1639 BC (562 years)
Intercept(s): 1918 1904 1890 BC
Intercept mean: 1904 BC
Calibration reference: Stuiver and Becker 1986

Beta-1219 6670 ± 215 bp (4720 ± 215 bc) Material: Charcoal
Site: Cerro Mangote (AG-1) Region: Central Panama
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: Combined sample from red clay zone (base of deposit).
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 5980 - 5230 BC (750 years)
Intercept(s): 5560 BC
Intercept mean: 5560 BC
Calibration reference: Stuiver and Pearson 1986

Beta-5870 3800 ± 120 bp (1850 ± 120 bc) Material: Charcoal
Site: Cueva de los Vampiros Region: Central Panama Unit: Test Pit 1

Phase: Monagrillo Period: Early Formative
Collected by R. Cooke. Submitted by R. Cooke.
Comments: Bottom of ceramic occupation.
Reference(s): Cooke 1984
Calibrated 2σ range: 2580 - 1910 BC (670 years)
Intercept(s): 2278 2234 2209 BC
Intercept mean: 2240 BC
Calibration reference: Stuiver and Becker 1986

GX-5267 5495 ± 200 bp (3545 ± 200 bc) Material: Charcoal
Site: Real Alto Region: Ecuador (2°23 S, 80°42'W)
Phase: Valdivia 1? Period: Early Formative
Comments: From refuse zone adjacent to Structure 2-77, a Valdivia household cluster.
Date may be too early for Valdivia I.
Reference(s): Damp et al. 1981:811
Calibrated 2σ range: 4780 - 3819 BC (961 years)
Intercept(s): 4344 BC
Intercept mean: 4344 BC
Calibration reference: Stuiver and Pearson 1986

GX-5268 4900 ± 170 bp (2950 ± 170 bc) Material: Charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Phase: Valdivia 1 Period: Early Formative
Comments: From upper surface of refuse zone and cairns associated with Structure 2-77.
Date is in accord with others from site of Loma Alta.
Reference(s): Damp et al. 1981:811
Calibrated 2σ range: 4032 - 3147 BC (885 years)
Intercept(s): 3691 BC
Intercept mean: 3691 BC
Calibration reference: Stuiver and Pearson 1986

GX-5269 6195 ± 215 bp (4145 ± 215 bc) Material: Charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Phase: Valdivia 1? Period: Early Formative?
Comments: Date dismissed as "out of stratigraphic context and too early" by Damp.
Reference(s): Damp 1984:574
Calibrated 2σ range: 5490 - 4586 BC (904 years)
Intercept(s): 5204 5159 5146 BC
Intercept mean: 5170 BC
Calibration reference: Stuiver and Pearson 1986

GX-7699 4630 ± 160 bp (2680 ± 160 bc) Material: Charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Phase: Valdivia 1 Period: Early Formative
Collected by J. Damp.
Comments: From hearth (Feature 74) associated with Structure 4, a Valdivia house.
Associated ceramics are "stylistically intermediary to Valdivia I and II."
Reference(s): Damp 1984:580
Calibrated 2σ range: 3772 - 2910 BC (862 years)
Intercept(s): 3360 BC
Intercept mean: 3360 BC
Calibration reference: Stuiver and Pearson 1986

GX-7704 5275 ± 175 bp (3325 ± 175 bc) Material: Charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Phase: Valdivia 1 Period: Early Formative
Reference(s): Damp 1984:574
Calibrated 2σ range: 4460 - 3700 BC (760 years)
Intercept(s): 4038 4012 4009 BC
Intercept mean: 4020 BC
Calibration reference: Stuiver and Pearson 1986

GX-8964 4670 ± 195 bp (2720 ± 195 bc) Material: Unknown
Site: Salango Region: Ecuador
Phase: Valdivia 4-5 Period: Early Formative
Collected 1982 by P. Norton.
Comments: Associated with mineral deposits from ancient edge of mangrove swamp.
Valdivia 4-5 style bowl immediately beneath level with mangrove remains.
Associated with ceramics, lithics, subsistence remains, and charcoal fragments.
Reference(s): Norton 1984:42
Calibrated 2σ range: 3939 - 2910 BC (1029 years)
Intercept(s): 3496 3427 3379 BC
Intercept mean: 3434 BC
Calibration reference: Stuiver and Pearson 1986

GX-9962 4510 ± 210 bp (2560 ± 210 bc) Material: Unknown
Site: Salango Region: Ecuador
Phase: Valdivia 4-5 Period: Early Formative
Collected 1982 by P. Norton.
Comments: Associated with mineral deposits from edge of ancient mangrove swamp.
Valdivia 4-5 style bowl immediately beneath level with mangrove remains.
Associated with ceramics, lithics, subsistence remains, and charcoal fragments.
Reference(s): Norton 1984:42
Calibrated 2σ range: 3700 - 2590 BC (1110 years)
Intercept(s): 3295 3242 3104 BC

Intercept mean: 3214 BC
Calibration reference: Stuiver and Pearson 1986

Gak-261 3070 ± 150 bp (1120 ± 150 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Kotosh Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1601 - 830 BC (771 years)
Intercept(s): 1289 1284 1260 1227 1225 1197 1196 1137 BC
1136 BC
Intercept mean: 1217 BC
Calibration reference: Stuiver and Becker 1986

Gak-262 3800 ± 110 bp (1850 ± 110 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Waira-jirca Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2490 - 1890 BC (600 years)
Intercept(s): 2268 2263 2203 2147 2146 BC
Intercept mean: 2205 BC
Calibration reference: Stuiver and Becker 1986

Gak-263 3150 ± 150 bp (1200 ± 150 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Chavin? Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1740 - 945 BC (795 years)
Intercept(s): 1428 1424 1413 BC
Intercept mean: 1422 BC
Calibration reference: Stuiver and Becker 1986

Gak-764 2040 ± 100 bp (90 ± 100 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito? Period: Late Preceramic?
Comments: Rejected as much too late.
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 354 BC - AD 226 (580 years)
Intercept mean: 45 BC
Calibration reference: Stuiver and Becker 1986

Gak-765 3750 ± 90 bp (1800 ± 90 bc) Material: Charcoal

Site: Kotosh Region: Peru
Phase: Kotosh Waira-jirca Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2470 - 1836 BC (634 years)
Intercept(s): 2139 2078 2075 2048 2046 BC
Intercept mean: 2077 BC
Calibration reference: Stuiver and Becker 1986

Gak-766a 3620 ± 100 bp (1670 ± 100 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito Period: Late Preceramic
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2273 - 1664 BC (609 years)
Intercept(s): 2009 1997 1940 1932 1925 BC
Intercept mean: 1961 BC
Calibration reference: Stuiver and Becker 1986

Gak-766b 3900 ± 100 bp (1950 ± 100 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito Period: Late Preceramic
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2600 - 2039 BC (561 years)
Intercept(s): 2451 2433 2392 2384 2356 BC
Intercept mean: 2403 BC
Calibration reference: Stuiver and Becker 1986

Gif-1325 3573 ± 110 bp (1623 ± 110 bc) Material: Wood charcoal
Site: Los Naranjos Region: Honduras Unit: T.9-21
Phase: Preceramic? Period: Late Archaic?
Collected 1967-69 by C. Baudez. Submitted 1969-70 by C. Baudez.
Comments: Fragments of burned branches in volcanic ash beneath Jaral phase deposits.
Sherds in deepest levels are attributed to animal burrows.
Sample is believed to have originated in a natural conflagration.
Reference(s): Baudez & Becquelin 1973
Calibrated 2σ range: 2274 - 1750 BC (524 years)
Intercept(s): 1922 BC
Intercept mean: 1922 BC
Calibration reference: Stuiver and Becker 1986

GrN-1056 2370 ± 60 bp (420 ± 60 bc) Material: Wood charcoal
Site: Chiapa de Corzo Region: Chiapas (16°42'N, 93°01'W)
Unit: Pit 24 Level: 2 Cat.: 1
Phase: Chiapa I Period: Early Preclassic
Collected 1956 by G. Lowe. Submitted by T. Ferguson.
Comments: From refuse dump with restorable vessels, ashes, and river snail shells.
Located 120 cm below base of Mound 1 substructures, same level as GrN-1056.
Associated with Early Preclassic ceramics.
Published in Radiocarbon 1964 6:363.
Calibrated 2σ range: 762 - 264 BC (498 years)
Intercept(s): 406 BC
Intercept mean: 406 BC
Calibration reference: Stuiver and Becker 1986

GrN-1172 2885 ± 60 bp (935 ± 60 bc) Material: Unknown
Site: Chiapa de Corzo Region: Chiapas (16°42'N, 93°01'W)
Phase: Chiapa I-II Period: Early Preclassic
Calibrated 2σ range: 1310 - 900 BC (410 years)
Intercept(s): 1079 1062 1052 BC
Intercept mean: 1064 BC
Calibration reference: Stuiver and Becker 1986

GrN-1512 3010 ± 50 bp (1060 ± 50 bc) Material: Charcoal
Site: Chiapa de Corzo Region: Chiapas (16°42'N, 93°01'W)
Unit: Pit 38 Level: 2 Cat.: 3
Phase: Chiapa I-II Period: Early Preclassic
Collected 1956 by G. Lowe. Submitted by T. Ferguson.
Comments: Two charcoal samples resting on sterile sand at base of cultural deposit.
Another portion of this specimen was dated as L-427.
Represents mixture of earliest and second earliest Early Preclassic phases.
Published in Radiocarbon 1964 6:363.
Calibrated 2σ range: 1429 - 1054 BC (375 years)
Intercept(s): 1294 1279 1264 BC
Intercept mean: 1279 BC
Calibration reference: Stuiver and Becker 1986

GrN-1525 2170 ± 50 bp (220 ± 50 bc) Material: Wood charcoal
Site: Chiapa de Corzo Region: Chiapas (16°42'N, 93°01'W)
Unit: Pit 32B Level: 2 Cat.: 7
Phase: Chiapa I-II Period: Early Preclassic
Collected 1956 by B. Warren. Submitted by T. Ferguson.
Comments: Portion of a burnt pole extending underneath outer stone walls of Mound 1.
Sample from 110 cm below SW corner of Wall C, in same soil level as GrN-1056.
With Early Preclassic sherds in soil underlaying outer Mound 1 constructions.
Published in Radiocarbon 1964 6:364.
Calibrated 2σ range: 390 - 74 BC (316 years)
Intercept(s): 346 322 226 225 207 BC
Intercept mean: 265 BC
Calibration reference: Stuiver and Becker 1986

GrN-774 3010 ± 150 bp (1060 ± 150 bc) Material: Charcoal
Site: Chiapa de Corzo Region: Chiapas (16°42'S, 93°01'W)
Unit: Pit 50 Level: 350 cm Cat.: 5
Phase: Chiapa I Period: Early Preclassic
Collected 1956 by B. Warren. Submitted by T. Ferguson.
Comments: Charcoal from deposit of burnt earth, ashes, and charcoal.
Context represents anciently filled-in wash.
Associated pottery is of earliest identified cultural period in Chiapas.
Published in Radiocarbon 1964 6:363.
Calibrated 2σ range: 1677 - 833 BC (844 years)
Intercept(s): 1294 1279 1264 BC
Intercept mean: 1279 BC
Calibration reference: Stuiver and Becker 1986

H-1258 4400 ± 140 bp (2450 ± 140 bc) Material: Shell
Site: Puerto Marquéz Region: Mexico Level: 33 (640-660 cm)
Phase: Pox Period: Early Formative
Collected 1960 by C. Brush. Submitted by C. Brush.

Comments: From earliest ceramic-bearing layer in test pit. Ceramics were abundant in all overlying 20 cm levels.
Reference(s): Brush 1965:194
Calibrated 2σ range: 3499 - 2626 BC (873 years)
Intercept(s): 3034 BC
Intercept mean: 3034 BC
Calibration reference: Stuiver and Pearson 1986

H-1263 4900 ± 130 bp (2950 ± 130 bc) Material: Shell
Site: Puerto Marquéz Region: Mexico Level: 38 (740-760 cm)
Phase: Preceramic Period: Late Archaic
Collected 1960 by C. Brush. Submitted by C. Brush.
Comments: No potsherds from this level or overlying 80 cm of deposits. Associated artifacts confined to obsidian chunks, retouched flakes, flint core.
Reference(s): Brush 1965:194
Calibrated 2σ range: 3990 - 3370 BC (620 years)
Intercept(s): 3697 BC
Intercept mean: 3697 BC
Calibration reference: Stuiver and Pearson 1986

H-1264 4200 ± 135 bp (2250 ± 135 bc) Material: Shell
Site: Puerto Marquéz Region: Mexico Level: 35 (680-700 cm)
Phase: Preceramic Period: Late Archaic
Collected 1960 by C. Brush. Submitted by C. Brush.
Comments: Ceramics absent from this level, overlying 20 cm, and all levels beneath it.
Reference(s): Johnson & MacNeish1972
Calibrated 2σ range: 3291 - 2460 BC (831 years)
Intercept(s): 2880 2798 2782 BC
Intercept mean: 2820 BC
Calibration reference: Stuiver and Becker 1986

Hv-4673 4335 ± 100 bp (2385 ± 100 bc) Material: Unknown
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Lot: J160
Phase: Valdivia 1-2 Period: Early Formative
Reference(s): Bischof 1972:278
Calibrated 2σ range: 3314 - 2620 BC (694 years)
Intercept(s): 2916 BC
Intercept mean: 2916 BC
Calibration reference: Stuiver and Pearson 1986

Hv-4837 4095 ± 90 bp (2145 ± 90 bc) Material: Unknown
Site: Valdivia Region: Ecuador Lot: Viteri E3
Phase: Valdivia A-B (3-5) Period: Early Formative
Reference(s): Bischof 1972:278
Calibrated 2σ range: 2900 - 2400 BC (500 years)
Intercept(s): 2589 BC
Intercept mean: 2589 BC
Calibration reference: Stuiver and Becker 1986

Hv-4838 4260 ± 100 bp (2310 ± 100 bc) Material: Unknown
Site: Valdivia Region: Ecuador Lot: Viteri E4
Phase: Valdivia A (2-3) Period: Early Formative
Reference(s): Bischof 1972:278

Calibrated 2σ range: 3092 - 2509 BC (583 years)
Intercept(s): 2888 2791 2789 BC
Intercept mean: 2823 BC
Calibration reference: Stuiver and Pearson 1986

I-445 4875 ± 170 bp (2925 ± 170 bc) Material: Pitar sp.
Site: Puerto Hormiga Region: Colombia (10°08'S, 75°29'W)
Unit: Ct I, Sq 4 Level: 3 (100 cm)
Phase: Puerto Hormiga Period: Early Formative
Collected and submitted 1961 by G. Reichel-Dolmatoff.
Comments: Date on shell from same stratum as I-1123, layer contains fiber-tempered ware.
Stratum described as "dirty shells in light brown soil, not well compacted."
Stratum contained 26 decorated sherds in Cut I, total of 143 from all cuts.
Reference(s): Reichel-Dolmatoff 1965:45, Bischof 1972:278
Calibrated 2σ range: 4033 - 3149 BC (884 years)
Intercept(s): 3692 BC
Intercept mean: 3692 BC
Calibration reference: Stuiver and Pearson 1986

I-565 3330 ± 170 bp (1380 ± 170 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1 Level: 110-115 cm Lot: Zone J Cat.: 9
Phase: Ajalpan Period: Early Formative
Collected 1962 by A. Garcia Cook. Submitted by F. Johnson.
Comments: Charcoal from small pit.
Rejected.
Associated with potsherds and mano.
Published in Radiocarbon 1969 11:93.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2128 - 1136 BC (992 years)
Intercept(s): 1681 1674 1623 BC
Intercept mean: 1659 BC
Calibration reference: Stuiver and Becker 1986

I-566 2975 ± 200 bp (1025 ± 200 bc) Material: Grass, fibers, sticks
Site: San Marcos Cave Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1E1 Level: Floor 2 (10-20 cm) Lot: Zone C
Cat.: Tc254-4b
Phase: Late Ajalpan Period: Early Formative
Collected 1962 by R. MacNeish. Submitted by F. Johnson.
Comments: Grass, fibers, and sticks from San Marcos Cave.
Associated with medium small corncobs, two preceramic artifacts, one potsherd.
Published in Radiocarbon 1969 11:96.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1690 - 790 BC (900 years)
Intercept(s): 1257 1247 1231 1216 1199 1195 1138 1135 BC
Intercept mean: 1202 BC
Calibration reference: Stuiver and Becker 1986

I-570 3450 ± 175 bp (1500 ± 175 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N2 Level: 122 cm Lot: Zone K1 Cat.: 13
Phase: Purrón Period: Early Formative
Collected 1962 by F. Johnson. Submitted by F. Johnson.

Comments: Charcoal from Purrón Cave.
Averaged by Johnson with I-670, I-666, and I-753.
Published in Radiocarbon 1969 11.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2287 - 1410 BC (877 years)
Intercept(s): BC
Intercept mean: 1746 BC
Calibration reference: Stuiver and Becker 1986

I-572 4725 ± 190 bp (2775 ± 190 bc) Material: Wood charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1E2 Level: 9 (185 cm) Lot: Zone L Cat.: 3a
Phase: Abejas Period: Late Archaic
Collected 1962 by F. Johnson. Submitted by F. Johnson.
Comments: Rotted fragments of tree branch in Purrón Cave.
Averaged by Johnson with I-755.
Published in Radiocarbon 1969 11:93.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 3690 - 2920 BC (770 years)
Intercept(s): 3512 3393 3389 BC
Intercept mean: 3431 BC
Calibration reference: Stuiver and Pearson 1986

I-666 3375 ± 200 bp (1425 ± 200 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S6E1 Level: 9 (142-147cm) Lot: Zone K Cat.: 22
Phase: Purrón Period: Early Formative
Collected 1962 by A. Garcia Cook. Submitted by F. Johnson.
Comments: Charcoal from Purrón Cave.
Averaged by Johnson with I-570, I-666, and I-753.
Published in Radiocarbon 1969 11.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2269 - 1135 BC (1134 years)
Intercept(s): 1690 1669 1663 1647 1646 BC
Intercept mean: 1663 BC
Calibration reference: Stuiver and Becker 1986

I-670 3375 ± 170 bp (1425 ± 170 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S6E1 Level: 10 (153-164 cm) Lot: Zone K1 Cat.: 23
Phase: Purrón Period: Early Formative
Collected 1962 by A. Garcia Cook. Submitted by F. Johnson.
Comments: Charcoal from Purrón Cave.
Averaged by Johnson with I-570, I-666, I-753.
Published in Radiocarbon 1969 11.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2139 - 1317 BC (822 years)
Intercept(s): 1690 1669 1663 1647 1646 BC
Intercept mean: 1663 BC
Calibration reference: Stuiver and Becker 1986

I-753 3725 ± 180 bp (1775 ± 180 bc) Material: Charcoal and wood
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N2E2 Level: 10 Lot: Zone K1 Cat.: 16

Phase: Purrón Period: Early Formative
Collected 1962 by A. Garcia Cook. Submitted by F. Johnson.
Comments: Charcoal and wood from Purrón Cave.
Averaged by Johnson with I-570, I-666, and I-670.
Published in Radiocarbon 1969 11:94.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2852 - 1680 BC (1172 years)
Intercept(s): 2139 BC
Intercept mean: 2139 BC
Calibration reference: Stuiver and Becker 1986

I-755 4675 ± 200 bp (2725 ± 200 bc) Material: Tree trunk
Site: Purrón Cave Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1E2 Level: 9 (185 cm) Lot: Zone L Cat.: Tc272-35
Phase: Abejas Period: Late Archaic
Collected 1962 by F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-572.
Published in Radiocarbon 1969 11:94.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 3945 - 2910 BC (1035 years)
Intercept(s): 3497 3423 3380 BC
Intercept mean: 3433 BC
Calibration reference: Stuiver and Pearson 1986

I-757 3850 ± 190 bp (1900 ± 190 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S7E2 Level: 170-180 cm Lot: Zone K Cat.: 24
Phase: Purrón Period: Early Formative
Collected 1962 by R. MacNeish. Submitted by F. Johnson.
Comments: Charcoal from Purrón Cave.
Averaged by Johnson with I-762, from same unit.
Published in Radiocarbon 1969 11:94.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2888 - 1772 BC (1116 years)
Intercept(s): 2334 BC
Intercept mean: 2334 BC
Calibration reference: Stuiver and Becker 1986

I-760 4300 ± 200 bp (2350 ± 200 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S6E1 Lot: Zones I and J Cat.: 21
Phase: Ajalpan? Period: Early Formative?
Collected 1962 by A. Garcia Cook. Submitted by F. Johnson.
Comments: Rejected as much too early.
Published in Radiocarbon 1969 11:94.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 3505 - 2460 BC (1045 years)
Intercept(s): 2915 BC
Intercept mean: 2915 BC
Calibration reference: Stuiver and Becker 1986

I-762 3900 ± 180 bp (1950 ± 180 bc) Material: Charcoal
Site: Purrón Cave (Tc 272) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S7E2 Level: 165 cm Lot: Zone K Cat.: 25

Phase: Purrón Period: Early Formative
Collected 1962 by R. MacNeish. Submitted by F. Johnson.
Comments: Charcoal from Purrón Cave.
Averaged by Johnson with I-757, from same unit.
Published in Radiocarbon 1969 11:95.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2900 - 1890 BC (1010 years)
Intercept(s): BC
Intercept mean: 2457 BC
Calibration reference: Stuiver and Becker 1986

I-767 2850 ± 190 bp (900 ± 190 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E Level: 175 cm Lot: Pit Cat.: C-2
Phase: Late Ajalpan Period: Early Formative
Collected 1962 by D. & D. Byers. Submitted by F. Johnson.
Comments: Charcoal at bottom of bell-shaped pit.
From base on which skeleton was found, associated with "Olmec-like" figurine."
Published in Radiocarbon 1969 11:97.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1500 - 451 BC (1049 years)
Intercept(s): 1047 1044 1013 BC
Intercept mean: 1035 BC
Calibration reference: Stuiver and Becker 1986

I-895 3525 ± 180 bp (1575 ± 180 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E4 Lot: Zone G1 Cat.: 30
Phase: Early Ajalpan Period: Early Formative
Collected by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-901.
Published in Radiocarbon 1969 11:97.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 2457 - 1440 BC (1017 years)
Intercept(s): 1883 1839 1834 BC
Intercept mean: 1852 BC
Calibration reference: Stuiver and Becker 1986

I-901 2810 ± 120 bp (860 ± 120 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E6 Lot: Zone G1 Cat.: 32
Phase: Early Ajalpan Period: Early Formative
Collected 1962 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-901 to date Zone G1.
Published in Radiocarbon 1969 11:97.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1373 - 790 BC (583 years)
Intercept(s): 997 995 973 957 941 BC
Intercept mean: 973 BC
Calibration reference: Stuiver and Becker 1986

I-908 2640 ± 130 bp (690 ± 130 bc) Material: Charcoal
Site: Coatepec (Ts 368) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S2E4 Lot: Zone K1 Cat.: 32

Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-914 and I-916.
Published in Radiocarbon 1969 11:99.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1188 - 410 BC (778 years)
Intercept(s): 805 BC
Intercept mean: 805 BC
Calibration reference: Stuiver and Becker 1986

I-914 2695 ± 120 bp (745 ± 120 bc) Material: Charcoal
Site: Coatepec (Ts 368) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S2E5 Lot: Zone K1 Cat.: 38
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-90[illegible].
Published in Radiocarbon 1969 11:100.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1211 - 447 BC (764 years)
Intercept(s): 887 832 BC
Intercept mean: 860 BC
Calibration reference: Stuiver and Becker 1986

I-915 2695 ± 120 bp (745 ± 120 bc) Material: Charcoal
Site: Coatepec (Ts 368) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1,S1 Lot: Zone J Cat.: 37
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-931.
Published in Radiocarbon 1969 11:100.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1211 - 447 BC (764 years)
Intercept(s): 887 832 BC
Intercept mean: 860 BC
Calibration reference: Stuiver and Becker 1986

I-916 2640 ± 120 bp (690 ± 120 bc) Material: Charcoal
Site: Coatepec (Ts 368) Region: Tehuacán (18°30'N, 97°30'W)
Unit: N1 Lot: Zone K1 Cat.: 40
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-908.
Published in Radiocarbon 1969 11:100.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1078 - 410 BC (668 years)
Intercept(s): 805 BC
Intercept mean: 805 BC
Calibration reference: Stuiver and Becker 1986

I-923 2865 ± 130 bp (915 ± 130 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E2 Lot: Zone F Cat.: 24
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.

Comments: Averaged by Johnson with I-935.
Published in Radiocarbon 1969 11:.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1430 - 800 BC (630 years)
Intercept(s): 1069 1066 1049 1037 1020 BC
Intercept mean: 1048 BC
Calibration reference: Stuiver and Becker 1986

I-929 3220 ± 130 bp (1270 ± 130 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E7 Lot: Zone H Cat.: 27
Phase: Early Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Published in Radiocarbon 1969 11:98.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1866 - 1116 BC (750 years)
Intercept(s): 1496 BC
Intercept mean: 1496 BC
Calibration reference: Stuiver and Becker 1986

I-931 2810 ± 130 bp (860 ± 130 bc) Material: Charcoal
Site: Coatepec (Ts 368) Region: Tehuacán (18°30'N, 97°30'W)
Unit: S2E5 Lot: Zone J Cat.: 34
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-915.
Published in Radiocarbon 1969 11:101.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1379 - 665 BC (714 years)
Intercept(s): 997 995 973 957 941 BC
Intercept mean: 973 BC
Calibration reference: Stuiver and Becker 1986

I-934 3100 ± 140 bp (1150 ± 140 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E9 Lot: Zone G Cat.: 33
Phase: Early Ajalpan Period: Early Formative
Collected 1963 by F. & D. Johnson. Submitted by F. Johnson.
Published in Radiocarbon 1969 11:98.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1691 - 944 BC (747 years)
Intercept(s): 1409 BC
Intercept mean: 1409 BC
Calibration reference: Stuiver and Becker 1986

I-935 2980 ± 130 bp (1030 ± 130 bc) Material: Charcoal
Site: Ajalpan (Ts 204) Region: Tehuacán (18°30'N, 97°30'W)
Unit: E4 Lot: Zone F Cat.: 28
Phase: Late Ajalpan Period: Early Formative
Collected 1963 by D. & F. Johnson. Submitted by F. Johnson.
Comments: Averaged by Johnson with I-923.
Published in Radiocarbon 1969 11:98.
Reference(s): Johnson & MacNeish 1972
Calibrated 2σ range: 1520 - 835 BC (685 years)

Intercept(s): 1287 1286 1258 1230 1216 1198 1195 1138 BC
1135 BC
Intercept mean: 1216 BC
Calibration reference: Stuiver and Becker 1986

I-1123 4502 ± 250 bp (2552 ± 250 bc) Material: Charcoal
Site: Puerto Hormiga Region: Colombia (10°08'S, 75°29'W)
Unit: Cut I Level: 3 (70 cm)
Phase: Puerto Hormiga Period: Early Formative
Collected 1963 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatoff.
Comments: "Carbón vegetal" from an occupational floor with hearths and burned shell. From same stratum as I-445, "dirty shells in light brown soil, not compacted." Stratum contained 26 decorated sherds in Cut I, total of 143 from all cuts.
Reference(s): Reichel-Dolmatoff 1965:46, Bischof 1972:278
Calibrated 2σ range: 3790 - 2499 BC (1291 years)
Intercept(s): 3308 3234 3178 3162 3135 BC
Intercept mean: 3203 BC
Calibration reference: Stuiver and Pearson 1986

I-1832 2805 ± 280 bp (855 ± 280 bc) Material: Unknown
Site: Unreported Region: Chiapas
Phase: Jocotal/Dunas Period: Early Preclassic
Calibrated 2σ range: 1689 - 264 BC (1425 years)
Intercept(s): 973 958 938 BC
Intercept mean: 956 BC
Calibration reference: Stuiver and Becker 1986

I-7069 4685 ± 95 bp (2735 ± 95 bc) Material: Shell
Site: OGSE-63 Region: Ecuador
Phase: Valdivia 1-2 Period: Early Formative
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3650 - 3100 BC (550 years)
Intercept(s): 3491 3486 3376 BC
Intercept mean: 3451 BC
Calibration reference: Stuiver and Pearson 1986

I-7075 4920 ± 120 bp (2970 ± 120 bc) Material: Charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: cairns
Phase: Valdivia 1-2 Period: Early Formative
Collected 1972 by P. Norton.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3980 - 3370 BC (610 years)
Intercept(s): 3695 BC
Intercept mean: 3695 BC
Calibration reference: Stuiver and Pearson 1986

I-7076 5010 ± 120 bp (3060 ± 120 bc) Material: Charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: cairns
Phase: Valdivia 1-2 Period: Early Formative
Collected 1972 by P. Norton.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 4034 - 3517 BC (517 years)

Intercept(s): 3781 BC
Intercept mean: 3781 BC
Calibration reference: Stuiver and Pearson 1986

I-7167 4460 ± 90 bp (2510 ± 90 bc) Material: Shell
Site: OGSE-42E Region: Ecuador Lot: mound A
Phase: Valdivia 1-2 Period: Early Formative
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3370 - 2900 BC (470 years)
Intercept(s): 3091 3065 3043 BC
Intercept mean: 3066 BC
Calibration reference: Stuiver and Pearson 1986

I-7877A 3060 ± 230 bp (1110 ± 230 bc) Material: Wood charcoal
Site: Unreported Region: Belize
Phase: Swasey? Period: Early Preclassic?
Collected by D. Puleston.
Comments: Trimmed wood post from bank of canal bordering raised fields on the Rio Hondo.
Reference(s): Hammond et al. 1976, Puleston
Calibrated 2σ range: 1882 - 800 BC (1082 years)
Intercept(s): 1374 1335 1322 BC
Intercept mean: 1344 BC
Calibration reference: Stuiver and Becker 1986

I-8161 3360 ± 225 bp (1410 ± 225 bc) Material: Charcoal
Site: Paso de la Amada Region: Chiapas
Phase: Barra Period: Early Formative
Collected 1974 by J. Ceja. Submitted 1974 by G. Love.
Comments: Collected from Barra phase living floors.
Reference(s): Love 1975:29
Calibrated 2σ range: 2290 - 1055 BC (1235 years)
Intercept(s): 1688 1671 1660 1651 1642 BC
Intercept mean: 1662 BC
Calibration reference: Stuiver and Becker 1986

I-8162 3300 ± 160 bp (1350 ± 160 bc) Material: Charcoal
Site: Paso de la Amada Region: Chiapas
Phase: Barra Period: Early Formative
Collected 1974 by J. Ceja. Submitted 1974 by G. Love.
Comments: Collected from Barra phase living floors.
Reference(s): Love 1975:29
Calibrated 2σ range: 2027 - 1135 BC (892 years)
Intercept(s): 1603 BC
Intercept mean: 1603 BC
Calibration reference: Stuiver and Becker 1986

I-9384 3325 ± 85 bp (1375 ± 85 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 1E Level: 150-160 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Complicated stratigraphy noted in Block 1E.
Lowest date in stratigraphy, but not earliest from excavation.
Associated with Monagrillo ceramics.

Reference(s): Ranere & Hansell 1978, Cocke 1984
Calibrated 2σ range: 1879 - 1430 BC (449 years)
Intercept(s): 1680 1675 1621 BC
Intercept mean: 1659 BC
Calibration reference: Stuiver and Becker 1986

ISGS-142 5000 ± 190 bp (3050 ± 190 bc) Material: Wood charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: Cairn 6 Level: < 210 cm Cat.: SC No.6
Phase: Valdivia 1-2 Period: Early Formative
Collected 1972 by P. Norton. Submitted by D. Lathrap.
Comments: Sample comes from within stone cairn No. 6, associated with Cranium #3.
Associated with very early forms of Valdivia vessels. Earlier than type site.
Published in Radiocarbon 1974 16:1:115.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 4233 - 3350 BC (883 years)
Intercept(s): 3780 3731 3727 BC
Intercept mean: 3746 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-146 4750 ± 120 bp (2800 ± 120 bc) Material: Wood charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: Cairn 1 Level: < 190 cm Cat.: SC No.1
Phase: Valdivia 1-2 Period: Early Formative
Collected 1972 by P. Norton. Submitted by D. Lathrap.
Comments: Sample comes from within stone cairn.
Associated with very early forms of Valdivia vessels. Earlier than type site.
Published in Radiocarbon 1974:16:1:116.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3779 - 3100 BC (679 years)
Intercept(s): 3510 3396 3388 BC
Intercept mean: 3431 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-190 3765 ± 85 bp (1815 ± 85 bc) Material: Wood charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: J-III Level: > 210 cm Cat.: LA-8
Phase: Valdivia 6 Period: Early Formative
Collected 1972 by P. Norton. Submitted by D. Lathrap.
Comments: From excavation in thin yellow clay buried by 210 cm of Valdivia refuse.
Yellow clay indicates refilling. Only cultural material in fill is Valdivia VI.
Date is acceptable, but somewhat later than samples from cairns in Unit J-III.
Published in Radiocarbon 1975 17:2:172.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 2460 - 1910 BC (550 years)
Intercept(s): 2174 2169 2141 BC
Intercept mean: 2161 BC
Calibration reference: Stuiver and Becker 1986

ISGS-192 4590 ± 120 bp (2640 ± 120 bc) Material: Charcoal
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Unit: J-III Level: < 220 cm Cat.: LA-7
Phase: Valdivia 1-2 Period: Early Formative
Collected 1972 by P. Norton. Submitted by D. Lathrap.

Comments: Associated with stone cairn #8, with early pottery at base of cultural deposit.
Date is acceptable, but slightly later than other dates from cairns.
Pottery from 16 cairns at site stylistically earlier than known material.
Published in Radiocarbon 1975 17:2:172.
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3630 - 2920 BC (710 years)
Intercept(s): 3344 BC
Intercept mean: 3344 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-274 4580 ± 80 bp (2630 ± 80 bc) Material: Charcoal
Site: San Pedro Region: Ecuador (2°30'S, 77°15'W)
Level: 20 Cat.: DWL-11
Phase: Unknown Period: Late Archaic?
Collected 1971 by H. Bischof. Submitted by D. Lathrap.
Comments: Charcoal from aceramic levels at base of excavation in Valdivia midden.
Dates Level 20, which is technically "aceramic." San Pedro sherds in Level 19
Possibility that absence of sherds is fortuitous. Overlain by San Pedro level.
Published in Radiocarbon 28:1:105.
Reference(s): Bischof 1973
Calibrated 2σ range: 3510 - 2936 BC (574 years)
Intercept(s): 3341 BC
Intercept mean: 3341 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-275 4700 ± 80 bp (2750 ± 80 bc) Material: Charcoal
Site: San Pedro Region: Ecuador (2°30'S, 77°15'W)
Level: 20 Cat.: DWL-12
Phase: Unknown Period: Late Archaic?
Collected 1971 by H. Bischof. Submitted by D. Lathrap.
Comments: Charcoal from aceramic levels at base of excavations in Valdivia midden.
Dates Level 20, which is technically "aceramic." San Pedro sherds in Level 19.
Possibility that absence of sherds is fortuitous. Overlain by San Pedro level.
Published in Radiocarbon 22:1:105.
Reference(s): Bischof 1973
Calibrated 2σ range: 3640 - 3136 BC (504 years)
Intercept(s): 3496 3427 3379 BC
Intercept mean: 3434 BC
Calibration reference: Stuiver and Pearson 1586

ISGS-385 4160 ± 80 bp (2210 ± 80 bc) Material: Charcoal
Site: Morona-Santiago Region: Ecuador (2°30'S, 77°15'W)
Unit: Cut 10 Level: 70-80 cm Cat.: #444
Phase: Pastaza Period: Early Formative
Collected 1969 by P. Porras. Submitted by D. Lathrap.
Comments: From site near Husanga in valley of Rio Pastaza in eastern Ecuador.
Date seen to agree well with stylistic dating of Pastaza phase ceramics.
Interpreted to support alignment of Amazon Pastaza phase with Valdivia IV.
Published in Radiocarbon 28:1:106.
Reference(s): Lathrap 1970, 1971
Calibrated 2σ range: 2910 - 2480 BC (430 years)
Intercept(s): 2862 2814 2738 2728 2695 2679 2665 2630 BC
Intercept mean: 2726 BC
Calibration reference: Stuiver and Becker 1586

ISGS-439 4110 ± 80 bp (2160 ± 80 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Cat.: #3438
Phase: Valdivia 2 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Sample from within small Valdivia II mound.
Compatible with stratigraphic relationship and acceptable Valdivia dates.
Relates to sequence of deliberate mound construction at W side of inner plaza.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 2890 - 2460 BC (430 years)
Intercept(s): 2850 2845 2652 2647 2612 BC
Intercept mean: 2721 BC
Calibration reference: Stuiver and Becker 1986

ISGS-446 4270 ± 80 bp (2320 ± 80 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Cat.: #1269
Phase: Valdivia 2 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Sample from within small Valdivia II mound.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Relates to sequence of deliberate mound construction at W side of inner plaza.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 3040 - 2614 BC (426 years)
Intercept(s): 2897 BC
Intercept mean: 2897 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-448 5620 ± 250 bp (3670 ± 250 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Unit: N,C-1,TrC Level: 90-100 cm Cat.: #2778
Phase: Unknown Period: Late Archaic?
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: From continuous stratigraphic profile of TrC in NW corner of community.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Associated with aceramic level underlying earliest Valdivia 1.5 - 2 occupation.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 5048 - 3824 BC (1224 years)
Intercept(s): 4459 4411 4409 BC
Intercept mean: 4426 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-452 4700 ± 300 bp (2750 ± 300 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Cat.: #3450
Phase: Valdivia 1 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Sample from within small Valdivia II mound.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Relates to sequence of deliberate mound construction at W side of inner plaza.

Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 4213 - 2590 BC (1623 years)
Intercept(s): 3496 3427 3379 BC
Intercept mean: 3434 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-466 4390 ± 80 bp (2440 ± 80 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Unit: C-15, TrC Level: 70-80 cm Cat.: #1178
Phase: Valdivia 1 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Relates to continuous stratigrphic profile of TrC in NW corner of community.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Associated with the appearance of Valdivia II ceramics.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 3330 - 2710 BC (620 years)
Intercept(s): 3018 3001 2926 BC
Intercept mean: 2982 BC
Calibration reference: Stuiver and Pearson 1986

ISGS-467 4140 ± 190 bp (2190 ± 190 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Unit: C-5, TrC Level: 70-80 cm Cat.: #2431
Phase: Valdivia 1 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Relates to continuous stratigraphic profile of TrC in NW corner of community.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Sample situated 10 cm above first appearance of Valdivia II ceramics.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 3302 - 2140 BC (1162 years)
Intercept(s): 2857 2821 2691 2689 2660 2637 2623 BC
Intercept mean: 2711 BC
Calibration reference: Stuiver and Becker 1986

ISGS-468 4760 ± 120 bp (2810 ± 120 bc) Material: Wood charcoal
Site: Real Alto Region: Ecuador (2°23'S, 80°42'W)
Unit: TrC Level: 80-90 cm Cat.: #3569
Phase: Valdivia 1 Period: Early Formative
Collected 1975 by D. Lathrap. Submitted by D. Lathrap.
Comments: Relates to continuous stratigraphic profile of TrC in NW corner of community.
Compatible with stratigraphic relationships and acceptable Valdivia dates.
Associated with the first appearance of Valdivia ceramics.
Published in Radiocarbon 1986 28:1:106.
Reference(s): Lathrap et al. 1977
Calibrated 2σ range: 3780 - 3106 BC (674 years)
Intercept(s): 3594 3589 3514 3391 3390 BC
Intercept mean: 3496 BC
Calibration reference: Stuiver and Pearson 1986

L-427 2730 ± 150 bp (780 ± 150 bc) Material: Unknown
Site: Chiapa de Corzo Region: Chiapas

Phase: Chiapa I-II Period: Early Preclassic
Calibrated 2σ range: 1368 - 432 BC (936 years)
Intercept(s): 895 867 839 BC
Intercept mean: 867 BC
Calibration reference: Stuiver and Becker 1986

L-1042C 4450 ± 100 bp (2500 ± 100 bc) Material: Unknown
Site: OGSE-42 Region: Ecuador
Phase: Valdivia 1 Period: Early Formative
Reference(s): Bischof 1972:278
Calibrated 2σ range: 3370 - 2786 BC (584 years)
Intercept(s): 3040 BC
Intercept mean: 3040 BC
Calibration reference: Stuiver and Pearson 1986

L-1042D 4700 ± 100 bp (2750 ± 100 bc) Material: Unknown
Site: OGSE-42 Region: Ecuador
Phase: Valdivia 1 Period: Early Formative
Reference(s): Bischof 1972:278
Calibrated 2σ range: 3690 - 3100 BC (590 years)
Intercept(s): 3496 3427 3379 BC
Intercept mean: 3434 BC
Calibration reference: Stuiver and Pearson 1986

L-1232 4250 ± 100 bp (2300 ± 100 bc) Material: Shell
Site: OGSE-42 Region: Ecuador Lot: C
Phase: Valdivia 1-2 Period: Early Formative
Reference(s): Hill 1975:Fig. 3
Calibrated 2σ range: 3076 - 2505 BC (571 years)
Intercept(s): 2885 2794 2786 BC
Intercept mean: 2822 BC
Calibration reference: Stuiver and Pearson 1985

L-1232H 3900 ± 150 bp (1950 ± 150 bc) Material: Unknown
Site: OGSE-46B-1 Region: Ecuador Lot: Layer B
Phase: Valdivia 7 Period: Early Formative
Reference(s): Hill 1975:21
Calibrated 2σ range: 2872 - 1920 BC (952 years)
Intercept(s): 2451 2433 2392 2384 2356 BC
Intercept mean: 2403 BC
Calibration reference: Stuiver and Becker 1986

L-1232I 3750 ± 150 bp (1800 ± 150 bc) Material: Unknown
Site: OGSE-46B-1 Region: Ecuador Lot: Layer B
Phase: Valdivia 7 Period: Early Formative
Reference(s): Hill 1975:21
Calibrated 2σ range: 2573 - 1740 BC (833 years)
Intercept(s): 2138 BC
Intercept mean: 2138 BC
Calibration reference: Stuiver and Becker 1986

LJ-4918 2740 ± 70 bp (790 ± 70 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: 35/35 Cat.: #3

Phase: Swasey Period: Early Preclassic
Collected by N. Hammond. Submitted by N. Hammond.
Comments: From early occupation level with first effigy whistles.
Younger than expected by several centuries.
Important for linking 35/35 and 35/30 and dating earliest musical instruments.
Published in <u>Radiocarbon</u> 1984 26:1:94.
Fractionation: σC_3 = -27.6%
Calibrated 2σ range: 1187 - 800 BC (387 years)
Intercept(s): 898 858 850 BC
Intercept mean: 869 BC
Calibration reference: Stuiver and Becker 1986

LJ-4919 2490 ± 70 bp (540 ± 70 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: 35/30 Cat.: #4
Phase: Swasey Period: Early Preclassic
Collected by N. Hammond. Submitted by N. Hammond.
Comments: From middle of Building Phase III. Defines III/IIIA boundary.
Date is several centuries younger than expected.
Published in <u>Radiocarbon</u> 1984 26:1:93.
Fractionation: σC_3 = -26.8%
Calibrated 2σ range: 800 - 400 BC (400 years)
Intercept(s): 761 683 659 633 620 612 594 BC
Intercept mean: 652 BC
Calibration reference: Stuiver and Becker 1986

LJ-4922 2520 ± 70 bp (570 ± 70 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: 35/30 Cat.: #7
Phase: Swasey Period: Early Preclassic
Collected by N. Hammond. Submitted by N. Hammond.
Comments: From early Phase III Early Formative patio. Defines Phase III/IIIA boundary.
Date is several centuries younger than expected.
Published in <u>Radiocarbon</u> 1984 26:1:94.
Fractionation: σC_3 = -26.5%
Calibrated 2σ range: 830 - 410 BC (420 years)
Intercept(s): 767 674 662 BC
Intercept mean: 701 BC
Calibration reference: Stuiver and Becker 1986

LJ-4923 2510 ± 60 bp (560 ± 60 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: 35/30 Cat.: #8
Phase: Swasey Period: Early Preclassic
Collected by N. Hammond. Submitted by N. Hammond.
Comments: From early Phase III.
Much younger than expected, and inseperable from late Phase III ages.
Does not accord with stratigraphy or ceramic sequence.
Published in <u>Radiocarbon</u> 1984 26:1:94.
Fractionation: σC_3 = -26.4%
Calibrated 2σ range: 810 - 410 BC (400 years)
Intercept(s): 765 677 661 606 605 BC
Intercept mean: 663 BC
Calibration reference: Stuiver and Becker 1986

M-529 2860 ± 300 bp (910 ± 300 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted 1957 by R. Heizer.
Reference(s): Science127:3306:1104
Calibrated 2σ range: 1769 - 380 BC (1389 years)
Intercept(s): 1049 1039 1016 BC
Intercept mean: 1035 BC
Calibration reference: Stuiver and Becker 1986

M-531 2560 ± 300 bp (610 ± 300 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted 1957 by R. Heizer.
Comments: Leveled base sands underlying and contemp. with Phase I platform in mound A-2.
Half of this sample run for UCLA-902, which overlaps early range of date.
Reference(s): Science127:3306:1104
Calibrated 2σ range: 1440 BC - AD 51 (1491 years)
Intercept mean: 790 BC
Calibration reference: Stuiver and Becker 1986

M-535 3110 ± 300 bp (1160 ± 300 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted 1957 by R. Heizer.
Comments: From Phase I floors at northeast corner of southwest platform.
Reference(s): Science127:3306:1104
Calibrated 2σ range: 2138 - 603 BC (1535 years)
Intercept(s): 1411 BC
Intercept mean: 1411 BC
Calibration reference: Stuiver and Becker 1986

M-978 3280 ± 200 bp (1330 ± 200 bc) Material: Unknown
Site: Chiapa de Corzo Region: Chiapas
Phase: Chiapa I Period: Early Formative
Calibrated 2σ range: 2131 - 1051 BC (1080 years)
Intercept(s): 1598 1569 1533 BC
Intercept mean: 1567 BC
Calibration reference: Stuiver and Becker 1986

M-1176 3070 ± 100 bp (1120 ± 100 bc) Material: Charcoal
Site: Malambo Region: Colombia
Phase: Malambo Period: Early Formative
Calibrated 2σ range: 1597 - 1019 BC (578 years)
Intercept(s): 1376 1332 1323 BC
Intercept mean: 1344 BC
Calibration reference: Stuiver and Becker 1986

M-1317 4480 ± 140 bp (2530 ± 140 bc) Material: Charcoal
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut J Level: Zone D (270-300 cm)
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by Evans.

Comments: From Cut J in village refuse.
Published in Radiocarbon 1964 6:18.
Reference(s): MEE 1965
Calibrated 2σ range: 3596 - 2703 BC (893 years)
Intercept(s): 3096 3053 3048 BC
Intercept mean: 3066 BC
Calibration reference: Stuiver and Pearson 1986

M-1318 4170 ± 140 bp (2220 ± 140 bc) Material: Charcoal
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut J Level: Zone D (300-330 cm)
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by Evans.
Comments: From Cut J in village refuse.
Associated with Valdivia A ceramics.
Published in Radiocarbon 1964 6:18.
Reference(s): MEE 1965
Calibrated 2σ range: 3072 - 2340 BC (732 years)
Intercept(s): 2865 2810 2747 2725 2697 2674 2668 BC
Intercept mean: 2741 BC
Calibration reference: Stuiver and Becker 1986

M-1320 5150 ± 150 bp (3200 ± 150 bc) Material: Charcoal
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut J Level: Zone E (360-390 cm)
Phase: Valdivia A Period: Early Formative
Collected by MEE. Submitted by C. Evans.
Comments: From Cut J in village refuse.
Date not in stratigraphic sequence.
Associated with Valdivia A ceramics.
Published in Radiocarbon 1964 6:18.
Reference(s): MEE 1965
Calibrated 2σ range: 4333 - 3640 BC (693 years)
Intercept(s): 3969 BC
Intercept mean: 3969 BC
Calibration reference: Stuiver and Pearson 1986

M-1321 4100 ± 140 bp (2150 ± 140 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut J Level: Zone E (390-420 cm)
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by Evans.
Comments: Shell in excellent condition from Cut J in village refuse.
This shell date is some 500 years later than charcoal date (M-1322) from level.
Associated with Valdivia A ceramics.
Published in Radiocarbon 1964 6:18.
Reference(s): MEE 1965
Calibrated 2σ range: 3014 - 2205 BC (809 years)
Intercept(s): 2598 BC
Intercept mean: 2598 BC
Calibration reference: Stuiver and Becker 1986

M-1322 4620 ± 140 bp (2670 ± 140 bc) Material: Charcoal
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)

Unit: Cut J Level: Zone E (400 cm)
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by Evans.
Comments: Charcoal from Hearth B, from Cut J in village refuse.
This charcoal date is some 500 years older than shell date (M-1321) from level.
Associated with Valdivia A ceramics.
Published in Radiocarbon 1964 6:18.
Reference(s): MEE 1965
Calibrated 2σ range: 3690 - 2920 BC (770 years)
Intercept(s): 3356 BC
Intercept mean: 3356 BC
Calibration reference: Stuiver and Pearson 1986

N-65-2 2820 ± 120 bp (870 ± 120 bc) Material: Unknown
Site: Kotosh Region: Peru
Phase: Kotosh Chavin Period: Early Initial
Calibrated 2σ range: 1369 - 665 BC (704 years)
Intercept(s): 971 960 932 BC
Intercept mean: 954 BC
Calibration reference: Stuiver and Becker 1986

N-66-a 2870 ± 230 bp (920 ± 230 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Kotosh Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1600 - 410 BC (1190 years)
Intercept(s): 1010 BC
Intercept mean: 1010 BC
Calibration reference: Stuiver and Becker 1986

N-67-2 2840 ± 170 bp (890 ± 170 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Kotosh Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1430 - 451 BC (979 years)
Intercept(s): 997 995 973 957 941 BC
Intercept mean: 973 BC
Calibration reference: Stuiver and Becker 1986

N-69-2 3100 ± 130 bp (1150 ± 130 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Waira-jirca Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1682 - 938 BC (744 years)
Intercept(s): 1376 1332 1323 BC
Intercept mean: 1344 BC
Calibration reference: Stuiver and Becker 1986

N-1594 3770 ± 85 bp (1820 ± 85 bc) Material: Charcoal
Site: CS-8 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit N3E3 Level: 980-1000 cm Cat.: 1
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.

Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:87.
Calibrated 2σ range: 2470 - 1926 BC (544 years)
Intercept(s): 2268 2263 2203 2147 2146 BC
Intercept mean: 2205 BC
Calibration reference: Stuiver and Becker 1986

N-1595 1900 ± 95 bp (ad 50 ± 95) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 100-120 cm Cat.: 2
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From uppermost stratum at shell midden site ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date is much later than others in large suite of samples.
Published in Radiocarbon 1977 19:1:87.
Calibrated 2σ range: 166 BC - AD 341 (507 years)
Intercept(s): AD 77
Intercept mean: AD 77
Calibration reference: Stuiver and Becker 1986

N-1596 4600 ± 75 bp (2650 ± 75 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 460-470 cm Cat.: 3
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From burial with aceraic deposits at shell midden site ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:87.
Calibrated 2σ range: 3613 - 3047 BC (566 years)
Intercept(s): 3360 BC
Intercept mean: 3360 BC
Calibration reference: Stuiver and Pearson 1986

N-1597 4020 ± 85 bp (2070 ± 85 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 240-245 cm Cat.: 4
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2878 - 2330 BC (548 years)
Intercept(s): 2573 2535 2506 BC
Intercept mean: 2538 BC
Calibration reference: Stuiver and Becker 1986

N-1598 3930 ± 70 bp (1980 ± 70 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 248-260 cm Cat.: 5
Phase: Chantuto Period: Late Archaic

Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2600 - 2205 BC (395 years)
Intercept(s): 2464 BC
Intercept mean: 2464 BC
Calibration reference: Stuiver and Becker 1986

N-1599 4050 ± 85 bp (2100 ± 85 bc) Material: Charcoal
Site: CS-6 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit N1E9 Level: 540-560 cm Cat.: 6
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: Lowest sample from aceramic deposits at shell midden site ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2886 - 2397 BC (489 years)
Intercept(s): 2584 BC
Intercept mean: 2584 BC
Calibration reference: Stuiver and Becker 1986

N-1600 3980 ± 85 bp (2030 ± 85 bc) Material: Charcoal
Site: CS-6 Region: Chiapas (15°10'N, 92°50'W)
Unit: NIE9 Level: 340-360 cm Cat.: 7
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: Uppermost sample from aceramic deposits at shell midden site ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2868 - 2280 BC (588 years)
Intercept(s): 2554 2548 2491 BC
Intercept mean: 2531 BC
Calibration reference: Stuiver and Becker 1986

N-1601 3890 ± 85 bp (1940 ± 85 bc) Material: Charcoal
Site: CS-6 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit N8W1 Level: 660-680 cm Cat.: 8
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: Lowest sample from aceramic stratum at shell midden site ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2590 - 2140 BC (450 years)
Intercept(s): 2455 2416 2405 BC
Intercept mean: 2425 BC
Calibration reference: Stuiver and Becker 1986

N-1887 4350 ± 90 bp (2400 ± 90 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)

Unit: Pit NOE2 Level: 540-560 cm Cat.: 9
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 3340 - 2703 BC (637 years)
Intercept(s): 3013 3007 2924 BC
Intercept mean: 2981 BC
Calibration reference: Stuiver and Pearson 1986

N-1888 4450 ± 90 bp (2500 ± 90 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 580-600 cm Cat.: 10
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 3370 - 2910 BC (460 years)
Intercept(s): 3096 3053 3048 BC
Intercept mean: 3066 BC
Calibration reference: Stuiver and Pearson 1986

N-1889 4320 ± 90 bp (2370 ± 90 bc) Material: Charcoal
Site: CS-7 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit NOE2 Level: 640-660 cm Cat.: 11
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date consistent with others in large suite of samples.
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 3309 - 2667 BC (642 years)
Intercept(s): 2919 BC
Intercept mean: 2919 BC
Calibration reference: Stuiver and Pearson 1986

N-1891-1 3960 ± 90 bp (2010 ± 90 bc) Material: Charcoal
Site: CS-8 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit N3E3 Level: 840-860 cm Cat.: 12
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: From same level as shell date of N-1891-2 at shell midden ca. 6.5 km inland.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date is slightly earlier than date on shell from same level (N-1891-2).
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2865 - 2200 BC (665 years)
Intercept(s): 2470 BC
Intercept mean: 2470 BC
Calibration reference: Stuiver and Becker 1986

N-1891-2 3710 ± 90 bp (1760 ± 90 bc) Material: Shell
Site: CS-8 Region: Chiapas (15°10'N, 92°50'W)
Unit: Pit N3E3 Level: 840-860 cm Cat.: 13
Phase: Chantuto Period: Late Archaic
Collected 1973 by B. Voorhies. Submitted by B. Voorhies.
Comments: Date on shell from shell midden site ca. 6.5 km inland. Late Archaic deposits.
Artifacts scarce, restricted to obsidian flakes, chipped and ground stone.
Date slightly later than charcoal date from same excavation level (N-1891-1).
Published in Radiocarbon 1977 19:1:88.
Calibrated 2σ range: 2464 - 1834 BC (630 years)
Intercept(s): 2137 2079 2074 2055 2044 BC
Intercept mean: 2078 BC
Calibration reference: Stuiver and Becker 1986

P-1551 2790 ± 60 bp (840 ± 60 bc) Material: Charcoal
Site: Chalchuapa Region: El Salvador (13°59'N, 89°41'E)
Phase: Tok Period: Early Preclassic
Collected 1967/69 by R. Sharer. Submitted by R. Sharer.
Reference(s): Sharer 1978
Calibrated 2σ range: 1208 - 820 BC (388 years)
Intercept(s): 971 960 932 BC
Intercept mean: 954 BC
Calibration reference: Stuiver and Becker 1986

P-1807 3610 ± 60 bp (1660 ± 60 bc) Material: Charcoal
Site: Chalchuapa Region: El Salvador (13°59'N, 89°41'E)
Unit: Test 2-3 Level: 11 Cat.: LC2-3.11
Phase: Tok Period: Early Preclassic
Collected 1967/69 by R. Sharer. Submitted 1969 by R. Sharer.
Comments: From lowest level in test pit in Laguna Cuzcachapa stratified deposits.
Date should be no later than terminal Early Preclassic.
Believed to be much too early.
Published in Radiocarbon 1974:16:2:230.
Reference(s): Sharer 1978
Calibrated 2σ range: 2198 - 1774 BC (424 years)
Intercept(s): 2013 1993 1966 BC
Intercept mean: 1991 BC
Calibration reference: Stuiver and Becker 1986

P-2750 2310 ± 180 bp (360 ± 180 bc) Material: Charcoal
Site: Playa de los Muertos Region: Honduras (14°18'N, 87°54'W)
Unit: Op. H. Level: 320-340 cm Lot: 17 Cat.: 5
Period: Early Formative?
Collected 1975 by N. Kennedy. Submitted 1976 by N. Kennedy.
Comments: Possibly contaminated with humic acids. Sample counted in small counter.
Associated with Early Formative ceramics.
Published in Radiocarbon 1981 23:2:237.
Reference(s): Kennedy 1977
Calibrated 2σ range: 830 BC - AD 54 (884 years)
Intercept mean: 395 BC
Calibration reference: Stuiver and Becker 1986

Q-1476 2970 ± 160 bp (1020 ± 160 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)

Unit: Op. 17B Level: 14
Phase: Swasey Period: Early Preclassic
Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Sample of burnt wood from burial cut into plaster platform.
Small sample. Traces of plaster removed with acid.
Associated burial contained three vessels, block of flint in place of a skull.
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: 1601 - 810 BC (791 years)
Intercept(s): 1257 1244 1233 1215 1199 1194 1139 1134 BC
Intercept mean: 1202 BC
Calibration reference: Stuiver and Becker 1986

Q-1571 3900 ± 65 bp (1950 ± 65 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 230
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Charred small branches from occupation trodden into top of old land surface
Stable isotopes ratios rule out contamination with mineral charcoal.
Earliest acceptable date for Swasey ceramics in terms of stratigraphy.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2577 - 2149 BC (428 years)
Intercept(s): 2457 BC
Intercept mean: 2457 BC
Calibration reference: Stuiver and Becker 1986

Q-1572 3760 ± 85 bp (1810 ± 85 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 239
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Charred wood from midden on ancient ground surface.
Stable isotopes ratios rule out contamination with mineral charcoal.
Date considered acceptable for ceramic associations and stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2470 - 1924 BC (546 years)
Intercept(s): 2201 2151 2145 BC
Intercept mean: 2166 BC
Calibration reference: Stuiver and Becker 1986

Q-1573 3580 ± 70 bp (1630 ± 70 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 189
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Burnt timber from same building as samples UCLA-2102d, Q-1576, and Q-1577.
Stable isotopes ratios rule out contamination with mineral charcoal.
Date considered acceptable for ceramic associations and stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2192 - 1740 BC (452 years)
Intercept(s): 2008 2003 1923 BC
Intercept mean: 1978 BC
Calibration reference: Stuiver and Becker 1986

Q-1574 3670 ± 65 bp (1720 ± 65 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 176
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Structural context.
Stable isotopes ratios rule out contamination with mineral charcoal
Date considered acceptable for stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2288 - 1835 BC (453 years)
Intercept(s): 2127 2125 2112 2100 2093 2084 2068 2065 BC
2036 BC
Intercept mean: 2090 BC
Calibration reference: Stuiver and Becker 1986

Q-1575 3200 ± 205 bp (1250 ± 205 bc) Material: Charcoal
Site: Barton Ramie Region: Belize
Phase: Jenney Creek Period: Early Preclassic
Collected 1976. Submitted by N. Hammond.
Comments: Associated with ceramics of early facet of Jenney Creek ceramic complex.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2013 - 931 BC (1082 years)
Intercept(s): 1492 1478 1463 BC
Intercept mean: 1478 BC
Calibration reference: Stuiver and Becker 1986

Q-1576 3660 ± 150 bp (1710 ± 150 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 219
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Burnt timber from same structure as samples UCLA-2102d, Q-1573, and Q-1577.
Stable isotopes ratios rule out contamination with mineral charcoal.
Date considered acceptable for associated ceramics and stratigraphic context.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2470 - 1641 BC (829 years)
Intercept(s): 2109 2103 2090 2085 2034 BC
Intercept mean: 2084 BC
Calibration reference: Stuiver and Becker 1986

Q-1577 3550 ± 85 bp (1600 ± 85 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 211
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Burnt timber from same structure as samples UCLA-2102d, Q-1573, and Q-1576.
Stable isotopes ratios rule out contamination with mineral charcoal.
Date considered acceptable for associated ceramic and stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2190 - 1646 BC (544 years)
Intercept(s): 1917 1906 1888 BC
Intercept mean: 1904 BC
Calibration reference: Stuiver and Becker 1986

Q-1578 3340 ± 65 bp (1390 ± 65 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 197
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Structural fill.
Stable isotopes ratios rule out contamination with mineral charcoal
Date considered acceptable for ceramic associations and stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 1862 - 1463 BC (399 years)
Intercept(s): 1684 1673 1637 BC
Intercept mean: 1665 BC
Calibration reference: Stuiver and Becker 1986

Q-1579 3260 ± 80 bp (1310 ± 80 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 175
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Fill context.
Stable isotopes ratios rule out contamination with mineral charcoal
Date considered acceptable for associated ceramics and stratigraphic position.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 1740 - 1395 BC (345 years)
Intercept(s): 1526 BC
Intercept mean: 1526 BC
Calibration reference: Stuiver and Becker 1986

SI-16 4220 ± 100 bp (2270 ± 100 bc) Material: A. subimbricata
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Ct J, Sec E Level: 390-420 cm Cat.: 872-A
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by C. Evans.
Comments: Shell from midden refuse.
SI-18 and this are from two different species of shell in the same level.
Published in Radiocarbon 1964 6:186.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3032 - 2494 BC (538 years)
Intercept(s): 2877 2800 2780 2712 2708 BC
Intercept mean: 2775 BC
Calibration reference: Stuiver and Becker 1986

SI-18 4230 ± 100 bp (2280 ± 100 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Ct J, Sec E Level: 390-420 cm Cat.: 872-B
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by C. Evans.
Comments: Shell from midden refuse.
SI-16 and this are from two different species of shell in the same level.
Published in Radiocarbon 1964 6:186.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3040 - 2498 BC (542 years)
Intercept(s): 2880 2798 2782 BC
Intercept mean: 2820 BC

Calibration reference: Stuiver and Pearson 1986

SI-20 2805 ± 105 bp (855 ± 105 bc) Material: Fine charcoal ash
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Ct J, Sec E Level: 330-360 Cat.: 870
Phase: Valdivia A-B? Period: Early Formative?
Collected 1961 by MEE. Submitted by C. Evans.
Comments: "Fine ash, dust type of charcoal" from shell midden refuse.
Submitted to test validity of this type of sample for dating.
Much too recent. Suggests contamination by more recent materials.
Published in Radiocarbon 1964 6:186.
Calibrated 2σ range: 1289 - 790 BC (499 years)
Intercept(s): 969 963 924 BC
Intercept mean: 952 BC
Calibration reference: Stuiver and Becker 1986

SI-22 4450 ± 90 bp (2500 ± 90 bc) Material: Charcoal
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Ct J, Sec D Level: 300-330 cm Cat.: 847
Phase: Valdivia A Period: Early Formative
Collected 1961 by MEE. Submitted by C. Evans.
Comments: Charcoal from same cultural period in shell midden refuse as SI-16 and SI-18.
Published in Radiocarbon 1964 6:186.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3360 - 2890 BC (470 years)
Intercept(s): 3040 BC
Intercept mean: 3040 BC
Calibration reference: Stuiver and Pearson 1986

SI-67 2830 ± 45 bp (880 ± 45 bc) Material: A. subrugosa
Site: La Cabuya (G-110) Region: Ecuador (1°58'S, 80°45'W)
Unit: Cut 2 Level: 20-40 cm Cat.: No. 1191
Phase: Machalilla Period: Early Formative
Collected 1961 by Evans & Meggers. Submitted by C. Evans.
Comments: Shell from midden at site of La Cabuya.
Associated with pottery of Machalilla culture.
Published in Radiocarbon 1965 7:251.
Reference(s): Meggers & Evans 1962, MEE 1965
Calibrated 2σ range: 1188 - 832 BC (356 years)
Intercept(s): 972 959 936 BC
Intercept mean: 956 BC
Calibration reference: Stuiver and Becker 1986

SI-69 3450 ± 50 bp (1500 ± 50 bc) Material: A. subrugosa
Site: Buena Vista (G-54) Region: Ecuador (1°56'S, 80°44'W)
Unit: Cut 1 Level: 60-80 cm Cat.: No. 1155
Phase: Valdivia (Late C) Period: Early Formative
Collected 1961 by Evans & Meggers. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 1884 - 1600 BC (284 years)
Intercept(s): 1735 1697 1696 BC
Intercept mean: 1709 BC
Calibration reference: Stuiver and Becker 1986

SI-71 4040 ± 55 bp (2090 ± 55 bc) Material: A. subrugosa
Site: Buena Vista (G-54) Region: Ecuador (1°56'S, 80°44'W)
Lot: 1 (100-130)
Phase: Valdivia C Period: Early Formative
Collected 1961 by Evans & Meggers. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2861 - 2409 BC (452 years)
Intercept(s): 2569 2538 2503 BC
Intercept mean: 2537 BC
Calibration reference: Stuiver and Becker 1986

SI-78 3970 ± 65 bp (2020 ± 65 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 80-100 cm Cat.: No. 312
Phase: Valdivia (Early C) Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2650 - 2280 BC (370 years)
Intercept(s): 2466 BC
Intercept mean: 2466 BC
Calibration reference: Stuiver and Becker 1986

SI-80 4140 ± 60 bp (2190 ± 60 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 20-40 cm Cat.: No. 309
Phase: Valdivia (Early C) Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2889 - 2494 BC (395 years)
Intercept(s): 2857 2821 2691 2689 2660 2637 2623 BC
Intercept mean: 2711 BC
Calibration reference: Stuiver and Becker 1986

SI-81 4270 ± 60 bp (2320 ± 60 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut A Level: 200-220 cm Cat.: No. 336
Phase: Valdivia (Mid. A) Period: Early Formative
Collected 1956 by Estrada. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3019 - 2625 BC (394 years)
Intercept(s): 2892 BC
Intercept mean: 2892 BC
Calibration reference: Stuiver and Pearson 1986

SI-82 4120 ± 65 bp (2170 ± 65 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut A Level: 180-200 cm Cat.: No. 335
Phase: Valdivia (Late A) Period: Early Formative
Collected 1956 by Estrada. Submitted by C. Evans.

Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2886 - 2470 BC (416 years)
Intercept(s): 2853 2828 2655 2644 2615 BC
Intercept mean: 2719 BC
Calibration reference: Stuiver and Becker 1986

SI-83 4530 ± 55 bp (2580 ± 55 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut A Level: 160-180 cm Cat.: No. 334
Phase: Valdivia (Late A) Period: Early Formative
Collected 1956 by Estrada. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3370 - 2933 BC (437 years)
Intercept(s): 3307 3235 3177 3163 3134 3112 3110 BC
Intercept mean: 3177 BC
Calibration reference: Stuiver and Pearson 1986

SI-84 4390 ± 60 bp (2440 ± 60 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 130-140 cm Cat.: No. 315
Phase: Valdivia (Late B) Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by C. Evans.
Comments: Replicated by second analysis of same sample (SI-84 R).
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3298 - 2790 BC (508 years)
Intercept(s): 3018 3001 2926 BC
Intercept mean: 2982 BC
Calibration reference: Stuiver and Pearson 1986

SI-84 R 4540 ± 50 bp (2590 ± 50 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 130-140 cm Cat.: No. 315
Phase: Valdivia (Late B) Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by C. Evans.
Comments: Replicate analysis of SI-84 R.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3370 - 3044 BC (326 years)
Intercept(s): 3338 3213 3203 BC
Intercept mean: 3251 BC
Calibration reference: Stuiver and Pearson 1986

SI-85 4170 ± 65 bp (2220 ± 65 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 120-130 cm Cat.: No. 314
Phase: Valdivia (Mid-L B) Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by C. Evans.
Published in Radiocarbon 1965 7:251.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2910 - 2501 BC (409 years)
Intercept(s): 2865 2810 2747 2725 2697 2674 2668 BC

Intercept mean: 2741 BC
Calibration reference: Stuiver and Pearson 1986

SI-107 3320 ± 170 bp (1370 ± 170 bc) Material: Charred food
Site: La Cabuya (G-110) Region: Ecuador (1°58'S, 80°45'W)
Unit: Cut 2 Level: 0-20 cm
Phase: Machalilla Period: Early Formative
Collected 1961 by Evans & Meggers. Submitted by C. Evans.
Comments: One of two samples (see SI-108) from sherds of same vessel in adjacent strata.
Discrepancy cannot be due to chronological difference.
Adhering to sherds of the Machalilla culture.
Published in Radiocarbon 1965 7:252.
Calibrated 2σ range: 2029 - 1114 BC (915 years)
Intercept(s): 1601 1561 1536 BC
Intercept mean: 1566 BC
Calibration reference: Stuiver and Becker 1986

SI-108 2980 ± 160 bp (1030 ± 160 bc) Material: Charred food
Site: La Cabuya (G-110) Region: Ecuador (1°58'S, 80°45'W)
Unit: Cut 2 Level: 20-40 cm
Phase: Machalilla Period: Early Formative
Collected 1961 by Evans & Meggers. Submitted by C. Evans.
Comments: One of two samples (see SI-107) from sherds of same vessel in adjacent levels.
Discrepancy cannot be due to chronological difference.
Adhering to sherds of the Machaiilla culture.
Published in Radiocarbon 1965 7:252.
Calibrated 2σ range: 1597 - 800 BC (797 years)
Intercept(s): 1212 1202 1192 1141 1132 1118 1115 BC
Intercept mean: 1159 BC
Calibration reference: Stuiver and Becker 1986

SI-112 3350 ± 200 bp (1400 ± 200 bc) Material: A. subrugosa
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut J Level: Zone D (390-420 cm)
Phase: Valdivia A? Period: Early Formative?
Collected by Evans & Meggers. Submitted by C. Evans.
Comments: Stratigraphically below SI-22, M-1318, and M-1317. Considered a minimum age.
"Sample was small and finely-divided and was not pretreated."
Sample should date earliest Valdivia levels at site.
Published in Radiocarbon 1965 7:250.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2187 - 1110 BC (1077 years)
Intercept(s): 1679 1676 1619 BC
Intercept mean: 1658 BC
Calibration reference: Stuiver and Becker 1986

SI-151 4820 ± 100 bp (2870 ± 100 bc) Material: Charcoal
Site: Puerto Hormiga Region: Colombia (10°08'N, 75°29'W)
Unit: Cut IV Level: 80 cm Cat.: 1
Phase: Puerto Hormiga Period: Early Formative
Collected 1963 by G. & A. Reichel-Dolmatoff. Submitted by C. Evans.
Comments: Cut IV contained 92 decorated sherds, large quantities fiber and sand tempered.
Published in Radiocarbon 1966 8:417.
Reference(s): Reichel-Dolmatoff 1965, Bischof 1972:278

Calibrated 2σ range: 3899 - 3370 BC (529 years)
Intercept(s): 3636 BC
Intercept mean: 3636 BC
Calibration reference: Stuiver and Pearson 1986

SI-152 4970 ± 70 bp (3020 ± 70 bc) Material: Pitar sp.
Site: Puerto Hormiga Region: Colombia (10°08'N, 75°29'W)
Unit: Cut IV Level: 75 cm Cat.: 2
Phase: Puerto Hormiga Period: Early Formative
Collected 1963 by G.& A. Reichel-Dolmatoff. Submitted by C. Evans.
Comments: Shell.
Cut IV contained 92 decorated sherds, large quantities fiber and sand tempered.
Published in Radiocarbon 1966 8:417.
Reference(s): Reichel-Dolmatoff 1965:45, Bischof 1972:278
Calibrated 2σ range: 3970 - 3640 BC (330 years)
Intercept(s): 3780 3731 3727 BC
Intercept mean: 3746 BC
Calibration reference: Stuiver and Pearson 1986

SI-153 5040 ± 70 bp (3090 ± 70 bc) Material: Pitar sp.
Site: Puerto Hormiga Region: Colombia (10°08'N, 75°29'W)
Unit: Cut IV Level: 110 cm Cat.: 3
Phase: Puerto Hormiga Period: Early Formative
Collected 1963 by G.& A. Reichel-Dolmatoff. Submitted by C. Evans.
Comments: Shell.
Cut IV contained 92 decorated sherds, large quantities fiber and sand tempered.
Published in Radiocarbon 1966 8:417.
Reference(s): Reichel-Dolmatoff 1965:45, Bischof 1972:278
Calibrated 2σ range: 3990 - 3700 BC (290 years)
Intercept(s): 3910 3878 3814 BC
Intercept mean: 3867 BC
Calibration reference: Stuiver and Pearson 1986

SI-1055 4370 ± 65 bp (2420 ± 65 bc) Material: Unknown
Site: Loma Alta Region: Ecuador (1°54'S, 80°38'W)
Lot: J150
Phase: Valdivia 1-2 Period: Early Formative
Reference(s): Bischof 1972:278
Calibrated 2σ range: 3292 - 2784 BC (508 years)
Intercept(s): 2922 BC
Intercept mean: 2922 BC
Calibration reference: Stuiver and Pearson 1986

SI-2838 3385 ± 75 bp (1435 ± 75 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 2E Level: 20-30 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Uppermost date and youngest in series from Block 2E.
Associated with Monagrillo ceramics.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 1890 - 1500 BC (390 years)
Intercept(s): 1691 1668 1665 BC
Intercept mean: 1675 BC

Calibration reference: Stuiver and Becker 1986

SI-2839 3485 ± 100 bp (1535 ± 100 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 2E Level: 50-60 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Consistent with stratigraphy in Block 2E.
Associated with Monagrillo ceramics.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 2133 - 1532 BC (601 years)
Intercept(s): 1867 1845 1828 1822 1813 1799 1776 BC
Intercept mean: 1821 BC
Calibration reference: Stuiver and Becker 1986

SI-2840 3615 ± 80 bp (1665 ± 80 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 2E Level: 95-100 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Consistent with stratigraphy in Block 2E.
Associated with Monagrillo ceramics.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 2271 - 1740 BC (531 years)
Intercept(s): 2014 1993 1969 BC
Intercept mean: 1992 BC
Calibration reference: Stuiver and Becker 1986

SI-2841 5385 ± 95 bp (3435 ± 95 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 2E Level: 110-120 cm
Phase: Monagrillo? Period: Early Formative?
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Consistent with stratigraphy in Block 2E.
Associated with Monagrillo phase occupation, but "inexplicably early."
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 4456 - 4000 BC (456 years)
Intercept(s): 4242 BC
Intercept mean: 4242 BC
Calibration reference: Stuiver and Pearson 1986

SI-2842 4405 ± 75 bp (2455 ± 75 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 1E Level: 20-30 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Complicated stratigraphy noted for Block 1E. Sample from ash lens.
Oldest date in series of four from excavation, but highest in stratigraphy.
Associated with Monagrillo materials.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 3340 - 2900 BC (440 years)
Intercept(s): 3036 BC
Intercept mean: 3036 BC
Calibration reference: Stuiver and Pearson 1986

SI-2843 3245 ± 100 bp (1295 ± 100 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 1E Level: 50-56 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Complicated stratigraphy noted in Block 1E.
Youngest date in series of four, but beneath older date of SI-2842.
Associated with Monagrillo materials.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 1750 - 1318 BC (432 years)
Intercept(s): 1520 BC
Intercept mean: 1520 BC
Calibration reference: Stuiver and Becker 1986

SI-2844 4135 ± 80 bp (2185 ± 80 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Panama (8°02'N, 80°28'W)
Unit: Block 1E Level: 97-100 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by Ranere & Hansell. Submitted by A. Ranere.
Comments: Complicated stratigraphy noted for Block 1E. Sample from ash lens.
Date is older than sample from overlying level, but underlain by younger date.
Associated with Monagrillo materials.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 2910 - 2490 BC (420 years)
Intercept(s): 2863 2812 2742 2726 2696 2677 2666 BC
Intercept mean: 2740 BC
Calibration reference: Stuiver and Becker 1986

TEM-106 5840 ± 95 bp (3890 ± 95 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C5 (35 cm) Cat.: #40
Phase: Preceramic Period: Late Archaic
Collected 1973 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Shell date from level immediately above bedrock.
Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 4940 - 4490 BC (450 years)
Intercept(s): 4772 4759 4728 BC
Intercept mean: 4753 BC
Calibration reference: Stuiver and Pearson 1986

TEM-107 2570 ± 95 bp (620 ± 95 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer B1 (5-10 cm) Cat.: #30
Phase: Monagrillo? Period: Early Formative?
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Associated with ceramics, but too late for Monagrillo.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 968 - 410 BC (558 years)
Intercept(s): 792 BC

Intercept mean: 792 BC
Calibration reference: Stuiver and Becker 1986

TEM-108 3630 ± 95 bp (1680 ± 95 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 2 Level: Layer C1 (20-25 cm) Cat.: #24
Phase: Preceramic Period: Late Archaic
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Dates top of Preceramic deposits at site. Overlain by ceramic occupation.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 2307 - 1740 BC (567 years)
Intercept(s): 2029 1990 1977 BC
Intercept mean: 1999 BC
Calibration reference: Stuiver and Becker 1986

TEM-109 5495 ± 100 bp (3545 ± 100 bc) Material: Charcoal
Site: Monagrillo Region: Central Panama (8°02'N, 80°28'W)
Unit: Block 2E Level: 100-110 cm Cat.: #70
Phase: Preceramic? Period: Late Archaic?
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: From next to lowest level in Block 2E. Similar in age to SI-2841.
Date may be non-cultural. However, it is consistent with stratigraphy in unit.
Overlain by levels containing Monagrillo materials.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere & Hansell 1978, Cooke 1984
Calibrated 2σ range: 4571 - 4047 BC (524 years)
Intercept(s): 4351 BC
Intercept mean: 4351 BC
Calibration reference: Stuiver and Pearson 1986

TEM-110 3540 ± 115 bp (1590 ± 115 bc) Material: Charcoal
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C4/D (30 cm +) Cat.: #38/41
Phase: Preceramic Period: Late Archaic
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Combination of two aggregate charcoal samples of "small flecks."
Possible reworking by termites suggested as source of contamination.
Younger than expected date.
Published in Radiocarbon 1979 21:3:475.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 2269 - 1600 BC (669 years)
Intercept(s): 1885 1837 1836 BC
Intercept mean: 1853 BC
Calibration reference: Stuiver and Becker 1986

TEM-119 4800 ± 100 bp (2850 ± 100 bc) Material: Crassotrea
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)
Unit: Area 1 Level: Layer 3 (30-45 cm) Cat.: CL-4
Phase: Monagrillo Period: Early Formative
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: Shell date from same context but slightly above TEM-124 and above TEM-123.
Associated with a total of 383 Monagrillo sherds.

Published in Radiocarbon 1979 21:3:475.
Reference(s): Cooke 1984
Calibrated 2σ range: 3790 - 3360 BC (430 years)
Intercept(s): 3629 3560 3544 BC
Intercept mean: 3578 BC
Calibration reference: Stuiver and Pearson 1986

TEM-120 3770 ± 80 bp (1820 ± 80 bc) Material: Crassotrea
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)
Unit: Area 2A Level: Layer 4 Cat.: CL-46
Phase: Monagrillo Period: Early Formative
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: Inside drip-line of rockshelter, immediately above TEM-119 and TEM-124.
Contemporaneous date (TEM-121) from Layer 5, above TEM-119 and TEM-124.
Associated with two Monagrillo-type sherds.
Published in Radiocarbon 1979 21:3:475.
Reference(s): Cooke 1984:277
Calibrated 2σ range: 2470 - 1962 BC (508 years)
Intercept(s): 2268 2263 2203 2147 2146 BC
Intercept mean: 2205 BC
Calibration reference: Stuiver and Becker 1986

TEM-121 3860 ± 90 bp (1910 ± 90 bc) Material: Crassotrea
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)
Unit: Area 2A Level: Layer 5
Phase: Monagrillo Period: Early Formative
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: Immediately above and to one side of earlier samples TEM-119 and TEM-124.
Roughly contemporaneous with TEM-120.
Associated with one Monagrillo-type sherd.
Published in Radiocarbon 1979 21:3:475.
Reference(s): Cooke 1984
Calibrated 2σ range: 2580 - 2041 BC (539 years)
Intercept(s): 2343 BC
Intercept mean: 2343 BC
Calibration reference: Stuiver and Becker 1986

TEM-122 3880 ± 80 bp (1930 ± 80 bc) Material: Charcoal
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)
Unit: Area 0 Level: Layers 7 and 8 Cat.: #2C
Phase: Monagrillo Period: Early Formative
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: Down talus slope from Area 2A, at junction between ceramic and preceramic.
Possibly a small (intrusive) fire-pit.
Associated with a total of ten Monagrillo sherds
Published in Radiocarbon 1979 21:3:475.
Reference(s): Cooke 1984:277
Calibrated 2σ range: 2580 - 2140 BC (440 years)
Intercept(s): 2453 2423 2398 BC
Intercept mean: 2425 BC
Calibration reference: Stuiver and Becker 1986

TEM-123 6860 ± 90 bp (4910 ± 90 bc) Material: Charcoal
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)

Unit: Area 2A Level: Layer 6 (0-15 cm) Cat.: #3C
Phase: Preceramic Period: Late Archaic
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: Charcoal sample associated with earliest signs of occupation on bedrock.
Located on sterile clay, beneath pile of shell, hearth (?) stones, sherds.
No ceramics, base of cultural occupation. Dates initial occupation of shelter.
Published in <u>Radiocarbon</u> 1979 21:3:475.
Reference(s): Cooke 1984:277
Calibrated 2σ range: 5960 - 5566 BC (394 years)
Intercept(s): 5727 BC
Intercept mean: 5727 BC
Calibration reference: Stuiver and Pearson 1986

TEM-124 4520 ± 100 bp (2570 ± 100 bc) Material: Charcoal
Site: Cueva de Ladrones LP-1 Region: Central Panama (8°30'N, 80°29'W)
Unit: Area 1 Level: Layer 2B Cat.: #1C
Phase: Preceramic Period: Late Archaic
Collected 1974 by Bird & Cooke. Submitted 1978 by Bird & Cooke.
Comments: At the base of a pile of shell and stones, perhaps a hearth.
Correlation with early ceramic/late preceramic transition.
Situated slightly underneath, but in the same context, as shell date TEM-119.
Published in <u>Radiocarbon</u> 1979 21:3:475.
Reference(s): Cooke 1984
Calibrated 2σ range: 3510 - 2920 BC (590 years)
Intercept(s): 3331 3226 3185 3155 3143 BC
Intercept mean: 3208 BC
Calibration reference: Stuiver and Pearson 1986

TEM-125 2540 ± 70 bp (590 ± 70 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer B2 (10-15 cm) Cat.: #32
Phase: Monagrillo? Period: Early Formative?
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Associated with ceramics, but too late for Monagrillo.
Published in <u>Radiocarbon</u> 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 830 - 410 BC (420 years)
Intercept(s): 787 772 668 665 BC
Intercept mean: 723 BC
Calibration reference: Stuiver and Becker 1986

TEM-126 2960 ± 80 bp (1010 ± 80 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer B3 (15-20 cm) Cat.: #33
Phase: Monagrillo Period: Early Formative
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Earliest reliable date for Monagrillo-type ceramics at this site.
Published in <u>Radiocarbon</u> 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Renere & Hansell 1978
Calibrated 2σ range: 1429 - 933 BC (496 years)
Intercept(s): 1238 1236 1214 1200 1193 1140 1133 BC
Intercept mean: 1193 BC

Calibration reference: Stuiver and Becker 1986

TEM-127 2790 ± 110 bp (840 ± 110 bc) Material: Crassotrea
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C3 (25-30 cm) Cat.: #36
Phase: Preceramic Period: Late Archaic
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 1309 - 790 BC (519 years)
Intercept(s): 971 960 932 BC
Intercept mean: 954 BC
Calibration reference: Stuiver and Becker 1986

TEM-128 3700 ± 100 bp (1750 ± 100 bc) Material: Protothaca asperima
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C3 (25-30 cm)
Phase: Preceramic Period: Late Archaic
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Stratigraphically below TEM-108 and TEM-126.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 2470 - 1782 BC (688 years)
Intercept(s): 2135 2080 2072 2058 2042 BC
Intercept mean: 2077 BC
Calibration reference: Stuiver and Becker 1986

TEM-130 4210 ± 90 bp (2260 ± 90 bc) Material: O. corteziensis
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C4 (30-35 cm) Cat.: #37
Phase: Preceramic Period: Late Archaic
Collected 1975 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1976
Calibrated 2σ range: 3032 - 2509 BC (523 years)
Intercept(s): 2883 2796 2784 BC
Intercept mean: 2821 BC
Calibration reference: Stuiver and Pearson 1986

TEM-131 6180 ± 120 bp (4230 ± 120 bc) Material: Anadara tuberculosa
Site: Aguadulce (AG-13) Region: Central Panama (8°11'N, 80°38'W)
Unit: Block 3 Level: Layer C4 (30-35 cm)
Phase: Preceramic Period: Late Archaic
Collected 1973 by A. Ranere. Submitted 1978-79 by A. Ranere.
Comments: Highly compressed stratigraphy with ca. 5000 yrs represented by 40-85 cm.
Published in Radiocarbon 1979 21:3:474.
Reference(s): Ranere 1975, 1976, Ranere & Hansell 1978
Calibrated 2σ range: 5350 - 4808 BC (542 years)
Intercept(s): 5208 BC
Intercept mean: 5208 BC
Calibration reference: Stuiver and Pearson 1986

TEM-174 5990 ± 180 bp (4040 ± 180 bc) Material: Crassotrea
Site: Cerro Mangote (AG-1) Region: Central Panama
Unit: Pothole 1 Level: 180-190 cm
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: Inside of same shell as TEM-175. From north wall.
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 5318 - 4470 BC (848 years)
Intercept(s): 4931 4928 4901 BC
Intercept mean: 4920 BC
Calibration reference: Stuiver and Pearson 1986

TEM-175 5140 ± 120 bp (3190 ± 120 bc) Material: Crassotrea
Site: Cerro Mangote (AG-1) Region: Central Panama
Unit: Pothole 1 Level: 180-190 cm
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: Inside of same shell as TEM-174. From north wall.
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 4240 - 3700 BC (540 years)
Intercept(s): 3979 BC
Intercept mean: 3979 BC
Calibration reference: Stuiver and Pearson 1986

TEM-176 5440 ± 130 bp (3490 ± 130 bc) Material: Crassotrea
Site: Cerro Mangote (AG-1) Region: Central Panama
Unit: Pothole 1 Level: 209-219 cm
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: Inside shell, red clay zone.
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 4573 - 3990 BC (583 years)
Intercept(s): 4338 BC
Intercept mean: 4338 BC
Calibration reference: Stuiver and Pearson 1986

TEM-206 6710 ± 175 bp (4760 ± 175 bc) Material: Protothaca aperima
Site: Cerro Mangote (AG-1) Region: Central Panama
Unit: Pothole 1 Level: 180-190 cm
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: At same level as samples TEM-174 and TEM-175. From north wall.
Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 5690 - 5248 BC (442 years)
Intercept(s): 5623 BC
Intercept mean: 5623 BC
Calibration reference: Stuiver and Pearson 1986

TEM-207 5055 ± 155 bp (3105 ± 155 bc) Material: Crassotrea
Site: Cerro Mangote (AG-1) Region: Central Panama
Unit: Pothole 1A Level: 145-155 cm
Phase: Preceramic Period: Late Archaic
Collected 1979 by A. Ranere. Submitted by A. Ranere.
Comments: Corrected for C12/C13 fractionation.

Reference(s): Ranere et al. 1980, Cooke 1984
Calibrated 2σ range: 4240 - 3520 BC (720 years)
Intercept(s): 3936 3871 3817 BC
Intercept mean: 3795 BC
Calibration reference: Stuiver and Pearson 1986

TEM-208 4350 ± 165 bp (2400 ± 165 bc) Material: Crassotrea
Site: Monagrillo (HE-5) Region: Central Panama (8°02'N, 80°28'N)
Unit: Block 2E Level: 152-157 cm
Phase: Monagrillo Period: Early Formative
Collected 1975 by A. Ranere. Submitted by A. Ranere.
Comments: Date on shell from excavations in Block 2E. C12/C13 fractionation corrected. Consistent with associations, stratigraphy and series of charcoal dates. Associated with Monagrillo materials.
Reference(s): Cooke 1984
Calibrated 2σ range: 3499 - 2506 BC (993 years)
Intercept(s): 3013 3007 2924 BC
Intercept mean: 2981 BC
Calibration reference: Stuiver and Pearson 1986

TK-42 3900 ± 900 bp (1950 ± 900 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito Period: Late Preceramic
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 4510 - 100 BC (4410 years)
Intercept(s): 2451 2433 2392 2384 2356 BC
Intercept mean: 2403 BC
Calibration reference: Stuiver and Pearson 1986

TK-43 3200 ± 80 bp (1250 ± 80 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Waira-jirca Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1682 - 1263 BC (419 years)
Intercept(s): 1447 BC
Intercept mean: 1447 BC
Calibration reference: Stuiver and Becker 1986

TK-44 2190 ± 250 bp (240 ± 250 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito? Period: Late Preceramic?
Comments: Rejected as much too early.
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 820 BC - AD 390 (1210 years)
Intercept mean: 290 BC
Calibration reference: Stuiver and Becker 1986

TK-108 3000 ± 80 bp (1050 ± 80 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Waira-jirca Period: Early Initial
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 1431 - 937 BC (494 years)
Intercept(s): 1257 1244 1233 1215 1199 1194 1139 1134 BC
Intercept mean: 1202 BC

Calibration reference: Stuiver and Becker 1986

TK-109 3360 ± 160 bp (1410 ± 160 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito Period: Late Preceramic
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2108 - 1263 BC (845 years)
Intercept(s): 1681 1674 1623 BC
Intercept mean: 1659 BC
Calibration reference: Stuiver and Becker 1986

TK-110 3470 ± 100 bp (1520 ± 100 bc) Material: Charcoal
Site: Kotosh Region: Peru
Phase: Kotosh Mito Period: Late Preceramic
Reference(s): Izumi & Terada 1972
Calibrated 2σ range: 2013 - 1530 BC (483 years)
Intercept(s): BC
Intercept mean: 1742 BC
Calibration reference: Stuiver and Becker 1986

TK-341a 3080 ± 70 bp (1130 ± 70 bc) Material: Charcoal
Site: Huacaloma Region: Peru
Phase: Early Huacaloma Period: Early Initial
Reference(s): Terada & Onuki 1982
Calibrated 2σ range: 1492 - 1054 BC (438 years)
Intercept(s): 1372 1359 1354 1337 1320 BC
Intercept mean: 1348 BC
Calibration reference: Stuiver and Becker 1986

TK-341b 2720 ± 240 bp (770 ± 240 bc) Material: Charcoal
Site: Huacaloma Region: Peru
Phase: Early Huacaloma Period: Early Initial
Comments: Date run on alkalai-soluble substances of sample TK-341a.
Reference(s): Terada & Onuki 1982
Calibrated 2σ range: 1450 - 214 BC (1236 years)
Intercept(s): 831 BC
Intercept mean: 831 BC
Calibration reference: Stuiver and Becker 1986

TK-409 2840 ± 90 bp (890 ± 90 bc) Material: Charcoal
Site: Huacaloma Region: Peru
Phase: Early Huacaloma Period: Early Initial
Reference(s): Terada & Onuki 1982
Calibrated 2σ range: 1291 - 800 BC (491 years)
Intercept(s): 997 995 973 957 941 BC
Intercept mean: 973 BC
Calibration reference: Stuiver and Becker 1982

TK-410 2770 ± 80 bp (820 ± 80 bc) Material: Charcoal
Site: Huacaloma Region: Peru
Phase: Late Huacaloma Period: Initial
Reference(s): Terada & Onuki 1982
Calibrated 2σ range: 1207 - 790 BC (417 years)
Intercept(s): 898 858 850 BC

Intercept mean: 869 BC
Calibration reference: Stuiver and Becker 1986

TK-625a 3240 ± 60 bp (1290 ± 60 bc) Material: Shell
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 4
Phase: Barlovento Period: Early Formative
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 1689 - 1410 BC (279 years)
Intercept(s): 1518 BC
Intercept mean: 1518 BC
Calibration reference: Stuiver and Becker 1986

TK-625b 3230 ± 90 bp (1280 ± 90 bc) Material: Shell
Site: Monsú Region: Colombia Unit: Cuad. G Level: Unidad 1
Phase: Barlovento Period: Early Formative
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 1734 - 1319 BC (415 years)
Intercept(s): 1502 BC
Intercept mean: 1502 BC
Calibration reference: Stuiver and Becker 1986

UCLA-902 2940 ± 80 bp (990 ± 80 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Unit: Mound A-2
Period: Early Formative
Collected 1955 by R. Heizer. Submitted 1964 by R. Heizer.
Comments: From leveled base sands, underlying and contemporaneous with Phase I platform.
One half of sample M-531.
Published in Radiocarbon 1965 7:345.
Reference(s): Science127:3306:1104
Calibrated 2σ range: 1410 - 922 BC (488 years)
Intercept(s): 1211 1203 1191 1158 1156 1143 1131 1119 BC
1113 BC
Intercept mean: 1158 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1253 3050 ± 90 bp (1100 ± 90 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted by R. Heizer.
Comments: Sherd-bearing refuse deposit in drainage trench NW of Great Pyramid.
Layer rested on sterile clay and apparently undisturbed.
No structural association with this sample, but pottery is typical of La Venta.
Published in Radiocarbon 1968 10:150.
Reference(s): Berger et al. 1967
Calibrated 2σ range: 1520 - 1018 BC (502 years)
Intercept(s): 1372 1359 1354 1337 1320 BC
Intercept mean: 1348 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1280B 1720 ± 180 bp (ad 230 ± 180) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)

Unit: Pit B/1 Level: 153-165 cm
Period: Early Formative?
Collected 1964 by R. Squier. Submitted by R. Berger.
Comments: Associated with "many sherds."
Published in Radiocarbon 1968 10:151.
Reference(s): Berger et al. 1967
Calibrated 2σ range: 100 BC - AD 660 (760 years)
Intercept(s): AD 261 278 294 295 337
Intercept mean: AD 292
Calibration reference: Stuiver and Becker 1986

UCLA-1281B 1760 ± 155 bp (ad 190 ± 155) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Unit: Pit B Level: 148-153 cm
Period: Early Formative
Collected 1964 by R. Squier. Submitted by R. Berger.
Comments: Charcoal from burnt hearth area.
Published in Radiocarbon 1968 10:151.
Reference(s): Berger et al. 1967
Calibrated 2σ range: 90 BC - AD 637 (727 years)
Intercept(s): AD 255 305 316
Intercept mean: AD 291
Calibration reference: Stuiver and Becker 1986

UCLA-1284B 2550 ± 60 bp (600 ± 60 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted by R. Heizer.
Comments: From bottom of Phase II pit, 68 in. below surface of NW platform.
Same sample as M-530 and UCLA-1284A, but pretreated with HCL.
Published in Radiocarbon 1968 10:150.
Reference(s): Science127:3306:1104, Berger et al. 1967
Calibrated 2σ range: 830 - 415 BC (415 years)
Intercept(s): 788 BC
Intercept mean: 788 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1286 3000 ± 60 bp (1050 ± 60 bc) Material: Charcoal
Site: La Venta Region: Veracrúz (18°10'N, 94°05'W)
Period: Early Formative
Collected 1955 by R. Heizer. Submitted by R. Heizer.
Comments: From artificial fill underlying and contemp. with Phase I floor in NW platform.
Sample previously run as M-534.
Published in Radiocarbon 1968 10:151.
Reference(s): Science127:3306:1104, Berger et al. 1967
Calibrated 2σ range: 1430 - 1023 BC (407 years)
Intercept(s): 1292 1281 1262 BC
Intercept mean: 1278 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1985a 3000 ± 160 bp (1050 ± 160 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17B Level: 17
Phase: Swasey Period: Early Preclassic

Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Burned wood from occupation debris immediately below Levels 13-16 and Q-1476.
Small sample. Traces of plaster removed with acid.
Associated with Swasey complex ceramics.
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: 1680 - 830 BC (850 years)
Intercept(s): 1292 1281 1262 BC
Intercept mean: 1278 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1985bc 1140 ± 100 bp (ad 810 ± 100) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17B Level: 20 and 22
Phase: Swasey? Period: Early Preclassic?
Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Combination of two very small samples from two different levels.
Date is much too late for associated materials, and is rejected by Hammond.
Associated with Early Preclassic ceramics, but out of stratigraphic sequence.
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: AD 660 - 1150 (490 years)
Intercept(s): AD 892 925 936
Intercept mean: AD 917
Calibration reference: Stuiver and Becker 1986

UCLA-1985d 1700 ± 60 bp (ad 250 ± 60) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17B Level: 23
Phase: Swasey? Period: Early Preclassic?
Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Charcoal from level immediately underlying Levels 20-22 (c.f. UCLA-1985bc).
Small sample. Date is much too late, and is rejected by Hammond.
Associated with Early Preclassic ceramics, but out of stratigraphic sequence.
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: AD 135 - 529 (394 years)
Intercept(s): AD 264 269 342 374 376
Intercept mean: AD 324
Calibration reference: Stuiver and Becker 1986

UCLA-1985e 4000 ± 155 bp (2050 ± 155 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17B Level: 32 Lot: 17B-28
Phase: Swasey Period: Early Preclassic
Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Charred wood from 25-30 cm thick midden on old land surface.
Earliest date for Swasey. Small sample. Traces of plaster removed with acid.
Midden "represents the debris from a substantial and sedentary occupation."
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: 2920 - 2044 BC (876 years)
Intercept(s): 2564 2541 2499 BC
Intercept mean: 2535 BC
Calibration reference: Stuiver and Becker 1986

UCLA-1985g 3180 ± 195 bp (1230 ± 195 bc) Material: Charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)

Unit: Op. 17C Level: 37
Phase: Swasey Period: Early Preclassic
Collected 1975 by D. Pring. Submitted by N. Hammond.
Comments: Burnt wood from occupational horizon sealing grave in limestone bedrock.
Small sample. Traces of plaster removed with acid.
Gives approximate date to burial with five Swasey vessels, sealed by Level 37.
Reference(s): Hammond et al. 1976, Hammond et al. 1979
Calibrated 2σ range: 1920 - 931 BC (989 years)
Intercept(s): 1488 1485 1452 BC
Intercept mean: 1475 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2102b 4740 ± 100 bp (2790 ± 100 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 155
Phase: Swasey? Period: Early Preclassic?
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Structural context, possibly the remains of building material (?).
Stable isotopes ratios rule out contamination with mineral charcoal
Date considered to be too early. Possible redeposition of earlier material.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 3776 - 3194 BC (582 years)
Intercept(s): 3604 3585 3518 BC
Intercept mean: 3569 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2102c 5140 ± 145 bp (3190 ± 145 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 210
Phase: Swasey? Period: Early Preclassic?
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Structural context, possibly the remains of building material (?).
Stable isotopes ratios rule out contamination with mineral charcoal
Date considered to be too early. Possible redeposition of earlier material.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 4340 - 3640 BC (700 years)
Intercept(s): 3979 BC
Intercept mean: 3979 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2102d 3700 ± 200 bp (1750 ± 200 bc) Material: Wood charcoal
Site: Cuello Region: Belize (18°05'N, 88°35'W)
Unit: Op. 17F Level: 189
Phase: Swasey Period: Early Preclassic
Collected 1976 by S. Donaghey. Submitted by N. Hammond.
Comments: Burnt timber from same building as samples Q-1573, Q-1576, and Q-1577.
Stable isotopes ratios rule out contamination with mineral charcoal
~~Acceptable date for Swasey associations.~~ In stratigraphic sequence with series.
Reference(s): Hammond et al. 1977, Hammond et al. 1979
Calibrated 2σ range: 2855 - 1543 BC (1312 years)
Intercept(s): 2133 2067 2047 BC
Intercept mean: 2082 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2149B 4200 ± 80 bp (2250 ± 80 bc) Material: Shell artifact
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 11
Phase: Pangola Period: Early Formative
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f
Comments: Date run on an "objeto de concha" from deposits above caliche floor (Piso 4).
Caliche floor separates this stratigraphically from Monsú and Turbana deposits.
Associated with ceramic type Pangola Incised.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 3019 - 2580 BC (439 years)
Intercept(s): 2880 2798 2782 BC
Intercept mean: 2820 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2149C 5300 ± 80 bp (3350 ± 80 bc) Material: Shell
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 13
Phase: Monsú Period: Early Formative
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Comments: Sample sealed beneath a caliche floor (Piso 4). From end of Monsú period.
Overlies more than a meter of ceramic deposits with types like Turbana Excised.
Associated with types Monsú Linear Incised and Turbana Broad Incised.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 4340 - 3980 BC (360 years)
Intercept(s): 4220 4200 4147 4110 4088 4060 4048 BC
Intercept mean: 4124 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2149D 2800 ± 80 bp (850 ± 80 bc) Material: Shell artifact
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 17
Phase: Barlovento? Period: Early Formative?
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Comments: Date on a shell disk offering from artifact assemblage in intrusive burial.
Burial appeared in Unidad 16 and penetrated to upper part of Unidad 17.
Associated with 76 small shell artifacts and human skull, but no ceramics.
Reference(s): Reichel-Dolmatoff 1985:176
Calibrated 2σ range: 1242 - 800 BC (442 years)
Intercept(s): 972 959 936 BC
Intercept mean: 956 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2167A 3500 ± 60 bp (1550 ± 60 bc) Material: Wood charcoal
Site: Mendez Region: Cordillera Unit: TR-4, N6W1 Level: 200 cm belo
w datum
Phase: Tronadora? Period: Early Formative?
Collected 1978-79 by L. Norr.
Comments: Recovered from culturally sterile stratum under Mound I (level 4).
Immediately overlain by occupational level (level 3).
Naranjo Phase ceramics from overlying level contain Tronadora-like sherds.
Reference(s): Norr 1982-83:140, Lange & Stone 1984
Calibrated 2σ range: 2028 - 1645 BC (383 years)
Intercept(s): 1878 1842 1830 1789 1785 BC
Intercept mean: 1825 BC
Calibration reference: Stuiver and Becker 1986

UCLA-2568A 4175 ± 80 bp (2225 ± 80 bc) Material: Shell
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 4

Phase: Barlovento? Period: Early Formative?
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Comments: Date is very early for Barlovento associations.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 2920 - 2503 BC (417 years)
Intercept(s): 2873 2803 2777 2716 2705 BC
Intercept mean: 2775 BC
Calibration reference: Stuiver and Pearson 1986

UCLA-2568F 4170 ± 360 bp (2220 ± 360 bc) Material: Bone
Site: Monsú Region: Colombia Unit: Cuad. A Level: Unidad 18
Phase: Turbana? Period: Early Formative?
Collected 1974 by G. Reichel-Dolmatoff. Submitted by G. Reichel-Dolmatof
f.
Comments: Date on bone from lowermost excavation unit in Cuadricula A. Large 1σ range.
Stratified below caliche floor and UCLA-2149C. Considered to be aberrant.
Associated with lowest levels, types Turbana Excised, Turbana Incised Punctate.
Reference(s): Reichel-Dolmatoff 1985:175
Calibrated 2σ range: 3700 - 1750 BC (1950 years)
Intercept(s): 2872 2804 2776 2717 2704 BC
Intercept mean: 2775 BC
Calibration reference: Stuiver and Becker 1986

UM-101 3135 ± 120 bp (1185 ± 120 bc) Material: Charcoal
Site: Salinas la Blanca Region: Chiapas (14°32'N, 92°11'W)
Unit: Mound 2 Cat.: 1
Phase: Navarijo Period: Early Preclassic
Collected 1973 by E. Shook. Submitted 1973 by E. Shook.
Comments: Charcoal from Mound 2.
Originally identified as early Pre-Classic Cuadros and Jocotal phases.
Associated with a large amount of pottery, stone, and shell artifacts.
Published in Radiocarbon 1974 16:3:403.
Reference(s): Shook & Hatch 1978, Coe & Flannery 1967
Calibrated 2σ range: 1690 - 1053 BC (637 years)
Intercept(s): 1431 1418 1416 BC
Intercept mean: 1422 BC
Calibration reference: Stuiver and Becker 1986

W-630 4050 ± 65 bp (2100 ± 65 bc) Material: Shell
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut H Level: 130-140 cm
Phase: Valdivia Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by Evans & Meggers.
Comments: Associated with ceramics from latter part of Valdivia phase.
Published in Radiocarbon 1960 2:181.
Reference(s): MEE 1965:149
Calibrated 2σ range: 2868 - 2403 BC (465 years)
Intercept(s): 2573 2535 2506 BC
Intercept mean: 2538 BC
Calibration reference: Stuiver and Becker 1986

W-631 4450 ± 200 bp (2500 ± 200 bc) Material: Shell
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut A Level: 400-420 cm
Phase: Valdivia A Period: Early Formative

Collected 1957 by Evans & Meggers. Submitted by Evans & Meggers.
Comments: Associated with ceramics from earliest part of Valdivia phase.
Published in Radiocarbon 1960 2:181.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3640 - 2506 BC (1134 years)
Intercept(s): 3040 BC
Intercept mean: 3040 BC
Calibration reference: Stuiver and Pearson 1986

W-632 4190 ± 200 bp (2240 ± 200 bc) Material: Shell
Site: Valdivia (G-31) Region: Ecuador (1°56'S, 80°45'W)
Unit: Cut A Level: 120-140 cm
Phase: Valdivia Period: Early Formative
Collected 1957 by Evans & Meggers. Submitted by Evans & Meggers.
Comments: Associated with ceramics from terminal part of Valdivia phase.
Published in Radiocarbon 1960 2:181.
Reference(s): MEE 1965:149
Calibrated 2σ range: 3340 - 2147 BC (1193 years)
Intercept(s): 2870 2806 2774 2720 2702 BC
Intercept mean: 2774 BC
Calibration reference: Stuiver and Becker 1986

W-739 3470 ± 120 bp (1520 ± 120 bc) Material: M. melongena
Site: Barlovento Region: Colombia (11°10'N, 75°00'W)
Unit: Mound E Level: Bottom (600 cm)
Phase: Barlovento Period: Early Formative
Collected 1957 by G. Reichel-Dolmatoff. Submitted by C. Evans.
Comments: Shells of Melongena melongena from midden accumulation.
Published in Radiocarbon 1960 2:180.
Reference(s): Reichel-Dolmatoff 1965
Calibrated 2σ range: 2138 - 1500 BC (638 years)
Intercept(s): 1808 1804 1771 1760 1754 BC
Intercept mean: 1779 BC
Calibration reference: Stuiver and Becker 1986

W-741 2980 ± 120 bp (1030 ± 120 bc) Material: M. melongena
Site: Barlovento Region: Colombia (11°10'N, 75°00'W)
Unit: Mound E Level: Upper (100 cm)
Phase: Barlovento Period: Early Formative
Collected 1957 by G. Reichel-Dolmatoff. Submitted by C. Evans.
Comments: Shells of Melongena melongena from midden accumulation.
Published in Radiocarbon 1960 2:180.
Reference(s): Reichel-Dolmatoff 1965
Calibrated 2σ range: 1500 - 843 BC (657 years)
Intercept(s): 1287 1286 1258 1230 1216 1198 1195 1138 BC
1135 BC
Intercept mean: 1216 BC
Calibration reference: Stuiver and Becker 1986

W-743 3140 ± 120 bp (1190 ± 120 bc) Material: M. melongena
Site: Barlovento Region: Colombia (11°10'N, 75°00'W)
Unit: Mound E Level: Middle (300 cm)
Phase: Barlovento Period: Early Formative
Collected 1957 by G. Reichel-Dolmatoff. Submitted by C. Evans.

Comments: Shells of Melongena melongena from midden accumulation.
Published in Radiocarbon 1960 2:180.
Reference(s): Reichel-Dolmatoff 1965
Calibrated 2σ range: 1691 - 1054 BC (637 years)
Intercept(s): 1432 1417 BC
Intercept mean: 1425 BC
Calibration reference: Stuiver and Becker 1986

WIS-1125 2920 ± 80 bp (970 ± 80 bc) Material: Charcoal
Site: La Ponga (OGSE-186) Region: Ecuador (1°53'S, 80°40'W)
Cat.: R-25
Phase: Machalilla 4 Period: Early Formative
Collected 10-11/1978 by R. Lippi. Submitted by R. Lippi.
Comments: Some earlier Machalilla and later (Chorrera/Engoroy) ceramics mixed in deposit.
Machalilla strata are superimposed by Chorrera/Engoroy and Guangala levels.
Associated with Ayangue Incised and late form of Machalilla Red Banded.
Published in Radiocarbon 1981 23:1:150.
Reference(s): Lippi et al. 1984
Fractionation: σC_3 = -24.4%%
Calibrated 2σ range: 1374 - 836 BC (538 years)
Intercept(s): 1187 1186 1080 1061 1053 BC
Intercept mean: 1113 BC
Calibration reference: Stuiver and Becker 1986

WIS-1140 2790 ± 80 bp (840 ± 80 bc) Material: Charcoal
Site: La Ponga (OGSE-186) Region: Ecuador (1°53'S, 80°40'W)
Cat.: R-14
Phase: Machalilla 2 Period: Early Formative
Collected 10-11/1978 by R. Lippi. Submitted by R. Lippi.
Comments: From sealed early Machalilla context.
Stratigraphically separated from overlying Machalilla material.
Strata above Machalilla levels contain Chorrera/Engoroy and Guangala materials.
Published in Radiocarbon 1981 23:1:150.
Reference(s): Lippi et al. 1984
Fractionation: σC_3 = -25.4%%
Calibrated 2σ range: 1210 - 800 BC (410 years)
Intercept(s): 967 966 904 BC
Intercept mean: 946 BC
Calibration reference: Stuiver and Becker 1986

WIS-1141 2880 ± 80 bp (930 ± 80 bc) Material: Charcoal
Site: La Ponga (OGSE-186) Region: Ecuador (1°53'S, 80°40'W)
Cat.: R-16
Phase: Machalilla Period: Early Formative
Collected 10-11/1978 by R. Lippi. Submitted by R. Lippi.
Comments: From ashy layer containing mixed early to middle Machalilla ceramics.
Temporary loss of stratigraphy attributed to aboriginal mixing of ash and soil.
Published in Radiocarbon 1981 23:1:150.
Reference(s): Lippi et al. 1984
Fractionation: σC_3 = -25.0%%
Calibrated 2σ range: 1311 - 830 BC (481 years)
Intercept(s): 1047 1044 1013 BC
Intercept mean: 1035 BC
Calibration reference: Stuiver and Becker 1986

Y-458-d 6810 ± 110 bp (4860 ± 110 bc) Material: Charcoal
Site: Cerro Mangote (AG-1) Region: Central Panama (8°18'N, 80°41'W)
Unit: Pit V Level: Stratum C, 130-145cm Cat.: 696A
Phase: Preceramic Period: Late Archaic
Collected 1956 by C. Mc.Gimsey.
Comments: Sample obtained during new excavations in 1956. Just above red clay zone.
Stratum C, the latest over much of the site, almost exclusively crab remains.
Published in Radiocarbon 1959 1:167.
Reference(s): McGimsey 1956, Willey & McGimsey 1954
Calibrated 2σ range: 5957 - 5490 BC (467 years)
Intercept(s): 5648 BC
Intercept mean: 5648 BC
Calibration reference: Stuiver and Pearson 1986

Y-585 4090 ± 70 bp (2140 ± 70 bc) Material: Charcoal
Site: Monagrillo (HE-5) Region: Central Panama (8°02'N, 80°28'W)
Unit: W.tr.,S.6 Level: Stratum 4 (95 cm) Cat.: 52.28.20 /19361
Phase: Monagrillo II-III Period: Early Formative
Collected 1952 by G. Willey. Submitted by G. Willey.
Comments: Charcoal from a small ash lens.
Dates ceramic but pre-agricultural culture described in Willey & McGimsey 1954.
Published in Radiocarbon 1959 1:166.
Reference(s): Willey & McGimsey 1954, Deevey et al. 1959
Calibrated 2σ range: 2889 - 2470 BC (419 years)
Intercept(s): 2853 2828 2655 2644 2615 BC
Intercept mean: 2719 BC
Calibration reference: Stuiver and Becker 1986

Y-1150 2928 ± 105 bp (978 ± 105 bc) Material: Charcoal
Site: Salinas la Blanca Region: Chiapas (14°30'N, 92°10'W)
Unit: Cut 2 Level: O (320-340 cm)
Phase: Cuadros Period: Early Preclassic
Collected 1962 by Coe & Flannery. Submitted by M. Coe.
Comments: From small hearth in northeast corner of Cut 2 at a depth of 338 cm.
Should be late in the Cuadros phase.
Published in Radiocarbon 1963 5:333.
Reference(s): Coe & Flannery 1968
Calibrated 2σ range: 1430 - 834 BC (596 years)
Intercept(s): 1210 1204 1190 1177 1153 1144 1130 1121 BC
1111 BC
Intercept mean: 1160 BC
Calibration reference: Stuiver and Becker 1986

Y-1151 2715 ± 105 bp (765 ± 105 bc) Material: Charcoal
Site: Salinas la Blanca Region: Chiapas (14°30'N, 92°10'W)
Unit: Cut 2 Level: U (440-460 cm)
Phase: Cuadros Period: Early Preclassic
Collected 1962 by Coe & Flannery. Submitted by M. Coe.
Comments: From hearth in northeast quadrant of Cut 2, at a depth of 450 cm.
Should be older than Y-1150.
Published in Radiocarbon 1963 5:333.
Reference(s): Coe & Flannery 1968
Calibrated 2σ range: 1210 - 595 BC (615 years)

Intercept(s): 892 879 835 BC
Intercept mean: 869 BC
Calibration reference: Stuiver and Becker 1986

Y-1154 2878 ± 105 bp (928 ± 105 bc) Material: Charcoal
Site: Salinas la Blanca Region: Chiapas (14°30'N, 92°10'W)
Unit: Cut 1 Level: BB (580-600 cm)
Phase: Cuadros Period: Early Preclassic
Collected 1962 by Coe & Flannery. Submitted by M. Coe.
Comments: Charcoal from refuse layer in Cut 1.
Sample is early in the Cuadros phase.
Published in Radiocarbon 1963 5:333.
Reference(s): Coe & Flannery 1968
Calibrated 2σ range: 1407 - 820 BC (587 years)
Intercept(s): 1077 1063 1051 BC
Intercept mean: 1064 BC
Calibration reference: Stuiver and Becker 1986

Y-1166 2764 ± 90 bp (814 ± 90 bc) Material: Charred bone
Site: Salinas la Blanca Region: Chiapas (14°30'N, 92°10'W)
Unit: Cut 1 Level: CC (600-620 cm)
Phase: Cuadros Period: Early Preclassic
Collected 1962 by Coe & Flannery. Submitted by M. Coe.
Comments: From a hearth in the northwest quadrant of Cut 1.
Sample probably entirely charred bone; dissolved in an alkalai solution.
Should be oldest sample, just above sterile deposits and water table.
Published in Radiocarbon 1963 5:333.
Reference(s): Coe & Flannery 1968
Calibrated 2σ range: 1212 - 790 BC (422 years)
Intercept(s): 968 965 905 BC
Intercept mean: 946 BC
Calibration reference: Stuiver and Becker 1986

Y-1285 3990 ± 160 bp (2040 ± 160 bc) Material: Unknown
Site: Region: Petén
Phase: Unknown Period: Early Preclassic
Collected by U. Cowgill.
Comments: Determination from pollen cores in Laguna de Petenxil, Peten, Guatemala.
Associated with maize pollen.
Reference(s): Hammond et al. 1976
Calibrated 2σ range: 2920 - 2039 BC (881 years)
Intercept(s): 2559 2544 2495 BC
Intercept mean: 2533 BC
Calibration reference: Stuiver and Becker 1986

Y-1317 3890 ± 100 bp (1940 ± 100 bc) Material: Charcoal
Site: Canapote Region: Colombia (10°27'N, 75°30'W)
Unit: Cut A Level: Layer 10, 190-210 cm
Phase: Canapote (late) Period: Early Formative
Collected 1962 by H. Bischof. Submitted by I. Rouse.
Comments: Aggregate sample from scattered charcoal pieces in stratified shell mound.
Refuse layer overlying 60 cm of Canapote deposits; sterile sand at 270 cm.
From late in Canapote period; Tesca period sherds in Layer 4 (80-110 cm).
Published in Radiocarbon 1969 11:2:631.

Reference(s): Bischof 1972:278
Calibrated 2σ range: 2853 - 2044 BC (809 years)
Intercept(s): 2455 2416 2405 BC
Intercept mean: 2425 BC
Calibration reference: Stuiver and Becker 1986

Y-1318 3510 ± 100 bp (1560 ± 100 bc) Material: Charcoal
Site: Barlovento Region: Colombia (10°27'N, 75°30'W)
Unit: Cut II Level: D-F (150 cm)
Phase: Barlovento (late)? Period: Early Formative
Collected 1962 by H. Bischof. Submitted by I. Rouse.
Comments: From charcoal lenses exposed by collapse of E profile of original excavation.
Corresponds in age to W-739, although it should be more recent.
Date may be too old for late Barlovento period.
Published in Radiocarbon 1969 11:2:632.
Reference(s): Bischof 1972:278, Reichel-D 1955
Calibrated 2σ range: 2138 - 1600 BC (538 years)
Intercept(s): 1880 1841 1832 BC
Intercept mean: 1851 BC
Calibration reference: Stuiver and Becker 1986

Y-1760 3730 ± 120 bp (1780 ± 120 bc) Material: Charcoal
Site: Canapote Region: Colombia (10°27'N, 75°30'W)
Unit: Cut D Level: Layer 4 (250-300 cm)
Phase: Tesca (early) Period: Early Formative
Collected 1962 by H. Bischof. Submitted by I. Rouse.
Comments: Aggregate sample from scattered pieces in refuse layer.
Above Layer 4, Tesca pottery is up to 30 cm below surface (Layers 2-3).
Canapote sherds like those with Y-1317 from Layer 6 (340-360 cm) to sterile.
Published in Radiocarbon 1969 11:2:630.
Reference(s): Bischof 1972:278
Calibrated 2σ range: 2480 - 1782 BC (698 years)
Intercept(s): 2140 BC
Intercept mean: 2140 BC
Calibration reference: Stuiver and Becker 1986

Y-1797 3010 ± 80 bp (1060 ± 80 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: 10 Lot: G1-T1-C10
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Aggregate sample of charcoal from three hearths in Remolino excavations.
Published in Radiocarbon 1969 11:2:619.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1487 - 1010 BC (477 years)
Intercept(s): 1294 1279 1264 BC
Intercept mean: 1279 BC
Calibration reference: Stuiver and Becker 1986

Y-1798 3100 ± 140 bp (1150 ± 140 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: 12 Lot: G1-T1-C12
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.

Comments: Charcoal from hearth in Level 12, Remolino excavations.
Published in Radiocarbon 1962 11:2:619.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1691 - 944 BC (747 years)
Intercept(s): 1409 BC
Intercept mean: 1409 BC
Calibration reference: Stuiver and Becker 1986

Y-1799 4100 ± 80 bp (2150 ± 80 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: 14
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Aggregate sample from four hearths in Level 14, Remolino excavations. Probably contaminated with asphalt.
Published in Radiocarbon 1962 11:2:619.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 2900 - 2470 BC (430 years)
Intercept(s): 2855 2824 2657 2640 2619 BC
Intercept mean: 2719 BC
Calibration reference: Stuiver and Becker 1986

Y-1800 3050 ± 100 bp (1100 ± 100 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: 18 Lot: G2-T1-C18
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Aggregate sample from four hearths in Level 18, REmolino excavations.
Published in Radiocarbon 1962 11:2:619.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1520 - 1010 BC (510 years)
Intercept(s): 1372 1359 1354 1337 1320 BC
Intercept mean: 1348 BC
Calibration reference: Stuiver and Becker 1986

Y-1801 3090 ± 80 bp (1140 ± 80 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 4 Level: H Lot: H-T4
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Charcoal from hearth in Level H, Remolino excavations.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1520 - 1111 BC (409 years)
Intercept(s): 1407 1394 1327 1326 BC
Intercept mean: 1364 BC
Calibration reference: Stuiver and Becker 1986

Y-1802 2870 ± 140 bp (920 ± 140 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Cat.: TE-Re.4'
Phase: San Lorenzo Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Aggregate sample from series of hearths in Remolino excavations.

Associated with deposit of whole and broken San Lorenzo phase vessels.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1430 - 790 BC (640 years)
Intercept(s): 1073 1065 1050 1031 1023 BC
Intercept mean: 1048 BC
Calibration reference: Stuiver and Becker 1986

Y-1907 1620 ± 120 bp (ad 330 ± 120) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Mon. 21
Phase: San Lorenzo? Period: Early Preclassic?
Collected 1966 by R. Diehl. Submitted by M. Coe.
Comments: Charcoal from offering directly beneath Monument 21.
Ceramics indicate confused stratigraphy, possible Villa Alta contamination.
Should date final placement of monument, but date inconsistent with series.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: AD 130 - 650 (520 years)
Intercept(s): AD 423
Intercept mean: AD 423
Calibration reference: Stuiver and Becker 1986

Y-1908 2960 ± 120 bp (1010 ± 120 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: D Cat.: SL-CC-LD
Phase: San Lorenzo Period: Early Preclassic
Collected 1967 by R. Diehl. Submitted by M. Coe.
Comments: Charcoal from hearth in Level D of Central Court
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1493 - 835 BC (658 years)
Intercept(s): 1238 1236 1214 1200 1193 1140 1133 BC
Intercept mean: 1193 BC
Calibration reference: Stuiver and Becker 1986

Y-1911 3090 ± 80 bp (1140 ± 80 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: Zone D, Floor 7 Cat.: M.30-1d
Phase: Chicharras Period: Early Preclassic
Collected 1967 by M. Coe. Submitted by M. Coe.
Comments: Charcoal from hearth at top of Floor 7, Monument 30 excavations.
Zone D predates setting of monument.
Associated with Chicharras phase pottery.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1520 - 1111 BC (409 years)
Intercept(s): 1407 1394 1327 1326 BC
Intercept mean: 1364 BC
Calibration reference: Stuiver and Becker 1986

Y-1912 3070 ± 80 bp (1120 ± 80 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 2 Level: Zone D (166 cm) Cat.: M. 30-2d

Phase: Chicharras Period: Early Preclassic
Collected 1966 by Diehl & Coe. Submitted by M. Coe.
Comments: Charcoal from hearth within Zone D, Monument 30 excavations.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1520 - 1055 BC (465 years)
Intercept(s): 1376 1332 1323 BC
Intercept mean: 1344 BC
Calibration reference: Stuiver and Becker 1986

Y-1931 4210 ± 100 bp (2260 ± 100 bc) Material: Wood charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 2 Level: Zone I Cat.: M. 23-2i
Phase: Chicharras? Period: Early Preclassic?
Collected 1967 by M. Coe. Submitted by M. Coe.
Comments: Aggregate sample from various concentrations in Zone I, Mon. 23 excavations.
Some wood fragments identified as palm.
Date is too old, and inconsistent with others in series.
Published in Radiocarbon 1962 11:2:620.
Reference(s): Cie and Diehl 1980
Calibrated 2σ range: 3040 - 2502 BC (538 years)
Intercept(s): 2883 2796 2784 BC
Intercept mean: 2821 BC
Calibration reference: Stuiver and Pearson 1986

Y-1933 3260 ± 120 bp (1310 ± 120 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Cut 1 Level: Zone Q Cat.: M. 30-1r
Phase: Bajío Period: Early Preclassic
Collected 1967 by M. Coe. Submitted by M. Coe.
Comments: Charcoal from dark sand layer (Zone Q) of Monument 30 excavations.
Published in Radiocarbon 1969 11:2:620.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1879 - 1265 BC (614 years)
Intercept(s): 1526 BC
Intercept mean: 1526 BC
Calibration reference: Stuiver and Becker 1986

Y-1934 2980 ± 100 bp (1030 ± 100 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Mound B2-1 Level: Zone C Cat.: NW M.I3
Phase: San Lorenzo Period: Early Preclassic
Collected 1967 by P. Kroster. Submitted by M. Coe.
Comments: Charcoal from just above bright red clay fill of Zone D in Mound B2-1.
Sample should date beginning of construction on this temple substructure.
Published in Radiocarbon 1962 11:2:621.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1489 - 923 BC (566 years)
Intercept(s): 1287 1286 1258 1230 1216 1198 1195 1138 BC
1135 BC
Intercept mean: 1216 BC
Calibration reference: Stuiver and Becker 1986

Y-1936 2980 ± 80 bp (1030 ± 80 bc) Material: Pinus ayacahuite

Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Pit II Level: Zone A (275-290 cm) Cat.: StIIkA
Phase: San Lorenzo Period: Early Preclassic
Collected 1967 by P. Kroster. Submitted by M. Coe.
Comments: Charcoal from wood identified as Pinus ayacahuite from Stratigraphic Pit II.
Published in <u>Radiocarbon</u> 1962 11:2:621.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1430 - 942 BC (488 years)
Intercept(s): 1287 1286 1258 1230 1216 1198 1195 1138 BC
1135 BC
Intercept mean: 1216 BC
Calibration reference: Stuiver and Becker 1986

Y-1937 2990 ± 70 bp (1040 ± 70 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Pit II Level: Zone A (290-305 cm) Cat.: StIII1A
Phase: San Lorenzo Period: Early Preclassic
Collected 1967 by P. Kroster. Submitted by M. Coe.
Comments: Charcoal from Zone A in Stratigraphic Pit II.
Published in <u>Radiocarbon</u> 1962 11:2:621.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1432 - 1010 BC (422 years)
Intercept(s): 1289 1284 1260 1227 1225 1197 1196 1137 BC
1136 BC
Intercept mean: 1217 BC
Calibration reference: Stuiver and Becker 1986

Y-1939 3090 ± 120 bp (1140 ± 120 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Pit II Level: Zone A (320-335 cm) Cat.: St.IInA
Phase: San Lorenzo A Period: Early Preclassic
Collected 1967 by P. Kroster. Submitted by M. Coe.
Comments: Charcoal from Zone A of Stratigraphic Pit II.
Published in <u>Radiocarbon</u> 1969 11:2:621.
Reference(s): Coe and Diehl 1980
Fractionation: σC_3 = -26.9%
Calibrated 2σ range: 1682 - 1012 BC (670 years)
Intercept(s): 1407 1394 1327 1326 BC
Intercept mean: 1364 BC
Calibration reference: Stuiver and Becker 1986

Y-2352 2980 ± 100 bp (1030 ± 100 bc) Material: Charcoal
Site: Ayotla Region: Central Mexico (18°17'N, 98°55'W)
Level: 185-205 cm
Phase: Bomba Period: Early Preclassic
Collected 1967 by P. Tolstoy. Submitted by M. Coe.
Comments: Yellow sandy stratum with ash and charcoal lenses.
Phase marked by appearance of composite-silhouette bowls, double-line break.
Published in <u>Radiocarbon</u> 1969 11:2:624.
Calibrated 2σ range: 1489 - 923 BC (566 years)
Intercept(s): 1287 1286 1258 1230 1216 1198 1195 1138 BC
1135 BC
Intercept mean: 1216 BC
Calibration reference: Stuiver and Becker 1986

Y-2353 2890 ± 80 bp (940 ± 80 bc) Material: Charcoal
Site: Ayotla Region: Central Mexico (18°17'N, 98°55'W)
Level: 265-285 cm
Phase: Justo Period: Early Preclassic
Collected 1967 by P. Tolstoy. Submitted by M. Coe.
Comments: Bottom of yellow zone near boundary with clayey layer.
Phase is "Olmec" — flat-based vessels, differentially fired rims, white ware.
Some figurines.
Published in Radiocarbon 1969 11:2:624.
Calibrated 2σ range: 1374 - 836 BC (538 years)
Intercept(s): 1187 1186 1080 1061 1053 BC
Intercept mean: 1113 BC
Calibration reference: Stuiver and Becker 1986

Y-2354 3020 ± 80 bp (1070 ± 80 bc) Material: Charcoal
Site: Ayotla Region: Central Mexico (18°17'N, 98°55'W)
Level: 285-305 cm
Phase: Ayotla Period: Early Preclassic
Collected 1967 by P. Tolstoy. Submitted by M. Coe.
Comments: Dark clayey stratum with ash and charcoal.
Ayotla phase forms continuum with Justo, but differs in makeup of assemblage.
Published in Radiocarbon 1969 11:2:624.
Calibrated 2σ range: 1490 - 1013 BC (477 years)
Intercept(s): 1313 1298 1296 1277 1266 BC
Intercept mean: 1290 BC
Calibration reference: Stuiver and Becker 1986

Y-2379 3210 ± 90 bp (1260 ± 90 bc) Material: Charcoal
Site: San Lorenzo Region: Veracrúz (17°45'N, 94°45'W)
Unit: Pit II Level: Zone A (650-740 cm)
Phase: Bajío Period: Early Preclassic
Collected 1967 by P. Kroster. Submitted by M. Coe.
Comments: Aggregate sample from concentrations in Zone A (dark sandy midden) in SP II.
Published in Radiocarbon 1969 11:2:621.
Reference(s): Coe and Diehl 1980
Calibrated 2σ range: 1723 - 1266 BC (457 years)
Intercept(s): 1494 BC
Intercept mean: 1494 BC
Calibration reference: Stuiver and Becker 1986

Y-2380 3180 ± 120 bp (1230 ± 120 bc) Material: Charcoal
Site: Tlatilco Region: Central Mexico (19°30'N, 99°15'W)
Unit: Burial 74
Period: Early Preclassic
Collected 1963 by A. Romano. Submitted by M. Coe.
Comments: Aggregate sample from Burial No. 74, Trench 36, Tlatilco IV excavations.
Included in offering with this burial was Tlatilco pottery mask.
Published in Radiocarbon 1969 11:2:623.
Calibrated 2σ range: 1740 - 1113 BC (627 years)
Intercept(s): 1488 1485 1452 BC
Intercept mean: 1475 BC
Calibration reference: Stuiver and Becker 1986

Y-2381 3090 ± 100 bp (1140 ± 100 bc) Material: Charcoal
Site: Tlatilco Region: Central Mexico (19°30'N, 99°15'W)
Unit: Burial 80
Period: Early Preclassic
Collected 1963 by A. Romano. Submitted by M. Coe.
Comments: Charcoal from Burial No. 80, Tlatilco IV excavations.
Date confirms contemporaneity with San Lorenzo phase on Gulf Coast.
Burial contained flat-bottomed bowl carved with Olmec hand-paw-wing motif.
Published in Radiocarbon 1969 11:2:623.
Calibrated 2σ range: 1602 - 1052 BC (550 years)
Intercept(s): 1407 1394 1327 1326 BC
Intercept mean: 1364 BC
Calibration reference: Stuiver and Becker 1986

ZK-333 4018 ± 80 bp (2158 ± 80 bc) Material: Charcoal
Site: Pandanche Region: Peru
Phase: Pandanche A Period: Early Initial
Collected by P. Kaulicke. Submitted by P. Kaulicke.
Comments: Large sample of charcoal from hearth delineated with stones.
Associated with sherds from a deep, wide-mouthed bowl.
Date is weighted average of two assays: 4075 ± 115 bp and 3960 ± 115 bp.
Reference(s): Kaulicke 1981
Calibrated 2σ range: 2876 - 2340 BC (536 years)
Intercept(s): 2572 2535 2505 BC
Intercept mean: 2537 BC
Calibration reference: Stuiver and Becker 1986

ZK-334 3393 ± 240 bp (1443 ± 240 bc) Material: Charcoal
Site: Pandanche Region: Peru
Phase: Pandanche A Period: Early Initial
Collected by P. Kaulicke. Submitted by P. Kaulicke.
Comments: Large sample from simple hearth with stones from possible organic windbreak.
Associated with Pandanche A ceramics.
Date is weighted average of two dates: 3440 ± 340 and 3345 ± 340 bp.
Reference(s): Kaulicke 1981
Calibrated 2σ range: 2430 - 1056 BC (1374 years)
Intercept(s): 1719 1715 1692 1667 1666 BC
Intercept mean: 1692 BC
Calibration reference: Stuiver and Becker 1986

APPENDIX B
Tephra Stratigraphy in the Arenal Basin

Volcanic Stratigraphy of the Arenal Region

Given the impact of past eruptions of Cerro Chato and Volcán Arenal on the study region, one of the principal aims of our ceramic analysis was to correlate the ceramic sequence with the geological sequence of volcanic tephra layers. In so doing, we were able to maximize the value of the natural stratigraphic sequence for the interpretation of site stratigraphies. Human occupation of the Arenal area was influenced periodically explosive eruptions from Cerro Chato and Volcán Arenal, two volcanoes at the eastern end of Lake Arenal. Violent explosions (plinian-subplinian eruptions) were probably responsible for the destruction of crops and habitations as well as the creation of fertile, tephra-enriched soils. A recognizable sequence of volcanic strata was traceable throughout the study area, and provided a unique opportunity for correlating stratigraphic sequences from a number of widely separated sites.

The stratigraphic sequence for the Arenal region referred to throughout this study (Fig. B.1) was initially formulated during excavations at the El Silencio cemetery site (G-150), during the 1984 season of the Proyecto Prehistórico Arenal (Bradley 1984, Melson 1984:Appendix A). It is based on the "El Tajo Sequence," a geological series of airfall tephras deposited by Volcán Arenal identified by geologist William Melson in 1977. The El Tajo Sequence is based on tephra units which appeared in profile at the site of El Tajo, situated on the south side of a hill 7 km downwind of the volcano and now submerged by the waters of Lake Arenal (Melson 1982, 1984; Aguilar 1984).

A 20 m thick stratigraphic cut at El Tajo, made by ICE earthmoving equipment during the construction of the Sangregado Dam, permitted detailed observation of the texture, color, and minerology of tephra layers. Each unit at El Tajo appeared as "a basal coarse tephra layer deposit on soil and overlain by fine tephra, which in prehistoric units becomes yet another soil zone" (Melson 1984:39). Nine successive tephra units have been identified, each of which represents either a major explosive event or series of small explosions during which a large volume of tephra was emplaced. Tephra from Volcán Arenal was carried by prevailing winds and deposited in a broad "apron" to the southwest of the volcano. The shape and thickness of this tephra apron varied with weather conditions and the volume of ejected material, and diminished in depth with distance from the volcano. While there may well have been more than the nine major eruptions identified at El Tajo, additional events were either small or subject to rapid erosion.

Because of the compressed stratigraphy and highly variable patterns of natural and cultural disturbance in the portion of the Arenal basin, where most of our excavations were conducted, a one-to-one correspondence between El Tajo tephra units and archaeological strata was not always possible. The volcanic tephra ejected by Volcán Arenal are not preserved in uniform layers across the region. The fact that it was most likely deposited on a dense, wet rainforest, the local erosional patterns, and the disturbance by treefall, animals, and cultural activity all contributed to the variable thickness of the layers. While the thickness of the profile at El Tajo made for a relatively clear observation of the depositional sequence, this was not true in the area where most of our excavations were concentrated. For this reason, a second sequence was devised which would be tied to the El Tajo sequence but was flexible enough to allow for subsequent reinterpretation. The "Silencio Sequence" identifies strata corresponding to past eruptions which appeared in modern roadcuts and at a number of archaeological sites in and near the Arenal basin. The most detailed profiles come from sites G-151, near a hilltop overlooking the Río Santa Rosa valley (Fig. B.2), G-175, on the southern shore of the lake near Río Chiquito, and Tronadora Vieja (G-163). Each of the "units" in the sequence represents a tephra deposit, a tephra deposit and soils weathered from it, or other regularly

Calendar Dates	El Tajo Sequence	Silencio Sequence	Ceramic Phases
	1	10	Historic
AD 1968			
	2	20	
AD 1400	3	30	Tilarán
		40	Silencio
AD 1000	4		
	5	41 50 52	
AD 500			
AD 300	6	53 53A	Late Arenal
AD 0	7	54	
	8	55	Early Arenal
500 BC			
	9	60	Tronadora
1500 BC	10	61?	
2000 BC		64?	
	Aguacate Formation	65	Fortuna

Fig. B.1: Schematic representation of Arenal Basin tephra stratigraphy.

G 151 C

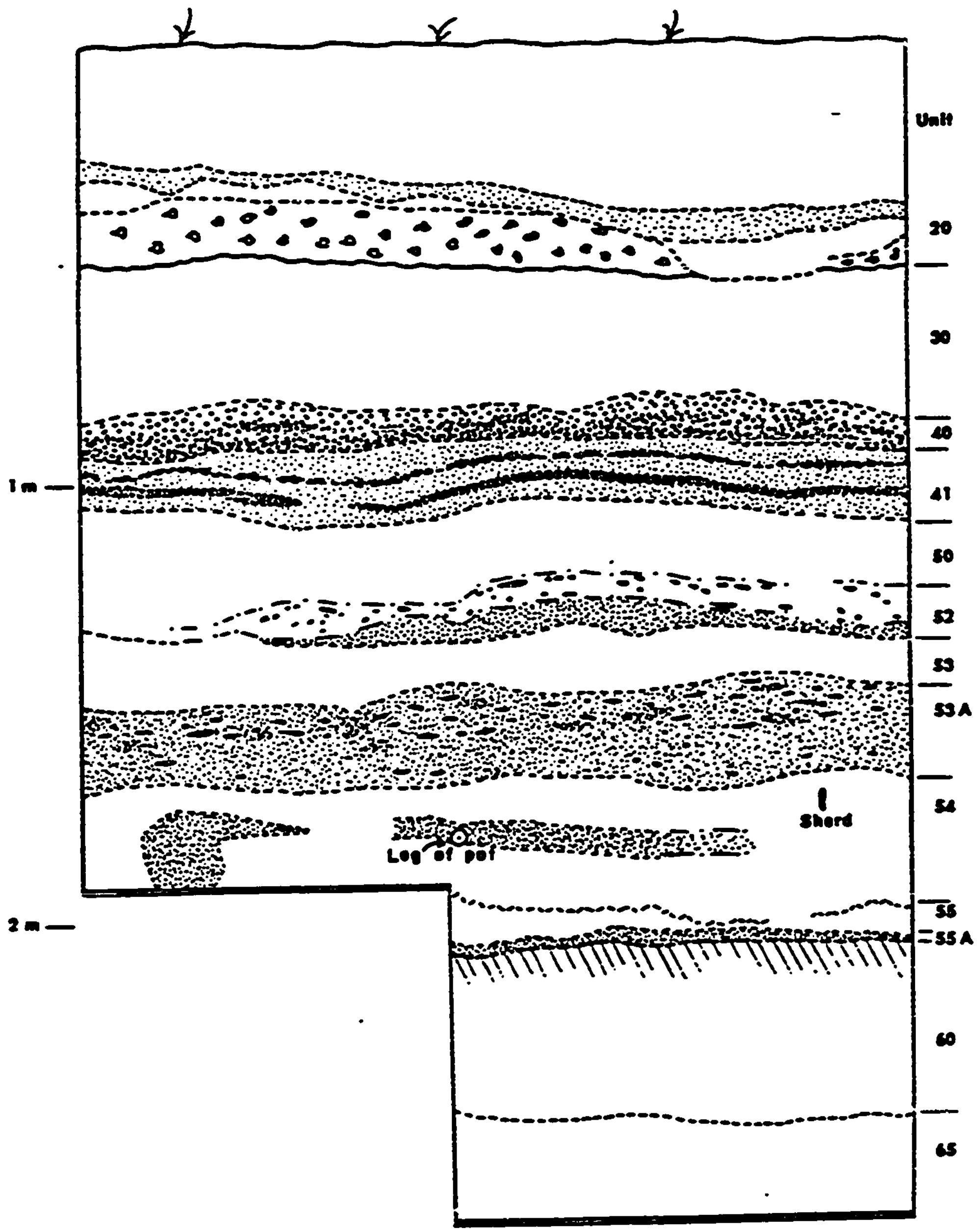


Fig. B.2: Stratigraphic profile from G-151.

occurring stratigraphic features which could be visually identified in excavations and profiles at a number of different locations. The discussion which follows will present a correlation between the El Tajo geological units (here designated ET1 through ET10) and the Silencio sequence, or Arenal basin archaeological stratigraphy (Units 10 through 65). These will be presented in their chronological, rather than stratigraphic order for the purpose of reconstructing a tentative volocanological sequence corresponding to the recent geological history of the Arenal area.

Recent research (Borgia et al. n.d.) has thrown additional light on the nature and chronology of the eruptive sequence of Cerro Chato, a volcano which is situated immediately to the southeast of Volcán Arenal. Cerro Chato, whose activity preceded that of Volcán Arenal, appears now as a large, truncated cone with a caldera and small lake, the remains of a massive, Mt. Saint Helens-like explosion. The tephra emplaced by explosions of Cerro Chato forms the base of the archaeological stratigrahic sequence, and is overlain by tephras from Volcán Arenal. Borgia's research has also provided further information on the eruptive sequence of Volcán Arenal. particularly with regard to the volcano's most recent explosive activity (AD 1500-1968).

Aguacate or uPPv (Unit 65)

The base of Arenal's tephra deposits, and of cultural remains in the Arenal basin, is a paleosol which has come to be known as "Aguacate" (Silencio Unit 65); however, it has no demonstrated relationship to, and is probably much younger than, the Aguacate Volcanic Series, named after the Aguacate Mountains in the western part of the Meseta Central (Dengo 1962:147). This paleosol is also referred to in the geological literature as the "uPPv" (Borgia et al. n.d.). In general, "Aguacate" is used as a catch-all designation for a heavily-weathered, red to orange, clay-rich material which is found throughout the region. For the most part, it is derived from the weathering of volcanic deposits which pre-date both Cerro Chato and Volcán Arenal. It occasionally contains well-developed paleosols from eroded tephras whose source Melson (1984) believed may have been Cerro Chato. One of these, a highly-weathered tephra in a swamp deposit near the Sangregado Dam, yielded a radiocarbon date of 21,790 ± 360 bp (uncalibrated, no lab number given; Melson et al. 1987:19). However, more recent evidence indicates that the early tephras from Cerro Chato are probably not as heavily weathered, and in fact were deposited on top of Aguacate at a much more recent date (Borgia et al. n.d.).

The "Aguacate" paleosol is most visible along the shore of Lake Arenal, where recent erosion removed the overlying volcanic deposits. It appeared at the base of all excavations as a solid, orange to red clay. While prehistoric excavations often penetrated it, Aguacate was usually sterile. Exceptions include Tronadora Vieja, where cultural material is found to a depth of 10-20 cm into the top of Aguacate.

The oldest known artifact from the surface of Aguacate is a Turrialba-style, fluted Paleo-Indian projectile point which may date as early as 8000 BC (Sheets n.d.). This suggests that the "Aguacate" paleosol were the ground surface for the first human occupation of the Arenal region. There are six radiocarbon dates associated with Archaic-style lithic debitage from the upper matrix of Aguacate which range between approximately 3700 and 2800 BC:

3950(3695)3381 BC [Tx-5286: 2940 bc ± 100]
3609(3360)3050 BC [Tx-5275: 2650 bc ± 70]
3609(3351)3040 BC [Tx-5278: 2630 bc ± 80]
3360(3066)2920 BC [Tx-5276: 2500 bc ± 70]
3014(2821)2590 BC [Tx-5274: 2260 bc ± 70]
2450(2090)1753 BC [SI-?: 1725 bc ± 100]

The first of these dates is based on a sample of wood charcoal from the matrix of Aguacate at the site of Piedras del Sol (A-186), a single-component Fortuna Phase site on the north shore of Lake Arenal. The rest are all from wood charcoal recovered from excavations at the site of Tronadora Vieja. Because of their direct association with lithic artifacts and the site's distance from Cerro Chato and Volcán Arenal, all of these samples are believed to derive from Fortuna Phase cultural activity and not material burned by volcanic explosions. All but the last are probably acceptable, however, it is important to acknowledge the existence of some unexplained discrepancies. For example, Tx-5274 comes from the same context and excavation unit as Tx-5275 and Tx-5278, but its average calibrated date is much later and it does not overlap the earlier dates at even the 2-sigma range. The last date cited (c.f. Melson et al. 1987, laboratory given without assay number) comes from the same charcoal sample as Tx-5274, but does not overlap it at the 2-sigma calibrated range (see Appendix A for complete descriptions of these samples). Despite these internal discrepancies, these dates suggest that the initial deposition of tephras from Cerro Chato on the surface of Aguacate is probably more recent than about 2800 BC.

Units 62 and 64

The two designations used to represent strata on the surface of Aguacate are Unit 62 and Unit 64. At sites such as the El Silencio cemetery (G-150), Unit 62 designates a heavy mix of Aguacate and overlying soils due to disturbance. Because this disturbance could happen at any time, this designation has no chronological significance.

Unit 64 is a dark, clay-laden stratum noted on the surface of Aguacate at Tronadora Vieja (G-163). This was initially believed to represent a primarily organic soil which predates the eruptions of Volcán Arenal.
However, recent evidence suggests that this stratum may in some places derive from the first of Cerro Chato's tephra deposits on the surface of Aguacate (Borgia, personal communication 1987). Unit 64 was highly discontinuous at

Tronadora Vieja, indicating that heavy weathering and erosion exposed the surface of Aguacate to cultural activity as well. In addition, the ceramics associated with this stratum suggest that in some places it was heavily disturbed by later cultural activity.

Units 60 and 61

The correspondence between the lowest tephra deposit (Unit 61) and the overlying stratum (Unit 60) noted in excavations and the earliest El Tajo tephra units remains unclear. According to recent evidence (Borgia et al. n.d.), these strata may not represent tephra from Volcán Arenal, but are in fact from Cerro Chato. The lowest stratum at El Tajo is ET10, a thick, black, well-developed paleosol which contained fragments of basaltic andesite and phenocrysts of plagioclase, hypersthene, augite, and olivine. The base of this unit was not identified, and therefore has not been positively identified as having originated from Volcán Arenal. The nature of its inclusions indicates that it did not develop from Aguacate, and Melson suggested that the basal tephra of ET10 might represent tephra from Cerro Chato (Melson 1984:49). This stratum may correspond to Silencio Unit 61, a hard, dark-grey, fine-grained tephra stratum overlying both Unit 64 and exposed Aguacate at Tronadora Vieja. Unit 61, first identified in 1985, probably corresponds to the "White 1" stratum noted at sites such as Viboriana (G-175) and Tronadora Vieja during the 1984 season (Bradley, Hoopes, and

Sheets 1984). Unit 60, a distinctive black stratum overlying Unit 61, probably corresponds to "Black 1" and possibly the black paleosol in ET10.

However, Melson (1984:48) tentatively identifies the parent tephra and derived soil "White 1-Black 1" combination from the Tilarán area with ET9. This El Tajo unit is described as relatively thin, with a thin basal layer of basaltic andesite lapilli. Its overlying soil zone is decribed as thinner than that which formed on ET8, therefore indicating a short timespan between this eruption and that responsible for the deposition of ET8. Knapp (n.d.) who has attempted to correlate samples of soil and tephra from Tronadora Vieja and other sites with the known characteristics and minerology of the El Tajo deposits, notes that the grey, phyric scoria characteristic of ET9 appears in Unit 60. She also suggests that the fine-grained separates from Unit 61 represent the zone of tephra lapilli which forms the base of ET9. However, Knapp also admits that their source could be the unknown base of ET10, and more recent evidence suggests that Unit 61 corresponds to tephra from Cerro Chato.

Two radiocarbon dates, 2470(2166)1834 BC [Tx-5277: 1780 bc $\pm$ 100], from the surface of Aguacate, and 2860(1822)1000 BC [Tx-5279: 1530 $\pm$ 320], from the contact between Unit 61 and the underlying Unit 64. Both are believed to derive from Tronadora Phase cultural activity in deposits stratigraphically situated beneath Unit

61, a distinct, hard-packed tephra stratum. The first date is completely overlapped by the second at the calibrated 2-sigma range, and the two dates suggest that the Arenal basin may have been occupied by the first ceramic-using populations in the Arenal area as early as 2000 BC. These dates are very close to those for three samples collected from the matrix of pyroclasitic flows associated with the Cerro Chato volcano's most recent explosive activity: 2200(1851) 1527 BC [?: 1560 bc ± 120], 2013(1825) 1665 BC [?: 1550 bc ± 50], and 2012(1761)1606 BC [?: 1510 bc ± 70]. These assays, the first on "carbonized organic matter... from a tephra layer at the western-northwestern base of Chato" and the latter two on carbonized branches found embedded in the tephra layer "just north of the saddle between Chato Volcano and Chatito, and on the southeastern flank of La Espina" (Borgia et al. n.d.:15), were not associated with any cultural remains. They overlap from 2012-1665 BC at the 2-sigma range, and suggest a calibrated date of around 1800 BC for Cerro Chato's last explosive activity. The similarity of the dates from archaeological and geological deposits, in addition to the stratigraphic position of Unit 61, suggests that this stratum corresponds to the most recent tephra from Cerro Chato. If this is true, it appears that the last major eruption of Cerro Chato occurred during the early Tronadora Phase, depositing a large quantity of tephra on Tronadora Vieja and possibly several other Early Formative sites.

Three dates have been reported from samples of what has been identified as the "basal Arenal paleosol" underlying ET9, and were collected at three locations to the east of Lake Arenal: in the Quebrada Guillermina, in a road cut near Quebrada La Palma, and in a road cut east of the Sanrgegado Dam (Borgia et al. n.d.:17). These are: 1681(1329)835 BC [?: 1075 bc ± 150], 1490(1117)800 BC [?: 945 bc ± 145], and 1079(811)414 BC [?: 700 bc ± 115], overlapping from 1079-835 BC at the calibrated 2-sigma range. Borgia notes that "paleosols give a maximum age of burial due to carbon accumulation during soil formation but... are more easily contaminated by younger carbon than charcoal," and interprets an average of these three dates as an approximate estimate of Volcán Arenal's first activity (Borgia et al. n.d.: 17). This would give ET9 a maximum age of about 1000-900 BC. Although Knapp has identified scoria characteristic of ET9 in Unit 60, the correlation of these two units is not completely clear. The cited radiocarbon dates suggest a period of approximately 800 years between the last explosion of Cerro Chato (Possibly Unit 61) and the deposition of ET9. However, ceramics from Unit 60 were not markedly different from those in Unit 61. Unit 60 was not a clear tephra unit and it was superimposed on Unit 61, although 800 years should have been sufficient time for the development of a thick paleosol on the surface of Chato's tephra. Rather than representing ET9, Unit 60 may be a paleosol associated with Unit 61, possibly corresponding to the black paleosol in ET10. ET9 is a relatively thin stratum at El Tajo, and the thickness of its overlying soil zone suggests that there was probably a short time span between this eruption and ET8, which we have tentatively correlated with Unit 55 (which overlies Unit 60). ET9 may not be visible as a separate stratum at Tronadora Vieja, and may have been mixed with Unit 60 through bioturbation and human activity. In this case, 1000-800 BC would be approximate dates for the uppermost part of this stratum.

One date of 800(50 BC)AD 640 [Tx-5081: 80 bc ± 300] was obtained from an aggregation of small fragments of charcoal from two separate excavations. It was associated with Tronadora Phase ceramics, and reported as having come from Unit 60 and below. While the earliest part of its 2-sigma range may be acceptable, this assay should probably be set aside on the basis of its relatively poor provenience and large 2-sigma range.

Units 54 and 55

Unit 60 is immediately overlain by Unit 55, characterized at sites in the Arenal basin as a coarse, yellow tephra layer which often appeared in small chunks. This stratum is believed to correspond to ET8, described as "a thick basaltic andesite unit, composed mainly of fine tephra with but a thin basal layer of basaltic andesite lapilli" (Melson 1984:47). "White 2-Black 2", identified as a basal tephra overlain by a dark soil zone, has been tentatively identified as ET8 (Ibid.).

The uppermost part of soil development on ET8 was the only segment of the El Tajo profile directly associated with absolute dates. An archaeological site with Arenal Phase ceramics (Aguilar 1984) was situated in the well-developed soil zone on top of ET8. Two samples of charcoal, reported to be from hearths at the site of El Tajo, yielded dates of 390(265)45 BC [SI-3459: 220 bc ± 65] and 86 BC(AD 173)390 [I-10804: 120 ad ± 80] (Aguilar 1984). Melson (1984) notes that the thickness of the developed soil between ET8 and the deposit which yielded these dates is comparable to that between the deposition of Unit 20 (ET2, dated ca. AD 1400) and Unit 10 (interpreted by Melson as ET1, Arenal's 1968 eruption), or around 550 years. Recent investigations (Borgia et al. n.d.) suggest that Unit 10 is not the same as ET1, but represents a tephra layer which was deposited at around AD 1700. The 2-sigma overlap range of the two dates from El Tajo is 86-45 BC. Adding to this the estimated time for soil development prior to the archaeological occupation of El Tajo, the date of the eruption of ET8, and therefore the deposition of Unit 55, is estimated at ca. 600 BC, given Melson's prior interpretation. Borgia's interpretation of Unit 10, however, would shorten the period for soil development to only 300 years, bringing the estimated date for ET8 up to ca. 350 BC.

This revised date for ET8 raises further problems with the interpretation of Unit 60. If the deposition of ET9 dates to ca. 900 BC and the deposition of ET8 dates to 350 BC, there should have been sufficient time (550 years) for the development of a thick paleosol between the two. However, Melson notes that the soil zone on ET9 is in fact less well-developed than that on ET8 in the El Tajo profile (1984:48). It is very likely that there is something wrong with Melson's assumption of the equivalency of rates of soil development on tephras. Until we know more about this process, it is probably best to treat estimates based on this assumption with caution. To date, there are no radiocarbon samples directly associated with either the base of ET8 or with Unit 55, and the time of the deposition of these strata -- although probably sometime between 900 and 350 BC -- remains unclear.

Silencio Unit 54 may correlate with the uppermost portion of ET8 (and the occupation of El Tajo archaeological site) and with the succeeding ET7. This El Tajo unit is marked by the re-appearance in the sequence of hornblende-phyric dacitic pumice lapilli (also characteristic of the basal portion of ET9), which appears at its base (Melson 1984:48). This eruption was responsible for the introduction to the region of large quantities of hornblende crystals. These appear as a major aplastic inclusion in the pastes of many Arenal Phase ceramics, and may help correlate the age of these ceramics with local volcanic activity. However, hornblende has also been noted in ET9, ET5, and ET2.

As a stratigraphic unit, Unit 54 was clearly visible only at the sites G-151 and Tronadora Vieja. Washed samples of Unit 54 taken from site G-151 were noted to contain coarse-grained pumice with hornblende phenocrysts and a light grey scoria, inclusions characteristic of ET7. Soil samples from below this level at G-151 were characterized by a dark grey phyric tephra, believed to be more similar to ET8 (Knapp n.d.).

A single radiocarbon date of 2010(597 BC)AD 660 [Tx-5280: 520 bc $\pm$ 560] comes from charcoal fragments recovered from the interior of a burial feature at Tronadora Vieja. Although this feature penetrated Aguacate to a depth of 175 cm, it appeared to have originated in Unit 54. However, the averaged, central calibrated date of this sample (an average of nine intersections with the calibration curve, ranging from 757-452 BC) is believed to be too early for the associated ceramics. While the true date of this sample may be closer to 450 BC, the sample's very large 2-sigma range and the nature of the segment of the calibration curve pertaining to this sample limits its value for accurate chronological interpretation.

Units 52 and 53

These two units, together with portions of Unit 54, constitute what has been termed the "50's Complex" or "Upper 50's." Individual units within this portion of the Silencio stratigraphy were not always readily apparent, and Units 52 and 53 were clear only in the profile at G-151 (Fig. B.2).

Unit 53 and 53A, its parent tephra, appear at G-151 as a light brown soil zone overlying black, grey, and orange tephra lenses (Melson 1984:54). Melson suggests that these may correlate with ET6, described as thin and petrologically unique, with mineral inclusions of "plagioclase, hypersthene, augite, and olivine-phyric basalt lapilli" (Ibid.:47). A large number of similar crystals were noted by Knapp in the "Upper 50's" strata at Tronadora Vieja, and she suggests that these most likely weathered from phyric tephra in ET6 (Knapp n.d.). However, Borgia (personal communication, 1987) reports that because of its thinness, ET6 is already difficult to identify near the Sangregado Dam, only 8 km from Volcán Arenal. He notes that it is unlikely that this tephra layer is identifiable as far away from the volcano as our stratigraphic cuts, and therefore correlations of Units 53 and 53A with ET6 should be considered very tentative.

Unit 52 is believed to represent the tephra deposit from which the overlying Unit 50 developed. It appears at G-151 with an upper zone of compact, fine tephra overlying a lower zone of darker, sandier tephra. Melson (1984:47) remarks that Unit 52 correlates petrologically with ET5, as does the overlying Unit 50.

Although the strata in which archaeological materials were recovered at the site were heavily disturbed, the principal cultural activity at Sitio Bolivar appears to have take place in tephra and soils deposited on top of Unit 54, possibly corresponding to Units 52 and 53. There are five radiocarbon dates available from this site:

830(400 BC)AD 1 [Tx-5271: 390 bc ± 170]
AD 79(245)410 [Tx-5272: ad 180 ± 60]
AD 182(394)540 [Tx-5273: ad 290 ± 70]
AD 432(642)770 [Tx-5270: ad 540 ± 80]
AD 770(919)1000 [Tx-5269: ad 820 ± 50]

The first of these, Tx-5271, was associated with a possible hearth at the base of the cultural deposits. On the basis of ceramic analysis, it is believed to be much too early for the principal occupation of the site. Conversely, the latest date, Tx-5269, which is derived from a possible hearth or cooking pit exposed by wave action on the shore of Lake Arenal (as was Tx-5272), is believed to be several hundred years too late. The remaining dates, two of which (Tx-5273 and Tx-5270) were obtained from dense deposits of disgnostic sherds and other artifacts, are believed to reliably date cultural activity at the site. Ceramics which appear to have derived from an occupation associated with Units 52 and 53 date approximately to AD 300-600.

Unit 50

Unit 50 was visible at archaeological sites in the Arenal basin and Río Santa Rosa basin as a thick, black, clay-laden soil zone. It developed from the underlying tephra stratum over what was probably a fairly long period of time. Melson (1984:47) believes that Unit 50 may correspond to the upper portion of ET5, and that a fine grey tephra noted at the top of the El Tajo unit is the same as the overlying Unit 41. The latter has been tentatively correlated with ET4 (Ibid.).

At Viboriana (G-175), the lower portions of this stratum were associated with Arenal Phase material. One radiocarbon date of AD 230(539)768 [Tx-5082: ad 420 ± 130], derived from an aggregate sample of fragments of wood charcoal obtained from widely separated excavation levels within Unit 50, is available from this site. A second date of AD 560(665)861 [Tx-5080: ad 610 ± 70] was obtained from charcoal at the site of Tronadorcita (G-161). While the exact stratigraphic context of this date is unknown due to disturbance (Bradley, Hoopes, and Sheets 1984:80), excavation notes indicated that it came from below Unit 30, and "probably" at the top of Unit 50. The cultural associations of the second date are unknown, and the presence of Arenal Phase ceramics in all lots between the surface and Unit 50 at this site suggest a large amount of disturbance. However, small amounts of Silencio Phase ceramics were present at the site.

At the El Silencio cemetery (G-150), Unit 50 marks the beginning of major Silencio Phase activity. A radiocarbon date of AD 79(245)410 [Tx-5078: ad 180 ± 60] is derived from charcoal obtained from the fill of a stone-lined tomb containing Silencio Phase ceramics. This date is considered to be several hundred years too early for the associated ceramics, and is believed to derive from redeposited charcoal from an earlier Arenal Phase occupation. However, the tomb from which this sample was obtained was overlain by Units 40 and 41, and this date helps provide a maximum age for these tephra layers.

Based on stylistic interpretations of Silencio Phase ceramics from the El Silencio site (G-150), the uppermost part of Unit 50 is believed to date to approximately AD 800-1000. However, in the absence of reliable radiocarbon associations from the upper part of this unit, this must be considered a rough estimate.

<u>Units 40 and 41</u>

Unit 41 appears as a fine grey tephra which immediately overlies Unit 50, and is believed to correspond to the top of ET5 (Melson 1984:47). ET4, which was noted at El Tajo to have a very poorly-developed overlying soil zone, has not been clearly identified in the stratigraphy of archaeological sites in the Arenal Basin (Melson 1984:46). It seems likely that it was either heavily weathered or corresponds with one of the tephra lenses identified as Unit 41. Recent investigations suggest that "in most stratigraphic sections units ET5 and ET4... should be considered as a single unit" (Borgia et al. n.d.:17), suggesting that ET4 may not correspond to any identifiable units in the Silencio sequence. The absence of any soil zone between Unit 41 and the overlying Unit 40 suggests that the eruptive events responsible for their deposition occurred within a relatively short period of time. Both are often found with clear internal strata, suggesting each may in fact represent a series of both large and small eruptions.

Unit 41 is overlain by Unit 40, a second tephra layer which ranges in color and texture from coarse, dark, lapilli to coarse, dark grey sand. This has been tentatively identified as the basal, lapilli-bearing poriton of ET3, while the overlying Unit 30 corresponds to the top, fine portion of this stratum (Melson 1984:51).

Units 41 and Unit 40 were found to have been deposited during the active Silencio Phase occupation of the El Silencio site. However, based on the evidence for continued cultural activity at the site after the deposition of these strata and the continuity of ceramic styles above and below these strata, there is no indication that the eruptions responsible for these tephras displaced local populations or interrupted the use of this site.

Two radiocarbon dates help to date the deposition of Unit 40: AD 1020(1175)1260 [?: ad 1080 ± 50] and AD 257(1269)1950+ [?: ad 1200 ± 500]. These were obtained from samples of carbonized plants preserved by a pyroclastic flow associated with the emplacement of ET3 at the base of the Quebrada Guillermina, east of Lake Arenal (Borgia et al. n.d.). Although the very large 2-sigma range of the second date limits its utility for chronological fine-tuning, these radiocarbon samples together with the deposition Unit 40 in the middle of the Silencio Phase occupation at the El Silencio site suggest a date of around AD 1000-1200 for this tephra horizon.

Unit 30

Unit 30 is an orange-brown soil zone which appears to have developed from the Unit 40 tephra, and therefore corresponds to the upper portion of ET3. It was found to contain evidence of both Silencio and Tilarán Phase activity at a number of sites in the Arenal area, most notably at El Silencio (Bradley 1984) and Dos Armadillos (G-154; Hoopes 1984).

Two radiocarbon dates have been associated with cultural activities in Unit 30 strata. The first is a date of AD 1208(1277)1384 [Tx-5077: ad 1210 ± 50], on charcoal from the El Silencio site. This sample was recovered in association with a dense sample of Silencio Phase ceramics overlying laja tombs (Burials 6-11; Bradley 1984: 102). This date is consistent with a suite of 21 radiocarbon dates for the Middle Polychrome period in Greater Nicoya, to which the Silencio Phase tradition is closely related. These range from a date of AD 777(919)996 [P-2181: ad 820 ± 40] from the site of Huerta del Aguacate (Sweeney 1975) to a date of AD 1260(1284)1410 [Hv-2691: ad 1290 ± 50] from the site of La Paloma (Healy 1980:308).

The second date, AD 1300(1356)1422 [Tx-5079: ad 1380 ± 30, comes from excavations at the Dos Armadillos site (Hoopes 1984b). It is derived from a sample of charcoal associated with a Tilarán Phase ceramic assemblage and the possible remains of prehistoric habitations. Although the culture-bearing deposits were immediately overlain by Unit 20, this sample appeared to represent the remains of cultural activity. There was no evidence for a catastrophic burial of cultural remains at the site, and because charcoal was relatively scarce in our excavations, the sample does not appear to have derived from fires caused by a volcanic eruption.

Based on an estimate for the time of the deposition of Units 40 and 41, Tx-5077 and comparable dates, and Tx-5079, Unit 30 appears to date to approximately AD 1000-1400.

Unit 20

This stratum represents a major eruption of Volcán Arenal, and typically had the largest particle size of any of the lapilli noted in stratigraphic profiles. It is composed of a largely unconsolidated, coarse, light grey dacitic pumice overlain by a dark brown, recently developed soil zone. Unit 20 was identified at all sites in the study area, and, having the texture of birdseed, was typically the easiest to excavate.

Unit 20, which corresponds to ET2, is dated by two radiocarbon assays: AD 1414(1437)1479 [SI-576: ad 1500 ± 30] and AD 1432(1450)1476 [SI-577: 1525 ad ± 10]. Both dates are derived from samples of charred bark and wood from trees buried by a prehistoric pyroclastic flow associated with the eruption of Volcán Arenal (Melson and Saenz 1974). Neither of these was directly associated with cultural materials, but probable Tilarán Phase sherds were recovered from beneath the same deposit on a nearby hill.

These dates, together with the date of AD 1300(1356) 1422 [Tx-5079: 1380 ad ± 30] from Dos Armadillos cited above, a probable date for the eruption eruption shortly after AD 1400.

Unit 10

Unit 10 is a light grey pumice tephra composed of particles of about 1-2 mm in diameter, and was evident at the top of all complete stratigraphic profiles in the Arenal area. It is typically mixed with topsoil and vegetation, and Melson has identified this tephra as ET1, representing material ejected from Volcán Arenal during its last violent eruptions between July 29 and 31, 1968. However, Borgia, on the basis of recent examinations of tephra stratigraphy near Volcán Arenal, disagrees. He believes that Unit 10 instead represents a major explosion which occurred between the deposition of Unit 20 and the

1968 eruption, probably around AD 1700 (Borgia et al. n.d.).

The identification of these strata in archaeological deposits at sites within the tephra apron was key to our reconstruction of past cultural activity in the Arenal region. While we were unable to identify Pompeii-like depositional situations on the scale of the house at Cerén, El Salvador (Sheets 1982) tephra deposits did help to preserve and separate successive occupations and features within the stratigraphy of individual sites. To date, there is no evidence to indicate that the periodic and often violent eruptions of Volcán Arenal had any major negative effects on local populations. If aboriginal occupation of the region was subject to periodic migrations and reoccupations induced by catastrophic volcanic eruptions, patterns of this activity have not yet been reflected in the archaeological record. However, it is also true that our excavation data is extremely limited, and there is no evidence to address the short-term effects that eruptions may have had on houses and fields. on may not accurately reflect short-term effects.

The beneficial effects of Volcán Arenal's presence on aboriginal occupation of the region can only be inferred. The regular deposition of tephra and its relatively rapid weathering into fertile, mineral-rich soils helped to counteract the intense leaching and nutrient depletion characteristic of tropical rainforest environments. The soils developed from Arenal's tephra undoubtedly helped to sustain the growth of populations and settlement of the region, and along with cultural factors these helped to define the prehistoric ecology of the Arenal basin.

APPENDIX C
Modal Analysis Data Entry: Sample Data Entry Screens

Stratum

<A> UNKNOWN	<N> 50cd	<1> 52/53	<d> 40/41
<B> 10	<O> 50cde	<2> 54/55	<e> 65 INT
<C> 20	<P> 50de	<3> 55/60	<f> 51
<D> 30	<Q> 50e	<4> 55/61	
<E> 40	<R> 52	<5> 55/64	
<F> 41	<S> 53	<6> 64/65	
<G> 50	<T> 54	<7> 30/50	
<H> 50a	<U> 55	<8> 50a/60	
<I> 50b	<V> 60	<9> 64 INT	
<J> 50ab	<W> 61	<0> 50u	
<K> 50abc	<X> 60/61	<a> 54/60	
<L> 50c	<Y> 64	<b> 61/64	
<M> 50d	<Z> 65	<c> 60/64	

Your choice (A - f)?

Context

<A> UNKNOWN
<B> SURFACE SCATTER
<C> SURFACE, RECENTLY ERODED
<D> EXCAVATED PRIMARY DEPOSIT
<E> PRIMARY DEPOSIT IMMEDIATELY BELOW A TEPHRA
<F> PRIMARY DEPOSIT ON TOP OF A TEPHRA
<G> PRIMARY DEPOSIT ON AGUACATE
<H> EXCAVATED SECONDARY DEPOSIT
<I> EXCAVATED DISTURBED DEPOSIT
<J> BURIAL
<K> HABITATION
<L> ARCHITECTURAL FILL OR POSTHOLD
<M> SHOVEL OR POSTHOLE TEST

Your choice (A - M)?

Enter letter of vessel part represented.

<A> UNKNOWN
<B> BODY SHERD
<C> RIM SHERD
<D> GENERAL BODY ANGLE
<E> SHOULDER
<F> BASAL ANGLE
<G> NECK
<H> BASE
<I> HANDLE
<J> ADORNO
<K> SUPPORT
<L> OTHER

Your choice (A - L)?

Sherd Size

<A> UNKNOWN
<B> VERY SMALL
<C> SMALL
<D> MEDIUM
<E> LARGE
<F> VERY LARGE

Your choice (A - F)?

Type:Variety Classification

<A> UNKNOWN
<B> TRONADORA (GENERAL)
<C> TRONADORA INCISED
<D> TONJIBE BEIGE
<E> TIGRA GROOVED-PUNCT.
<F> ZETILLAL STAMPED
<G> TAJO GOUGE-INCISED
<H> SHELL-STAMPED (GEN.)
<I> ARENAL (GENERAL)
<J> BOCANA INCISED
<K> LOS HERMANOS BEIGE
<L> LAS PALMAS RED/BEIGE
<M> CHARCO BLACK-ON-RED
<N> HUILA ZONED-PUNCTATE
<O> TRIANGLE IMPRESSED
<P> MOJICA IMPRESSED
<Q> MOJICA:MOJICA
<R> MOJICA:LAGUNA
<S> MOJICA:ARRASTRADA
<T> MOJICA:CORRIDA
<U> CONGO PUNCTATE
<V> ZELAYA BICHROME
<W> ZELAYA TRICHROME
<X> GUINEA INCISED
<Y> GUINEA:USULUTAN
<Z> TAMINO INCISED

Is the type listed?Y What is it (A - Z)?

Vessel Form

<A> UNKNOWN
<B> TECOMATE (GENERAL)
<C> OLLA-TECOMATE
<D> BOWL (GENERAL)
<E> INCURVING BOWL
<F> STRAIGHT BOWL
<G> HEMISPHERICAL BOWL
<H> CARINATED BOWL
<I> TRIPOD (GENERAL)
<J> COMP. SILHOUETTE BOWL
<K> COMP. SILHOUETTE TRIPOD
<L> INCURVING TRIPOD
<M> STRAIGHT TRIPOD
<N> SHALLOW OPEN TRIPOD
<O> JAR (GENERAL)
<P> SHORT-NECKED JAR
<Q> NECKED JAR (SMALL)
<R> VERTICAL NECKED JAR
<S> NECKED STORAGE JAR
<T> OUTCURVING NECKED JAR
<U> OUTFLARING NECKED JAR
<V> CALABASH JAR
<W> CYLINDER (GENERAL)
<X> SHORT CYLINDER
<Y> TALL, CURVED CYLINDER
<Z> SHERD DISK
<1> BOTTLE FORM

Your choice (A - 1)?

Surface Finish

<A> UNKNOWN
<B> ERODED
<C> UNSLIPPED
<D> UNSLIPPED AND SMOOTHED
<E> 'FLOATED'
<F> UNSLIPPED AND POLISHED
<G> PARTLY SLIPPED
<H> PARTLY SLIPPED AND SMOOTHED
<I> PARTLY SLIPPED AND POLISHED
<J> SLIPPED
<K> SLIPPED AND SMOOTHED
<L> SLIPPED AND POLISHED
<M> ONLY TRACES OF SLIP

Your choice (A - M)?

Paste Color

<A> UNKNOWN
<B> BEIGE
<C> CREAM
<D> WHITE
<E> PINK
<F> RED
<G> RED-ORANGE
<H> ORANGE
<I> BRIGHT ORANGE
<J> BROWN
<K> LIGHT BROWN
<L> DARK BROWN
<M> RED-BROWN
<N> BLACK
<O> GREY
<P> YELLOWISH

Your choice (A - P)?

Surface Color

<A> UNKNOWN	<N> BLACK
<B> BEIGE	<O> GREY
<C> CREAM	
<D> WHITE	
<E> PINK	
<F> RED	
<G> RED-ORANGE	
<H> ORANGE	
<I> ORANGE-BEIGE	
<J> BROWN	
<K> LIGHT BROWN	
<L> DARK BROWN	
<M> RED-BROWN	

Your choice (A - O)?

Vessel Rim

<A> UNKNOWN	<N> FLATTENED EXT. THICKENED
<B> DIRECT (GENERAL)	<O> TAPERED DIRECT
<C> ROUNDED DIRECT	<P> OUTCURVING
<D> FLATTENED DIRECT	<Q> INCURVING
<E> INTERIOR THICKENED	<R> FOLDED
<F> ROUNDED INTERIOR THICKENED	<S> OUTFLARING DIRECT
<G> FLATTENED INTERIOR THICKENED	<T> OUTFLARING TAPERED
<H> EXTERIOR THICKENED	<U> TAPERED (GENERAL)
<I> ROUNDED EXTERIOR THICKENED	<V> DIRECT VERTICAL
<J> EXTERIORLY BOLSTERED	<W> EVERTED
<K> BEVELLED	<X> TRIANGULAR X-SECTION
<L> 'T-SHAPED'	<Y> FLATTENED EVERTED
<M> FLATTENED	

Your choice (A - Y)?

Lip Treatment

<A> UNKNOWN
<B> PLAIN
<C> SLIPPED
<D> INCISED
<E> GROOVED
<F> APPLIQUE'
<G> SLIP + INCISION
<H> SLIP + INCISION + APPLIQUE'
<I> SLIP + APPLIQUE'
<J> SLIPPED AND GROOVED'
<K> PAINTED AND GROOVED
<L> SCALLOPED
<M> SLIP + SCALLOPING
<N> SLIPPED AND FLANGED
<O> SLIP + FLANGE + INCISION
<P> PAINTED AND FLANGED
<Q> PAINTED

Your choice (A - Q)?

Incision Depth

<A> UNKNOWN
<B> NO INCISION
<C> WIDE, ROUND-BOTTOMED GROOVING
<D> GROOVE-INCISION
<E> HARD, PRE-FIRING INCISION
<F> FINE PRE-FIRING INCISION
<G> COARSE PRE-FIRING INCISION
<H> FINE, POST-FIRING ENGRAVING
<I> COARSE, POST-FIRING ENGRAVING
<J> GOUGE-INCISION
<K> FINE STRIATIONS
<L> HEAVY STRIATIONS
<M> STICK BURNISHING

Your choice (A - M)?

Incision Design

<A> UNKNOWN
<B> NO INCISION
<C> HORIZONTAL (GENERAL)
<D> SINGLE HORIZONTAL
<E> MULTIPLE HORIZONTAL
<F> VERTICAL (GENERAL)
<G> SINGLE VERTICAL
<H> MULTIPLE VERTICAL
<I> 'COMBED' VERTICAL
<J> HORIZONTAL AND VERTICAL
<K> GEOMETRIC FREIZE
<L> HATCHED RECTANGLES
<M> HATCHED TRIANGLES
<N> STRIATIONS
<O> GUILLOCHE
<P> STRIATIONS W/ OCHER
<Q> OBLIQUE
<R> HORIZONTAL AND OBLIQUE
<S> OBLIQUE W/ OCHER
<T> H/V INFILLED W/WHITE
<U> HORIZONTAL ZONING
<V> PARALLEL INCISIONS
<W> ZONING (GENERAL)
<X> OCHER CROSSHATCH
<Y> GEOMETRIC (GENERAL)
<Z> GEO. W/ OCHER

Your choice (A - Z)?

Impressions

<A> UNKNOWN
<B> NO IMPRESSIONS
<C> FINGERNAIL (GENERAL)
<D> SINGLE-ROW FINGERNAIL
<E> DOUBLE-ROW FINGERNAIL
<F> MULTIPLE-ROW FINGERNAIL
<G> SHELL STAMPED (GENERAL)
<H> SHELL ROCKER-STAMPING
<I> SHELL DRAG-AND-JAB
<J> MOJICA:MOJICA
<K> MOJICA:CORRIDA
<L> MOJICA:ARRASTRADA
<M> SINGLE-ROW TRIANGLE
<N> DOUBLE-ROW TRIANGLE
<O> MULTIPLE-ROW TRIANGLE
<P> BAR IMPRESSIONS
<Q> TINY IMPRESSIONS
<R> REED IMPRESSIONS
<S> TRIANGULAR (GENERAL)
<T> ZONED (GENERAL)
<U> STAMPING (GENERAL)
<V> V-SHAPED IMPRESSIONS
<W> LIGHT IMPRESSIONS
<X> LINEAR ON APPLIQUE
<Y> UNIDENTIFIED TRACES
<Z> VERT. TICKS W/OCHER

Your choice (A - Z)?

Adorno

<A> UNKNOWN
<B> NO ADORNOS
<C> BODY - ANTHROPOMORPHIC
<D> BODY - ZOOMORPHIC
<E> BODY - BIRD EFFIGY
<F> LIP - ANTHROPOMORPHIC
<G> LIP - ZOOMORPHIC
<H> LIP - BIRD EFFIGY
<I> SUPPORT - ANTHROPOMORPHIC
<J> SUPPORT - ZOOMORPHIC
<K> SUPPORT - BIRD EFFIGY

Your choice (A - K)?

Punctation

<A> UNKNOWN
<B> NO PUNCTATION
<C> HORIZONTAL (GENERAL)
<D> VERTICAL (GENERAL)
<E> SINGLE-ROW HORIZONTAL
<F> DOUBLE-ROW HORIZONTAL
<G> MULTIPLE-ROW HORIZONTAL
<H> VERY FINE SINGLE ROW
<I> ZONED PUNCTATION (GENERAL)
<J> LARGE ZONED PUNCTATION
<K> FINE ZONED PUNCTATION
<L> HEAVY PUNCTATION (GENERAL)
<M> FINE PUNCTATION (GENERAL)
<N> DRAG-AND-JAB
<O> OBLIQUE PUNCTATION
<P> FINE W/ OCHER
<Q> PUNCTATE APPLIQUE
<R> FINE VERTICAL

Your choice (A - R)?

Modelling

<A> UNKNOWN
<B> NO MODELLING
<C> BODY ANTHROPOMORPHIC
<D> BODY ZOOMORPHIC
<E> RIM DECORATION
<F> MODELLED SUPPORTS
<G> MODELLED HORIZ. RIDGES

Your choice (A - G)?

Applique'

<A> UNKNOWN
<B> NO APPLIQUE'
<C> GENERAL APPLIQUE'
<D> STRIP APPLIQUE'
<E> STRIP APPLIQUE' W/ GROOVING
<F> ZOOMORPHIC APPLIQUE'
<G> ZOOMORPHIC APPLIQUE' ON HANDLE
<H> ZOOMORPHIC APPLIQUE' ON BODY
<I> ZOOMORPHIC APPLIQUE' ON SUPPORTS
<J> ANTHROPOMORPHIC APPLIQUE'
<K> ANTHROPOMORPHIC APPLIQUE' ON HANDLE
<L> ANTHROPOMORPHIC APPLIQUE' ON BODY
<M> ANTHROPOMORPHIC APPLIQUE' ON SUPPORTS
<N> PELLET APPLIQUE'
<O> VERTICAL STRIPS
<P> LINEAR STRIPS
<Q> CURVILINEAR STRIPS

Your choice (A - Q)?

Red Painting

<A> ABSENT
<B> PRESENT
<C> LINEAR ELEMENTS
<D> BAND ON INT. AND EXT. RIM
<E> BAND ON INTERIOR RIM ONLY
<F> BAND ON EXTERIOR RIM ONLY
<G> NARROW VERT./HORIZ. LINES
<H> NARROW VERTICAL LINES
<I> NARROW HORIZONTAL LINES
<J> MULTIPLE WAVY LINES, INT.
<K> MULTIPLE WAVY LINES, EXT.
<L> WIDE VERTICAL BANDS
<M> WIDE HORIZONTAL BANDS
<N> WIDE HORIZONTAL STREAKS
<O> TRIANGULAR MOTIFS
<P> TRIANGLES ON INT., RED LINES
<Q> TRIANGLES ON EXT., RED LINES
<R> PAINTED ZONING
<S> INCISED ZONING
<T> SLIP ON LIP
<U> SLIPPING ON VESSEL BOTTOM
<V> SLIPPING ON RIM AND NECK
<W> SLIPPING ON INT & LIP
<X> RED DESIGN ON LIP
<Y> RED ON STRIP APPLIQUE'
<Z> SPLOTCHY APPLICATION

Is the design listed here?

Black Painting

<A> ABSENT
<B> PRESENT
<C> LINEAR ELEMENTS
<D> BAND ON INT. AND EXT. RIM
<E> BAND ON INTERIOR RIM ONLY
<F> BAND ON EXTERIOR RIM ONLY
<G> NARROW VERT./HORIZ. LINES
<H> NARROW VERTICAL LINES
<I> NARROW HORIZONTAL LINES
<J> MULTIPLE WAVY LINES, INT.
<K> MULTIPLE WAVY LINES, EXT.
<L> WIDE VERTICAL BANDS
<M> WIDE HORIZONTAL BANDS
<N> DECORATION OF APPLIQUE'
<O> TRIANGULAR MOTIFS
<P> TRIANGLES ON INT., LINES
<Q> TRIANGLES ON EXT., LINES
<R> PAINTED ZONING
<S> INCISED ZONING
<T> SLIPPING
<U> SLIPPING ON VESSEL BOTTOM
<V> SLIPPING ON RIM AND NECK
<W> SLIPPING ON INTERIOR
<X> BLACK DESIGN ON LIP
<Y> SURFACE OF RIM
<Z> SPLOTCHY APPLICATION

Your choice (A - Z)?

Polychrome

<A> ABSENT
<B> PRESENT
<C> GEOMETRIC DESIGNS
<D> WHITE WAVY LINES ON RED
<E> RED WAVY LINES ON WHITE
<F> BAR-AND-DOT RIM MOTIF
<G> 'KAN' CROSS MOTIF
<H> HUMAN FIGURE MOTIF
<I> BLACK WAVY LINES ON WHITE
<J> RED AND BLACK ON WHITE
<K> MULTIPLE WAVY LINES, EXT.
<L> RED GEOMETRIC ON WHITE
<M> RED GEOMETRIC AND WAVY
<N> ORANGE BANDS ON WHITE
<O> PAPAGAYO LIFE FORMS ON EXT.
<P> PAPAGAYO LIFE FORMS ON INT.
<Q> CHIRCOT JAGUAR PATTERN
<R> ALTIPLANO INTERIOR
<S> ALTIPLANO EXTERIOR
<T> BLACK AND RED LINES ON WHITE
<U> ORANGE AND BLACK DESIGNS
<V> STEP-AND-FRET MOTIF
<W> 'JAGUAR JAW' MOTIF
<X> BLACK & WHITE ON RED

Your choice (A - X)?

Function

<A> UNKNOWN
<B> STORAGE
<C> LARGE, UTILITARIAN STORAGE
<D> SMALL, SPECIALIZED STORAGE
<E> SERVING
<F> COOKING
<G> DECORATIVE OR CEREMONIAL
<H> UTILITARIAN (GENERAL)
<I> SPINDLE WHORL
<J> GENERAL THIN-WALLED
<K> WORKED SHERD

Your choice (A - K)?

Use Wear

<A> UNKNOWN
<B> NO WEAR PRESENT
<C> WEAR ON EXTERIOR
<D> ABRASION ON BASE OR SUPPORTS
<E> ABRASION ON HANDLES
<F> WEAR ON INTERIOR
<G> ABRASION ON INTERIOR BOTTOM SURFACE
<H> ABRASION ON VESSEL RIM
<I> INTERIOR AND EXTERIOR WEAR

Your choice (A - I)?

Burning

<A> UNKNOWN
<B> NO CHARCOAL
<C> CHARCOAL ON INTERIOR
<D> CHARCOAL ON EXTERIOR
<E> CHARCOAL ON INTERIOR AND EXTERIOR
<F> FIRECLOUDS
<G> BLACKENED INTERIOR
<H> BLACKENED EXTERIOR
<I> BLACKENED INTERIOR AND EXTERIOR

Your choice (A - I)?

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