

Archaeological evidence for transpacific voyages from Asia since 6000 BP

BETTY J. MEGGERS¹

RESUMEN

La identificación de similitudes genéticas entre las poblaciones indígenas del Japón y de los Andes hace necesario volver a examinar la evidencia cultural de contactos transpacíficos precolombinos. Este artículo describe cuatro casos bien documentados, dos en el Ecuador y dos en Mesoamérica, todos ellos desechados por la mayoría de los antropólogos por ser ejemplos de convergencia o invención independiente. El caso ecuatoriano más temprano, que apoya la introducción de la cerámica desde el Japón occidental en ca 6000 AP, es especialmente pertinente porque reúne las dos regiones que tienen las frecuencias más elevadas del virus HTLV-1. El segundo, fechado ca 2000 AP, introdujo varios rasgos culturales con antecedentes que estaban más difundidos en Asia. En Mesoamérica, nuevas investigaciones de la cultura Olmeca refuerzan la evidencia de antecedentes Shang, implicando un contacto ca 3200 AP. Elementos chinos adicionales se han documentado en la cultura Maya comenzando ca 2500 AP. Otros rasgos culturales con antecedentes asiáticos que incluyen cerbatanas, tela de corteza y balsas, y rasgos biológicos que incluyen parásitos intestinales y gallinas domesticadas, podrían haber sido introducidos durante uno de estos episodios o en otros todavía no documentados arqueológicamente.

Introduction

Although cultural similarities between Asia and America have long been cited in support of transpacific contact prior to the European discovery, this evidence is rejected by most anthropologists on the assumption that the traits are susceptible to independent duplication. Genetic similarities, such as the concentration of HTLV-I carriers in Japan and the Andes, are less readily dismissed as the result of

convergence or independent evolution. The existence of biological replications affirms the credibility of the cultural evidence, which in turn can suggest potential sources and times of arrival of voyagers from Asia. In this review, I will describe the four best documented archeological examples of transpacific introductions to northwestern South America and Mesoamerica between ca 6000 and 2500 BP. The character and timing of these events provide a context for identifying the possible association of other biological and cultural traits with Asian prototypes.

Criteria for Identifying Diffusion

Whereas biologists use genetic evidence to differentiate independent origin, convergence, and common descent among plants and animals of similar appearance, anthropologists have no equally reliable criteria for identifying the origins of cultural similarities. Functional constraints can produce remarkable convergences in tools and weapons, and adaptation to similar environments can produce detailed resemblances in settlement patterns and subsistence techniques. The results may produce comparable sequences of cultural development, as occurred prehistorically in the Southwestern United States and northwestern Argentina (Meggers, 1964). Consequently, unless a historical relationship can be demonstrated, most anthropologists consider even the most complex and arbitrary duplications to be independent. The problem thus becomes: what criteria can be used to identify traits unlikely to be reinvented?

The following rules have been specified to identify transpacific introductions: (1) the traits compared should be of equal age in Asia and America; (2) there should be a history of development in the donor area and a sudden appearance without antecedents in the receiver area; (3) there should be a wider geographical distribution in the donor area, consistent with greater antiquity; (4) there should be no functional limitations that would favor

¹ Smithsonian Institution, Washington DC, USA.

independent recurrence; (5) several arbitrary elements should be combined into a distinctive complex, and (6) there should be a route and means of transport from the donor to the receiver area (Meggers, 1971). The most critical of these criteria in my view is the arbitrary character of the elements. As in the case of genetic and linguistic duplications, each selection from an infinite set of alternative possibilities lowers the probability of independent replication of the assemblage.

There are four archeological complexes of different ages that meet these criteria, two in northwestern South America and two in Mesoamerica.

Northwestern South America Jomon-Valdivia/San Jacinto, ca 6000 BP

The first detailed archeological documentation of a transpacific introduction was provided in 1965 with the publication of *Early Formative Period of Coastal Ecuador* by Meggers, Evans, and Estrada. This monograph describes and illustrates the pottery of the Valdivia Tradition with carbon-14 dates beginning ca 5600 BP. Although execution is competent and decoration involves more than two dozen arbitrary combinations of a variety of plastic techniques (incising, excising, punctating, finger grooving, rocker stamping, shell stamping, shell scraping, drag-and-jab), no developmental antecedents have been identified in the New World (Fig. 1).

By contrast, Jomon pottery in Japan has been traced from simple beginnings ca 12,000 BP. Vessel shapes and decoration diversified during subsequent millennia and most of the decorative motifs present in early Valdivia occur in the Late Early and Early Middle Jomon of Kyushu (Fig. 2). A ceramic complex of equal antiquity was more recently identified on the north coast of Colombia (Oyuela, 1995). San Jacinto pottery is also sophisticated in form and decoration, and appears suddenly in fully developed form. Carbon-14 dates extending from 6000 to 5300 BP place it contemporary with early Valdivia and some Jomon decorative techniques are shared, but the emphasis on modeling, cordimpressing, and incisions terminating in punctations implies greater affinity with central Honshu. The similarity between the elaborate San Jacinto castellated-rim treatments and the flamboyant Jomon "flame ware" is particularly striking (Fig. 3; Meggers, 1995).

Although no New World antecedents have been identified either ceramic complex and all of the

criteria specified for favoring transpacific diffusion are fulfilled, most anthropologists continue to argue for independent origins (Fiedel, 1992: 349-351; Bruhns, 1994: 361; Hoopes, 1994) on the assumption that pottery is easy to invent, that the decorative techniques are obvious, that seaworthy watercraft did not exist, and that survival of an ocean crossing is unlikely. Recent evidence from Japan and the adjacent Southwestern Pacific eliminates the last two objections.

Navigational capacity

Various kinds of archeological evidence indicate that long-distance voyages were being undertaken in the Southwestern Pacific region several millennia earlier than 6000 BP. Carbon-14 dates from New Ireland, New Britain, and the Admiralty and Solomon Islands establish the existence of human occupation by 33,000 BP, which required crossing more than 100 km of open water (White, 1993). The presence in sites of paleolithic age on the Japanese mainland of obsidian originating from a flow on the island of Kozushima testifies to repeated sea voyages prior to the Jomon Period (Oda 1990: 64). The existence of terminal Early/beginning Middle Jomon pottery on Hachijo-jima in the Izu Archipelago has "confirmed that Jomon people had gone across the Black Current in dugout canoes to islands more than 300 km away from the Japanese mainland" as early as 6,000 to 7,000 B.P. (Oda, 1990: 60-61). Maritime communication between the Early and Middle Jomon inhabitants of the Izu Islands and regions to the south is documented by the presence of ornaments of amber, jadeite, and serpentine; minerals not available locally (Oda, 1990: 170,74).

Incentive to leave Japan

The existence of maritime capacity much earlier raises the question why the two apparently independent voyages from Japan documented thus far both date ca 6000 BP. A possible explanation is provided by the violent eruption of Kikai volcano on a small island off southern Kyushu, characterized as «the biggest explosive event in the Japanese Holocene» (Machida, 1990: 32). According to Machida, "it would be expected that the Jomon culture in the southern part of Kyushu would have perished in the holocaust of pyroclastic flows and that almost the whole of Southwestern Japan would have been significantly devastated by ash fall

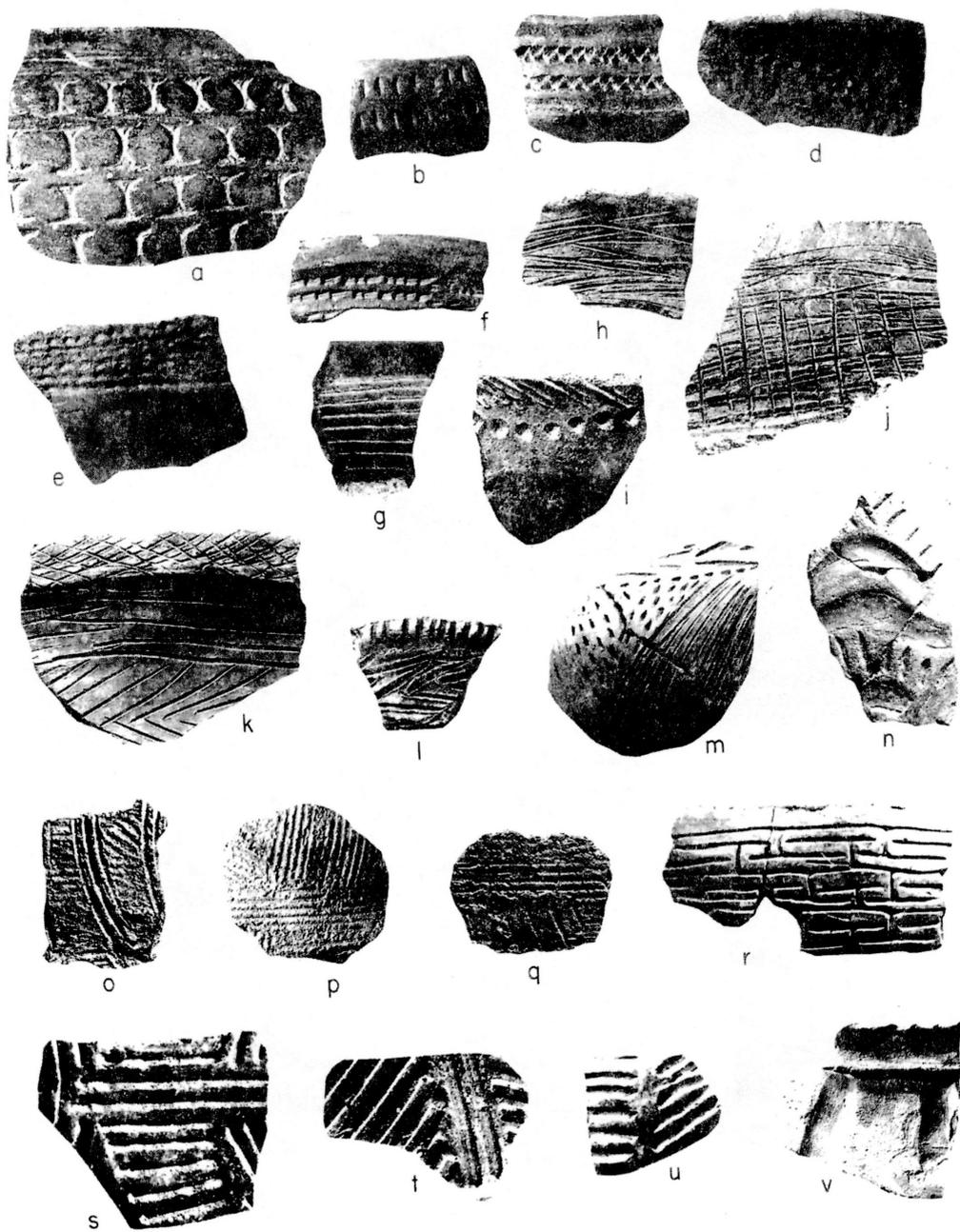


Fig. 1. Decorated pottery of the Valdivia Tradition, coastal Ecuador. a. Excision; b, Fingernail impression; c-d, Rocker stamping; e, Cord impression; f-g, Multiple drag-and-jab; h, Zigzag incision; i, Incisions bordered by a row of punctates; j, Crosshatch; k, Combination of incised motifs; l, Nicked rim; m, Zoned punctuation; n, y, Finger grooving; o-q, Shell scraping; r, Interlocking incisions; s-u, Broad-line incised; v, Folded-over rim.

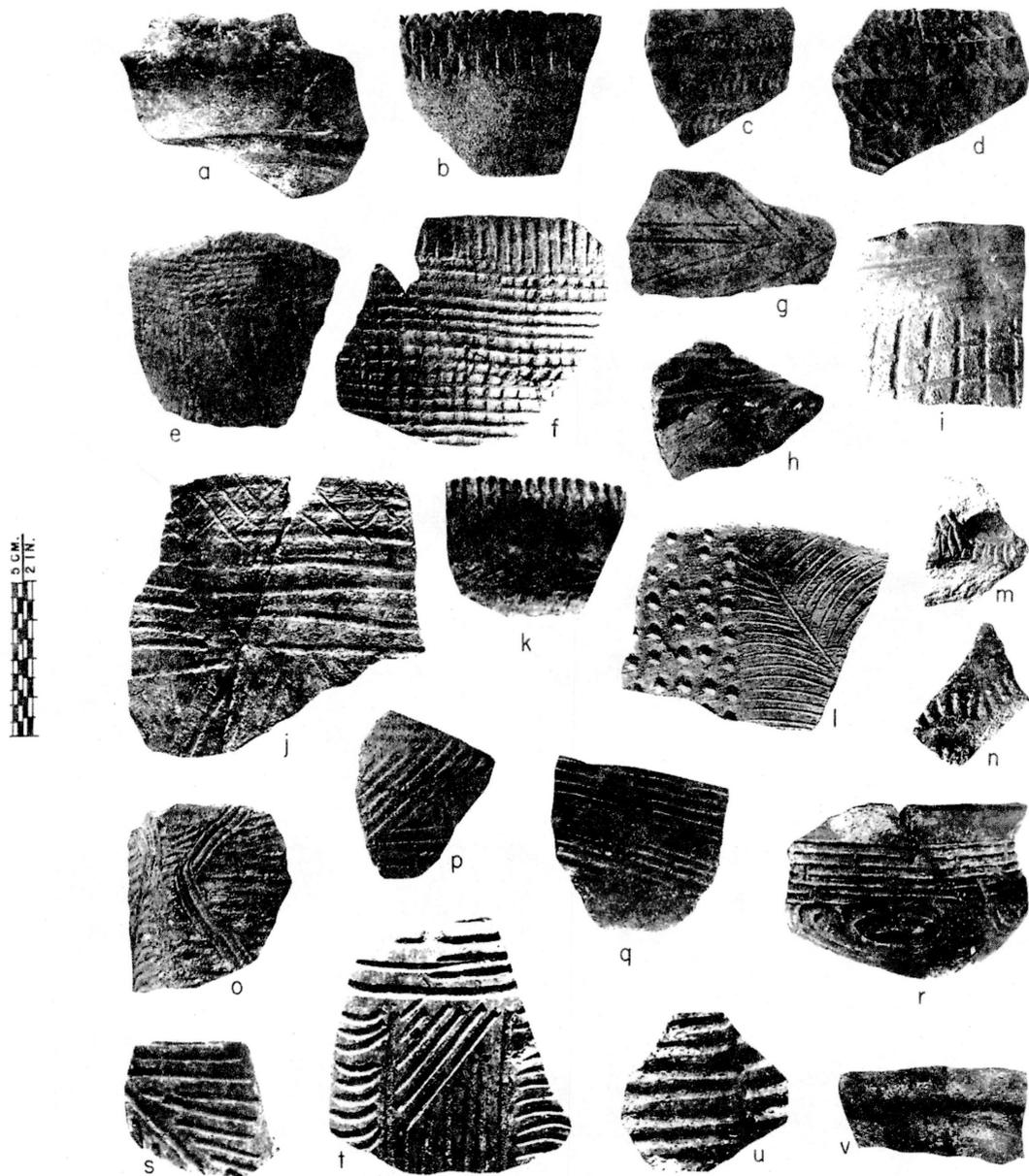
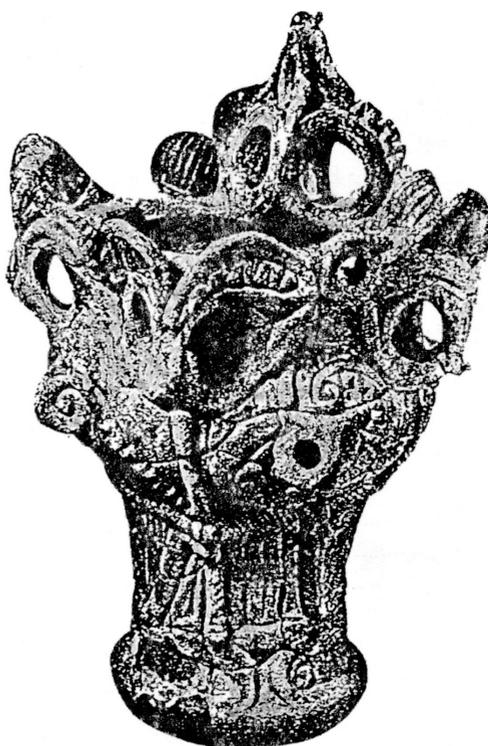


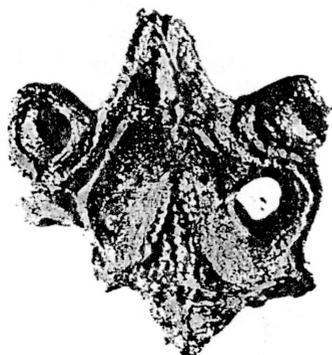
Fig. 2. Decorated pottery of the Early Middle Jomon Period, Japan. a, Excision; b, Fingernail impression. c-d, Rocker stamping; e, Cord impression; f, Multiple drag-and-jab, g, Zigzag incision; h, Incision bordered by a row of punctates; i, Crosshatch; j, Combination of incised motifs; k, Nicked rim; l, Zoned punctate; m-n, Finger grooving; o, q, Shell scraping; r, Interlocking incisions; s-u, Broad-line incised; v, Folded-over rim.



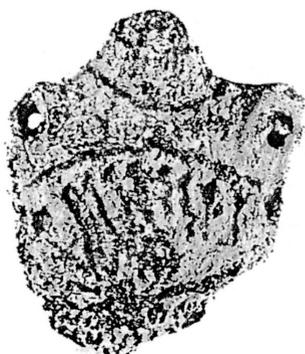
San Jacinto



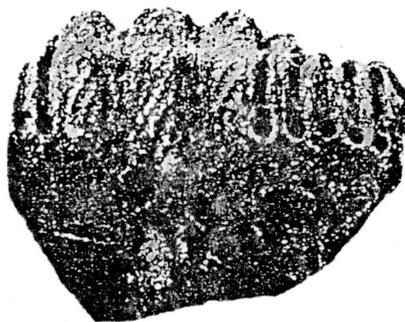
Miyashiro (Iida-city)



San Jacinto



San Jacinto



Toroku (Kumamoto-city)

Fig. 3. Similarities in rim treatment and decoration of San Jacinto pottery from Colombia (left) and Jomon pottery from central Honshu, Japan (after Meggers, 1995).

(probably damp) and associated events such as tsunami» (ibid). The demographic impact is reflected in a density of only 1 site per 100 km² on Kyushu, compared with 1 site per 10 km² on Hokkaido and 1 site per km² on Honshu during the Middle Jomon period (Koike 1992: 54 and Fig. 2. 1990).

Although some 40 carbon-14 dates from various parts of Japan extend between ca 7500 and 4000 BP, 16 cluster ca 6300 BP and have been considered to date the event (Machida and Fusao 1983: Fig. 3; Machida 1990). The coincidence in timing between this catastrophe and the appearance of Jomon related pottery at two locations in the Americas suggests a cause and effect relationship.

Genetic evidence of migration

A world-wide survey of 13 genetic markers reveals that the Noanama, an indigenous group on the Pacific coast of Colombia, share the highest seropositivity against the human T-cell leukemia virus HTLV- 1 with the indigenous inhabitants of the Ryukyus and western Japan (Len-S. et al., 1995). This correlation, as well as common possession of the 9 bp deletion in mtDNA and other genetic markers, has been attributed by several geneticists to transpacific immigration (Len-S. et al., 1994; Cann 1994; Kirk, 1979). Hence, it is noteworthy that the Naonama territory is near the mouth of the Rio San Juan on the central Pacific coast of Colombia, along the route postulated in 1965 to account for the presence of Valdivia decorative techniques and motifs in the Puerto Hormiga complex, at that time the earliest pottery known on the north cost (Fig. 4; Meggers, Evans, and Estrada, 1965). The genetic evidence suggests that the immigrants responsible for the antecedent San Jacinto complex landed on the relatively inhospitable Pacific coast and followed the inland route to the north, where environmental conditions and subsistence resources were more comparable to those they had left behind in Japan (Oyuela Caycedo, 1996).

Southeast Asia - Bahia/Jama-Coaque ca 2500 BP

The Regional Developmental Period of Ecuador, which extends between ca 2500 BP (500 BC) and 1500 BP (AD 500), is characterized by the crystallization of distinct localized cultures from generalized Formative Period antecedents (Meggers 1966: 67-118). Among the coastal configurations, the Bahia and Jama-Coaque complexes

exhibit a number of features with Asian counterparts. Both the elements and their variations are widespread and earlier in southeast Asia. In the Americas, the majority are restricted to the central coast of Ecuador, where they appear ca 2500 BP without local antecedents (see Estrada and Meggers 1961 for details).

Although pottery house models are relatively common in the Andean area and Mesoamerica, and occur during the preceding Formative Period in Ecuador, several features of the Regional Developmental Period examples from northern Manabi and Esmeraldas provinces are unusual. These include concave ridges that rise to peaks at the ends (Fig. 6), double roofs, ornamented facades, and columns, all of which are characteristic of domestic architecture throughout southeast Asia and Indonesia, and have been reported from Japan (Estrada and Meggers, 1961: Figs. 1-5; Kidder, 1959: Figs. 33, 143).

Pottery neckrests occur in a variety of shapes and constructions that are duplicated in Asia, where they are made of wood, cloth, and stone as well as pottery and remain in use today (Estrada and Meggers 1961: Figs. 6-9). Panpipes graduated from both sides toward the center are ancient in China and have been reported ethnographically from Burma (Estrada and Meggers 1961: Although pottery figurines in both complexes are abundant, diversified, and often elaborately dressed and ornamented, the type designated La Plata Seated is distinctive in its leg and arm positions, arm and neck ornaments, and headdress, all of which have counterparts in southeast Asia (Fig. 7). The tuskshaped pendant or magatama and circular ear plugs were characteristic ornaments in Japan and Korea from the late neolithic period onward (Kidder 1959: 68-69).

It is noteworthy that these traits are associated with Austronesian speakers, whose expansion is said to have «proceeded more rapidly and extensively than any other in prehistoric times» (Bellwood, 1991: 92). From a homeland in southern China and Taiwan, they swept across islands southeast Asia to the western frontiers of Polynesia between ca 4000 and 1000 BP (Bellwood, 1991:92). The navigational skills and colonizing spirit implied by this dispersal may have facilitated expansion across the remaining distance to the coast of Ecuador.

Mesoamerica

Shang-Olmec, ca 3200 BP

The inception of Olmec culture in Mesoamerica

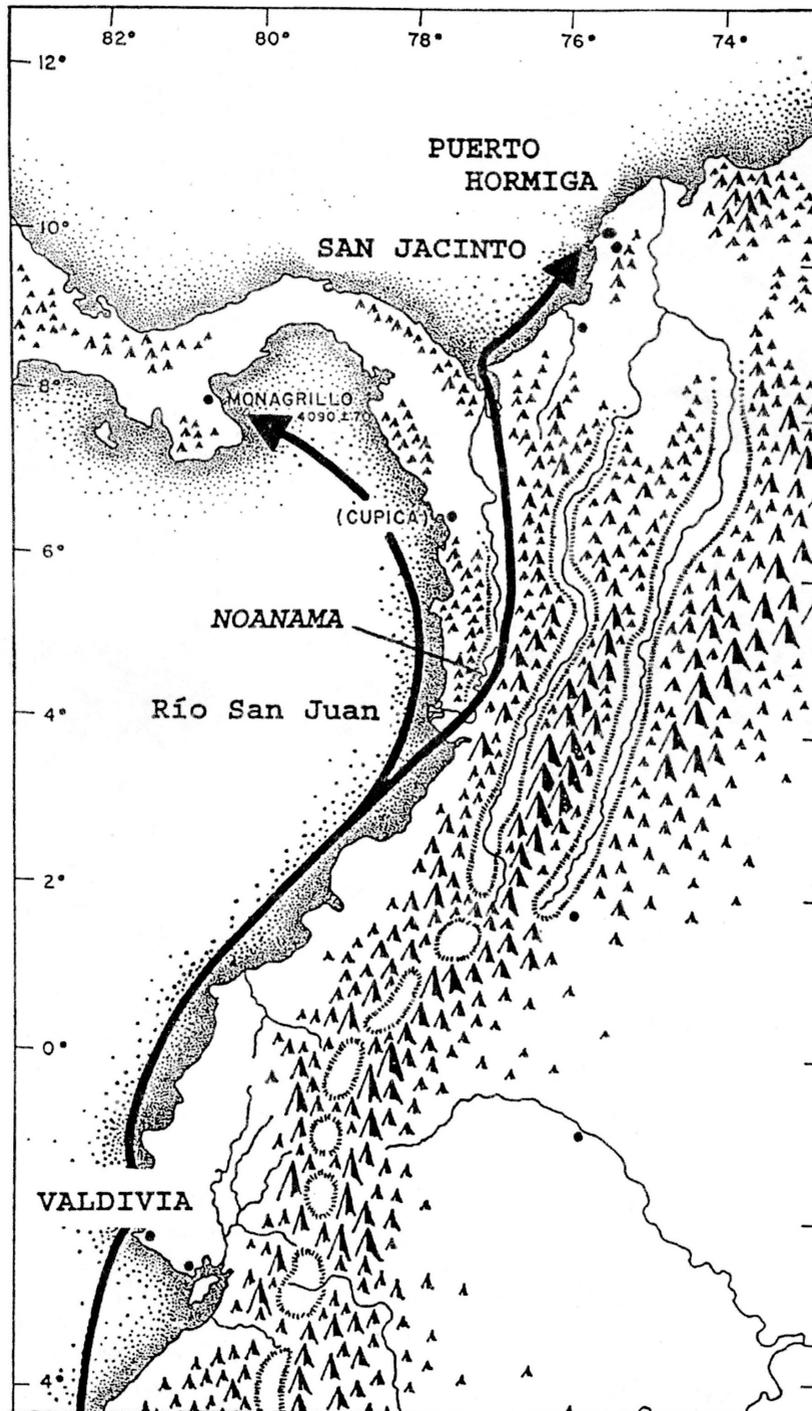


Fig. 4. Location of the Noanama on the west coast of Colombia, intermediate between the distributions of the Valdivia and San Jacinto ceramic complexes (after Meggers, Evans, and Estrada, 1965).

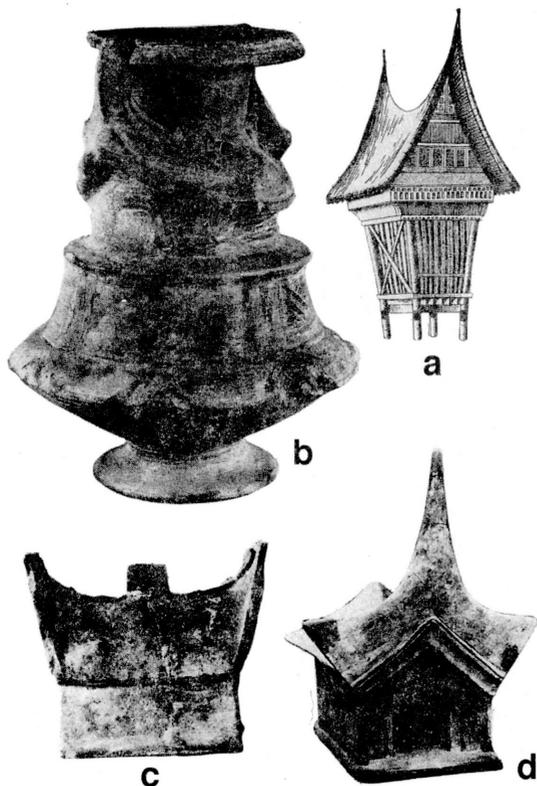


Fig. 5. Pottery models of houses from Regional Developmental Period complexes on coastal Ecuador with saddle roofs characteristic of southeast Asian buildings. a, Adang highlands, Sumatra; b-c, coastal Ecuador (after Estrada and Meggers, 1961: Fig. 4).

about 3200 BP is marked by the sudden adoption by local sedentary farming communities of new cultural traits, among them monumental art, large-scale construction, an accurate calendar, jade working, emblems of rank, feline stylizations, and numerous distinctive symbols, all present earlier in the Shang civilization of China (Meggers, 1975, Xu, 1996).

Most Shang-Olmec resemblances are artistic depictions, whose arbitrary form minimizes the probability of independent invention. Jade tablets or batons of several sizes and shapes identify differences in rank among Shang officials and appear to have had similar significance among the Olmec (Fig. 8). Felines were symbols of power and superiority in both cultures and their depictions exhibit the same range from ferocious to gentle,



Fig. 6. Similarities in sitting position, ornaments, and headdress of figurines from the Regional Developmental Period on the central coast of Ecuador and southeast Asia. a, Java, 13-14th century; b, Campa (Annam), 10th century; c-d, Coastal Ecuador (after Estrada and Meggers, 1961: Fig. 10).

realistic to stylized, and the same lack of a lower jaw (Meggers, 1975: Fig. 9). Both early Chinese and Olmec depictions show a depression or cleft in the center of the head (Fig. 9). Polished concave mirrors of hematite, magnetite or ilmenite, which require a high level of technical skill to produce, occur in both cultures.

The most remarkable feature is the presence on Olmec carvings of symbols identical to those used in Shang writing and which Shang experts are able to read (Xu, 1996: 17-28 and pers. com.). Shang characters are distinctive among ancient writing systems in representing a word rather than a sound or syllable. As a result, a message can be read by anyone familiar with the meaning of the symbol without knowing the language of the writer. This

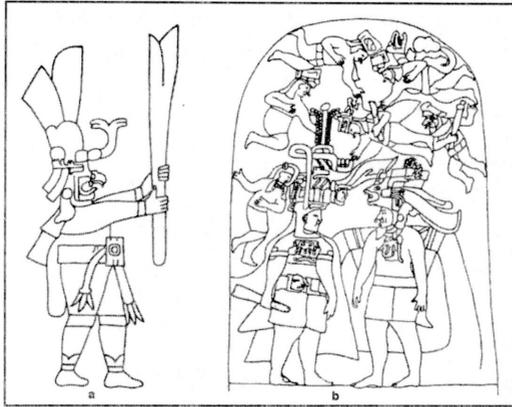


Fig. 7. Similarities between the shapes of batons shown on Olmec sculptures (top) and Shang emblems of rank (after Meggers 1975: Figs. 6-7).

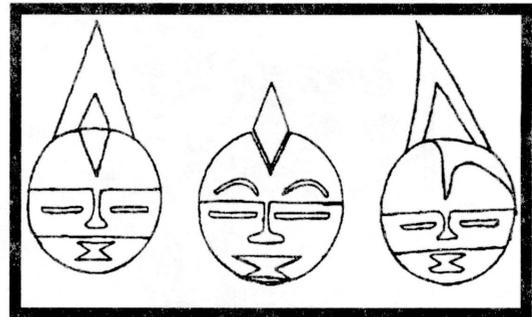
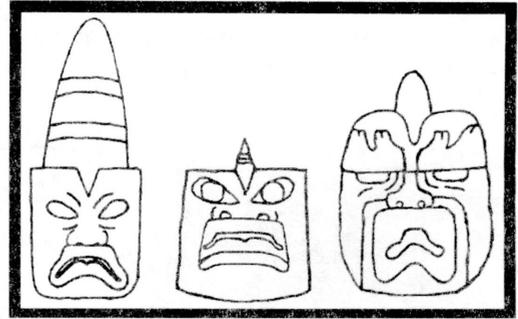


Fig. 8. Olmec (top) and early Chinese depictions of humans with cleft heads (after Xu 1996: Fig. 37).

universality facilitated communication among the speakers of the dozens of mutually unintelligible languages in China and would have had the same advantage among speakers of the many unrelated languages in Mesoamerica. This function is consistent with the rapid spread and fidelity of replication of the symbols in Mesoamerica, since modification would hinder their interpretation. Like the present-day Internet, the improved means of communication accelerated the pace and scope of cultural elaboration.

Southeast Asia - Maya, ca 2500 BP

The striking similarities between the stepped pyramids topped by temples, the ornamented facades of buildings, the calendrical cycles and zodiacs (Barber, 1990:89), the details of dress and ornament,

and other prominent features of Mayan and southeast Asian cultures have attracted attention for more than a century. Many of these elements are absent in Olmec and have post-Shang prototypes in Asia (Meggers, 1971). As with Olmec, the new features were superimposed on local antecedents.

A comprehensive compilation of shared decorative motifs documents the remarkable similarities in form and content. Depictions of elephants range from realistic to stylized (Thompson, 1989: Figs. 106-107); similar masks appear above doors (op. cit., Fig. 112); parasols are symbols of authority (op. cit., Fig. 115). Celestial serpents (op. cit., Fig. 119), abstract religious symbols (op. cit., Fig. 116), and the yin/yang or “cosmic duality” (op. cit., Figs. 117, 127-128) are among other duplications. These and 13 Asian elements constituting an “omnibus power sign” appeared simultaneously in

Mesoamerica ca 2500 BP (500 BC) and persisted with similar embellishments until European contact (Fig. 10). Numerous similarities in ritualized hand positions of human figures also occur (Shao 1976).

The case for common origin is enhanced by the rarity of any of these elements in other ancient Old World civilizations (Thompson, 1989: Table III).

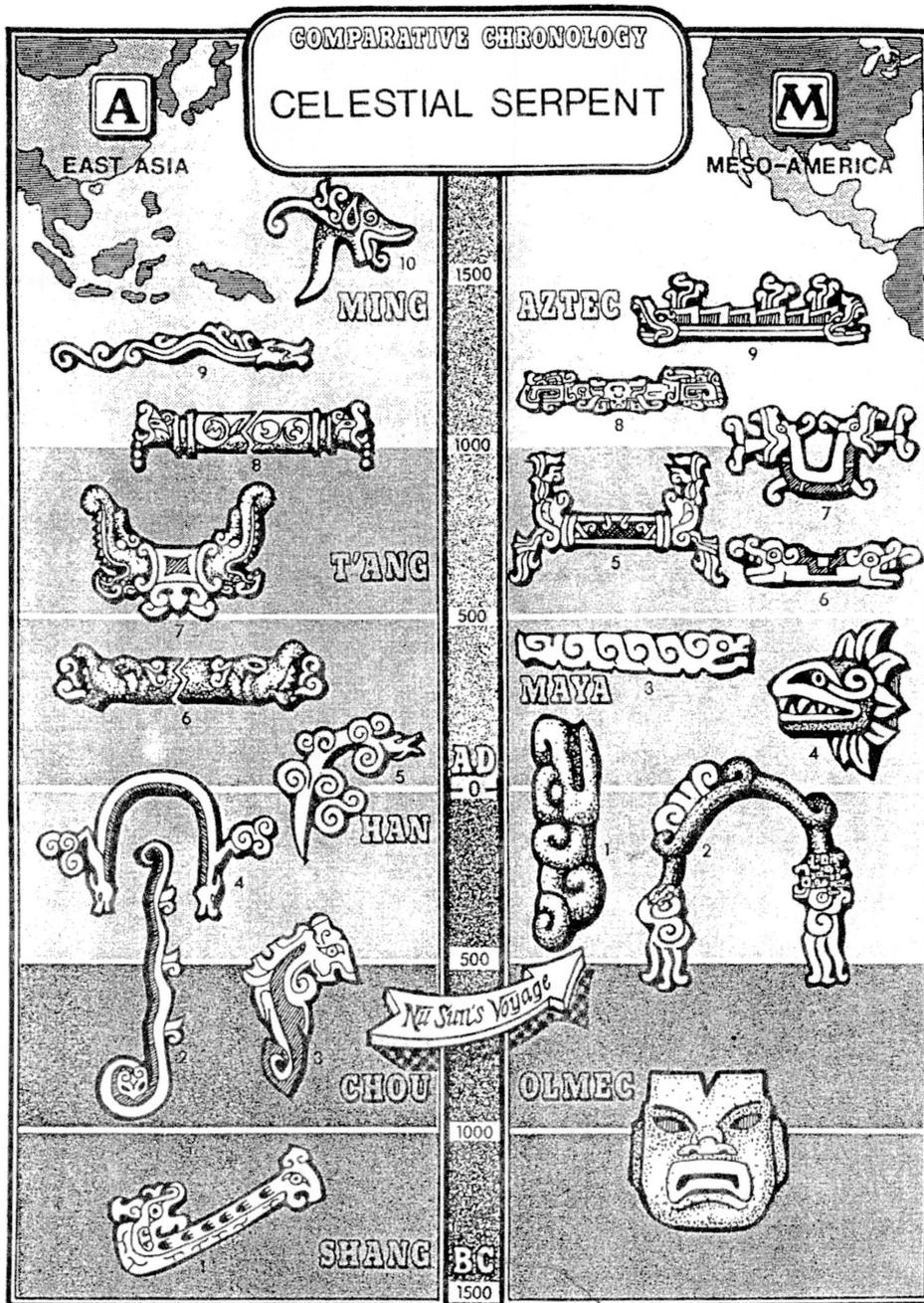


Fig. 9. Similarities between the evolution of variations in Chinese and Mesoamerican depictions of the Celestial Serpent motif (after Thompson 1989).

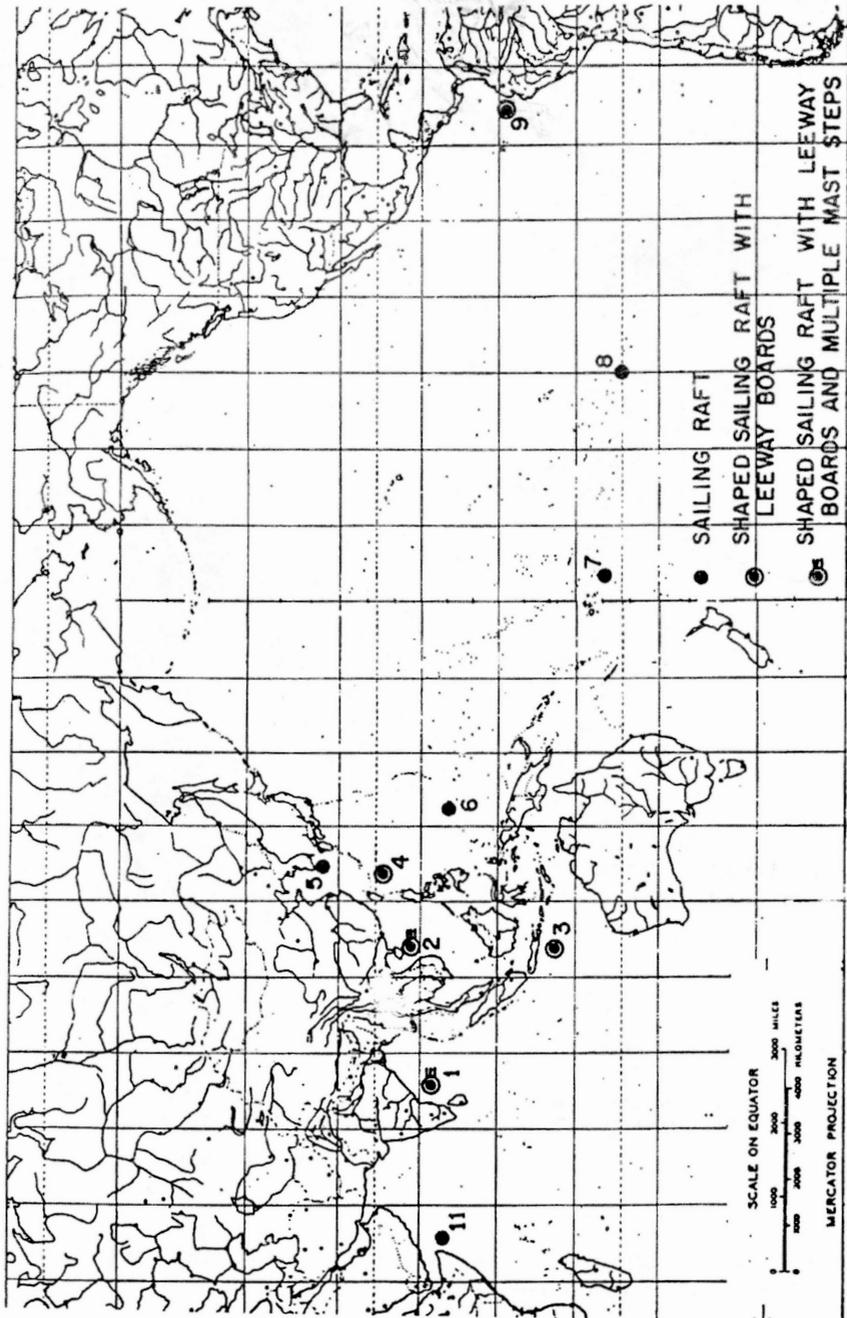


Fig. 10. Distribution of several varieties of sailing rafts in southeast Asia; the only New World occurrence is on the coast of Ecuador (after Doran 1971).

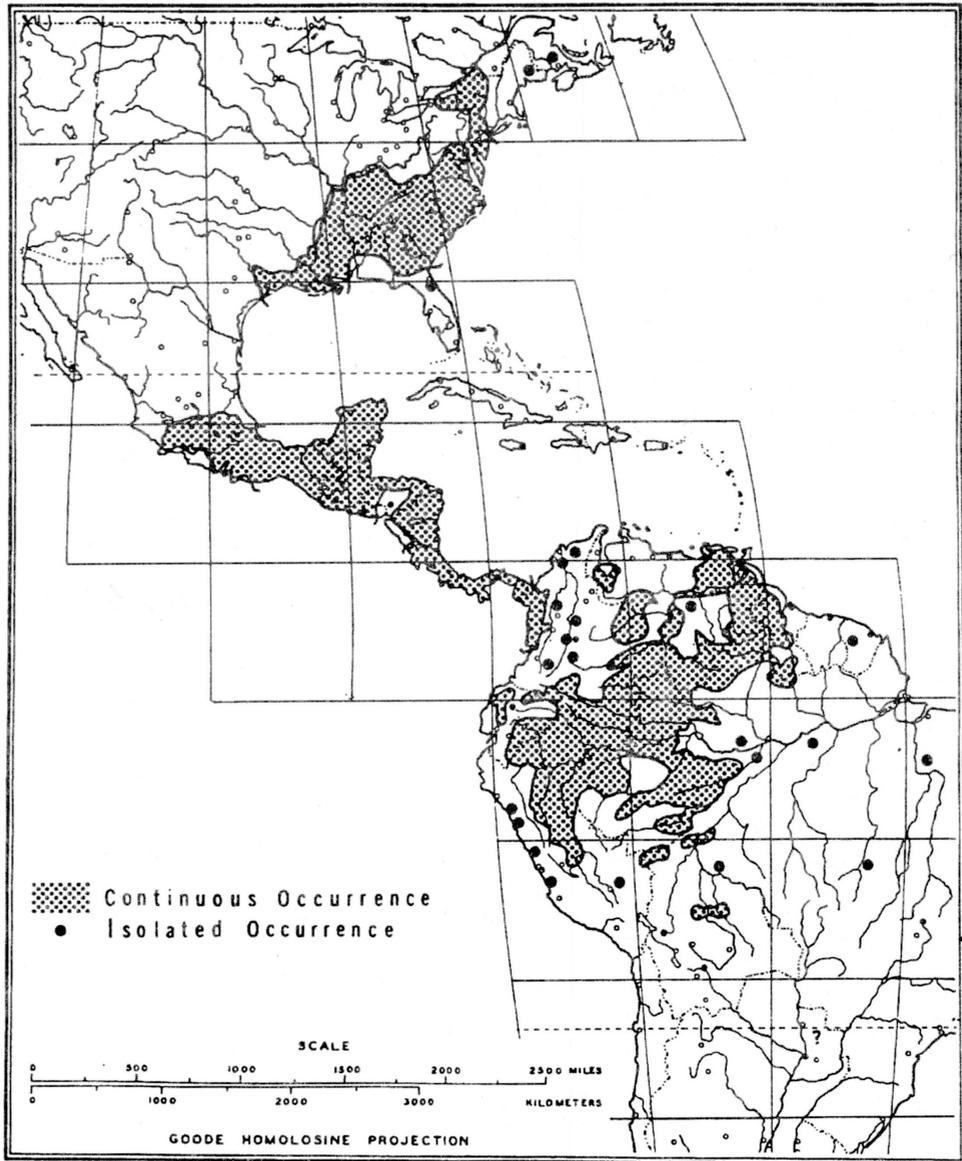


Figure 11. Distribution of blowguns in the New World. The existence of the greatest elaboration in eastern Ecuador, Colombia, and Peru suggests dispersal from this region (after Jett, 1970).

A technological complex that has received comprehensive analysis to assess the probability of independent invention is bark paper and cloth. Detailed comparison of ca 100 variables of manufacture, ca 140 variables of use, and ca 100 details of design led Tolstoy (1963; 1991: 12) to the conclusion that “Mesoamerican papermaking qualifies as a member of one family of Southwest Asian barkcloth and paper industries. Its direct connection to them would be unproblematical were it not for its geographical location”. Indeed, the similarities between the complexes in Sulawesi and Mesoamerica are closer than those between and nearby Java and Borneo (Barber, 199P:93).

Tolstoy considers the Central and South American expressions to be different, leaving open the decision between independent introduction and diffusion within the Americas. Small rectangular stones with flat surfaces bearing parallel grooves that have been encountered in Ecuadorian sites of the Regional Developmental Period are identical to bark beaters still used in the Celebes (Ling, 1962: Pl. 5A), suggesting the technology may have been introduced to South America during the second Ecuadorian episode.

Other traits of probable asian derivation

Several other widespread New World traits have Asian antecedents, suggesting they were introduced during one of the episodes described above. Among these are sailing rafts, blowguns, chickens, and intestinal parasites.

Sailing rafts

Rafts were and are a widespread means of river and ocean transportation in southeast Asia and Oceania, with greatest concentrations between Malaysia and western Polynesia, and between Indonesia and southern Japan (Doran, 1971: Fig. 7.9). A shaped variety steered with leeway boards occurs in several parts of Asia, but is restricted in the Americas to coastal Ecuador (Fig. 11; Estrada, 1954: 47-56). Although the antiquity of this variety in Asia has not been established, its use along the Chinese coast by the 5th century BC suggests it could have been introduced to Ecuador at the beginning of the Regional Developmental Period (Ling 1956). The seaworthiness of rafts is well documented and the feasibility of a transpacific crossing was demonstrated in 1947 by the famous voyage of Kon-

Tiki from Ecuador to the Marquesas (Heyerdahl, 1950). The Jomon-Valdivia crossing was replicated in 1980 by the rapid and uneventful trip by the Yasei-Go III from Tokyo to San Francisco (Meggers, 1987).

Blowguns

Blowguns have a wide distribution in southeast Asia, where they vary from single and double tubes of cane or bamboo to wooden tubes constructed by splitting and grooving or by boring (Jett, 1970). Clay pellets and darts are used as missiles. The greatest elaboration occurs in Borneo and simpler forms are distributed eastward from New Guinea across Indonesia, and northward across Malaya and the Philippines, with an outlyer in Japan. Their antiquity and place of origin have not been established.

The single-tube type is widely distributed in the Americas, with concentrations in eastern North America, southern Mexico and Central America, and northern and western Amazonia (Fig. 12), whereas the double-tube and split-and-grooved types are limited to northwestern South America (Jett, 1970: 678). Both pellets and darts are used as missiles, the latter often poisoned. Archeological evidence from Mexico and the coast of Peru established the use of blowguns by ca 1500 BP (Jett 1970: 676). Given the New World center of elaboration in northwestern South America, Jett (1970: 686) suggests that «diffusion took place from this area, whose core was probably around the conjunction of Colombia, Ecuador, and Peru». This pattern of dispersal suggests an introduction to the coast of Ecuador during the Regional Developmental Period.

Domestic chickens

Biological and archeological evidence indicates that chickens were domesticated in southeast Asia by 6000 BC (Langdon, 1989: 167). The Andean form, *Gallus inauris*, has a square rump instead of an upturned tail, «frizzle» feathers, and feather tufts extending from the ears, and lays eggs with blue shells, the restriction of a tailless and frizzlfeathered breed to Japan leads Langon (1989) to propose a precolumbian transpacific introduction (see also Carter, 1971).

Another Asian breed, characterized by black flesh and bones, occurs in Mesoamerica, where it plays a role in curing ceremonies with Asian



Fig. 12. Distribution of languages of the Proto-Mayan-YUCHA stock implying migration of the speakers of Yunga, Uru-Chipaya, and Araucanian from Mesoamerica (after Stark 1973).

counterparts. The association between these birds and rituals with speakers of proto Mayan languages in Mesoamerica, Bolivia (Chipaya), and Chile (Mapuche) suggests a relatively early dispersal (Johannessen, 1981; Carter, 1998).

Parasites

Two tropical Asian species of hookworms and

whipworms were identified among indigenous Paraguayan groups nearly a century ago (Darling, 1921; Soper, 1927; Manter, 1967). Since both **Ancylostoma duodenale** and **Trichuris trichiura** have a terrestrial phase that requires warm and moist soil conditions, they could not have survived a long human migration via the Bering Strait. **Ancylostoma** and **Trichuris** eggs and larvae have been identified in human coprolites from an

archeological site in southeastern Brazil with carbon-14 dates beginning ca 2800 BP (Ferreira et al., 1983; 1989) and adult *Ancylostoma* have been found in the intestine of a Peruvian mummy dated ca 2900 BP (Allison et al., 1974). (Coprolites containing hookworm eggs from Pedra Furada rock shelter in northeastern Brazil, considered to date as early as 7000 BP, are not of human origin; Chame, 1992). Their Asian origin and New World antiquity have led several parasitologists to suggest that their introduction was a by-product of the Jomon-Valdivia contact (Manter, 1967: 4; Confalonieri et al., 1991: 865; Reinhard, 1992: 241).

Genetic, linguistic, and biological correlations

It has long been a truism of anthropology that biology, language, and culture are independent variables. Migrants may adopt the language of the group with which they amalgamate rather than impose their own, with or without introducing new cultural elements. Perpetuation of genetic differences depends on the reproductive success of the immigrants, which is affected by their numbers in relation to the size of the receiving population, the degree of intermixture, and other social and biological circumstances. These variables eliminate any necessary correlation between cultural, linguistic, and genetic distributions (see Pawley and Ross, 1993 for the role of these factors in tracing the spread of Austronesian speakers).

Interpreting the genesis of linguistic and genetic distributions is handicapped by their intangibility. Languages leave no physical record until after the adoption of writing and human remains are rarely preserved. Although rules have been developed for inferring the homelands of language families and estimating the times of separation within families, it is rarely possible to establish the locations of the speakers at any particular time in the past. Similar uncertainties confront efforts to infer historical relationships from genetic distributions among modern populations (Merriwether et al., 1997: 216). Consequently, the existence of a set of genetic, linguistic, and cultural traits among widely separated Mesoamerican and Andean populations assumes potential significance.

The variation in mtDNA among indigenous Americans has been classified into four major founding lineages, designated as A,B,C, and D (Merriwether et al., 1997: 08). Analysis of skeletal remains from the early Maya site of Copn, Honduras

revealed the absence of the 9bp deletion, although the deletion is diagnostic of lineage B and is frequent among modern Yucatecan Maya and other neighboring groups. The deletion is also absent among a few contemporary Central (Kuna) and South American populations (Piaroa, Ticuna) and among prehistoric Chilean and Peruvian mummies (León et al., 1994: 134). Although Merriwether et al., suggest various biological explanations for this absence, including founder effects, intra-Maya differences, drift or selection, and small sample size, Cann (1994) and Len et al., (1994) raise the question of a transpacific introduction. Several linguists have grouped Mayan, concentrated on the Yucatan Peninsula in Mexico and lowland Guatemala, Yunga spoken by the precolumbian Mochica-Chimu population on the north coast of Peru, Uru and Chipaya spoken in the Bolivian altiplano, and Araucanian spoken in southern Chile into a single stock (Fig. 14). Linguistic considerations suggest that this ProtoMayan-YUCKA stock originated in the northwest highlands of Guatemala ca 4600 BP and that the ancestor of the South American languages split off ca 4400 BP. Migration of some of the speakers to the southern Peruvian highlands, resulting in UruChipaya, is estimated to have occurred ca 4100 BP. The separation of Araucanian (Mapuche) from Yunga is dated ca 3900 BP (Stark, 1973; Hemp, 1967).

Although little attention has been given to identifying cultural associations, Stark (1973: 105) suggests they may have introduced maize and platform mounds to the Andean region. Another trait with a similar distribution is the melanotic or blackboned chicken. These birds and associated curing rituals documented among the Maya in Guatemala have their closest counterparts among the Chipaya and Mapuche in the Andean area (Johannessen, 1981: 433). These examples illustrate the benefits of using more than one source of evidence for reconstructing precolumbian population movements and reinforce the need for collaboration among the disciplines involved.

Conclusion

Biologists agree that all living things evolved from a common origin by a combination of organic processes that were periodically disrupted by catastrophic physical events, and that the history of life is consequently unique. If any species is extinguished, it will not reevolve. By contrast, most

anthropologists consider the evolution of culture to have proceeded independently in the eastern and western hemispheres, indicating that the process is repeatable. If modern civilization is extinguished, similar technological and sociopolitical advances can reemerge.

The willingness of anthropologists to accept even arbitrary and abstract configuration as independently invented places the burden of proof for transoceanic contact on the biological evidence. Reaching a consensus will depend on collaboration among all the disciplines involved. I have tried to show that archeological evidence can identify the times and places of several transpacific arrivals. If biological innovations can be correlated, they will make the existence of Asian introductions difficult to dispute. Biologists need to place their data in a chronological framework, which depends on the reliability of the archeological associations. None of

us is sufficiently familiar with the relevant information in another field to recognize potential pitfalls. The fact that we attend different scientific meetings and publish in different journals prevents us from appreciating the extent to which we may have goals in common.

Consequently, I congratulate the organizers of this symposium for taking a significant step to overcome the barriers toward the interdisciplinary collaboration necessary to resolve the most fascinating enigma of New World prehistory.

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