Ford Revisited: A Critical Review of the Chronology and Relationships of the Earliest Ceramic Complexes in the New World, 6000-1500 B.C.

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Abstract

In 1969, Ford offered a comprehensive model for the diffusion of ceramic production and Formative lifeways in the New World. Although criticized as simplistic, it was echoed by other "unitary" models, such as Lathrap's spread of Tropical Forest culture outward from a lowland South American hearth. Radiocarbon dates suggest that the earliest American pottery appears in the Amazon basin as early as 6000 B.C. However, there is little support for an "ex Amazonas lux" spread of pottery technology. Diffusionary models predict early complexes will resemble one another at first and then diverge over time, but comparative analysis reveals substantial variability even at the earliest time level. Heterogeneity among the earliest complexes indicates several likely hearths for the independent evolution of ceramic production, including: 1) lowland Brazil, 2) northern Colombia; 3) coastal Ecuador, 4) coastal Peru, 5) central Panama, 6) southern Mesoamerica, 7) the southeastern U.S., and 8) the central U.S.

KEYWORDS: Ceramics, Americas, Early Formative, Radiocarbon Dating

INTRODUCTION

Since the first stratigraphic excavations in Mexico and the southwestern U.S., ceramics and cultural chronologies in the New World have been inextricably linked. The appearance of pottery is used to signal significant boundaries in regional periodizations, as indicated by pottery's role in the definition of the Early Woodland, Pueblo I, Early Formative, Early Preclassic, and Initial Periods. Interest in early ceramic complexes of the New World has waxed and waned as theoretical concerns shifted from time-space systematics to issues of culture process, but the examination of patterns in ceramic manufacture and decoration remains one of the most useful methodologies for investigating culture history. Ford's (1936) observation that ceramics can be used to measure cultural variation in space and time has long been taken for granted, but there have been few evaluations of broad patterns of ceramic complexes in the Americas since his posthumous synthesis (Ford, 1969). New evidence for pottery dated to 6000 B.C. from the lower Amazon (Roosevelt et al., 1991) calls for a re-evaluation of the chronology and significance of early ceramics for interpreting relationships between early societies in the New World, especially with regard to the emergence and spread of pottery.

The origin of ceramic technology in the Americas has long been a source of debate. A perusal of current world prehistory texts is revealing of what is often considered common knowledge. Fiedel (1992, p. 353), citing associations of ring-shaped shell mounds with fiber-tempered pottery at Puerto Hormiga in northern Colombia and in the southeastern U.S., as well as dates for early ceramics from coastal Ecuador and the Tehuacán Valley, asks:

> Is this simply a matter of two isolated groups of coastal shellfish collectors independently discovering that, as replicative experiments have shown, vegetal fibers make an excellent tempering agent? Or can it be that the appearance of pottery in all these areas between 3000 and 2000 B.C. is not a coincidence, but instead shows that ceramic techniques diffused from a single source?

The actual situation is considerably more complicated than these questions imply. The earliest pottery in northern Colombia does not come from coastal shell middens, but inland sites where shellfish were a relatively minor component of the diet. Many of the shellfish collectors using early pottery in the southeastern U.S. were not on the coast, but at inland sites with freshwater molluscs. That pottery first appeared "in all these areas between 3000 and 2000 B.C." is also a fallacy. With calibration, the period during which early ceramic complexes appeared in Colombia and the southeastern U.S. stretches out to over 2000 calendar years. What at one time appeared to be a relatively rapid and uniform spread of technology has been revealed to be a highly variable process occurring over a period of several thousand years.

The adoption of ceramics has frequently been interpreted as an important step towards the emergence of complex society. Spinden (1917) argued that regionally specialized cultures emerged from a common base of village farming, and suggested that both pottery and early agriculture had diffused north and south in the Americas from an ancient hearth in Mexico. Vaillant (1934) recognized that the picture was far more complex, but acknowledged the importance of understanding a common cultural substrate. By the late 1950s, it was clear that

there had been a long tradition of ceramic production in the Americas. The advent of ^{14}C dating helped anchor complexes in time, confirming that pottery use had begun at least as early as 3000 B.C. Willey and Phillips (1958), while recognizing that ceramics and early agriculture did not always go hand in hand, emphasized pottery as an important component of their Formative stage.

Spinden's was but one of the first in a long line of diffusionistic models. By the mid-1960s, early dates suggested that the origins of New World ceramic technology were to be found not in Mexico but South America--and possibly Japan. Pottery from Ecuador dating to ca. 3000 B.C. was surprisingly sophisticated. To Estrada, Meggers, and Evans (1962, Meggers et al., 1965, Meggers and Evans, 1966) and Ford (1969), similarities between Valdivia and Jomon pottery indicated that the former had been introduced to the Americas by seafaring colonists. The hypothesis for a Japanese origin of Valdivia ceramics has been weakened by arguments that chance landings of Jomon fishermen would have been highly unlikely (McEwen and Dickson, 1978) and by the fact that Jomon specialists have been reluctant to offer it support. Advocates of this hypothesis have made it difficult for others to evaluate their comparisons by failing to present Jomon and Valdivia assemblages in comparable detail and by neglecting to cite references that would permit an objective review of the Japanese data. Meggers (1987, 1992) remains adamant that ceramic resemblances indicate transpacific diffusion. However, few archaeologists support her position, and she has yet to address recent evidence that indicates temporal priority for ceramic production in Brazil and northern Colombia.

According to Ford's "Colonial Formative" model, ceramic-producing cultures from coastal Ecuador established colonies on the Caribbean coast of Colombia that later served as points of origin for the fiber-tempered ceramic technologies of Florida and Georgia. Northwestern South America was also the source of inspiration for Mesoamerican ceramic traditions (Ford, 1969, p. 185). Meggers and Evans (1978), indefatigable supporters of this model, cited coastal Ecuador as the origin of a cultural expansion that skirted inland regions of South America and led to the colonization of the coasts of Guayana and eastern Brazil by early ceramic-producing populations with coastal-oriented economies. From the evidence available in the 1950s through the 1970s, it was apparent that a disproportionate number of sites with early ceramics were characterized by shell mounds. This helped foster the perception that subsistence and settlement patterns associated with these early complexes were relatively homogeneous. Proponents of these models included Meggers and Evans (1962; Meggers et al., 1965), Coe (1960, 1961), and Ford (1969). The spirit, if not the specifics, of their arguments appealed to a large number of scholars (cf. Lathrap et al., 1975; Lowe, 1975; Myers, 1978).

The model advocated by Ford and by Meggers and Evans saw a common origin in Jomon for Valdivia, Puerto Hormiga, and Stalling's Island pottery, as well as that of Alaka (Guyana) and Mina (Brazil) (Meggers and Evans, 1978, Fig. 12.3). Its principal critic was Lathrap (1971, 1973, 1977), for whom similarities between Valdivia and early ceramics from the eastern slopes of the Andes supported an origin for ceramic technology in lowland South America. Linking ceramics with agriculture and belief systems, he proposed a unitary model for the

expansion of a Formative culture with its roots in the tropical forests of the Amazon basin. It was his firm belief that Precolumbian agriculture and sedentism originated in the Amazon, where the tropical forest provided a fertile environment for the evolution of rich mythologies and complex ideologies that provided foundations for the first agricultural societies in Mesoamerica, the Central Andes, and the southeastern United States (Lathrap, 1971, 1977, 1982, 1987). Among the attractions of this model was the notion of a common Formative substrate for all New World complex societies. While the motivations for such a model are complex, its theoretical underpinnings can be traced to ideas such as Childe's (1942) concept of a "neolithic revolution" (Lathrap 1966, p. 266), and Sauer's (1952) models for human dispersals of useful plants, and the demographic and technological trends that accompanied the domestication of plants and animals. This concept led to an implicit linkage of sedentism and ceramic production with agriculture, along with the notion that models for the diffusion of ceramic technology could also be used to explain the spread of Formative lifeways.

In the 25 years since the publication of Ford's model, there has been a phenomenal increase in the quality and quantity of information on early pottery producing societies in the Americas. With increasingly detailed information on specific regional sequences, the explanatory value of broad comparisons has declined significantly. What has emerged is a picture of enormous cultural variability among early ceramic-producing cultures. Models for the relationships between ceramic styles, local identities, cultural practices, and specific historical trajectories have eclipsed models that seek to explain how cultural patterns diffused outward from an ancestral hearth.

Interpreting Early Ceramics

There are several significant obstacles to the interpretation of early ceramic producing cultures. The small number and dispersed nature of early populations makes sites difficult to find. Their frequent location in alluvial or volcanic environments renders most invisible to normal reconnaissance and their ephemeral nature makes them difficult to investigate. This bias in site discovery must be taken into consideration. The large number of early ceramic sites represented by coastal or riverine shell middens may have more to do with our ability to locate sites than with the nature of early subsistence practices. Additional problems are caused by bias in the archaeological record. Although they tend to last longer than subsistence or habitational remains, ceramics, especially when poorly fired, are not always preserved. Fiber-tempered pottery may not survive at all in areas subject to periodic freezing and thawing (Reid, 1984; Skibo et al., 1989). Whole ceramic vessels from the earliest periods are practically unknown.

Despite these problems, pottery is an important class of information. The constituent elements of ceramics, unlike knappable stone, are ubiquitous in the environment. Ceramics are 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. Pottery is common in Precolumbian assemblages. The plasticity of the medium and the additive aspects of decoration, together with the wide range of individuals who can produce these artifacts, make pottery especially informative. Ceramics can elucidate patterns in technology and style as well as modes of production, distribution, and communication.

Furthermore, ceramics tend to "stay in place." In societies that lack sophisticated distribution mechanisms, pottery remains at the household or village level and is therefore likely to indicate local traditions. In the absence of long-distance transport, ideas about technology, form, and decoration move more readily across the landscape than the objects themselves. Changes in ceramic style among early village cultures are more likely to represent the movement of people or ideas than the movement of objects. For this reason, ceramics are especially useful for evaluating culture contact and culture change through time and space.

From a methodological point of view, the problem becomes one of distinguishing between the diffusion of the idea behind the manufacture of fired clay vessels and the independent invention of technologies and styles. Recognizing "contact" or "influence" requires one to establish relationship between cultures producing ceramics for the first time and possible donor cultures. If a given ceramic vessel industry (that is, beyond just the idea of firing clay) is the result of external influence, one should expect a large number of correspondences between this industry and that of its "donor" culture with respect to:

1) techniques of ceramic production, including preparation of the paste (such as addition of a particular temper), vessel forming (modeling, coiling, etc.), and firing;

2) style and decoration, including vessel shapes, appendages, and surface treatment (use of slipping, painting, and plastic manipulation); and

3) broader cultural practices related to ceramic production, distribution, and use.

If such correspondences cannot be demonstrated between contemporaneous ceramic complexes, hypotheses for the diffusion of ceramic production are weakened. If contemporaneous complexes show a high degree of heterogeneity, hypotheses for independent invention may prove to be more parsimonious. This is particularly true when antecedents for pottery containers in different materials, such as gourds or stone bowls, are apparent.

DATING THE EARLIEST CERAMICS 6000-2500 B.C.

Radiocarbon dates in this article are given as ranges of calendar years, calibrated to 95% confidence intervals rounded to the nearest decade. At first citation, they are presented with the sample laboratory number, the date in uncorrected ^{14}C years B.P., and the counting error in brackets. All dates have been calibrated using the CALIB program (revised version 3.03) from the Quaternary Isotope Laboratory at the University of Washington, Seattle (Stuiver and Reimer 1993) and a bidecadal curve recommended as the international standard by the 12th International Radiocarbon Conference (Stuiver and Pearson 1993; Pearson and Stuiver, 1993). Uncorrected dates calculated with a 5730-year half-life for ^{14}C have been adjusted for a 5568-year half-life prior to calibration. However, correction factors for southern hemisphere and marine reservoir effects have not been applied.

The Amazon Basin

The earliest New World pottery is reported from Taperinha, a riverine site with abundant shell on the lower Amazon near Santarem, Brazil (Roosevelt et al., 1991; Fig. 1). Excavations in 1987 revealed 48 strata of shells, pottery, and other

organic remains. Taperinha ceramics have been dated by a series of 13 assays on charcoal, shell, and pottery. These include one conventional date on shell fragments, 11 dates on various materials by accelerator mass spectrometry (AMS), and a single date from thermoluminescence (TL). Two of the AMS dates are from organic residues on a single sherd (Hedges et al. 1992). Given the variety of materials and techniques, the dates are surprisingly consistent. The AMS dates range from 6110-5740 B.C. [OxA-1546: 7090 ± 80 B.P.] to 5430-5050 B.C. [OxA-1540: 6300 ± 90 B.P.], placing the dated portion of the excavated assemblage squarely in the sixth millennium B.C. The single conventional date, from shell excavated at the site in the late 19th century, is 4470-4270 B.C. [GX-12844: 5705 ± 50 B.P.]. The TL date, on the sherd dated by AMS, is 7110 ± 1422 B.P. [Ox-581a36] (Roosevelt et al., 1991).

While excavations at Taperinha have only been partially published, there are several issues to consider in the evaluation of these dates. The ceramic sample from within and below the stratum that produced the earliest date is small (5 sherds in Test 1). Taperinha sherds were found throughout the stratigraphy, from the surface and upper levels (which also contained much later Santarem pottery) to the bottom of Test 1. The majority of Taperinha sherds (62%) came from above the most recently dated level. Since no dates have been provided for the strata in which they appear, it is difficult to determine the full range of time during which this pottery was manufactured. However, it is not difficult to interpret Taperinha as a location utilized periodically over a period of several centuries that was also attractive to much later Santarem peoples.

Of 383 Taperinha sherds, only 3% were decorated. Decoration, which appears in one of the earliest strata, includes notched rims, curvilinear incision, and fine punctation. Vessels included both incurving-rim and straight-sided jars or bowls. Taperinha pottery is a fragile, sand-tempered, red-brown ware, reportedly succeeded by an organic-tempered ware. The priority of sand-tempered pottery in Brazil is the reverse of its relationship to fiber-tempered pottery in northern Colombia. However, fiber-tempered pottery does not appear in the earliest complexes from either Ecuador or southern Central America. There is no reason to believe that fiber-tempered pottery should always appear before other types of ceramics, although organic-tempered pottery may be preferred by mobile groups for their lighter weight and greater durability (Skibo et al., 1989).

Post molds in the lowest excavation levels suggest Taperinha was a small settlement supported by riverine foraging (Roosevelt et al., 1991, p. 1624). Reliability of resources and permanence of occupation would have been advantageous for pottery production. The site's location on a large river system would also have facilitated the communication of technology and presumably the transport of vessels. Given the early appearance of ceramics at Taperinha, it would be surprising if related complexes were not widely distributed throughout the Amazon basin. Although the data from Taperinha suggest great antiquity for sedentary or semi-sedentary villages in the Amazon basin, they also support the hypothesis that ceramic use and agricultural systems are not linked in New World assemblages. It is unlikely that maize was cultivated in the Amazon basin as early as the sixth millennium B.C. Even if present, the economic value of maize as a grain at this time would have been low. Experimentation with manioc for this

time period remains undocumented, and there is no evidence that other domesticates were utilized.

Following Taperinha pottery in time is that of the Mina phase, known from shellmounds near the coast in mangrove swamps south of the mouth of the Amazon (Simoes, 1981). Twelve ^{14}C determinations have been obtained from charcoal and shell in direct association with Mina pottery at the sites of Porto da Mina and Ponta de Pedras. Several were published by Simoes (1981); however, errors and exclusions have been corrected here using original records (Smithsonian Institution Archives, Accession No. 87-035, Smithsonian Environmental Research Center, Radiocarbon Dating Laboratory Records, c. 1968-1986, Box 9.) At Porto da Mina, the nine earliest dates range from 4350-3390 [GX-2472: 5115 ± 195 B.P.] to 3340-2790 [SI-2544: 4380 ± 80 B.P.]. At Ponta de Pedras, the earliest date was 3500-2910 B.C. [SI-1030: 4500 ± 90 B.P.] (Simoes, 1981, p. 18). There is no indication that either of these sites had Preceramic occupations. The Mina phase is defined on the basis of a sample of 64,332 sherds, 60% of which came from stratigraphic excavations. Unlike the much earlier Taperinha ceramics or contemporaneous pottery from northern Colombia, it is predominantly shell-tempered. Mina also differs from early Colombian pottery in that about 27% of the sample, from the latter part of the phase, had a red wash. At this early date, Mina and Valdivia 2 (Hill, 1975, or Valdivia A [Meggers et al., 1965]) are the only complexes in the New World with red slipping, which is not known to appear elsewhere in South America until about 1800 B.C. In spite of this shared trait, which may differ significantly in that early Valdivia pottery has a thick, maroon slip while Mina pottery is described as

having a "red wash," Mina and Valdivia vessel forms are quite distinct. Mina vessels are described as round, flat-based vessels with incurving or (more commonly) outcurving direct rims and flat or rounded lips. Decoration includes brushing, scraping, rouletting, and some incising (Simoes, 1981).

Meggers and Evans (1978, p. 551) cite a strong affinity between Mina pottery and the shell-tempered Alaka phase ceramics from Guyana. The latter have not been as well dated. Two dates of 4950-4730 [SI-4333: 5965 ± 50 B.P.] and 2880-2490 [SI-4332: 4115 ± 50 B.P.] were obtained from excavations in middens of freshwater shell at Barabina (Williams, 1981, pp. 15-16), an inland site located in a range of small hills, but the association of Alaka ceramics with these dates is not clear. Williams (1981, p. 21) notes two sherds at a depth of 35 cm, the same as that of SI-4332. However, they appear below a burial and are attributed to disturbance. Verrill (1918, p. 13), in earlier excavations at the site, reported pottery throughout the depth of the shell deposits. Further investigation is required if temporal as well as stylistic correlations are to be established between the two.

The earliest Taperinha dates are about 1400 years earlier than the oldest ceramic complex in Colombia (Oyuela, 1987, 1990). There is also a gap of about 1200 ^{14}C years between the most recent AMS date in the Taperinha series and the oldest date for Mina. It is only fair to note that the great antiquity of the series of twelve dates from Taperinha and its range relative to those for the next earliest ceramic complexes in South America immediately calls it into question. An alternative interpretation is that there is something wrong with the Taperinha chronology. However, given that the dates derive from a number of materials

(charcoal, shell, and organic acids in the pottery itself) and include a TL date (albeit imprecise) as well as both conventional and AMS dates, it is difficult to reject the Taperinha series on technical grounds. At first consideration, the Taperinha dates seem much too early. But how early is "too early"? Until it can be demonstrated that there has been some systematic error in the dating of materials from the site, the series cannot be rejected out of hand without also rejecting several other early dates from lowland South America..

If the Taperinha dates are correct, it is clear that we are only beginning to appreciate the vast antiquity of ceramic traditions and semi-sedentary or sedentary settlements in the rich floodplains of the Amazon basin. However, recent publications on ceramic typology and chronology in this region are notoriously poor. Much more needs to be learned (and published) about early Brazilian ceramics before relationships between early pottery-producing cultures can be satisfactorily appraised. At present, gaps in time and space make it difficult to evaluate possible relationships between Taperinha pottery and early ceramics of northern Colombia and coastal Ecuador. If ceramic traditions do begin in lowland South America as early as 6000 B.C., one of their characteristics is a remarkable conservativeness in techniques of ceramic decoration, with simple techniques of incision and punctation enduring for several thousand years.

Northern Colombia

The earliest ceramics in Colombia come from several sites (Reichel-Dolmatoff, 1965a, 1965b, 1985; Oyuela, 1987, Rodriguez, 1988, Legros et al., 1988, Oyuela, 1990, Oyuela and Rodriguez, 1990), including Puerto Hormiga,

Monsú, San Jacinto 1, San Jacinto 2, Puerto Chacho, Canapote, and Barlovento (Fig. 2). These provide an almost continuous sequence, although a high degree of local variabilty makes it difficult to determine specific relationships between local assemblages.

The earliest pottery is from San Jacinto 1, a small (380 m²) site formed by the occupation of a point bar in a stream meander in the foothills south of the Canal del Dique near Cartagena. It is dated by three assays: 4940-4710 B.C. [PIT-0155: 5940 ± 60 B.P.], 5450-3640 B.C. [Beta-20352: 5700 ± 430 B.P.], and 4710-4350 B.C. [PIT-0154: 5665 ± 75 B.P.] (Oyuela, 1990), all from charcoal in stratified occupational refuse. Excavations in 1992 revealed the existence of buried house floors and hearths in association with a larger ceramic sample. However, the excavator estimates that no more than 20-30 people were living at the site at a single time (Oyuela, personal communication, 1992). The initial pottery sample consisted of 352 sherds tempered with chopped grass (Oyuela, 1987, 1990). Vessels included incurving-rim bowls, globular neckless jars, and spouted jars decorated with deep incision, excision, and modeled zoomorphic motifs. Decorative motifs are highly diverse. Oyuela suggests that, unlike the standardized motifs found on later pottery at Puerto Hormiga and Monsú, this represents a period of experimentation.

Decorated fiber-tempered pottery similar to that from San Jacinto 1 was also found at Puerto Chacho (Legros et al., 1988) and nearby San Jacinto 2 (Oyuela, 1987, 1990). At both sites, it was in deposits with sand-tempered sherds. A date of 4310-3800 B.C. [Beta-26200: 5220 ± 90 B.P.] comes from deposits with ceramics at Puerto Chacho (Oyuela and Rodriguez, 1990). San Jacinto 2, a

hilltop site that may represent a village of around 100 people (Oyuela, personal communication, 1992), differs from Puerto Chacho, Puerto Hormiga, and Monsú in that it is has no shell middens. Organic temper in sherds provided two dates: 3510-2940 B.C. [PIT-0362: 4565 ± 80 B.P.] and 2030-1620 B.C. [PIT-0361: 3505 ± 85 B.P.]. The dates are widely separated in time. However, if the former is correct, it suggests contemporaneity with sherds from Puerto Hormiga (see below), which also had both fiber- and sand-tempered pottery.

Monsú, south of Cartagena, was originally described as having the earliest ceramics in South America (Reichel-Dolmatoff, 1985) based on an early date of 4330-3960 B.C. [UCLA-2149C: 5300 ± 80 B.P.] on shell associated with Monsú and earlier Turbana phase pottery. Although Reichel-Dolmatoff (1985, p. 175) thought it dated material from the end of the Monsú period, it is much too early on stylistic grounds. The decoration on Turbana and Monsú ceramics, which Reichel-Dolmatoff (1985, p. 175) tentatively dated to ca. 4600-4200 B.C. (5750-5350 B.P.), is similar to that on Canapote pottery, which dates to ca. 2300 B.C. (Wippern, 1987, Rodriguez, 1988, Rodriguez, 1990, Oyuela, 1990, Raymond et al., 1991). Two assays, one on bone associated with Turbana ceramics beneath the above-mentioned sample (UCLA-2149C) and dating to 3660-1740 B.C. [UCLA-2568F: 4170 ± 360 B.P.] and one on a shell artifact from overlying strata associated with Pangola phase pottery (Reichel-Dolmatoff, 1985, p. 175) of 2929-2500 B.C. [UCLA-2149B: 4200 ± 80 B.P.] are more consistent with the later interpretation.

Puerto Hormiga, also near the Canal del Dique, was one of the first sites acknowledged to have third millennium B.C. pottery (Reichel-Dolmatoff, 1965b).

Its principal occupation dates sometime between 4000-2500 B.C., based on five dates ranging from 3980-3670 B.C. [SI-153: 5040 ± 80 B.P.] to 3780-2490 B.C. [I-1123: 4502 ± 250 B.P.] (Reichel-Dolmatoff, 1965, p. 46). All were associated with undecorated fiber-tempered and decorated, sand-tempered ceramics that fall into three principal "wares" (Reichel-Dolmatoff, 1965b). The most abundant was tempered with long, thin fibers with round cross-sections that left tubular hollows and gave sherds a "sponge-like consistency" inimical to preservation. The second consists of stronger pottery tempered with short, flat leaves. The third, and least abundant, was sand-tempered. Fiber-tempered vessels were formed by modeling and fired at low temperatures. Only the sand-tempered pottery was coil-made and decorated.

Decoration on the sand-tempered Puerto Hormiga pottery includes shallow grooving with a red ochre fill, dentate rocker-stamping, shell-edge stamping, and modelled zoomorphic appendages (Reichel-Dolmatoff, 1965b, p. 55). Curvilinear motifs are common, and design elements include zoned areas of punctation, stamping, and incised lines.

Coastal Ecuador

Some intriguing ceramic artifacts from coastal Ecuador raise further questions about models for transpacific diffusion. At Altomayo, Damp and Vargas (1990) describe a strip of burned clay and a "tangerine-sized piece of fired clay [that] clearly depicts the pattern of fingers pressed into a ball of soft clay" from preceramic levels. The authors interpret these to represent "a period of experimentation with clay as a plastic medium... formed and intentionally fired to

create ceramic objects." A flat stone object with incisions, described as a precursor to plain stone figurines characteristic of early Valdivia, is believed to support the interpretation of these levels as pre-Valdivia. However, this evidence remains tenuous at best. The site, a camp for the seasonal exploitation of mangrove resources, may be aceramic rather than Preceramic. Damp and Vargas place the early levels of Altomayo in the Chuculunduy phase, intermediate between the preceramic Vegas (8000-4650 B.C.) and early ceramic Valdivia (3500-1650 B.C.) phases. However, without associated ^{14}C dates, the argument that these levels represent the beginning of Valdivia ceramic technology remains weak.

Bischof and Viteri (1972), during a re-excavation of the Valdivia type site, identified 27 sherds in strata below ones with Valdivia pottery as a pre-Valdivia complex called San Pedro. No dates were reported for San Pedro levels, but four come from underlying ones. These range from 3490-3040 B.C. [Hv-4839: 4535 ± 55 B.P.] to 2900-2290 B.C. [Hv-4675: 4075 ± 110 B.P.]. Although from aceramic deposits (Bischof, 1972, p. 272), they are significantly later than some Valdivia dates. Damp (1988) notes that pottery similar to San Pedro was found in Valdivia 2 levels at Real Alto, for which he suggests a date of around 2400 B.C., about 1000 years too late to be "pre-Valdivia."

Recognition of the earliest phase of Valdivia ceramic production remains problematic. Hill (1975) sees the earliest facet of Valdivia ceramics (Valdivia 1) as characterized by simple, necked vessels that have no resemblance to Jomon pottery. On the basis of studies of large collections of material, she concludes that the entire sequence can be interpreted as a product of in situ culture change--not

one introduced from abroad (Hill, 1975, p. 25). Meggers (1988, 1992) has argued that Hill's seriation is erroneous because it was based primarily on materials from surface collections and excavations at Punta Concepción, a site whose assemblage may not be representative of the full range of ceramic variation, is erroneous. However, Hill also made use of less-problematic excavated materials from Loma Alta (see below). Unfortunately, the Valdivia type site, excavated by Meggers, Evans, and Estrada (1965), is also poor one for dating the beginnings of this culture. Bischof and Viteri (1972, p. 550) report stratigraphic intrusions into underlying aceramic deposits and charcoal that may contaminate that of ceramic-bearing levels (Bischof, 1972, p. 271). It has long been noted that the oldest date from this site of 4330-3640 B.C. [M-1320: 5150 ± 150 B.P.] is stratigraphically and temporally out of order (Bischof, 1972, p. 269; Hill, 1975, p. 7). Still, the remaining 17 dates from Meggers, Evans, and Estrada's (1965) excavations range from 3690-2920 B.C. [M-1322: 4620 ± 140 B.P.] to 2870-2410 B.C. [W-630: 4050 ± 55 B.P.] with only small deviations in stratigraphic order.

The earliest dates for Valdivia ceramics are not from the type site but from Real Alto, in the Chanduy Valley, and Loma Alta, in the Valdivia Valley (Lathrap et al., 1977, 1986; Damp, 1984a, 1984b; Stahl, 1984). Several of these are also problematic. Of two dates from Real Alto, 5560-4600 B.C. [GX-5269: 6095 ± 215 B.P.] and 4780-3830 B.C. [GX-5267: 5495 ± 200 B.P.], the first is out of sequence and considered to be too early (Damp, 1984a, p. 574). Although the second comes from a midden adjacent to a Valdivia 1 house feature, its validity is also doubted (Damp et al., 1981, p. 811). A third, 5050-3950 B.C. [ISGS-448: 5620 ± 250 B.P.], is from an aceramic level underlying the earliest Valdivia

occupation (Lathrap et al., 1977) and may predate the ceramic occupation. The earliest accepted date comes from Loma Alta, a site with no shell middens located approximately 15 km inland, where a date of 4460-3700 B.C. [GX-7704: 5275 ± 175 B.P.] was associated with a Valdivia 1 household cluster (Damp, 1984a). This sample comes from a hearth at the base of cultural deposits and precedes a cluster of six dates between about 4000-3500 B.C. (see Stahl, 1984), that Damp (1984a, p. 574) interprets as representing "a well established Valdivia 1 occupation." Five additional dates from stone cairns range from 4040-3540 B.C. [I-7076: 5010 ± 120 B.P.] to 3640-2920 B.C. [ISGS-192: 4590 ± 120 B.P.] (Hill, 1975, Fig. 3). On the basis of these, Damp (1984a, p. 573) estimates that Valdivia 1 lasted from about 5250-4650 B.P., or 4000-3400 B.C. It is important to note that the Valdivia phase as a whole lasts over 2000 years, ending around 1700 B.C.

Central Panama

Monagrillo pottery has been identified in deposits stratified over Preceramic levels at five rockshelters. It appears in environments as diverse as the Río Cobre shelter at over 1000 m in a humid montane forest and at five shellmounds in the coastal zone, including the Monagrillo type site and Zapotal (Cooke and Ranere, 1992a, P. 270-271). There are a total of 18 dates from contexts with Monagrillo ceramics, which were also made over a span of 2000 years. The earliest, 4450-3980 B.C. [SI-2841: 5385 ± 95 B.P.], is from the type site on Parita Bay. However, it comes from dispersed charcoal fragments in reworked beach sediments and is unreliable (Hansell and Adams 1980). A later date of 3780-3360 B.C. [TEM-119: 4800 ± 100 B.P.], from shells associated with

an occupational midden containing 383 sherds at the inland site of Cueva de los Ladrones is suggested by Cooke (1984) as the earliest acceptable date for pottery. At the base of the feature, charcoal from a preceramic hearth dated to 3510-2910 B.C. [TEM-124: 4520 ± 100 B.P.], suggesting a preceramic/ceramic transition at the site at around 3500 B.C. Three other dates from ceramic-bearing deposits are 2570-2050 B.C. [TEM-122: 3880 ± 80 B.P.], 2570-2030 B.C. [TEM-121: 3860 ± 90 B.P.], and 2460-1940 B.C. [TEM-120: 3770 ± 80 B.P.]. Nine others have been obtained from the type site. The earliest acceptable assays are: 3340-2880 B.C. [SI-2842: 4405 ± 75 B.P.] (Ranere and Hansell, 1978), 3500-2500 B.C. [TEM-208: 4350 ± 165 B.P.] (Cooke, 1984), 2900-2470 B.C. [SI-2844: 4135 ± 80 B.P.] (Ranere and Hansell, 1978), and 2880-2460 B.C. [Y-585: 4090 ± 70 B.P.] (Deevey et al., 1959). These are followed by five dates ranging from 2190-1740 B.C. [SI-2840: 3615 ± 80 B.P.] to 1741-1268 B.C. [SI-2843: 3245 ± 100 B.P.] (Ranere and Hansell, 1978). Together, these date Monagrillo to about 3500-1500 B.C.

Monagrillo pottery is described as "both conceptually conservative and regionally homogeneous" (Cooke and Ranere, 1992a, p. 271). Shapes are simple, lacking bases and collars. According to Cooke and Ranere (1992a, p. 271) "it was made 'serendipitously,' that is, when needed for containing liquids, drinking, and eating. Decoration is absent from the oldest assemblage at Cueva de Ladrones, and it is believed that incised motifs and red paint on vessel rims developed centuries after the pottery was first made (Cooke and Ranere, 1992a, p. 271). Although Ford (1969, p. 157) saw Monagrillo as composed of elements from supposedly earlier traditions in both Mesoamerica and South America "brought to

the south coast of Panama by early seafarers," its temporal priority over any Mesoamerican complexes, technical inferiority to the earliest South American pottery, and its presence at inland as well as coastal sites suggest a local origin.

Monagrillo pottery shows no clear correlation with either sedentism or a particular subsistence strategy, although there is evidence for increasing site size and the use of domestic structures over time. This trend may be associated with "maximization of coastal resources via technological improvements c. 4000 B.P." (Cooke and Ranere, 1992b, p. 126). Given evidence that slash-and-burn cultivation of maize and other crops caused significant alteration of the environment around this same time, the makers of Monagrillo pottery may have been incipient agriculturalists (Bush, cited in Cooke and Ranere, 1992a, p. 273).

Mesoamerica

In Mesoamerica, only two complexes have been interpreted as dating prior to 3000 B.C. These are 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; Fig. 3). Both are characterized by undecorated tecomates (neckless, incurving-rim jars based on gourd forms) of coarse appearence. However, although they may be the earliest ceramics in Mesoamerica, there is a good chance that they have been placed 1000 years too early.

Both Puerto Marquéz and Zanja are coastal sites, similar to some of the early ceramic sites in Colombia, Panama, and Ecuador. Three dates were run on shells from deep excavations at Puerto Marquéz. Two come from preceramic

deposits: 3970-3370 B.C. [H-1263: 4900 ± 130 B.P.] and 3250-2460 B.C. [H-1264: 4200 ± 135 B.P.]. (The first is from the bottom 20 cm of a full meter of deposits completely devoid of ceramic artifacts.) The third, at 3500-2620 [H-1258: 4400 ± 140 B.P.] is from the deepest level with ceramics, 40 cm above the second date. Pottery was reported as abundant in this and all superimposed levels (Brush, 1965, p. 194, Johnson and MacNeish, 1972). H-1264 and H-1258 overlap at the 95% confidence interval (CI). If ceramics do appear at the site sometime between the two dates, the preceramic/ceramic transition probably occurs around 3000-2800 B.C. However, it is important to note that these two samples are close in both time and relative stratigraphic position, and that their temporal and stratigraphic order do not coincide. Shell middens are notorious for the vertical mobility of materials. An alternative interpretation might be that all three dates pertain to the preceramic occupation of the site, leaving Pox ceramics undated and possibly a good bit later.

Purrón ceramics are dated by six assays from two stratigraphic units, ranging from 2890-1880 B.C. [I-762: 3900 ± 180 B.P.] to 2190-1170 B.C. [I-666: 3375 ± 200 B.P.] and overlapping from 2190-1880 B.C., or 310 years, in the 95% CI. The excavators have suggested a beginning date of 2900 B.C. based on similarities to Pox and two dates from the end of the preceding Abejas phase (Johnson and MacNeish, 1972, p. 25). Given their overlap, the dates could well represent a short occupation beginning around 2000 B.C. However, the excavators push for a liberal interpretation to accomodate a continuous sequence. They suggest that the Purrón phase was about 1200 years long, ending around 1700 B.C. (3450 B.P.; MacNeish et al., 1970, p. 21).

Pox pottery is undecorated, with the exception of occasional traces of red slip. Its most diagnostic feature is its rough, pitted surface. 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" (Brush, 1965, p. 194). These forms are similar to those of other early complexes, but do not necessarily indicate temporal priority. Purrón sherds are also 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.

For almost 30 years, Pox and Purrón have remained the only Mexican ceramic assemblages with third millennium dates. This raises the question of why other contemporaneous assemblages have not been identified. One explanation is that the dates have been misinterpreted. If all three of the Puerto Marquez dates pertain to the preceramic occupation, and if we discount the excavator's preference for a continuous sequence and interpret the Purrón levels as a short occupation discontinuous with Abejas, it is difficult to justify dating Pox and Purrón much earlier than 2000 B.C. Until additional information is available, this interpretation is the most parsimonious for its consistency with other dates.

North America

The antiquity of ceramic technology in North America has been evident since the first ^{14}C dates for fiber-tempered pottery from Florida (Bullen, 1960, 1961; Bullen and Stoltman, 1972). Sassaman (1993) defines three distinct areas of fiber-tempered pottery production in the southeastern U.S.: 1) the Stallings and St. Simons traditions of the Savannah River Valley in South Carolina and Georgia, 2)

the Orange tradition of northern Florida, and 3) the Wheeler tradition of the Tennessee Valley. Fiber-tempered pottery has also been reported from the Lower Missouri River (Reid, 1984). The oldest fiber-tempered complex in North America is from Rabbit Mount, in the Savannah River Valley of South Carolina (Stoltman, 1966). Here, Stallings Plain sherds were found in association with two ^{14}C dates: 3630-2880 B.C. [GXO-343: 4525 ± 135 B.P.] and 3610-2920 B.C. [GXO-345: 4540 ± 95 B.P.]. Orange pottery has been associated with a number of dates, the earliest of which include 2920-2350 [O-1047: 4125 ± 115] at Bilbo in Georgia (Bullen, 1961, p. 104), 2890-2460 [?: 4115 ± 77] at Grove's Orange Midden in Florida (Russo et al., 1992, p. 101), and 2910-2200 [G-599: 4050 ± 125] at the Palmer site in west Florida (Bullen, 1961, p. 104). Wheeler series pottery has been associated with few ^{14}C assays, but it is considered on the basis of cross-dating to have appeared around 3000 B.P. (Sassaman, 1993, p. 21).

The dates associated with Stallings pottery substantially overlap those for fiber- tempered pottery at Puerto Hormiga, and similarities in plastic decoration have led several authors to postulate an introduction of fiber-tempered ceramic technology to the southeastern U.S. from northern South America (Ford, 1966, 1969; Crusoe, 1972, Sears, 1977; Meggers and Evans, 1978, Lathrap, 1987). Ford (1966) hypothesized that early fiber-tempered ceramic complexes in North America were derived from those to the south. He specifically suggested that Stalling's Island (Georgia) and Orange Incised (Florida) fiber-tempered pottery represented a combination of Puerto Hormiga technology with Valdivia- and Machalilla-inspired styles. However, the origins of North American ceramics are clearly more complex than a northward diffusion or population migration. The

Thom's Creek tradition on the southern North Carolina coast--once believed to have developed from earlier fiber-tempered wares--is now identified as a sand-tempered industry that was contemporaneous with Stallings and Orange throughout most of the third millennium B.C. (Trinkley, 1980, Sassaman, 1993). Produced on the coast, its inception postdates the inland appearance of Stallings pottery by about 500-600 years. Although a date of 3650-1750 B.C. [UGa-584: 4170 ± 350] comes from Spanish Mount, it has been questioned on the basis of its poor association and large error (Sassaman 1993, p. 20). The earliest acceptable date associated with Thom's Creek is one of 2840-1990 [I-3047: 3890 ± 110] from the Small Ford Shell Ring (Calmes, 1968).

The principal vessel forms for fiber-tempered pottery in the southeastern U.S. are large-mouthed, shallow, open bowls with slightly-rounded to flat bases and straight or slightly incurving rims (Sassaman, 1993, p. 67). The three forms recognized for Thom's Creek are shallow bowls and deep jars with unrestricted orifices and a shallow bowl with a slightly restricted orifice. Fiber-tempered wares are decorated with deep incision ("grooving"), and punctation with a variety of implements. Decoration on both fiber-tempered and early sand-tempered pottery includes stamping with reeds, shells, and fingers (Sassaman, 1993, p. 69).

Although pottery was made over a wide area of the southeastern U.S., the evidence suggests that the adoption of ceramic technology was a slow process, lasting over 2000 years. During this period, its use was variable and highly regionalized, with vessels varying widely in form and decoration. Sassaman (1993), provides the most complete discussion of this variation, suggesting that the appearance and distribution of ceramic vessels and soapstone artifacts reveal

substantial complexity in Late Archaic exhange networks and the effects of social interaction on the adoption of new technology. Furthermore, Bullen's (1960) argument for the independent invention of pottery in the southeastern U.S. has received support from recent evidence. At Grove's Orange Midden in central Florida, fired balls and lumps of clay in association with dates of 4770-4350 B.C. [?: 5691 ± 85 B.P.] and 3370-2690 B.C. [?: 4399 ± 123 B.P.] were recovered from excavation levels which did not contain sherds but were stratified below those containing early pottery. "Thus, the deepest occupation levels at Grove's Orange Midden may represent the period of transition from a pre-ceramic to a ceramic-producing (Orange period) society" (Russo et al., 1992, p. 99)--with a clear implication for local experimentation and independent invention of ceramic vessels. Radiocarbon assays from the site suggest this transition occurred around 3000-2500 B.C.

Long traditions of shellfish collecting before pottery was known raise the question of why this technology did not appear earlier than it did. Sassaman (1993) suggests that the transition to ceramic use resulted from the use of soapstone for indirect moist cooking by sedentary, hunting-and-gathering populations. There is evidence that early experimentation with rudimentary ceramic technology also appears well inland, in areas where shellfishing was not an important activity. In the Munkers Creek phase of the Flint Hills of northeastern Kansas (Schmits, 1978, pp. 123-214; Witty, 1982, pp. 124-126), fired clay beads and small figurines have been associated with an Archaic occupation dating to 5000 B.P. Experimentation during the Munkers Creek phase probably resulted in an independent development of ceramics in Kansas and

Missouri, which first appear between ca. 3300 and 1900 B.C. (Reid, 1984, p. 71). The Nebo Hill phase in the Missouri Valley has been dated by three dates of 3630-2910 B.C. [?: 4550 ± 115 B.P.] from the Turner-Casey site (Schmits and Wright, 1981, p. 511), 2100-1690 B.C. [UGa-1332: 3555 ± 65 B.P.] from the type site (Reid, 1980, pp. 30-31), and 2460 - 20 A.D. [DIC-913: 2970 ± 490 B.P.] from the Sohn site (Reeder, 1978, p. 91) . These are supplemented by a series of four thermoluminescence dates on chert between 1940-1260 B.C. (Blakeslee and Rohn, 1982, pp. 669-670). Fiber-tempered pottery was found at all three sites, although the total sample is small (Reid, 1984, p. 59). Vessels were built from coils or strips and the paste was tempered with prairie tallgrasses and sedges. Apart from a small boss, the sherds are undecorated. Sherd size made it impossible to recognize vessel forms, but it seems likely that Nebo Hill pottery is a local innovation unrelated to fiber-tempered wares from the southeastern U.S. Furthermore, Reid (1984) and Skibo and others (1989) argue that freeze-thaw cycles may have destroyed most of the low-fired ceramics in more northern climates of North America, suggesting that the evidence for early inland complexes may be elusive.

Discussion

There is an enormous range of variability in the quality of the ceramics identified as the earliest complexes in Colombia, Ecuador, Panama, Mexico, and the southeastern U.S. Meggers has suggested that this variability results from a process analogous to the founder effect and genetic drift from a common ancestor (Meggers et al., 1965, pp. 6-7, Meggers, 1975). If this were true, one would expect

the greatest similarity among the earliest complexes, with increasing divergences over time. However, no uniform tradition of ceramic technology can be identified even for the earliest technologies in the period between 4600-2500 B.C.

There is a significant overlap between Monagrillo chronology and the majority of dates for Valdivia. However, the two complexes are different in terms of technology and style. From Valdivia 2 on, the design and technical quality of Valdivia ceramics display a high level of sophistication. Monagrillo pottery, on the other hand, is crude and poorly made (Ford, 1969, p. 155; Cooke and Ranere, 1992a, p. 271). Necked jars, abundant in Valdivia, are absent in Monagrillo and decoration is rare. Monagrillo shares several motifs with Puerto Hormiga, including incised lines ending in punctations, excised areas where lines meet, and spiral motifs (Ford, 1969, pp. 155-157; Cooke and Ranere, 1992, Fig. 7). However, it lacks the latter's modeled, stamped, punctate, and hatched designs. Painted decoration, its most common manifestation in Monagrillo being red-painted bowl rims, is absent on early Colombian ceramics. No fiber-tempered stage has been recognized for Monagrillo, and, unlike the earliest Colombian ceramics, all Monagrillo pottery was shaped by coiling.

In spite of their temporal overlap, the differences between Valdivia, San Jacinto, Puerto Hormiga, Mina, Monagrillo, Stallings, Orange and Thom's Creek ceramics are more remarkable than their similarities. Even if the earliest Colombian ceramics were dated 1000 years later, they would still differ from contemporaneous Ecuadorian pottery. Modelling does not appear in the Ecuadorian sequence until Valdivia 6 (Staller n.d.), and there is no evidence that fiber-tempering was ever utilized as a manufacturing technique in Valdivia or

Monagrillo. The principal vessel shapes of San Jacinto 1 and Puerto Hormiga are large, incurving-rim bowls. In contrast, the earliest Valdivia pottery consists of deep, thick-walled jars, some with everted necks (although small, incurving-rim bowls are present). Their decorative modes are also different. While wide-bottomed groove-incision and channelling on unslipped vessels are common to all of the early Colombian phases, the earliest decoration on Valdivia 1 ceramics is simple "combing", standardized fine-line patterns, and incising on everted necks or the sides of bowls (Hill, 1975). In Hill's seriation, Valdivia 2 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 maroon slip. The chief markers of the next Valdivia phase (Valdivia 3) are "piecrust" rims and the appearance of pottery figurines (Hill, 1975, p. 4).

Stylized figurines and necked jars with elaborate rim forms typical of Valdivia assemblages are absent from all other pre-2000 B.C. complexes. Any attempts to correlate stylistic changes between the Ecuadorian and Colombian sequences are frustrated by major disjunctions. While some of the incised, curvilinear designs in San Jacinto, Puerto Hormiga, and Monagrillo may have been inspired by the deeply incised motifs of Valdivia 4 pottery, they are completely different from a technical point of view. According to Hill's seriation, wide grooving does not appear in Ecuador until Valdivia 4 (ca. 2600 B.C.), almost 1000 years after its appearance in Colombia. Modes strongly diagnostic for Puerto Hormiga and Monagrillo ceramics--zoomorphic modelling on the former and red painted bowl rims on the latter--are absent from the Valdivia sequence. Large,

open plates such as those noted through several phases at sites in northern Colombia are completely unknown from Valdivia.

The following was once a truism: "It is perhaps significant that the earliest pottery form in Colombia, Peru, and Ecuador is... a tecomate" (MacNeish et al., 1970, p. 29). As noted above, the earliest Valdivia vessels are necked jars and shallow bowls, not pumpkin-shaped tecomates. True tecomates do not appear in northern Colombia until the Barlovento phase, and typical Monagrillo ceramics were not gourd-shaped tecomates either, but deep, straight-walled or short, incurving rim bowls. This marked differences between necked and neckless jar traditions suggests divergent traditions of Early Formative vessel shapes existed as early as 3500 B.C. Furthermore, given that most Valdivia ceramics display more sophisticated slipping and firing than either Puerto Hormiga or Monagrillo, evidence for sharing of technological information is limited. Coastal Ecuador apparently did not play a significant role in the transmission of ceramic styles or technology to other parts of the New World during Valdivia times. Differences between the earliest pottery complexes in Brazil, Ecuador, Colombia, and Panama and a range of over 3000 years (ca. 6000-3000 B.C.) for the first appearance of ceramics in each argue strongly for either the independent invention of ceramics in each of these regions or the communication of little more than the idea of fired clay ceramics without templates of form or decoration. The earliest pottery in all areas was extremely simple, was not explicitly linked to a repertoire of formal or decorative modes, and no vessel form, except perhaps large, simple, direct-rim bowls, is common to Valdivia, San Jacinto, Monagrillo, Mina, and Stallings.

It is not until around 2600 B.C. that the ceramics of the Ecuadorian coast resemble assemblages from northern Colombia. According to Hill (1975, p. 17), "semicircular, rectangular, or free form zones outlined by incision and filled with small punctation are found exclusively in Valdivia 6", a phase dated to approximately 2600-2500 B.C. (4100-3950 B.P.; Hill, 1975, p. 21). Recent data (Staller n.d.) indicates these continue to the end of the Valdivia sequence. 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 B.C.

In Mesoamerica, Pox and Purrón have been viewed as credible examples of an incipient or experimental industry, foreshadowed by the use of stone vessels (and probably gourd containers) in the preceding preceramic period. However, both are apparently later than the other phases under discussion. The simplicity and probable later dates for the early Mesoamerican pottery argues in favor of independent invention. Pox and Purrón tecomates are far more similar to gourds than any of the Central or South American vessels, suggesting a direct inspiration from this form in these and related complexes like Espiridión of the Oaxaca Valley (Marcus, 1983).

The tecomate and flat-based, flaring-wall bowl are clearly early forms in the Tehuacan Valley and elsewhere in Mesoamerica. 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 B.C. It is possible that these (which may in turn have imitated gourds) influenced later ceramic forms.

Flat-based, flaring-wall bowls--ubiquitous in virtually all early Mesoamerican assemblages--are absent from Valdivia, Monagrillo, Colombian, and southeastern U.S. assemblages. They appear to be a Mesoamerican innovation with limited geographical distribution, characteristic of Mesoamerican assemblages almost from the inception of ceramic technology.

As MacNeish put it (MacNeish et al., 1970, p. 25), "The source of Purrón pottery and, for that matter, of Mesoamerican pottery in general, is one of archaeology's $64,000 questions." The two principal hypotheses have been independent invention or diffusion from South America. Many scholars have favored the second explanation (cf. Lowe, 1975), but it can be ruled out on both chronological and stylistic grounds. Except for the gourd form itelf, which is present in Mesoamerica well before the earliest pottery, there are no South American ceramic prototypes for the Mesoamerican tecomate. The existence of stone and gourd prototypes for early Purrón supports the hypothesis of local invention. As noted above, however, Mesoamerican ceramics may not appear before 2000 B.C. By this time, technological antecedents are present throughout much of the Central American isthmus. These probably began in central Panama or areas to north, eliminating northwestern South America as the likely source of origin for Mesoamerican ceramic traditions.

REGIONAL EARLY FORMATIVE FLORESCENCE, 2500-1500 B.C.

Mesoamerica

Mesoamerica experienced a veritable explosion of ceramic styles between 2000 and 1500 B.C. There is a great deal of variety between individual

complexes, but 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 decorated ceramics appear during the Barra phase. Three dates are available for this phase from Paso de la Amada (Ceja, 1985; Clark et al., 1987): 2280-1330 B.C. [Beta-16238: 3460 ± 180 B.P.], 2270-1060 B.C. [I-8161: 3360 ± 225 B.P.], and 1960-1200 B.C. [I-8162: 3300 ± 160 B.P.]. Barra is followed by Locona (Blake, 1991), dated by five samples ranging from 2180-1320 B.C. [Beta-14244: 3420 ± 170 B.P.] to 1520-930 B.C. [Beta-14243: 3040 ± 110 B.P.]. Subsequent Ocós dates are 1680-1200 B.C. [Beta-13838: 3180 ± 100 B.P.] and 1510-930 B.C. [Beta-16239: 3020 ± 100 B.P.]. The Barra/Locona/Ocós series therefore dates from approximately 1850-1350 B.C. It is followed by two phases, Cherla and Cuadros, the latter of which terminates around 1000 B.C. (Clark, 1991, Figure 2).

Green and Lowe (1967, p. 74) initially felt that Barra may have derived from earlier complexes to the south. However, they also noted that vessel shapes were nearly identical to ground stone prototypes of flat-bottom bowls, hemi-spherical bowls, and tecomates. They attributed grooving and fluting to the imi-tation of gourds and squash, and suggested that "what may have diffused from the south was skill and little else except a few rather close decorative design

similarities" (Green and Lowe, 1967, p. 62). Lowe (1975, p. 9) made much of the congruity between Barra forms and decorations and complexes from the Louisiana Gulf Coast to northern Colombia and Ecuador, but noted, "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". Coe (1960, 1961) was more enthusiastic about long-distance connections, attributing the shared attributes between Ocós and Conchas and Chorrera to a direct sea trade between La Victoria and the coast of Ecuador that resulted in the introduction of iridescent painting, plain rocker-stamping, and "pinching" (Coe, 1961, p. 135), as well as a "Chavinoid" plastic decoration within curvilinear zones (Coe, 1960, p. 372). However, Coe also noted a sharing of "shell-stamping, zoned punctation, and the use of surface indentation or depression, combined with raised ridges for zoning purposes" between Ocós and the Sarigua complex of central Panama. (Coe, 1960, p. 383). In addition to ceramic vessels, the early Soconusco complexes are characterized by a rich figurine tradition. However, it is important to note that these are stylistically unrelated to Valdivia figurines and that early complexes in Central American and Colombia do not have figurines.

After 1500 B.C., pottery was manufactured over a wide area of Mesoamerica. A review of all complexes dating before 1000 B.C. is beyond the scope of this article, but outside coastal Chiapas, only a few have been dated as early as 1500 B.C. Espiridión, in the Oaxaca Valley, is contemporaneous with Purrón and may date as early as 2000 B.C. (Marcus, 1983). In western Mexico, Kelly (1980) suggests Capacha ceramics from Colima may date as early as 1800 B.C. on the basis of a single ^{14}C date of 2200-1220 B.C. [GX-1784: 3400 ± 200

B.P.] and similarities with Machalilla ceramics of Ecuador. In central Mexico, Tolstoy (1978, pp. 256-257) places the Justo phase as early as 1500 B.C. In the Maya area, the Swasey complex of Belize was originally dated to 2500 B.C. (Hammond et al., 1979), but a recent evaluation suggests it may date no earlier than the late second millennium B.C. (Andrews and Hammond, 1990, Law et al., 1991).

Costa Rica

In northwestern Costa Rica, the Tronadora complex is contemporaneous with Barra/Locona/Ocós to the north and with Monagrillo, Barlovento, Canapote, and Valdivia 6 to the south (Hoopes, 1985, 1987). The type site provided nine dates, four of which pertain to a preceramic occupation and five of which were from ceramic-bearing contexts. The preceramic dates range from 3610-3050 B.C. [Tx-5275: 4600 ± 70 B.P.] to 2390-1750 B.C. [SI-?: 3675 ± 100 B.P.], suggesting a preceramic/ceramic transition around 2000 B.C. The three useful dates associated with Tronadora pottery are: 3350-2910 B.C. [Tx-5276: 4450 ± 70 B.P.], 2460-1790 B.C. [Tx-5277: 3730 ± 100 B.P.] and 2850-990 B.C. [Tx-5279: 3480 ± 320 B.P.] (Hoopes, 1985, 1987). (A fourth date, 800 B.C. - A.D. 640 [Tx-5081: 2030 ± 300], is considered erroneous.) The first, although found in direct association with a hearth and pottery with charcoal residue, is considered to be too early. Preceramic charcoal in a stratum immediately below ceramic levels leaves open the possibility of contamination. However, three dates associated with pyroclastic flows from a nearby volcano overlap from 2010-1670 B.C. at the 95% CI, dating the tephra stratum that caps the earliest Tronadora features and artifacts

to around 1800 B.C. (Hoopes, 1987). The Tronadora phase is probably represented by an occupation of short duration.

Tronadora pottery is most closely related to Chaparrón, in northern Costa Rica, La Montaña, in the Atlantic Watershed region (Snarskis, 1978, 1984), and Dinarte, on Ometepe Island in Lake Nicaragua (Haberland, 1966, 1992). Other related Costa Rican complexes include Barva in the central highlands (Snarskis, 1984), Naranjo at Sitio Méndez (Norr, 1986), and Curré in the Térraba-Coto Brus valley (Corrales, 1985, 1989). Tronadora's closest ties outside Central America are with coastal Chiapas. Similarities include red-rimmed tecomates and outflaring-wall bowls, round-bottomed incision, grooved rims, punctation, and dentate rocker-stamping. However, there are also distinct differences. Chiapan tecomates are sharply incurving and typically have tapered rims. Only a few true tecomate rims were found at Tronadora Vieja. Most rims are either heavily exteriorly-bolstered or comma-shaped. Tall, shell-stamped cylindrical vessels characteristic of Tronadora, La Montaña, and Dinarte are not found in coastal Chiapas. The greatest difference between early Costa Rican and Chiapan complexes is the absence of figurines in the former. Although abundant at early Mesoamerican sites, solid figurines are unknown in Costa Rican assemblages. Hollow figurines did not appear in Costa Rica until 500-300 B.C.

The picture presented by Costa Rican ceramic assemblages suggests a high degree of early regional diversity. While Tronadora and Chaparrón have some resemblances to Mesoamerican complexes, they differ in decoration, vessel forms, and the absence of figurines. Both Costa Rican complexes are found at inland sites, which also differs from the pattern in coastal Chiapas. La Montaña, another

related inland complex, differs further in the presence of budares (ceramic griddles).

Central Panama

According to Cooke (1984, p. 283), the site of Monagrillo was abandoned sometime between 1400-1100 B.C. (3150-2900 B.P.). The only other Early Formative Panamanian ceramic complex is Sarigua, known from the large, multi-component site of La Mula-Sarigua. Sarigua ceramics are thin and unslipped, and decoration consists of incision, shell-edge stamping, punctation, and appliqué ridges. Willey (1971, p. 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 Mesoamerica. Its clearest similarities are with Curré, from southwestern Costa Rica (Cooke, personal communication, 1993). Radiocarbon dates from ceramic contexts at the site of La Mula-Sarigua include two dates of 1120-840 B.C. [Beta-6006: 2820 ± 50] and 900-610 B.C. [Beta-21898: 2640 ± 60] (Cooke and Ranere, 1992b, Table 2). However, much more work needs to be done to clarify what was occurring with Panamanian ceramics between 2000-1000 B.C.

Northern Colombia

The northern Colombian sequence is virtually continuous between 4000 and 1000 B.C., but relationships between phases are complicated. Early complexes have been identified from several sites to the southeast of Cartagena, including Puerto Hormiga, San Jacinto 1 and 2, Puerto Chacho, and Monsú. As

noted above, Turbana and Monsú, followed by a third phase called Pangola, were placed very early by Reichel-Dolmatoff (1985). However, these are less convincing than either San Jacinto 1 or Puerto Hormiga as incipient industries. Furthermore, the decoration characteristic of Turbana (Reichel-Dolmatoff, 1985, Figs. 18-22) also appears on pottery from the Canapote (2500-2000 B.C.) and Barlovento (1700-1000 B.C.) phases, with which Rodriguez (1990) and Oyuela (1990) now consider Turbana to be contemporaneous.

Monsú yielded the first dates between those of Puerto Hormiga and Canapote. These would fill a long-standing chronological gap if they were not problematic. A date of 2920-2500 B.C. [UCLA-2149B: 4200 ± 80 B.P.] was associated with Pangola pottery in deposits overlying Turbana and Monsú levels (Reichel-Dolmatoff, 1985, p. 175). A date of 3660-1740 B.C. [UCLA-2568F: 4170 ± 360 B.P.] on bone from the lowest excavated levels and in association with Turbana pottery was rejected as too late. However, in spite of its wide range of error, it may be more accurate than the early date of 4330-3960 B.C. [UCLA-2149C: 5300 ± 80] Reichel-Dolmatoff accepted for Monsú. An almost identical date of 2920-2490 B.C. [UCLA-2568A: 4175 ± 80 B.P.] was obtained from a higher level. Although associated with Barlovento, it is much earlier than the majority of dates for this complex. At Canapote, Barlovento ceramics were found above levels with Canapote and Tesca ceramics--both of which are associated with dates later than UCLA-2568A and earlier than seven other dates for Barlovento contexts. Acceptance of UCLA-2568A would place Barlovento ceramics closer in time to Puerto Hormiga, to which Bischof (1972) claims they are closely related, but it is inconsistent with the chronology of neighboring sites.

Pottery from the successive phases of Canapote, Tesca, and Barlovento was identified in stratigraphic deposits at Canapote, a shellmound in the suburbs of Cartagena (Bischof, 1966, 1972). Canapote and Tesca phases are dated by two ^{14}C assays from the site. The first, at 2610-2040 B.C. [Y-1317: 3890 ± 100 B.P.], comes from a refuse layer on top of 60 cm of Canapote deposits and is considered to be late in the phase. The second, 2470-1770 B.C. [Y-1760: 3730 ± 120 B.P.], overlies Canapote deposits and is assigned to the succeeding early Tesca phase (Bischof, 1972, p. 278). On the basis of these, Bischof (1972, p. 273) proposed a beginning date for Canapote around 2850 B.C., making it roughly coeval with Reichel-Dolmatoff's (1985, p. 175) Pangola phase at Monsú. Canapote pottery is 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" (Bischof, 1966, p. 487). Forms are exclusively globular, round-bottomed vessels. Early Tesca pottery is decorated with broad incised lines, and most designs are curvilinear. The first use of zoned hatchure, which is important for later decorations, appears in the Tesca phase (Bischof, 1972, p. 277). Tesca is contemporaneous with the El Pozón complex in San Marcos, dated by an assay of 2190-1790 [Beta-16125: 3650 ± 60] (Plazas and Falchetti 1986).

Barlovento pottery is known from a number of sites, especially the type site, Canapote, and Monsú. At Canapote, Barlovento material was found above Tesca levels (Bischof, 1966). At Monsú, Barlovento ceramics appear above Pangola phase levels. If we exclude the earliest date cited by Reichel-Dolmatoff (UCLA-2568A), Barlovento ceramics are dated by seven ^{14}C samples. The

earliest is 2130-1530 B.C. [Y-1318: 3510 ± 100 B.P.]. It was retrieved by Bischof in 1962 from deposits exposed by the collapse of a profile from Reichel-Dolmatoff's 1957 excavations at Barlovento, a group of six shellmounds in the swamps to the north of Cartagena. Initially thought to be too early, it was subsequently deemed acceptable (Bischof, 1972). Three other dates from the site are stratigraphically consistent at 2130-1510 B.C. [W-739: 3470 ± 120 B.P.], 1680-1040 B.C. [W-743: 3140 ± 120 B.P.], and 1510-850 B.C. [W-741: 2980 ± 120 B.P.], and are supported by two more stratified shell dates from Barlovento contexts at Monsú: 1670-1400 B.C. [TK-625a: 3240 ± 60 B.P.]--from the same excavation level as the sample rejected as too early (UCLA-2568A)--and 1730-1270 B.C. [TK-625b: 3230 ± 90 B.P.]. The most recent assay dates to 1160-810 B.C. [UCLA-2149D: 2800 ± 80 B.P.] (Reichel-Dolmatoff, 1985, pp. 175-76). It is almost completely overlapped by the most recent Barlovento date from the type site (W-741) in the 95% confidence interval. Taken together, they suggest a terminal date for Barlovento around 1000 B.C. Given a conservative interpretation of the above dates, and rejecting the two early assays from Monsú, we can date Barlovento to approximately 1800-1000 B.C. It is therefore roughly contemporaneous with late Monagrillo, early Tronadora, Barra/Locona/Ocós, and early complexes on the Peruvian coast (see below).

The Colombian and Central American assemblages share a large number of specific decorative modes. However, vessel forms and the majority of decorations differ markedly. Barlovento signals a stylistic change. 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 is characterized by exuberant curvilinear volutes and sigmoids with zoned incision and punctation (Reichel-Dolmatoff, 1985, Figs. 45-54), including shallow incisions filled with red ochre. Vessel lips on wide, open plates are broad and decorated with incised and punctate designs (Reichel-Dolmatoff, 1985, Figs. 55-56). Modelled decoration--an important Puerto Hormiga mode--is absent in Canapote, rare in Tesca, but abundant in early and middle Barlovento. Vessel forms consist primarily of large (40 cm diameter) incurving-rim bowls with direct, tapered, or interior-thickened rims, deep, vertical-walled bowls, and open plates or possible budares (griddles). In all of these, Barlovento differs markedly from Tronadora. Bolstered rims, grooved rims, cylinders, and squat jars are absent. The complete absence of red slipping or painting and any type of figurine tradition also distinguishes this complex from contemporaneous ones in Pacific Chiapas.

Ecuador

Several samples date the end of Valdivia. Hill (1975, p. 21) sees the period ending sometime after 2300 B.C. (3850 B.P.), based on two dates of 2870-1940 B.C. [L-1232H: 3900 ± 150 B.P.] and 2570-1740 B.C. [L-1232I: 3750 ± 150 B.P.] associated with Valdivia 7 assemblages at OGSE-46B-1 . The most recent acceptable date for Valdivia from the type site is 2620-2280 B.C. [SI-78: 3970 ± 65 B.P.] (Meggers et al., 1965, p. 149). At Loma Alta, a date of 2460-1930 B.C. [ISGS-190: 3765 ± 85 B.P.] associated with Valdivia 6 ceramics (Hill, 1975, Fig. 3) overlaps the two dates from OGSE-46B-1 at the 95% CI. Two dates from La Emerenciana in El Oro province of 2490-1690 B.C. [SMU-2225: 3707 ± 148]

and 2290-1009 B.C. [SMU-2241: 3361 B.P. ± 246] come from Valdivia 8 contexts (Staller, personal communication 1993). These, together with a date on shell of 1890-1620 B.C. [SI-69: 3450 ± 50 B.P.] at the Buena Vista site (Meggers et al., 1965, p. 149), suggest a terminal date for Valdivia as late as 1650 B.C. (Staller n.d., personal communication, 1993). The most recent date associated with Valdivia ceramics, 1260-800 B.C. [SI-20: 2805 ± 105 B.P.], can probably be rejected.

Six dates are available for the succeeding Machalilla phase. Three are from the site of La Cabuya: 2030-1200 B.C. [SI-107: 3320 ± 170 B.P.], 1530-810 B.C. [SI-108: 2980 ± 160 B.P.], and 1120-850 B.C. [SI-67: 2830 ± 45 B.P.] (Meggers et al., 1965, p. 149). SI-107 and SI-108 overlap from 1530-1200 B.C. at the 95% CI. However, although both come from charcoal residue on the same vessel, the excavators consider SI-107 to be the most accurate. In the interest of a continuous chronological sequence, and citing evidence for the co-occurrence of Machalilla and Late Valdivia ceramics, they prefer an early interpretation and place Machalilla at approximately 2500-1700 B.C. (3950-3450 B.P.; Meggers et al., 1965, p. 174).

A more recent assessment based on three dates from La Ponga and a reinterpretation of the La Cabuya dates places the phase somewhat later (Lippi et al., 1984). These dates, 1380-900 B.C. [WIS-1125: 2920 ± 80 B.P.], 1300-840 B.C. [WIS-1141: 2880 ± 80 B.P.], and 1150-800 B.C. [WIS-1140: 2790 ± 80 B.P.], are all from stratified midden deposits. Machalilla deposits at La Ponga were overlain by Chorrera/Engoroy and Guangala ceramics, and the earliest sample comes from a mixed context. However, the other two were clearly

associated with Machalilla ceramics. Although not in stratigraphic order, the dates overlap from 1150-900 B.C. in the 95% CI. The excavators' interpretation of these samples dates Machalilla to 1400-900 B.C. (3150-2750 B.P.) with a terminal date for Valdivia of 1700 B.C. (Lippi et al., 1984, p. 118). Machalilla ceramics may date as early as 1600 B.C., an interpretation supported by recent research on the complex Valdivia/Machalilla transition period (Staller, personal communication 1993). This indicates that they are roughly contemporaneous with (and not prior to) the latter half of Monagrillo, the middle and latter portions of Barlovento, Tronadora, and Locona/Ocós.

Like Barlovento, Machalilla ceramics are distinct from contemporary complexes in Mesoamerica and Central America. While these are distinguished by smoothed, round-bottomed groove-incision, Machalilla ceramics are decorated with fine, sharp incisions (Meggers and Evans, 1962, p. 187). Two innovations appear, the stirrup-spout vessel and the carinated bowl. Carinated bowls--complex-silhouette vessels with a marked incurving angle at the shoulder--appear in Valdivia 6 around 2500 B.C. (Hill, 1975, p. 21). However, they do not become common until Machalilla times. The carinated bowl is also found in Kotosh Waira-jirca and Early Tutishcayno (Lathrap, 1971, p. 88). Carinated bowls do not appear in northern Colombia until the first centuries B.C., and they are not prominent in either Central America or Mesoamerica until after 1000 B.C. It is difficult to say whether they originate on the coast or in lowland South America.

The origins of stirrup spouts are equally vague. Spouted bottles and stirrup-spout fragments have been found at La Emerenciana, on the southern coast of Ecuador, in association with late Valdivia pottery dating to ca. 1850-1650 B.C.

(Staller, personal communication, 1993). They are also known from Cotocollao, in the Ecuadorian highlands, from contexts dated stylistically to 1500-900 B.C. (Villalba, 1988). On the north coast of Peru, Cupisnique is usually recognized as the earliest complex with stirrup spouts, but its dating to 1600 B.C. represents at best an educated guess. Lathrap (1971, p. 90) once suggested that double-spout-and-bridge bottles found in Kotosh Waira-jirca and Early Tutishcayno were ancestral to the stirrup-spout form in Ecuador. This hypothesis has been weakened by the discovery of stirrup-spouts in late Valdivia contexts, but it is only fair to acknowledge that the relationship between the ceramics of southern Ecuador and the north coast of Peru at this time remains poorly understood.

At present, it is difficult to demonstrate clear relationships between Machalilla and cultures either to the north or south. Although there are a number of specific modes that are shared, the differences between Ecuadorian and other northern South American complexes are greater than the similarities. This is true even for northern Colombia. Barlovento, for example, lacks the polished, fine-engraved, carinated bowls of Machalilla. Its large, unslipped, wide-grooved, in-curving-rim bowls indicate vast stylistic differences between these contemporaneous complexes. However, although it is difficult to sustain models for population migrations such as those suggested by Meggers and Evans (1966, p. 247), it is still premature to rule out interchanges of ceramic technology and style between Ecuador and Mesoamerica/Central America during Machalilla, Chorerra, and subsequent phases.

Peru

Although it seems likely that ceramic technology diffused into northern Peru from Ecuador sometime prior to 2500 B.C., the manufacture of ceramics in other regions of the central Andes appears to have resulted from a combination of independent invention and the transmission of technology and styles from areas in the eastern lowlands. The earliest dates associated with pottery in Peru come from the northern highlands near Cajamarca. Kaulicke (1981) reports two dates of 2870-2310 B.C. [ZK-333: 4018 ± 80 B.P.] and 2330-1070 B.C. [ZK-334: 3393 ± 240 B.P.] from Pandanche, both associated with hearths and pottery. Each of these represents the weighted average of a pair of assays. However, they they were recovered in reverse stratigraphic order and overlap only slightly in the calibrated 95% CI. An additional date of 2470-1920 B.C. [?: 3785 ± 100 B.P.] is reported for Pandanche A from the site of Machaipungo (Kaulicke 1975, p. 50). If ZK-333 can be discredited on stratigraphic grounds, the remaining dates for Pandanche would not contradict an initial date of 2000 B.C., similar to that for other regions of Peru. The "Pandanche A" complex is characterized by both fine- and coarse-paste 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 Pacopampa, also in the Cajamarca Valley, and Monte Grande, in the upper Jequetepeque Valley, but there are no ^{14}C dates (Tellenbach, 1981) and contradictory evidence suggests that this material may be later than originally hypothesized by Kaulicke (Burger, personal

communication 1993). Kaulicke suggests that Peruvian ceramics derive from southern Ecuador, citing parallels between Pandanche A, Late Valdivia, and Machalilla pottery. This interpretation is supported by similarities between Pandanche A ceramics and late Valdivia pottery from southern El Oro (Staller, personal communication, 1993). However, such contact need not date any earlier than the second millennium B.C.

Throughout the rest of the Central Andes region, the dates for the appearance of ceramics are surprisingly consistent (see Burger 1992, Appendix). Ceramics first appear between 2500 and 2000 B.C. on the central and north-central coast of Peru. Pozorski and Pozorski (1990, Table 1) report 22 dates for early ceramic contexts at Pampa de Las Llamas-Moxeke in the Casma Valley. These range from 2450-1900 [UGa-5796: 3745 ± 85 B.P.] to 1510-1040 B.C. [UGa-4504: 3070 ± 85 B.P.]. At Las Haldas, the introduction of pottery is dated by three assays, ranging from 2290-1610 B.C. [GaK-606: 3590 ± 130 B.P.] (Matsuzawa, 1978, p. 666) to 1930-1520 B.C. [Tx-631: 3430 ± 80 B.P.] (Grieder, 1975, pp. 99). These overlap from 1930-1610 B.C. at the 95% CI. Early coastal pottery consists of largely undecorated neckless jars (elongated, rather than tecomate-shaped). In the Virú Valley, early Guañape ceramics were decorated with appliqué "ribs" or strips of clay with finger-punching or short incisions, modelling, and zoned punctation near vessel rims (Strong and Evans, 1952). While finger-punched fillets are similar to decorations on Pandanche A ceramics, only the zoned punctation (a mode whose ubiquity on virtually all early ceramic complexes is probably coincidental) is shared with Ecuadorian complexes.

On the central coast,the earliest dates come from La Florida (Patterson and Moseley, 1968; Mejía, 1978) and La Galgada (Grieder et al., 1988). Initial pottery at La Florida has been dated by four assays ranging from 2620-1690 B.C. [N-44: 3760 ± 170 B.P.] (Fung, 1988, ff. 22) or 2290-1780 B.C. [GX-1210: 3680 ± 85] to 2400-1680 B.C. [GX-04456: 3645 ± 120 B.P.] (Patterson, 1985, p. 64). However, there is some uncertainty regarding the correct citation of samples N-44 (Patterson, personal communication, 1993) and N-87, the latter of which is said to come from La Florida (Patterson 1985, p. 64) but has also been published as being from Paracas (Yamasaki et al. 1966, p. 337). New ceramic forms at La Florida include small, double-spouted bottles with bridge handles (Mejía, 1978). At La Galgada, ceramics overlie a preceramic occupation dated by two assays of 2140-1740 B.C. [UGa-4583: 3590 ± 75 B.P.] and 2270-1790 B.C. [Tx-4447: 3670 ± 70 B.P.]. The earliest date for pottery contexts was almost identical, at 2190-1790 B.C. [Tx-4448: 3650 ± 60 B.P.] (Greider et al., 1988, p. 69). The Toril style from Huaricoto in the highland portion of the Santa Valley is related to both the early La Galgada and Guañape ceramics. Although not associated with ^{14}C dates, it was stratified between Late Preceramic and Initial Period deposits. Toril ceramics are technically unsophisticated, consisting primarily of neckless ollas with incomplete firing and a coarse quartz temper. Decoration is rare (Burger, 1985, pp. 506-510, 1991, 1992, p. 58).

On the southern coast, the earliest pottery appears sometime between 2500 and 1400 B.C. Erizo, in the Ica valley, has been dated by four assays ranging from 2580-2040 B.C. [GX-0185: 3890 ± 90 B.P.] to 1500-1030 B.C. [UCLA-969: 3050 ± 80 B.P.] (Rowe, 1967, Gayton, 1967, p. 1). Unfortunately, this pottery has been

neither described nor illustrated. Five dates for the related Hacha pottery from the Acarí valley date from 1410-1000 B.C. [UCR-2088: 2990 ± 70] to 1010-790 B.C. [UCR-2089: 2730 ± 70] (Riddell and Valdez, 1987, p. 7). Lanning (1967, p. 83) rejected the earliest two dates and suggested an initial date for Hacha of 1700-1600 B.C. (3350-3450 B.P.)--roughly contemporaneous with the Valdivia/Machalilla transition. Fung (1988, p. 82) places Hacha and Erizo at 1400 B.C.

Pottery appears in the southern highlands at the same time as on the southern coast. Marcavalle ceramics from the Cuzco, Puno, and Anadahuaylas regions are reportedly similar to contemporaneous Erizo and Hacha (Fung, 1988, p. 83). The earliest levels at Waywaka in Andahuaylas date to 2140-1630 B.C. [UCLA-1808E: 3550 ± 100 B.P.], and contained neckless ollas, short-necked ollas, small bowls, and vessels with spouts and strap handles (Grossman, 1985, p 53-58). At Marcavalle, the earliest pottery dates to around 1500 B.C. (Fung, 1988, p. 83). Early pottery at Chiripa and Wankarani in western Bolivia has been dated to around 1700 B.C. (Browman, 1980, Fung, 1988, p. 83). Lanning (1967, p. 87) suggested that the most likely routes of diffusion of Initial Period pottery were up the Marañon and Huallaga Rivers. He also believed that the ancestry of Kotosh and Tutishcayno ceramics would eventually be traced to the low montaña or the Amazon lowlands (Lanning, 1967, p. 88).

In the highlands, the earliest pottery comes from the Kotosh Waira-jirca phase at Kotosh and Shillacoto. Waira-jirca has five ^{14}C dates, ranging from 2560-1910 B.C. [GaK-262: 3800 ± 110 B.P.] to 1420-990 B.C. [TK-108: 3000 ± 80 B.P.], but is tentatively dated to 1700-1100 B.C. (3450-2950 B.P.; Izumi and

Terada, 1972, p. 307). Roughly contemporaneous phases have been defined for La Pampa (Terada, 1979), Huacaloma (Terada and Onuki, 1982), and Cerro Blanco (Terada and Onuki, 1988), all in the northern highlands. Early Huacaloma ceramics are dated by three assays: 1510-1120 B.C. [TK-341a: 3080 ± 70 B.P.], 1440-260 B.C. [TK-341b: 2720 ± 240 B.P.], and 1260-810 B.C. [TK-409: 2840 ± 90 B.P.]. (Terada and Onuki, 1982, p. 258). At Cerro Blanco, five dates for early pottery range from 1880-1520 B.C. [TK-710: 3390 ± 70 B.P.] to 1010-800 B.C. [TK-712: 2750 ± 60 B.P.] (Terada and Onuki, 1988, p. 4). At all of these sites, the earliest vessels are large tecomates, short-necked jars, and carinated bowls.

At La Pampa and Huacaloma, early decoration includes appliqué fillets and ribs, suggesting relations with Las Haldas and Guañape (Terada, 1979, p. 176). In Waira-jirca, decorative techniques include incision, punctation, burnishing, and plain rocker-stamping. The most distinctive decoration is stylized geometric zoning, infilled with fine cross hatching. There are notable similarities between Waira-jirca pottery and that of the tropical forest lowlands to the east. The Early Tutishcayno phase at Yarinacocha, on the central Ucayali at the western edge of the Amazon basin, is also similar to Waira-jirca (Lathrap, 1962, 1970, 1971). Shared traits include 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, p. 307). Contact between Kotosh and lowland areas is suggested by assemblages with both Waira-jirca and lowland sherds, such as at the Cave of the Owls (Lathrap and Roys, 1963).

Similarities between Waira-jirca, Early Tutishcayno, and Valdivia were noted by Meggers and Evans (1961; Meggers et al.1965), who attributed these to a

diffusion of technology into the eastern slopes of the Peruvian highlands from coastal Ecuador. In contrast, Lathrap (1971, p. 96) believed the origins of Early Tutishcayno were to be found "in the flood plains on the major rivers of the tropical forests of South America." The origins of Waira-jirca ceramics are more complicated than a diffusion from either Ecuador or the Amazon. Lathrap (1971, p. 93) saw them as a blending of eastern lowland traditions with indigenous Central Andean traditions. Stylistic similarities to Valdivia and Pandanche pottery suggests influence from the north, via the highlands or possibly the Marañon drainage. However, Roosevelt's dates for early Amazonian pottery support Lathrap's hypothesis of a lowland origin for ceramic technology. At present, the earliest pottery from the Peruvian montaña is the Cobichanque complex from the Alto Pachitea (Allen 1968, Lathrap 1970, pp. 96-98), where at Casa de la Tía 67 sherds were associated with dates of 2320-1930 B.C. [P-991: 3728 B.P. ± 65], 2190-1680 B.C. [P-992: 3587 B.P. ± 95], and 1880-1450 B.C. [P-990: 3368 B.P. ± 77]. Vessel forms include simple and carinated bowls, slipped and highly polished with fine sand and shell temper. They suggest an east-to-west diffusion, although the evidence remains weak.

Noting a predominance of carinated bowls in Late Tutishcayno, Lathrap (1963, p. 239; 1970, p. 92; 1971, P. 89) also suggested contacts between the eastern Amazon and Machalilla. In a subsequent publication, he attributed these similarities to the existence of a widespread carinated bowl tradition associated with root-crop agriculture from the lowland tropical forest (Foster and Lathrap, 1973). However, maize use in Machalilla times (Lippi, Bird, and Stemper, 1984) suggests the carinated bowl "tradition" is not linked to a particular agricultural

orientation. As noted above, there are insufficient data to say whether carinated bowls originated in coastal Ecuador or east of the Andes.

Discussion

Ceramic traditions in the northern highlands of Peru may be related to Late Valdivia/Machalilla traditions in Ecuador. However, early pottery on thePeruvian coast was far removed from developments either on the Ecuadorian coast or in northern Colombia. Although general similarities are present, the significant differences cannot be overlooked. One of the most striking differences is chronological. Pottery production, even in northern Peru, appears over a thousand years later in the Andean region south of Ecuador than it does in the Valdivia culture. Once pottery does come into use, sometime between 2500 and 2000 B.C., it appears over a large area of the Andes within the space of just a few centuries.

What remains to be defined is the role of Ecuadorian cultures in the emergence of Peruvian ceramic traditions. Although there are striking relationships between Valdivia iconography and Late Preceramic pyroengraved gourds from the Peruvian coast (Lathrap et al., 1975, p. 29), large, elongated, incurving-rim bowls and tecomates have no good precedents in the Ecuadorian sequence. These might easily have been derived from preceramic gourds or basketry. Geography makes a direct diffusion of styles from northern Colombia unlikely. While an origin in the tropical lowlands remains a possibility, it is just as likely that pottery was invented independently on the Peruvian coast. This is not readily apparent for the highlands. If early traditions of ceramic manufacture existed in the Amazon basin, the strong ties between sites like Kotosh and

lowland regions suggest that at least some ideas about ceramic forms and decorations--if not the technology itself--may have been introduced from the east. This hypothesis awaits support from dated assemblages in western Amazonia.

CONCLUSIONS

In sum, the initial adoption of pottery vessels by New World cultures was neither rapid nor uniform with respect to either technology or style. Contrary to earlier models, the first pottery cannot be broadly characterized as having first appeared at coastal shellmiddens and then spread to similar sites by migration or diffusion. The earliest dated ceramics in the New World are sand-tempered wares that appeared in the context of a semi-sedentary, freshwater shellfishing culture on the lower Amazon in Brazil between 6000 and 5000 B.C. The next oldest pottery is a fiber-tempered complex that was manufactured at seasonally-occupied inland sites in northern Colombia around 5000-4500 B.C. Although there is evidence for earlier experimentation with fired clay, sand-tempered ceramic vessels appeared at both inland and coastal sites in Pacific Ecuador around 4000-3500 B.C. (about the same time as a shell-tempered industry appeared together with sand-tempered wares on the Brazilian coast). In Panama, the earliest pottery is a crude, sand-tempered ware that appeared at inland rockshelters around 3500 B.C. and shortly afterwards at shellfishing settlements on the coast. In North America, the earliest ceramics from South Carolina and Florida date to ca. 3500-3000 B.C. and included both fiber- and sand-tempered wares. A fiber-tempered technology also appeared in the central U.S. sometime between 3300 and 1900 B.C.

Around 2000 B.C., sophisticated, decorated wares were being manufactured in the highlands of northwestern Costa Rica. Given a revised interpretation of the temporal placement for Pox and Purrón ceramics, ceramics may not have appeared in Mesoamerica until this same time. However, after 2000 B.C., they evolved rapidly and were adopted over a wide area--perhaps in conjunction with the spread of competitive feasting practices (Clark and Blake, 1991; Blake et al., 1992). The pattern is surprisingly similar in the central Andes. Although the first pottery in the northern highlands of Peru may date as early as 2500 B.C., it was not until after 2000 B.C. that ceramic technology appeared throughout the coast and in central and southern highland regions. However, within 500 years, elaborate pottery was being produced at a large number of sites between the Pacific coast and the eastern slopes of the Andes.

If one were to consider the dates for only the idea of ceramic technology, ignoring techniques of paste preparation, vessel form, and decoration--as well as the even more important variable of cultural context--one could support Lathrap's suggestion that the Amazon basin was an important hearth for New World ceramic production only at a very general level. Plotting ^{14}C dates on a map, chronological contours might be interpreted as a spread of ceramic technology westward from eastern Brazil and then south- and northward (with a broad jump across the Caribbean from Colombia to Florida around 3500 B.C.). However, the diffusionary model suggested by this archaic and simplistic approach would not go far towards explaining the tremendous variation evident in early complexes and their cultural contexts.

The idea that clay could be baked to form permanent containers is so simple that it was probably widely known to Archaic societies. A closer look at specific tempering technologies, vessel forms, and decorations reveals a wide variety of vessel-making strategies. In Brazil and Ecuador, sand-tempered pottery appears first (followed by shell-tempered pottery in Brazil). Fiber-tempered wares precede sand tempering in Colombia, but the two appear to be roughly contemporaneous within circumscribed regions of the southeastern U.S. As early as 3500 B.C., Colombian potters showed a strong preference for modelled, unslipped, open bowls decorated with wide grooving and appliqué while their Ecuadorian counterparts were shaping coil-made, necked jars and vessels decorated with a thick red slip and fine incision. This divergent trend continues for over a thousand years, with significant differences between the neckless bowl tradition in northern Colombia and a well-developed necked-jar tradition throughout the Valdivia sequence. By 2000 BC, there is tremendous variation in technology, form, and decoration, ranging from pumpkin-shaped tecomates with brilliant red slips in coastal Chiapas to elongated, neckless jars with fillet appliqué on the central coast of Peru. Neither the earliest forms and technologies nor the subsequent developmental trajectories are suggestive of broad, diffusionary trends. To the contrary, the earliest ceramics in the Americas are characterized by a highly regionalized diversity in form, decoration, and manufacturing techniques from their inception.

In spite of the apparent chronological cline, the great range of regional variability suggests independent invention played a greater role in the adoption and development of ceramics than the widespread diffusion of technologies and

styles suggested by authors like Ford, Meggers and Evans, and Lathrap. The current status of archaeological information makes it difficult to document how many different loci of ceramic development existed. However, for now, we can recognize at least eight strong candidates: 1) lowland Brazil, 2) northern Colombia; 3) coastal Ecuador, 4) the central coast of Peru, 5) central Panama, 6) southern Mesomerica, 7) the southeastern U.S., and 8) the central U.S. The broad 4000-year time span for the appearance of early pottery in the New World, as well as the range of ceramic styles apparent in the earliest complexes throughout the Americas is emblematic of the tremendous complexity of the Early Formative landscape. This complexity is accentuated when variables such as settlement size and permanence, preference for specific ecological zones, and subsistence strategies are taken into account (Hoopes, 1992). In Brazil, Colombia, Panama, and the southeastern U.S., the earliest pottery was manufactured by seasonally mobile foragers, without any evidence for a strong reliance on horticulture. In South Carolina, Georgia, and Florida, ceramics were being manufactured for at least two millennia before agricultural societies predominated. On the other hand, in coastal Peru, monumental public architecture and irrigation agriculture were common before ceramics were ever utilized.

Rather than emerging dendritically and diffusing outwared with a uniform cultural substrate linked to particular subsistence and settlement strategies, ceramic production in the New World emerged in a variety of situations and locations over a period of at least 4000 years. The enormous variation of social contexts for the emergence of ceramic production is readily apparent in the highly complex social landscape of earlier, preceramic societies. The function of early

pottery in its multiple contexts in the New World varied as widely as the plasticity of the medium and the range of human creativity. It is apparent that broad, diffusionary models such as Ford's are inadequate for explaining either the mechanisms responsible for the appearance or the significance of early pottery for the societies that used it. Further research on the detailed reconstruction of specific, regional histories is required if we are to understand the effects of new technologies--such as ceramics--within their specific cultural contexts.

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References

Allen, W. L. (1968). A Ceramic Sequence for the Alto Pachitea, Perú. Unpublished Ph.D. dissertation, Dept. of Anthropology, University of Illinois, Champaign-Urbana.

Andrews, E. W., V, and N. Hammond (1990). Redefinition of the Swasey Phase at Cuello, Belize. American Antiquity 55(3): 570-584.

Bischof, H. (1966). Canapote--an Early Ceramic Site in Northern Colombia. Preliminary Report. Proceedings of the 36th International Congress of Americanists, 1, Seville, pp. 484-491.

Bischof, H. (1972). The Origins of Pottery in South America--Recent Radiocarbon Dates from Southwest Ecuador. Proceedings of the 40th International Congress of Americanists 1, Rome, pp. 269-281.

Bischof, H., and J. Viteri G. (1972). Pre-Valdivia Occupations on the Southwest Coast of Ecuador. American Antiquity 37(4): 548-551.

Blake, M. (1991). An Emerging Early Formative Chiefdom at Paso de la Amada, Chiapas, Mexico. In Fowler, W. R. (ed.), The Formation of Complex Society in Southeastern Mesoamerica, CRC Press, Boca Raton, pp. 27-46.

Blake, M., J. E. Clark, B. Chisholm, and K. Mudar (1992). Non-Agricultural Staples and Agricultural Supplements: Early Formative Subsistence in the Soconusco Region, Mexico. In Gebauer, A. B. and T. D. Price (eds.), Transitions to Agriculture in Prehistory, Prehistory Press, Madison, Wisconsin, pp. 133-151.

Blakeslee, D. J., and A. H. Rohn (1982). Man and Environment in Northeastern Kansas: The Hillside Lake Project, Vol. 3. Draft report submitted to the U.S. Army Corps of Engineers, Kansas City District.

Browman, D. L. (1980). Tiwanaku Expansion and Altiplano Economic Patterns. Estudios Arqueológicos 5: 107-120.

Brush, C. F. (1965). Pox Pottery: Earliest Identified Mexican Ceramic. Science 149: 194-195.

Bullen, R.P. (1960). The Earliest Pottery in Southeastern United States, 2000-1000 B.C. and Its Case as an Independent Invention. 6th International Congress of Anthropological and Ethnological Sciences, Paris.

Bullen, R. P. (1961). Radiocarbon Dates for Southeastern Fiber-Tempered Pottery. American Antiquity 27: 104-106.

Bullen, R. P., and J. Stoltman (eds.) (1972). Fiber-Tempered Pottery in the Southeastern United States and Northern Colombia: Its Origins, Context, and Significance. Florida Anthropological Society Publications 6, part 2. The Florida Anthropologist, Fort Lauderdale.

Burger, R. L. (1985). Prehistoric Stylistic Change and Cultural Development at Huaricoto, Peru. National Geographic Research 1: 505-534.

Burger, R. L. (1991). The Beginning of Ceramic Use in Peru as Viewed from Huaricoto. Paleoetnológica 5:259-266.

Burger, R. L. (1992). Chavín and the Origins of Andean Civilization. Thames and Hudson, New York.

Calmes, A. (1968). Test Excavations at Three Late Archaic Shell-Ring Mounds on Hilton Head Island, Beaufort County, South Carolina. Southeastern Archaeological Conference Bulletin 8: 45-48.

Ceja T., J.F. (1985). Paso de la Amada: An Early Preclassic Site in the Soconusco, Chiapas. Papers of the New World Archaeological Foundation, 49, Brigham Young University, Provo.

Childe, V. G. (1942). What Happened in History. Middlesex, England, Penguin Books.

Clark, J. E. (1991). The Beginnings of Mesoamerica: Apologia for the Soconusco Early Formative. In Fowler, W. R. (ed.), The Formation of Complex Society in Southeastern Mesoamerica, CRC Press, Boca Raton, pp. 13-26.

Clark, J. E., M. Blake, P. Guzy, M. Cuevas, and T. Salcedo (1987). Final report to the Instituto Nacional de Antropología e Historia of the Early Preclassic Pacific Coastal Project. Ms. on file, New World Archaeological Foundation, Brigham Young University, Provo.

Clark, J. E., and M. Blake (1991). The Power of Prestige: Competitive Generosity and the Emergence of Rank Societies in Lowland Mesoamerica. In Brumfiel, E., and J. Fox (eds.), Factional Competition and Political Development in the New World, New York, Cambridge University Press.

Coe, M. D. (1960). Archaeological Linkages with North and South America at La Victoria, Guatemala. American Anthropologist 62: 363-393.

Coe, M. D. (1961). La Victoria, an Early Site on the Pacific Coast of Guatemala. Papers of the Peabody Museum of Archaeology and Ethnology, 53, Harvard University, Cambridge, Mass.

Cooke, R. G. (1984). Archaeological Research in Central and Eastern Panama: A Review of Some Problems. In Lange, F.W., and D.Z. Stone (eds.), The Archaeology of Lower Central America, University of New Mexico Press, Albuquerque, pp. 263-304.

Cooke, R. G., and A. J. Ranere (1992a). The Origin of Wealth and Hierarchy in the Central Region of Panama (12,000-2,000 BP), with Observations on Its Relevance to the History and Phylogeny of Chibchan-Speaking Polities in Panama and Elsewhere. In Lange, F. W. (ed.), Wealth and Hierarchy in the Intermediate Area, Dumbarton Oaks Research Library and Collection, Washington, D.C., pp. 243-316.

Cooke, R. G., and A. J. Ranere (1992b). Prehistoric Human Adaptations to the Seasonally Dry Forests of Panama. World Archaeology 24: 114-133.

Corrales U., F. (1985). Prospección y excavaciones estratigráficas en el Sitio Curré (P-62-Cé) Valle Diquís, Costa Rica. Vínculos 11: 1-15.

Corrales U., F. (1989). La Ocupación Agricola Temprana del Sitio Arqueológico Curré, Valle del Diquís. Thesis presented for the degree of Licenciado in Anthropology, University of Costa Rica, San Pedro, Costa Rica. MS. on file, Depto. de Antropología y Sociología, Universidad de Costa Rica.

Crusoe, D. L. (1972). Interaction Networks and New World Fiber-Tempered Pottery. Ph.D. dissertation, Department of Anthropology, University of Georgia.

Damp, J. (1984a). Architecture of the Early Valdivia Village. American Antiquity 49: 573-585.

Damp, J. (1984b). Environmental Variation, Agriculture, and Settlement Processes in Coastal Ecuador (3300-1500 B.C.). Current Anthropology 25: 106-111.

Damp, J. (1988). Casa y Comunidad: Patrones Económicos, Arquitectónicos e Ideológicos de Real Alto, Valdivia Temprano. Corporación Editorial Nacional, Quito.

Damp, J., and P. Vargas (1990). Altomayo and Real Alto: The Early Ceramics of Coastal Ecuador. MS. on file, Dept. of Anthropology, University of Kansas, Lawrence.

Deevey, E. S., L.J. Gralenski, and V. Hoffren (1959). Yale Natural Radio-Carbon Measurements, IV, Radiocarbon Supplement, 1, New Haven.

Estrada, E., B. J. Meggers, and C. Evans (1962). Possible Transpacific Contact on the Coast of Ecuador. Science 135: 371-372.

Fiedel, S. J. (1992). Prehistory of the Americas (2nd ed.), Cambridge University Press, New York.

Ford, J. A. (1936). Analysis of Indian Village Site Collections from Louisiana and Mississippi, Anthropological Study No. 2, Department of Conservation, Louisiana Geological Survey.

Ford, J. A. (1966). Early Formative Cultures in Georgia and Florida. American Antiquity 31: 781-799.

Ford, J. A. (1969). A Comparison of Formative Cultures in the Americas: Diffusion or the Psychic Unity of Man? Smithsonian Contributions to Anthropology 11. Washington, D.C.

Foster, D. W., and D. W. Lathrap (1973). Further Evidence for a Well-Developed Tropical Forest Culture on the North Coast of Colombia During the First and Second Millennium B.C. Journal of the Steward Anthropological Society 4: 160-199.

Fung P., Rosa (1988). The Late Preceramic and Initial Period. In Keatinge, R.W. (ed.), Peruvian Prehistory, Cambridge University Press, New York, pp. 67-96.

Gayton, A.E. (1967). Textiles from Hacha, Perú. Ñawpa Pacha 5: 1-14.

Green, D., and G. W. Lowe (1967). Altamira and Padre Piedra, Early Preclassic Sites in Chiapas, Mexico. Papers of the New World Archaeological Foundation, 20, Provo.

Grieder, T. (1975). A Dated Sequence of Building and Pottery at Las Haldas. Ñawpa Pacha 13: 99-112.

Grieder, T., A.B. Mendoza, C. E. Smith, Jr., and R.M. Malina (1988). La Galgada, Peru: A Preceramic Culture in Transition, Austin, University of Texas Press.

Grossman, J. W. (1985). Demographic Change and Economic Transformation in the South Central Highlands of Pre-Huari Peru. Ñawpa Pacha 21: 45-126.

Haberland, W. (1966). Early Phases on Ometepe Island, Nicaragua. Proceedings of the 36th International Congress of Americanists 1: 399-403. Seville.

Haberland, W. (1992). The Culture of Ometepe Island: Preliminary Sketch (Survey and Excavations, 1962-1963). In Lange, F.W., P.D. Sheets, A. Martínez, and S. Abel-Vidor (eds.), The Archaeology of Pacific Nicaragua, Albuquerque, University of New Mexico Press, pp. 63-118.

Hammond, N., D. Pring, R. Wilk, S. Donaghey, F. Soul, E. Wing, A. Miller, and L. Feldman (1979). The Earliest Lowland Maya? Definition of the Swasey Phase. American Antiquity 44(1): 92-110.

Hansell, P., and J. Adams (1980). The Application of Sediment Analysis to Cultural Deposits. Paper presented at the 45th Annual Meeting of the Society for American Archaeology, Philadelphia.

Hedges, R. E. M., C. Timie, and R. A. Housley (1992). Results and Methods in the Radiocarbon Dating of Pottery. Radiocarbon 34: 906-915.

Hill, B. (1975). A New Chronology of the Valdivia Ceramic Complex from the Coastal Zone of Guayas Province, Ecuador. Ñawpa Pacha 10-12: 1-39.

Hoopes, J. W. (1985). El complejo Tronadora: cerámica del período formativo medio en la cuenca de Arenal, Guanacaste, Costa Rica. Vínculos 11: 111-118.

Hoopes, J. W. (1987). Early Ceramics and the Origins of Village Life in Lower Central America. Ph.D. dissertation, Dept. of Anthropology, Harvard University, University Microfilms International, Ann Arbor.

Hoopes, J. W. (1992). Early Formative Cultures in the Intermediate Area: A Background to the Emergence of Social Complexity. In Lange, F.W. (ed.), Wealth and Hierarchy in the Intermediate Area, Washington, D.C., Dumbarton Oaks, pp. 43-84.

Izumi, S., and K. Terada (1972). Andes 4. Excavations at Kotosh, Peru, 1963 and 1966. University of Tokyo Press, Tokyo.

Johnson, F., and R. S. MacNeish (1972). Chronometric Dating. In Johnson, F. (ed.) The Prehistory of the Tehuacan Valley, Vol. 4: Chronology and Irrigation. University of Texas Press, Austin pp. 3-58.

Kaulicke, P. (1981). Keramik der fruhen Initialperiode aus Pandanche, Dpto. Cajamarca, Peru. Beitrage zur allgemeinen und vergleichenden Archaologie 3: 363-389.

Kelly, I. (1980). Ceramic Sequence in Colima: Capacha, An Early Phase. Anthropological Papers of the University of Arizona, No. 37. Tucson.

Lanning, E. P. (1967). Peru Before the Incas. Prentice Hall, Inc., Englewood Cliffs.

Lathrap, D. W. (1962). Yarinacocha: Stratigraphic Excavations in the Peruvian Montaña. Ph.D. dissertation, Harvard University, Cambridge, Mass.

Lathrap, D. W. (1963). Possible Affiliations of the Machalilla Complex of Coastal Ecuador. American Antiquity 29: 239-241.

Lathrap, D. W. (1966). Relationships Between Mesoamerica and the Andean Areas. In Ekholm, G.F. and G. R. Willey (eds.), Handbook of Middle American Indians, Vol. 4: Archaeological Frontiers and External Connections, University of Texas Press, Austin, pp. 265-276.

Lathrap, D. W. (1970). The Upper Amazon, Thames and Hudson, London.

Lathrap, D. W. (1971). The Tropical Forest and the Context of Chavín. In Benson, E. P. (ed.), Dumbarton Oaks Conference on Chavín, Dumbarton Oaks, Washington, D.C., pp. 73-100.

Lathrap, D. W. (1973). The Antiquity and Importance of Long Distance Trade Relationships in the Moist Tropics of Pre-Columbian South America. World Archaeology 5: 170-86

Lathrap, D. W. (1977). Our Father the Cayman, Our Mother the Gourd: Spinden Revisited or a Unitary Model for the Emergence of Agriculture in the New World. In Reed, C.A. (ed.), Origins of Agriculture, The Hague, Mouton pp. 713-752.

Lathrap, D. W. (1982). Complex Iconographic Features Shared by Olmec and Chavín and Some Speculations on Their Possible Relationship. In Marcos, J. G. and P. Norton (eds.), Primer Simposio de Correlaciones Anthropológicas Andino-Mesoamericano, Escuela Politécnica del Litoral, Salinas, Ecuador, pp. 301-328.

Lathrap, D. W. (1987). The Introduction of Maize in Prehistoric North America: The View from Amazonia and the Santa Elena Peninsula. In Keegan, W. F. (ed.), Emergent Horticultural Economies of the Eastern Woodlands. Center for Archaeological Investigations, Occasional Paper 7, Southern Illinois University, pp. 345-371.

Lathrap, D. W., D. Collier, and H. Chandra (1975). Ancient Ecuador: Culture, Clay, and Creativity, 3000-300 B.C., Field Museum of Natural History, Chicago.

Lathrap, D. W., J. Marcos, and J. Zeidler (1977). Real Alto: An Ancient Ceremonial Center. Archaeology 30(1): 2-13.

Lathrap, D. W., J. Marcos, and J. Zeidler (1986). Real Alto: Un Centro Ceremonial Agro Alfarero Temprana (Valdivia). In J. Marcos (ed.),

Arqueología de la Costa Ecuatoriana: Nuevos Enfoques, Vol. 1, Escuela Politécnica del Litoral, Centro de Estudios Arqueológicos y Antropológicos, Guayaquil, Ecuador, pp. 51-84.

Lathrap, D. W., and L. Roys (1963). The Archaeology of the Cave of the Owls in the Upper Montaña of Peru. American Antiquity 29: 27-38.

Law, I. A., R. A. Housley, N. Hammond, and R. E. M. Hedges (1991). Cuello: Resolving the Chronology through Direct Dating of Conserved and Low-Collagen Bone by AMS. Radiocarbon 33: 303-315.

Legros, T., C. Rodriguez, and C. Pauly (1988). Arqueología del Formativo Temprano en las Llanuras del Caríbe Colombiano. Museo del Oro, Boletín 20(1): 131-132, Bogotá

Lippi, R. D., R. McK. Bird, and D. M. Stemper (1984). Maize Recovered at La Ponga, an Early Ecuadorian Site. American Antiquity 49: 118-124.

Lowe, G. W. (1975). The Early Preclassic Barra Phase of Altamira, Chiapas: A Review with New Data. Papers of the New World Archaeological Foundation, 38, Provo.

McEwan, G. F., and D. B. Dickson (1978). Valdivia, Jomon Fishermen, and the Nature of the North Pacific: Some Nautical Problems with Meggers, Evans, and Estrada's (1965) Transoceanic Contact Hypothesis. American Antiquity 43(4): 362-371.

MacNeish, R. S., F. A. Peterson, and K. V. Flannery (1970). The Prehistory of the Tehuacan Valley, Vol. 3: Ceramics, University of Texas Press, Austin.

Marcus, J. (1983). The Espiridion Complex and the Origins of the Oaxacan Formative. In Flannery, K.V. and J. Marcus (eds.), The Cloud People:

Divergent Evolution of the Zapotec and Mixtec Civilizations, New York, Academic Press, pp. 42-43.

Matsuzawa, T. (1978). The Formative Site of Las Haldas, Perú: Architecture Chronology. American Antiquity 43: 652-673.

Meggers, B. J. (1975). Application of the Biological Model of Diversification to Cultural Distribution in Tropical Lowland South America. Biotropica 7: 141-161.

Meggers, B. J. (1987). El orígen transpacífico de la cerámica Valdivia: Una revaluación. Boletín del Museo Chileño de Arte Precolombino 2: 9-31.

Meggers, B. J. (1992). Jomon-Valdivia Similarities: Convergence or Contact? NEARA Journal 27: 23-22.

Meggers, B. J., and C. Evans (1962). The Machalilla Culture: An Early Formative Complex on the Ecuadorian Coast. American Antiquity 28: 186-192.

Meggers, B. J., C. Evans, and E. Estrada (1965). Early Formative Period of Coastal Ecuador: the Valdivia and Machalilla Phases. Smithsonian Contributions to Anthropology 1. Smithsonian Institution, Washington.

Meggers, B. J., and C. Evans (1966). A Transpacific Contact in 3000 B.C. Scientific American 214: 28-35.

Meggers, B. J., and C. Evans (1978). Lowland South America and the Antilles. In Jennings, J. D. (ed.), Ancient Native Americans, W. H. Freeman, San Francisco, pp. 543-592.

Mejía Xesspe, T. (1978). Importancia Prehistórica de la "Huaca Florida" en el Valle de Lima. III Congreso Peruano El Hombre y la Cultura Andina (Lima 1977), Actas y Trabajos 2: 493-520.

Myers, T. P. (1978). Formative Period Interaction Spheres in the Intermediate Area: Archaeology of Central America and Adjacent South America. In Browman, D. L. (ed.), Advances in Andean Archaeology, Mouton, The Hague, pp. 203-234.

Norr, L. (1986). Archaeological Site Survey and Burial Mound Excavations in the Río Naranjo/Bijagua Valley of the Guanacaste Cordillera. Journal of the Steward Anthropological Society 14: 1-2.

Oyuela C., A. (1987). Dos sitios arqueológicos con cerámica desgrasante de fibra vegetal en la serranía de San Jacinto (Departamiento de Bolívar). Boletín de Arqueología, Fundación de Investigaciones Arqueológicas Nacionales 2(1): 5-26.

Oyuela C., A. (1990). New Evidence of Early Ceramics in the New World. Paper presented at the 55th Annual Meeting of the Society for American Archaeology, Las Vegas.

Oyuela C., A., and C. Rodriguez R. (1990). Shell Midden Formation. Paper presented at the Sixth International Conference of the International Council for Archaeozoology, Smithsonian Institution, Washington, D.C.

Patterson, T. and M. E. Moseley (1968). Late Preceramic and Early Ceramic Cultures of the Central Coast of Peru. Ñawpa Pacha 6: 115-133.

Patterson, T. (1985). The Huaca La Florida, Rimac Valley, Peru. In Donnan, C. (ed.), Early Ceremonial Architecture in the Andes. Dumbarton Oaks Research Library and Collection, Washington, D. C., pp. 59-69.

Pearson, G. W., and M. Stuiver (1993). High-Precision Bidecadal Calibration of the Radiocarbon Time Scale, 500-2500 B.C. Radiocarbon 35: 25-33.

Peterson, D. A. (1980). The Introduction, Use, and Technology of Fiber-Tempered Pottery in the Southeastern United States. In Browman, D. (ed.), Early Native Americans, Mouton, The Hague, pp. 362-372.

Plazas, C., and A. M. Falchetti (1986). Cerámica arcaica en las sábanas de San Marcos, Sucre. Boletín de Arqueología, Fundación de Investigaciones Arqueológicas Nacionales 1(2): 16-23.

Pozorski, S., and T. Pozorski (1990). Reexamining the Critical Preceramic/Ceramic Period Transition: New Data from Coastal Peru. American Anthropologist 92: 481-491.

Ranere, A. J., and P. Hansell (1978). Early Subsistence Patterns along the Pacific Coast of Central Panama. In Stark. B.L. and B. Voorhies (eds.), Prehistoric Coastal Adaptations: The Economy of Maritime Middle America Academic Press, New York, pp. 43-59.

Raymond, J. S., A. Oyuela C., and P. Carmichael (1991). A Comparison of the Earliest Ceramic Technologies of Ecuador and Colombia. Paper presented at the 56th Annual Meeting of the Society for American Archaeology, New Orleans.

Reeder, R. (1978). The Sohn Site, 23JA110, Jackson County, Missouri. Report submitted to the Missouri State Highway Commission, Jefferson City.

Reichel-Dolmatoff, G. (1965a). Colombia, Praeger, New York.

Reichel-Dolmatoff, G. (1965b). Excavaciones arqueológicas en Puerto Hormiga, Departamiento de Bolívar. Publicaciones de la Universidad de Los Andes, Antropología, 2, Bogota.

Reichel-Dolmatoff, G. (1985). Monsú: Un sitio arqueológico. Fondo de Promoción de la Cultura del Banco Popular, Bogota.

Reid, K. C. (1980). Nebo Hill, Archaic Political Economy in the Riverine Midwest. Ph.D. dissertation, Dept. of Anthropology, University of Kansas, University Microfilms, Ann Arbor.

Reid, K. C. (1984). Fire and Ice: New Evidence for the Production and Preservation of Late Archaic Fiber-Tempered Pottery in the Middle-Latitude Lowlands. American Antiquity 49(1): 55-76.

Riddell, F., and L. Valdez (1988). Hacha y la Ocupacíon Temprana de Acarí. Gaceta Arqueológica Andina 16: 6-10.

Rodriguez R., C. (1988). Las Tradiciones Alfareras Tempranas en las Llanuras del Caríbe Colombiano. Boletín de Arqueología, Fundación de Investigaciones Arqueológicas del Banco de la Republica 3(2): 26-40, Bogotá.

Rodriguez R., C. (1990). Otro Conchal con Cerámicas Tempranas en la Llanura de Desborde del Bajo Río Magdalena (Canal del Dique). Paper presented at the 55th Annual Meeting of the Society for American Archaeology, Las Vegas.

Roosevelt, A. C., R.. A. Houseley, M. Imazio da Silveira, S. Maranca, and R. Johnson (1991). Eighth Millennium Pottery from a Prehistoric Shell Midden in the Brazilian Amazon. Science 254: 1621-1624.

Rowe, J. H. (1967). An Interpretation of Radiocarbon Measurements or Archaeological Samples from Peru. In Rowe, J. H. and D. Menzel (eds.), Peruvian Archaeology: Selected Readings, Peek Publications, Palo Alto, CA, pp. 16-30.

Russo, M., B. A. Purdy, L. A. Newson, and R. M. McBee (1992). A Reinterpretation of Late Archaic Adaptations in Central-East Florida: Grove's Orange Midden. Southeastern Archaeology 11: 95-108.

Sassaman, K. E. (1993). Early Pottery in the Southeast: Tradition and Innovation in Cooking Technology, University of Alabama Press, Tuscaloosa.

Sauer, Carl O. (1952). Agricultural Origins and Dispersals. American Geographical Society, New York.

Schmits, L. J. (1978). The Coffey Site: Environment and Cultural Adaptation at a Prairie-Plains Archaic Site. Midcontinental Journal of Archaeology 3: 69-185.

Schmits, L. J., and C. A. Wright (1981). The Turner-Casey Site (23JA35). In Schmits, L.J. (ed.), Little Blue Prehistory: Archaeological Investigations at Blue Springs and Longview Lakes, Jackson County, Missouri. Draft report submitted to the U.S. Army Corps of Engineers, Kansas City District.

Sears, W. H. (1977). Seaborne Contacts between Early Cultures in the Lower Southeastern United States and Middle through South America. In The Sea in the Pre-Columbian World, E. P. Benson (ed.), pp. 1-13. Washington, D.C.: Dumbarton Oaks Research Library and Collections.

Skibo, J. M., M. B. Schiffer, and K. C. Reid (1989). Organic-Tempered Pottery: An Experimental Study. American Antiquity 54(1): 122-146.

Simoes, M. F. (1981). Coletores-pescadores ceramistas do litoral do Salgado (Pará): Nota Preliminar. Boletim do Museu Paraense Emilio Goeldi, Nova Serie 78: 1-31.

Snarskis, M. J. (1978). The Archaeology of the Central Atlantic Watershed of Costa Rica. PhD dissertation, Columbia University, University Microfilms International, Ann Arbor.

Snarskis, M. J. (1984). Central America: The Lower Caribbean. In Lange, F.W. and D.Z. Stone (eds.), The Archaeology of Lower Central America University of New Mexico Press, Albuquerque, pp. 195-232.

Spinden, H. J. (1917). The Origin and Distribution of Agriculture in America. Proceedings of the 19th International Congress of Americanists, Washington, pp. 269-276.

Stahl, P. (1984). Tropical Forest Cosmology: The Cultural Context of the Early Valdivia Occupations at Loma Alta. Ph.D. dissertation, Dept. of Anthropology, University of Illinois, University Microfilms International, Ann Arbor.

Stoltman, J. B. (1966). New Radiocarbon Dates for Southeastern Fiber-Tempered Pottery. American Antiquity 31: 872-874.

Strong, W. D., and C. Evans (1952). Cultural Stratigraphy in the Virú Valley, Northern Peru: The Formative and Florescent Epochs. Columbia University Studies in Archaeology and Ethnology 4.

Stuiver, M. and G. W. Pearson (1993). High-precision Bidecadal Calibration of the Radiocarbon Time Scale, A.D. 1950-500 B.C. and 2500-6000 B.C. Radiocarbon 35: 1-23.

Stuiver, M., and Reimer, P. (1993). Extended ^{14}C Data Base and Revised CALIB 3.0 ^{14}C Age Calibration Program. Radiocarbon 35: 215-230.

Tellenbach, M. (1981). Vobericht uber die erste Kampagne der Ausgrabung bei Montegrande im Jequetepeque-Tal, Nordperu. Beitrage zur Allegemeinen und Vergleichenden Archaologie 3: 415-435.

Terada, K. (1979). Excavations at La Pampa in the North Highlands of Peru, 1975. University of Tokyo Press, Tokyo.

Terada, K. and Y. Onuki (1982). Excavations at Huacaloma in the Cajamarca Valley, Peru, 1979. University of Tokyo Press, Tokyo.

Terada, K. and Y. Onuki (1988). Las Excavaciones en Cerro Blanco y Huacaloma, Cajamarca, Peru, 1985, University of Tokyo Press.

Trinkley, M. B. (1980). A Typology of Thom's Creek Pottery for the South Carolina Coast. South Carolina Antiquities 12: 1-35.

Trinkley, M. B. (1986). Indian and Freedmen Occupation at the Fish Haul Site (38BU805), Beaufort County, South Carolina. Research Series 7. Columbia, S. C.: Chicora Foundation.

Vaillant, G. C. (1934). The Archaeological Setting of the Playa de los Muertos Culture. Maya Research 1(2): 87-100.

Villalba O., Marcelo (1988). Cotocollao: Una Aldea Formativa del Valle de Quito. Miscelanea Antropológica Ecuatoriana, Serie Monográfica 2, Museos del Banco Central del Ecuador, Quito.

Willey, G. R. (1971). An Introduction to American Archaeology, Volume II: South America. Prentice Hall, Inc., Englewood Cliffs.

Willey, G. R., and C. R. McGimsey (1954). The Monagrillo Culture of Panama. Peabody Museum Papers, 54, Cambridge, Mass.

Willey, G. R., and P. Phillips (1958). Method and Theory in American Archaeology. University of Chicago Press, Chicago.

Williams, D. (1981). Excavation of the Barabina Shell Mound North West District: An Interim Report. Archaeology and Anthropology 4: 13-38.

Wippern, A.M. (1987). Debate sobre Monsú. Boletín Cultural y Bibliográfico, Banco de la República, 24(12): 84-87. Bogotá.

Witty, T. A., Jr. (1982). The Slough Creek, Two Dog and William Young Sites, Council Grove Lake, Kansas. Kansas State Historical Society Anthropological Series 10.

Yamasaki, F., T. Hamada, and C. Fujiyama (1966). Riken Natural Radiocarbon Measurements II. Radiocarbon 8: 324-339.

Figure Legends

Fig. 1: Early ceramic complexes in North, Central, and South America.

Fig. 2: Early ceramic complexes in South America.

Fig. 3: Sites with early ceramics in northern Colombia.

Fig. 4. Table of radiocarbon dates cited in the text.

Fig. 5. Chronological ranges of ceramic complexes cited in the text.