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Technology, Organization, and Approaches

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Cover illustration:
An Early Middle Sicán depiction
of the "Sicán Lord" masked face
from Huaca del Pueblo Batán Grande.
Drawing by Kathryn M. Cleland
and Izumi Shimada
THE EARLIEST CERAMIC TECHNOLOGIES OF THE NORTHERN ANDES: A COMPARATIVE ANALYSIS

J. Scott Raymond, Augusto Oyuela-Caycedo, and Patrick H. Carmichael

ABSTRACT A comparative analysis of the earliest ceramic complexes from Colombia and Ecuador, known, respectively, as San Jacinto and Valdivia, reveals significant differences in the construction, firing, and finishing technologies. This, together with the fact that the ceramic complexes bear very little formal resemblance to each other, is used to suggest that there is no compelling reason to infer a connection or causal relationship between the early technologies. It is argued, rather, that an explanation for the early occurrences of these two complexes is more likely to be found in changing economic and social contexts occurring in the South American tropics during the seventh and sixth millennia B.P. which placed a positive cultural value on ceramic production.

SPANISH ABSTRACT Un análisis comparative de los complejos cerámicos más tempranos de Colombia y Ecuador, conocidos como San Jacinto y Valdivia respectivamente, revela diferencias significativas en las tecnologías de manufactura, cocción y acabado. Esto, junto con el hecho de que los mencionados complejos cerámicos presentan una mínima semejanza formal entre uno y otro, no es una razón convincente para inferir una conexión o una relación causal entre las tecnologías tempranas. Se debate, mas bien, que una explicación para los comienzos tempranos de los dos complejos se puede encontrar probablemente en contextos de cambio social y económico que ocurrieron en los trópicos sudamericanos durante el séptimo y sexto milenio antes del presente, el cual da un valor cultural positivo a la producción de la cerámica.

Introduction

Archaeologists have given a great deal of attention to the beginnings of pottery making. The invention of pottery has been regarded by many as an essential first step in the development of civilizations. The early presence of pottery has been taken as a sign of sedentism, of the beginnings of agriculture, and of changes in customary ways of storing and cooking foods. Debates have raged over whether ceramic technologies were the result of repeated independent inventions or whether they spread from a few centers of origin. Friendships have been lost over disagreements about how degrees of similarity and difference among ceramic traditions are to be measured and interpreted. Freudian analysts would probably find a rich body of data in studying this archaeological fixation on a craft which is mainly of recreational and esthetic importance in the modern world. But the fact remains that in the dusty remnants of past cultures broken bits of pottery are among the few indices which survive, and questions of when, why, and how pottery making came into being take on added importance in that context.

In this paper we compare the beginnings of ceramic production in western Ecuador and northern Colombia, comparing specifically early Valdivia with the San Jacinto complex (Fig. 1). Our comparisons are based on recent field research and on formal and technological studies of the respective ceramic complexes. We are less interested in whether or not these complexes had a common origin than in trying to understand the technological, social, and economic contexts of ceramic production in their respective cultures, which we believe will eventually tell us more about why pottery came into being.

Andean Ceramics

Fig. 1. Northern Andean region, showing the locations of Valdivia, San Jacinto, and Puerto Hormiga.

Valdivia and Puerto Hormiga both received notoriety in the 1960s as the "earliest known Formative Cultures" (Ford 1966:782). This claim was based on (1) radiocarbon dates that placed the beginnings of each at the end of the sixth millennium B.C., (2) the presence of pottery, and (3) the size of the sites, which was believed to indicate rather sedentary settlements (Meggers et al. 1965; Reichel-Dolmatoff 1965a). Valdivia, which was the first discovered, was also believed by its finders to be the earlier of the two complexes. Since Valdivia pottery was without known antecedents and since it bore some resemblance to pottery of the Japanese Jomon culture, Meggers et al. (1965) asserted that it was introduced to coastal Ecuador by direct transpacific contact. Furthermore, they suggested that the early ceramic cultures of Colombia, including Puerto Hormiga, were derived from Valdivia.

The "Japanese origins" hypothesis was rejected by several archaeologists (Collier 1968; Lathrap 1967; Bischof 1967); however, some archaeologists (Ford 1966; Willey 1971: 275–276) favored it over the possibility that pottery-making technology originated in either the Ecuadorian or Colombian lowlands. The idea that the so-called essential elements of civilization (e.g., agriculture, sedentism, pottery making, metallurgy) began in the arid heartlands of Mesoamerica and the Central Andes and later diffused elsewhere was well entrenched in the thinking of New World archaeologists. Spinden had cogently articulated this thesis in 1917, and most of the debate through to the early 1960s had been concerned with which of the two nuclear centers was responsible for particular innovations. The discovery of pottery in the tropical lowlands of Ecuador and Colombia which predated the earliest pottery in either Mexico or Peru by a millennium or more contradicted the underlying assumption of such thinking. James Ford (1966, 1969), trying to take account of such contradictions, suggested that the elements of the Formative spread from separate centers of origin. Pottery, he suggested, was first "spread by seafaring people who estab-
Fig. 2. Graphic comparison of uncalibrated radiocarbon dates from the San Jacinto and Valdivia complexes.
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Fig. 3. Five rim sherds from Nomland's collection at C-113. Courtesy of Phoebe Apperson Hearst Museum of Anthropology. Photograph by A. Oyuela-Caycedo.

lished colonies on distant shores.” Such population movements, he said, were “similar to the long-distance colonizing ventures of the Vikings” (Ford 1966:782).

This was a bold and creative attempt to remodel Spinden’s (1917) “Archaic Hypothesis” to fit with the apparent implications of archaeological data of the 1960s, and one which continues to have some appeal, especially with the concept of “dependent invention” as applied by Clarke and Gossen (1995). Dependent invention is understood as stimulus diffusion where technical knowledge or ideas are changed rapidly by the borrowing group. This concept reconciles differences between diffusionist models and those which argue for local social and economic explanations. We shall argue that evidence accumulated in the last two decades indicates that ceramic production in Ecuador and Colombia during the sixth millennium B.P. (Fig. 2) was stimulated by local social and economic developments and that there is no reason to invoke outside influence, much less outside colonists; however, we do not preclude the possibility of the transmission of knowledge over a large part of tropical America. Furthermore, we suggest that practical knowledge of the basic elements of pottery making in lowland South America may have preceded by centuries, or perhaps millennia, the beginnings of ceramic production in either area.

Colombia

In Colombia, the study of early ceramics, of what we are calling the San Jacinto complex, started in 1932. In that year archaeologist Gladys Ayer Nomland collected sherds from several sites along the lower Magdalena river in the vicinity of the municipality of San Jacinto. Among the sites that she discovered is C-113, which yielded a collection of fiber-tempered sherds (Fig. 3). Regrettfully, the report that Nomland wrote has never been published, nor have we had access to the manuscript, so we have not been able to determine the exact location of the site. We believe, however, based on the locations of other sites which Nomland investigated, that C-113 is either El Bongal or the site now known as Bucarelia (Fig. 4). The collection from C-113 shares its ceramic style and technology with assemblages from a series of sites of the lower Magdalena valley. These are the sites of Puerto Hormiga, Puerto Chacho, El Guamo, El Bongal, Bucarelia,3 San Jacinto 1, and San Jacinto 2. Given her experience with the ceramics of northern South America (Nomland 1933, 1935), it seems probable that Nomland would have placed the C-113 collection at the early end of the sequence. Cruxent and Rouse (1958:35–37), however, were the first to argue in print for its early placement.4

In 1954, Gerardo Reichel-Dolmatoff and Alicia Dussan de Reichel initiated a long-term investigation of the early Formative of northern Colombia. This led to the discovery of several shell middens in the vicinity of Cartagena, including the well-known sites of Puerto Hormiga, Monsu, Barlovento and Canapote. This last
site was later excavated by Henning Bischof (Reichel-Dolmatoff and Dussan de Reichel 1991; Reichel-Dolmatoff 1954, 1955, 1965a, 1965b, 1985).

Since the completion of the Reichels' work, additional sites with fiber-tempered ceramics have been located and excavated. In 1987, excavations were carried out by Thierry Legros and Camilo Rodríguez at the site of Puerto Chacho in the Canal del Dique. The site is located on the same alluvial terrace as Puerto Hormiga and is contemporaneous with it (Legros 1990; Rodríguez 1995). The previous year, Oyuela (1987) located two sites, San Jacinto 1 and 2, with fiber-tempered pottery. They are inland, in the area of the municipality of San Jacinto, near where Nomland had carried out her survey. These two sites depart radically from the settlement patterns of the sites previously known, being located in a transitional hilly savannah environment in what is known as the Serrania de San Jacinto.

All the sites previously studied which had early ceramics were located in an ancient estuarine environment where people had access to multiple niches of resources. The Puerto Hormiga and Puerto Chacho middens result from intensive exploitation of these resources during a wet period of sea transgression and formation of estuarine environments. Later, the drop in sea level moved the coastline farther away and limited the resources. The people remained in the area but with different subsistence strategies emphasizing inland gathering and sea and river fishing (Oyuela 1996). There were riverine and swamp adaptations during the same period as Puerto Hormiga but these are very poorly understood (see Angulo 1988).

Contrasting with the estuarine context of Puerto Hormiga and Puerto Chacho, the sites of San Jacinto 1 and San Jacinto 2 are situated in the Andean foothills nearly 220 m above the flood plain of the lower Magdalena and more than 60 km from the present seashore (Fig. 4). San Jacinto 1, located on a flood plain of a small tributary to the Magdalena, is the older of the two. First revealed in a stream cut, excavations at the site have disclosed seven discrete superposed cultural strata, interbedded with sterile clay layers and overlain by
between 3.25 and 4 m of alluvial deposit. Excavations which opened an area of 75 m² confirmed the existence of a living floor (stratum 9) which was the most recent of a sequence of occupations on an active point bar during successive dry seasons (Fig. 5). Stratum 9 covered an area of 380 m², as defined by auger testing. Ten radiocarbon dates from charcoal—three from the stream cutbank and seven from excavated features—place the occupations between 5900 and 5300 B.P. (Fig. 2), and the sequence of dates corresponds with the stratigraphic order (Oyuela 1993).

San Jacinto 2, situated on a hilltop, has no overburden. Preliminary investigations suggest that the site represents a settlement covering an oval area of about 2,340 m². Samples of organic temper combined from several sherds yield two dates 1000 years apart (PITT-0362: 4565±80 B.P.; PITT-0361: 3505±85 B.P.) and in reverse stratigraphic order. Since these sherds came from a midden and not from discrete living floors, the dates cannot be associated with specific occupations of the site but they do indicate that the ceramics are contemporary in part with the Puerto Horniga ceramics. For the purposes of this paper direct dating of the pottery is sufficient.

Stylistically, pottery from both San Jacinto assemblages is very similar to the Puerto Horniga pottery and pottery of other assemblages from sites near Puerto Horniga along the Canal del Dique. It is not, however, similar in form or decoration to the early pottery from the site of Monsi. Stylistic comparisons of the early Monsú/Turbana pottery suggest that it should be chronologically aligned with the later Canapote materials and that the shell radiocarbon dates may have been misleadingly early (Oyuela 1995; Rodriguez 1988, 1995; Legros et al. 1988; Wippern 1987). Pottery from San Jacinto 2 is very similar to pottery from the undated El Bongal site, suggesting contemporaneity between the two occupations. Each of the inland assemblages—San Jacinto 1, San Jacinto 2 and El Bongal—exhibits a greater variety of vessel forms and decorative motifs than do the coastal Puerto Horniga or Puerto Chacho assemblages.

**Ecuador**

Valdivia pottery was first identified by Bushnell (1951) in the course of his pioneering archaeological reconnaissance of the Santa Elena Peninsula; however, because the pottery he found was in a mixed context with later materials, he did not recognize the great antiquity of the Valdivia style. It was Estrada (1956) who, as a result of his investigations at a site in the present-day village of Valdivia, gave the style its name and identified it as the earliest ceramic style in Ecuador. Subsequently, the collaborative research of Estrada, Meggers, and...
Evans revealed the startlingly early radiocarbon dates associated with Valdivia pottery (Evans et al. 1959; Meggers et al. 1965).

Sites with Valdivia assemblages are now known from a broad area of southwestern Ecuador, including most of the present-day provinces of Manabí and Guayas (Fig. 6). The first discoveries and excavations were made at sites situated along the coast, but most of the sites since then have been discovered in the small coastal river valleys and in the broad lowlands of the Guayas river. Direct and indirect evidence suggests that there was significant reliance on horticulture, complemented by fishing, hunting, and foraging (Raymond 1988, 1989, 1995; Raymond et al. 1980; Damp et al. 1981; Pearsall 1988; van der Merwe et al. 1993).

The preceramic Vegas populations, living on the Santa Elena Peninsula before Valdivia, practiced a broad-spectrum hunting-fishing-foraging economy with some dependence on cultivated plants (Stohter 1985, 1988; Piperno and Pearsall 1990). Vegas communities exhibited a certain degree of sedentism in that groups aggregated frequently at a base settlement where rituals, including at least funerary rites, were carried out. The base settlement continued to be occupied over a 4,000-year span, suggesting that there was a strong and persistent tie between community and geographical location (Stohter 1985, 1988; Raymond 1993, 1995).

The appearance of Valdivia is marked by a significant change in settlement patterns, with the focus of settlement shifting to the alluvial bottoms of the coastal valleys. At the site of Real Alto, by the middle of the fifth millennium B.P., large houses, capable of sheltering several nuclear families, were arranged around what has been interpreted as a ceremonial plaza (Marcos 1978; Lathrap et al. 1977; Zeidler 1984). Similar settlement plans, though not as thoroughly investigated and mostly on a smaller scale, are evident at other Valdivia sites, and the pattern seems to have been established with the first of the settlements (Raymond 1993). Valdivia settlements have been interpreted—we think reasonably—as hamlets and villages with some degree of social and economic interdependence (Zeidler 1986; Raymond 1988,
1989, 1993, 1995; Damp 1984). The earliest Valdivia settlements, however, may not have been fully sedentary. They are larger (4 to 10 times) than the largest of the Vegas settlements and were planned settlements; however, the small huts of early Valdivia are only slightly larger (ca. 3.5 m across) than those of Vegas and no less flimsy, suggesting that they were designed to be built and rebuilt quickly. The spacing between the early settlements (Damp 1984; Raymond 1989, 1995) suggests that communities were associated with specific geographical domains. Early Valdivia, then, seems to reflect a process of increasing sedentism, associated with a growing dependence on plant cultivation and a high degree of community control over specific wild resources which were exploited by mobile segments of the population.

The ceramic chronology first defined by Meggers et al. (1965) has generally been confirmed by later investigations, but Hill's (1975) eight-phase seriation is a more fine-grained scaling of the time sequence. In this paper we focus on ceramic production during early Valdivia, by which we mean the first two phases of Hill's seriation. Radiocarbon assays on charcoal associated with early Valdivia assemblages at Loma Alta and Real Alto fall between about 5200 and 4400 B.P., making them roughly contemporary with Puerto Hormiga but more recent than San Jacinto 1 (Fig. 2). We must mention that Valdivia may not have been the earliest ceramic complex in western Ecuador. A small number of very different sherds have been ascribed to a style called San Pedro, which may be either contemporary with or earlier than Early Valdivia (Bischof and Viteri 1972; Bischof 1979; Damp 1979; Damp and Vargas 1995). The chronological position of San Pedro, however, does not concern us here since only a handful of San Pedro sherds have been recovered, and there is insufficient evidence of their economic or social context.

Ceramic Production

Comparisons between the early Ecuadorian and Colombian ceramics have focused mainly on decorative techniques. We have tried to go beyond these and compare the early complexes in terms of the different aspects of ceramic production: resources used, the technologies of constructing and firing vessels, vessel shapes, and the social and economic context of vessel use. Our comparisons are partly based on microscopic analysis of thin sections, examination of cross-sections and surfaces of sherds, and X-ray imagery. We should also mention that our observations and generalizations about Valdivia pottery are based on a much larger body of data (published and unpublished) than is available for the San Jacinto complex pottery.

Vessel Shapes and Decoration

The vessel forms of the San Jacinto complex consist mainly of hemispherical vessels with convex, direct, unmodified rims (Fig. 7). The Puerto Hormiga and Puerto Chacho assemblages consist almost entirely of bowls, a small percentage of which have oval or boat-shaped horizontal cross-sections (Fig. 8). The inland assemblages add large closed-mouth jars and generally have a greater variety of vessel forms. Some vessels are equipped with pouring spouts and many have lug-like
handles which bear incised, excised, and modeled zoomorphic motifs. Additional excised and incised decoration occurs in bands below the rims of bowls and jars (Fig. 9). San Jacinto 1 exhibits less standardization of decorative motifs than do the later assemblages. Oyuela (1987, 1995) suggests that a principal use of the jars was for liquid storage to accommodate detoxification of foods, fermentation, and to protect liquids from vermin.

As Norton (1977) has observed, early Valdivia exhibits a highly standardized set of vessel forms. Three forms comprise 90% of each of the assemblages: hemispherical bowls with direct, incurving rims; jars with tall necks and unmodified rims; squat jars with short necks and folded rims (Fig. 10). Variants of these—e.g., tall-necked jars with folded rims, tetrapod bowls—comprise the remaining 10%. Decoration, which consists mainly of incised and excised bands below the rims, follows a very explicit set of rules. Bowls are slipped red, burnished, and incised and/or excised using a hard, sharp stylus, probably made from hardwood or bone (Fig. 11). Designs vary, but are generated from a limited set of design elements. Jars are rarely excised but a much greater variety of instruments were used for incision, including finger tips, fingernails, seashells, and multipointed tools. Jars exhibit a greater variety of designs than bowls, but the designs are less intricate, often just the repetition of a single design element, and less well executed. Modeling, other than bossing on the shoulders of squat jars, is almost unknown in early Valdivia. Ceramic figurines, for which Valdivia is
Fig. 10. Vessel forms of early Valdivia: (a) tall-necked jars; (b) squat jars with folded rims; (c) hemispherical bowls. Drawing by P. Mathews.

Fig. 11. Sherds from early Valdivia hemispherical bowls, illustrating surface finish and incised decoration. Photograph by Gerald Newlands.
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Fig. 12. Graphic comparison of percentages of types of temper among four San Jacinto complex assemblages.

well known, do not occur in significant frequency until the end of phase 2 and were previously made in stone.

Temper, Firing Conditions, and Vessel Construction

Both San Jacinto sites confirm that the earliest ceramics of northern Colombia were tempered with plant fibers (Fig. 12). The entire assemblage from San Jacinto 1 is fiber-tempered. Like the Puerto Hormiga assemblage, most of the pottery from San Jacinto 2 is fiber-tempered (69%), but a significant proportion (31%) is tempered with fine sand. Five of the 16 San Jacinto 2 sherds for which there are X-ray images show evidence of grog temper mixed with sand and fiber. In the recent analysis of the pottery from Puerto Chacho, which has a ceramic assemblage identical to that of Puerto Hormiga, Rodríguez (1995) defines an additional category of temper which he calls mixto. He defines this as a mix of fiber and mineral (sand) temper (Rodríguez 1995:146). We have not distinguished this as a separate category because we believe that the “mineral component” was a natural inclusion in the clay, and reflected variability in the raw materials rather than an intentional addition to the ceramic paste. This is not the case with the chopped fibers, which were clearly added, and for this reason we collapse the two categories of mixto and fiber temper into our fiber-tempered category (Fig. 12). At Puerto Hormiga, Reichel-Dolmatoff (1965a, 1965b) distinguished two
types of fiber temper; tubular filaments and grass blades. Pottery tempered with the former had a porous fabric, with the latter, a dense fabric. Porous pottery predominated and was completely undecorated. Tubular filaments are rare in the San Jacinto temper, which consists mainly of grass-like particles with some grit inclusions. The pottery is predominantly nonporous and frequently decorated. Reichel-Dolmatoff also distinguished two other wares at Puerto Hormiga based on the differing densities of sand temper. This distinction is not evident in the San Jacinto 2 assemblage, but the sand temper, like that of Puerto Hormiga, is very fine-grained.

The pottery from Puerto Hormiga is reported to have been fired in an oxidizing atmosphere (Reichel-Dolmatoff 1965a). The black to gray cores, however, indicate that the organics were not completely oxidized. The fiber-tempered sherd from San Jacinto 1, El Bongal, and C-113 have black to dark gray cores and sharp boundaries between cores and oxidized surfaces. The surface color is partly a result of post-depositional weathering, but the sharp boundary between surface and core suggests low oxidized firing with rapid exposure to an oxidizing atmosphere during cooling (Rye 1981:114–118). This may have been achieved by the use of firing ovens. One hundred twelve ovens with oxidized, burnt clay walls were discovered at San Jacinto 1 by Oyuela (1993, 1995) in recent excavations (Fig. 13). Although most of the ovens were associated with fire-cracked rock and were used for cooking, they would also have made suitable firing ovens, and firing conditions would have been oxygen reducing.6

The lighter gray cores of the sand-tempered sherd from San Jacinto and the uniformity of color between surface and core suggest greater oxidation during firing. No wasters from overfiring or poorly controlled firing are evident in the San Jacinto assemblages, nor does Reichel-Dolmatoff report such evidence from Puerto Hormiga or Rodriguez for Puerto Chacho. Despite the lack of evidence to the contrary, however, we should be cautious in assuming that all firing was well controlled. Sherd from underfired pottery, for example, are unlikely to have survived, given the humid conditions of deposition.

Reichel-Dolmatoff (1965a:20–26) has suggested that all of the Puerto Hormiga pottery was manufactured by direct shaping.7 Our X-ray analysis of nine fiber-tempered sherd from the San Jacinto assemblages also indicates that direct shaping was used. The interpretation of X-ray images of three sand-tempered sherd8 from San Jacinto 2 is less certain. Two show faint indications of coiling. We cannot be certain of the original orientation of the third sherd. Depending upon the orientation, it shows clear evidence of either coiling or drawing.9 Though this is a limited sample, it suggests that manufacturing techniques used on vessels with fiber-tempered pastes were different from those used on vessels with sand-tempered pastes. It also suggests that by the fifth millennium B.P., potters at the inland sites were using a wider variety of manufacturing techniques than the coastal potters. This, however, needs to be studied further through X-ray analysis of Puerto Hormiga sherds.
and of a larger sample from San Jacinto 2.

Early Valdivia pottery is tempered with sand. Judging by the range in size of the sand particles and the variation in quantity, the sand seems clearly to have been added as a temper rather than occurring as a natural inclusion. Meggers et al. (1965:42–87) report shell particles together with the sand in some of their types, which suggests that coastal potters were sometimes using beach sand, since shell is not found naturally in the sands of the Valdivia river. No shell or other calcareous particles were identifiable in any of the samples which we examined from Loma Alta and other inland sites. A few sherds from Loma Alta contained glog. This, as far as we know, is the only report of glog in Valdivia pottery, which may be due to the paucity of glog in the sherds but may also be due to the rarity of thin-section analysis of Valdivia pottery.

Small amounts of organic material are also visible in cross-sections of some sherds. These are probably natural or accidental inclusions in the clay, although they may have been added to increase plasticity of the clay or enhance the resistance to thermal shock in cooking pots. There are no apparent correlations between amounts of temper or particle size and vessel form, or between assemblages, but such patterns may emerge when a larger sample has been examined.

Firing of Valdivia pottery was done in an oxidizing atmosphere and in most cases organic was completely oxidized. A few specimens, however, were either accidentally or deliberately reduced, and some of these exhibit sharp boundaries between black cores and oxidized surfaces. These might also be explained by occasional use of clays which were rich in organics.

Consistent horizontal voids visible in the X-ray images of early Valdivia sherds indicate that potters used coiling to manufacture vessels. Meggers et al. (1965:42) reached the same conclusion on the basis of breakage patterns. Breakage, however, did not clearly indicate coiling in the assemblages we examined. In fact coil bonding was so complete that coil junctions were rarely visible in magnified cross-sections. Those that were faintly visible were spaced at intervals of about 1 cm. and were at an oblique angle with respect to the vessel surface, indicating that coils were pulled upward on the insides of vessels and pushed downward on the outside to achieve bonding. On X-ray images of the two nearly complete jars, spiral coiling was evident. In the sample analyzed there is no evidence of the use of any other construction techniques.

Surface treatment

The weathered surfaces of the San Jacinto sherds make it difficult to assess surface treatment. There is no evidence of the use of slips, but the surfaces were prepared to an even, smooth condition before they were decorated. Incision, punctuation, and stamping were applied to surfaces which had dried to a leather-hard state.

Surface treatment of early Valdivia pottery varies in relation to vessel form and probably in relation to utilitarian and social function. Surfaces of jars were finished to an even, smooth state but were rarely burnished and almost never slipped. Jar necks, as mentioned above, were commonly decorated, using incision, punctuation, and combing. Incision was often done before the surface had dried to a leather-hard state, so that little ridges of clay border the edges of the incision. Bowls were almost always slipped red inside and outside and the surfaces were prepared by smoothing and burnishing. Bowls were commonly decorated with incision and sometimes with excision, both of which were done after the vessel had been slipped. The ragged edges of the incisions on some vessels give the impression that they were engraved after firing, imitating the technology of engraving gourds. Microscopic inspection shows, however, that although the vessel surfaces were hardened, the subsurface clay was still plastic when the incisions were made, indicating that the incision was done on slipped bowls as the last stage of manufacture before firing. This suggests that the potters were applying slip by wiping it on after the vessels were completely dry, since slip cannot be wiped on effectively when the surface is still wet (Rye 1981:25). That inference is consistent with occasional horizontal striations which are visible in the slip and the absence of drip lines, which one would expect to see on some of the specimens if the vessels were dipped in the slip.

Organization of Production

The social and economic dimensions of ceramic production are much more elusive in the archaeological record than the technological. Yet we cannot hope to understand much about the early development of pottery without attempting to learn about pots and the parts they played in the lives of the people who made and used them.

There is no evidence of economic specialization in early Valdivia society or in the societies associated with the early Colombian ceramics. And there is no reason to believe that pottery was a craft of specialists. Pottery has been found mainly in middens and as part of the debris associated with everyday life. There are no indications that special areas within settlements were reserved for ceramic production. Though the empirical proof consists largely of a lack of evidence to the contrary, it seems plausible to infer that pottery was produced within the
context of a household economy. Judging by the quantities of pottery, there was at least a strong cultural value placed on its use, regardless of its real utilitarian value.

There is no evidence that non-local materials were used. Pots were made from clays and tempers readily available within walking distance of the settlement. Hematite, used for slipping Valdivia bowls and rubbed into incisions on Puerto Hormiga pots, may have been a little more difficult to find but was available locally to those familiar with the mineral deposits. Wood for firing was also at hand around the settlements. Pots were decorated with tools which could have been made from a variety of materials lying about the house—e.g., shells, bone, wood.

Pottery, then, seems to have been made by the household for the household. If pottery was exchanged, it does not seem to have traveled far from home—exchanged with neighboring communities, perhaps. The regional distributions of the San Jacinto and Valdivia ceramic styles were very likely a function of commnal exchange and social networking. Here, of course, we need to recognize that the physical exchange of pots may be difficult to detect within the regions. Mineralogical or trace-element signatures, for example, are unlikely to be useful since within each region—the lower Magdalena valley in Colombia and the western valleys of the Colonche Hills in Ecuador—the clays, silts, and sands derive from common geological sources. If, however, Loma Alta, situated in the middle Valdivia valley, had exchanged pottery with a coastal settlement, we might expect to find some pottery with beach sand and shell inclusions, like that reported by Meggers et al. (1965:42–87).

A household mode of production for pottery fits with other indices of social and economic contact. In Ecuador, settlements in the Valdivia and Chanduy valleys seem to have been mostly economically self-sufficient (Raymond 1988, 1989, 1995; Norton 1977; Marcos 1986; Zeidler 1986; Damp 1984), with very limited exchange of basic goods between coast and nearby interior regions. Sea foods, for example, were brought in moderate quantities to inland settlements via what were probably informal household economic ties. Extra-regional exchange in exotic goods such as spondylus shell and obsidian, which is very evident later, appears to have been rare in early Valdivia. Inter- and intra-regional exchange is not evident in the Colombian assemblages either. In the case of San Jacinto there is clear evidence that even if there was a degree of mobility this was limited to a defined territory, due to the patchy and seasonal distribution of resources (Oyuela 1996; Bonzani 1995).

Norton (1977) plausibly suggested that Valdivia bowls were used for serving, drinking, and eating and that cooking was done in jars, particularly those with folded rims which could easily be lifted from the fire. Our analysis supports Norton’s suggestion in that some jars exhibit charring from use over a fire, while no bowls show such evidence. Reichel-Dolmatoff (1965a:27–28) and Oyuela (1987:4) have made similar but less specific suggestions about vessels of Puerto Hormiga and San Jacinto. At Puerto Hormiga and San Jacinto 2 some sand-tempered pots were used for cooking as evidenced by carbonized residues on the exterior; however, at San Jacinto 1 cooking was done in earthen ovens using heated rocks (see Figs. 5 and 13) and none of the pottery shows evidence of having been used over a fire. A distributional analysis of the pottery and fire-cracked rocks from stratum 9 at San Jacinto 1, which yielded a very low Pearson’s correlation of 0.083 (Oyuela 1995:140), confirms that pottery was not associated with activity areas of cooking. An attribute analysis of the ceramics indicates that the San Jacinto 1 vessels were probably used to serve and store liquids and, perhaps, for fermentation (Pratt 1995). Unfortunately analysis thus far has failed to yield organic residues such as liquids which would be indicative of such uses.11

In both the Ecuadorian and Colombian complexes we are probably on safe ground inferring that vessels were made to serve domestic utilitarian requirements. The low frequency of pottery in the San Jacinto 1 strata, however, particularly in comparison to fire-cracked rocks but also in comparison to later assemblages from San Jacinto 2, Puerto Hormiga, and Puerto Chacho (Oyuela 1995), suggests that pottery had a limited role and one that was more social than utilitarian. If we limit our inferences to thoughts about utilitarian production, we ignore the fact that households comprise social contexts and that members of households participate in wider social networks. Furthermore, as Brown (1989: 205) has pointed out, “there are alternative (utilitarian) functions that the simplest pottery could fulfill.” Pots and other artifacts are involved in social events beyond mere utilitarian purposes, as we argue below. (For an alternative model on the cultural evolution of pottery technology see Oyuela 1995.)

Cairn burials of pottery discovered by Norton (1977) at Loma Alta attest a symbolic role for pottery from early Valdivia, though we can only guess at the symbolic meaning. Marcos (1978) has correlated vessel categories with structures and mound-building episodes at Real Alto, showing that Valdivia pottery was employed differentially in ceremonial events. Some of the early Colombian sites, including Puerto Hormiga (Reichel-Dolmatoff 1965a) and San Jacinto 2 (Oyuela 1995), and many of the Valdivia sites, including Loma Alta and
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Real Alto (Marcos 1978; Lathrap et al. 1975; Lathrap et al. 1977; Raymond 1988, 1993, 1995; Damp 1984; Stahl 1984) represent communities which were built according to a definite plan. This suggests that relationships among households, including economic and social interactions, may also have conformed to traditional patterns. We can only speculate, but it seems reasonable to suppose that relationships within the communities and between communities was effected in part through domestic artifacts, including such things as dress, tools, and utensils. The relatively high incidence of decorated pottery in both the early Colombian and the early Ecuadorian complexes \(^{12}\) suggests that the manipulation of ceramic style may have been an active medium of social communication. \(^{13}\)

The early ceramic assemblages of Colombia and Ecuador exhibit recognizable ceramic styles. Because of the much larger samples from Ecuador, the style can be more clearly defined in terms of the rules for interrelating vessel forms and decoration and, to some extent, the rules for generating designs. It is clear that common standards for making and decorating pottery were held by people living over a large part of southwestern Ecuador and that these standards were closely adhered to as early as 5200 B.P. It follows that these same standards were used to judge the quality of the pottery and decoration, and by implication the skill of the potter. We have no way of discovering whether potting skills were explicitly recognized in society, but the high quality of Valdivia pottery, in terms of the technical standards of manufacture, indicates that a high cultural value was placed on good pottery. It seems probable that the self-esteem and social standing of potters was affected by the quality of their products. \(^{14}\)

For Puerto Hormiga and Puerto Chacho there is little variability in the form of the hemispherical bowls (Reichel-Dolmatoff 1965a: figs. 5–8). This can be interpreted as simplicity of form or standardization of production. The inland assemblages of San Jacinto 1 and 2 exhibit a great deal of variability of form and decoration. \(^{15}\) The samples, however, are too small to be able to determine rules for decoration and form or to assess intersite or intrasite standardization of such rules. The high frequency of decoration (24% and 47% of rim sherd respectively from each site [Pratt 1995]) suggests that pottery served in part as a medium of social communication. The high quality of manufacture exhibited by both the San Jacinto assemblages and the Puerto Hormiga sand-tempered wares indicates that pottery had a high social and/or economic value. It follows that potting skills may have attracted social recognition and have been a dimension of achieved status.

Summary and Conclusions

Whether looked at from the point of view of technology, vessel form, or decorative style, these early ceramic complexes of Ecuador and Colombia have very few points of similarity. We have discovered no similarities beyond the few decorative traits that Ford (1966; 1969) and Meggers et al. (1965) noted in their comparisons. The dissimilarities are much more profound, in our opinion, particularly those associated with pottery making. The ancient Colombians and Ecuadorians made their pots from very different kinds of pastes. Even the sand-tempered wares of Colombia are distinct from those of Valdivia, though that may in part reflect differences in clay and sand resources. Firing technologies differed as well, with the Colombian wares fired in more reducing atmospheres, perhaps in firing ovens, and the Ecuadorian pottery in oxidizing conditions. Vessel construction was by coiling in Valdivia and predominantly by direct shaping in the San Jacinto complex.

We might be inclined to explain away the technological differences if there were strong formal similarities. It is possible to derive one complex from the other, but with the scale of transformations required to do so, almost any ceramic tradition could be derived from any other, especially if we consider the possibility of dependent invention.

Arguments favoring a common origin for pottery have rested on the assumption that the invention of pottery making was a rare event. If that was so in South America, then the common technological antecedents of these two early traditions of Colombia and Ecuador must belong to a still more remote and as yet undiscovered development. Alternatively, we suggest that peoples living in the sedentary world of the tropical lowlands had, as part of their general store of knowledge about the natural environment, a general understanding of clays and their characteristics when dried and/or burnt. This is illustrated quite clearly by the burnt clay linings of the earth ovens. There is no reason to believe that the people were any less observant of, or familiar with, the mineralogy than they were of the plants and animals.

The beginnings of pottery production, then, would seem better understood as a social and economic development than as the spread and adoption of a rare invention. And it is in the social and economic context of production that we see significant similarities between these ancient ceramic traditions. Both evolved in the context of the tropical lowlands. Valdivia exhibits a greater degree of sedentism than is apparent for San Jacinto, especially during San Jacinto 1 when there was a high degree of mobility associated with the exploitation of patchy seasonal resources. In both cases, however, mobility was restricted to defined areas which were
associated with specific communities. Emphasis on these resources undoubtedly varied; collecting, for example, may have been economically more important for the San Jacinto 1 populations than for the San Jacinto 2 or Valdivia populations. Raw materials for making pottery were also from the vicinity of the settlements. Production and distribution of the pottery appear to have been within the community, with households probably comprising the basic units of production. Pottery had both utilitarian and social functions. It seems a fair guess that the qualities of manufacture and decoration anticipated the ethnographically recorded use of ceramic style among South American tropical forest peoples to signal and interpret personal, family, community, and ethnic dimensions of society (see for example DeBoer 1990). The fact that some Valdivia vessels are ceramic replicas of carved gourds suggests that the decorative style may have been transferred among media.

The search for earlier or distant origins for both Valdivia and San Jacinto has been prompted in part by the expectation that the earliest pottery should be more poorly made. Intuitively that makes some sense. But what does intuition tell us about how long it should take to go from the crude beginnings to the refined achievements of these two traditions? We acknowledge that there seem to have been technological thresholds in the evolution of ceramic manufacture (polychrome slip painting is an example) that took a long time to develop. But we suggest that, with two preconditions, San Jacinto and early Valdivia may represent technological development over one or two generations. The two preconditions are (1) a rudimentary understanding of the physical behavior of clay and (2) clear sociocultural rewards for ceramic production.16

We do not argue that the development of pottery in either area was necessarily completely free of outside influence. But we do suggest that it does not make much difference whether we see it as a process of adoption or invention. Rather our understanding is more likely to be enhanced by studying the social and economic conditions which encouraged ceramic production. In Ecuador and Colombia this means furthering our knowledge about the changes which tropical lowland societies were undergoing during the 6th millennium B.P. Judging from recent discoveries of early pottery elsewhere (Barnett and Hoopes 1995), tropical lowland societies in the lower and upper Amazon, and lower Central America may have been experiencing similar changes.

Notes
1. Significant revisions have been made to a version of this paper which was published in Spanish (Raymond et al. 1994). That version was originally written in 1991. Since then, Oyuela and Bonzani carried out excavations at San Jacinto 1 and completed their dissertations (Oyuela 1993; Bonzani 1995), information from which we have incorporated in this version. We have also examined the ceramic materials collected by Gladys Nomland from site C-113, which are stored at the Phoebe Apperson Hearst Museum of Anthropology at the University of California, Berkeley. We are grateful to Madeleine Fang, Patricia Lyon, and John Rowe for arranging access to the collection. We also wish to thank Clara Inez Botero at the ICAN-Museo Nacional in Bogotá for making it possible to photograph the reconstructed vessel from Puerto Chacho, Vic Krantz for taking the photograph, and Betty Meggers for arranging the funding which made it possible for Vic Krantz to travel to Bogotá to photograph the San Jacinto complex collections.

2. Here and elsewhere in this chapter we use “fiber-tempered” to refer to organic fibers which were mixed into the ceramic paste and carbonized during firing. Those we have examined appear to be grass fibers; however, we have not identified species, nor have we ruled out other fibrous plant material such as moss.

3. El Guamo is located near the town of Las Palmas in the municipality of San Juan de Nepomuceno. El Bongal is located in the hills near Zambrano. Bucaralá is located on the river bank of the Magdalena river north of Zambrano. Because of its riverine location, we believe that Bucaralá is more likely than El Bongal to be site C-113 located by Nomland. Reichel-Dolmatoff and Dussan de Reichel’s (1991) excavations at Bucaralá failed to turn up any San Jacinto pottery; however, a surface collection from the cut bank carried out by Legros and Rodriguez (pers. comm., 1987) did recover fiber-tempered pottery in the San Jacinto style. It is possible that the excavations of the Reichels were not deep enough to penetrate the San Jacinto component.

4. Lathrap (1970:65) noted the formal similarities between the fiber-tempered pottery collected by G. Nomland at Bucaralá (C-113) and the Puerto Hormiga pottery and suggested that the Bucaralá materials were of comparable age or older. And before Lathrap, Crummet and Rouse (1958:35–37) suggested that the Bucaralá pottery, which they referred to as San Jacinto, was the earliest pottery in Colombia.

5. The study of Valdivia is based mainly on a sample of about 12,000 rim sherd from the assemblage excavated at Loma Alta, on surface collections from six additional sites in the Valdivia valley and neighboring valleys with early Valdivia components, and on a sample from the early Valdivia assemblages excavated at Real Alto. A 1% random sample, stratified by context and vessel form, from the Loma Alta assemblage was thin-sectioned and examined under a petrographic microscope for mineral identification and shape and size of aplastic inclusions. The sherd from which the thin sections were taken were also examined through a stereoscope to examine vessel construction and paste. X-ray images, film radiographs, and xeroradiographs, of a judgmentally selected sample of these sherd were examined for further indications of construction technology. A small selection of sherd from the early Valdivia
component at Real Alto and of early Valdivia sherds from six other sites in the Valdivia and neighboring valleys was also subjected to all of the above examinations. From Colombia the analysis is based on a sample of the excavated assemblages from San Jacinto 1 and San Jacinto 2. The Colombian samples were not thin-sectioned, but were examined by binocular microscope and X-ray images.

6. This warrants further investigation and experimentation given the rarity of known firing devices from pre-Columbian contexts (Arnold 1985:218). Also, since reduced oxygen firing may be characteristic of Formative ceramic technology in northern Colombia (see Wagner et al. in this volume; Gebhard et al. 1988–89), other Formative sites should be examined for oven-like features (see illustrations of Formative kilns in Shimada et al. in this volume). Since the use of firing ovens elsewhere in the world seems to correlate with extremely wet climates (Arnold 1985:215), they may have been functionally important to the development of ceramic technology in the humid tropics of lowland Colombia.

7. By “direct shaping” we mean that a vessel was made by hand beating and pulling a ball or disc of clay into the desired form.

8. None of the other sand-tempered sherds in the sample from San Jacinto 2 was large enough to examine construction patterns from the X-ray image.

9. By “drawing” we mean squeezing the clay and pulling it upward.

10. All of the X-ray images but these two were of rims or shoulders. To complete the manufacturing study it will be necessary to X-ray vessel bottoms, especially of the bowls.

11. An analysis of a sample of San Jacinto 1 pottery for organic residues is being conducted by Dr. Richard Evershed of the Department of Biochemistry, University of Liverpool. Dr. Evershed (pers. comm. with Oyuela, 1994) has thus far been unsuccessful in detecting any organic residues on the pottery.

12. Twenty percent of the San Jacinto 1 sherds are decorated and 30% of those from San Jacinto 2. For early Valdivia, 25% of the bowls are decorated, 65% of the folded-rim jars, and 30% of the tall-necked jars.

13. We do not wish to draw a direct analogy, but we find that the social dynamics of pottery making and use among the present-day Panoons of the Peruvian Upper Amazon instructive (DeBoer 1990; DeBoer and Lathrap 1979; DeBoer and Moore 1983; Lathrap 1983).

14. The interrelationship between quality control and social standing of potters is well documented for the modern Shipibo and Comibo, the highly skilled potters of the Ucayali mainstream (DeBoer 1990; DeBoer and Lathrap 1979; Lathrap 1983). Perhaps more relevant to our suggestion is the fact that among the backwoods Cashinahua, poor potters by Shipibo-Comibo standards, manufacturing standards are also reinforced by social opinion. “Whenever she makes pottery, a Cashinahua woman is doing much more than simply filling her cookware requirements; her reputation as an artist is at stake . . . her skill at it reflects directly upon her personal worth, and partially determines the degree of respect she commands from other Cashinahua” (Ferguson 1975:126).

15. Assemblages from the newly discovered sites of El Guamo and El Bongal exhibit similar ranges of variability.

16. Sociocultural rewards could be based on social and/or utilitarian roles ascribed to pottery, as well as cost-efficiency factors such as those mentioned by Brown (1989; discussed by Oyuela 1995). Regardless of the underlying reasons, however, we believe that the development and maintenance of a ceramic industry was contingent on the development of positive social values for ceramic production.

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