THE CHIRA BEACH RIDGES, SEA LEVEL CHANGE, AND THE ORIGINS OF MARITIME ECONOMIES ON THE PERUVIAN COAST

JAMES B. RICHARDSON III
Chief Curator, Section of Man

ABSTRACT

The Chira beach ridges have been radiocarbon dated and provide the best available evidence for the establishment of the north Peruvian coast at 5000 B.P. The stabilization of sea level coincides with a change in the east Pacific Ocean current patterns. These two natural events are seen as major causal factors in the subsequent rise of complex pre-ceramic maritime societies on the coast of Peru.

INTRODUCTION

The question of the origins and development of maritime societies on the Peruvian coast has engendered heated discussions by the archaeological community. However, little attention has been paid by archaeologists to the various disciplines, especially oceanography, that are able to provide many of the answers that have been posed concerning this crucial juncture in Peruvian cultural development. Changing environments and biological systems are key to our understanding of man's adaptation to this coast through time. Geological, tectonic, environmental, and oceanographic changes and the El Niño perturbation, all must be an integral part of any discussion centering upon the emergence of Peruvian maritime societies.

There are two environmental factors that are crucial to any discussion concerning the emergence of maritime based societies on the Peruvian coast: the date of the establishment of the modern climate and the...
formation of the present coastline. A major change in the east Pacific current patterns takes place prior to 5000 B.P., which, in turn, is responsible for the northward shift of the cold Peru current that brings with it the major fishery that was intensively exploited by late preceramic populations (Rollins et al., 1981; Sandweiss et al., 1983). This event coincides with the formation of the present coastline of Peru at the time when modern sea level was reached. The beach ridges of the Chira River of northwest Peru, provide the best information of the date when modern sea level was attained. Both these two events occurred at circa 5000 B.P. and it is after this date that maritime oriented societies develop on the coast.

**Holocene Environmental Change**

In 1981, I presented a model to explain the emergence of maritime societies on the Peruvian coast (Richardson, 1981). A main causal factor was seen to be the rise of sea level to present levels by 5000 B.P. It was demonstrated that the use of maritime resources can be traced as far back as 10,000 B.P. and that the evidence for early maritime exploitation lies submerged on the continental shelf, because the Peruvian coast was many times wider during the Holocene. Complex maritime societies were established when modern sea level and essentially modern distributions of molluscan and fish resources was attained. The developments leading up to the establishment of sedentary maritime societies on the Peruvian coast is to be found on the continental shelf, for the origin of maritime subsistence patterns was not an abrupt transition from hunting and gathering to littoral resources as so often stated, but rather a gradual process of adaptation that preceded the pre-cotton preceramic by several thousand years.

Prior to 5000 B.P., the coastal environment was also markedly different from that of the present. Campbell (1982) reconstructs the environment of northwestern Peru as one with annual monsoon rains, savannas, forests, lakes, and marshlands at 14,000 B.P. The mangrove molluscan fauna from archaeological sites, north of Lambayeque point to continued wetter conditions as late as 5500 B.P. (Richardson, 1978; Cardenas, 1979).

Recent studies in the Santa Valley region has resulted in the identification of an extensive warm water molluscan fauna in a series of preceramic sites (Rollins et al., 1981; Sandweiss et al., 1983). This fauna suggests that the ocean current system of the eastern Pacific was different from that of today. Dating to 5000 B.P., these shellfish species now inhabit the warm water Panamic-Province north of 7.5° south latitude. This study and corroborating evidence from marine sediments off the Central Peruvian Coast also points to a warm water regime prior to 5000 B.P. (DeVries, 1979).
This ever-growing body of evidence now suggests that we can only extend our present day model of the current pattern of this portion of the east Pacific Ocean back about 5000 B.P. The evidence strongly suggests that from at least 11,000 B.P. to about 5000 B.P., the central and northern coasts of Peru were bathed by warm Panamic Province-type waters, which today are found only north of Paita, about 5° south latitude. If the Equatorial warm water current was a yearly visitor to the coast or a year around phenomena, it would have major implications for a different climate and resource base available to pre-5000 B.P. coastal populations. Rainfall would have fallen on coast seasonally and land based resources may have been more abundant. If this scenario is valid, the coast of Peru, from Lima northward, would have had a warm water current bathing its shores. The northern extension of the Peru Current with its upwelling and its abundance of resources would have been south of Lima, moving northward and becoming established in its present position after 5000 B.P. The hunters, gatherers, and maritime resource users would have enjoyed a higher abundance of land based resources in grasslands/forests across the wide expanse of the continental shelf prior to 5000 B.P. The warm water ocean resources, may have been markedly less than those enjoyed by post-5000 B.P. populations subsisting on cold water faunas. The dramatic change from the warm water to a cold water ocean regime prior to 5000 B.P. decreased rainfall on the coast to the point of turning the landscape into its current desert environment. The implantation of the cold water current by 5000 B.P. across the widest expanse of the continental shelf between 6° and 15° south latitude, provided the resource base for the succeeding rise of complex maritime societies on the Peruvian coast. The modern weather patterns of the eastern Pacific was established by 5000 B.P. and at the same time, sea level attained its present position. It is with the establishment of the modern coastline and climate that large archaeological sites appear in profusion in this area of the Peruvian coast.

The Chira Beach Ridges

The best evidence to date for the establishment of the modern coastline on the western South American coast are the beach ridges of the Peruvian north coast. There are three sets of Holocene ridges, one situated north of the mouth of the Piura River and sets south and north of the Chira River (Fig. 1). Only the set north of the Chira River will be presented in detail.

The research into the Pleistocene marine terraces and Holocene Beach ridges has a long history in northwest Peru, stemming back to Thomas Bosworth’s Geology of the Tertiary and Quaternary Periods in the North-West Part of Peru (1922) in which he discussed the Pleistocene tablazo.
systems and the Holocene deposits of the Talara area. Other investigators, notably Horace Richards (1962), Lemon and Churcher (1961), Chotowski (manuscript), Woodman and Polia (1974), Nestor Chigne (1975), and Campbell (1982) have made studies of the Pleistocene and Holocene deposits. The archaeological research on the occupation of the Chira ridges began in 1965 in conjunction with a major research program on climate change and cultural development in the Chira and Piura River valleys. The twelve unpublished radiocarbon dates from these beach ridges provide the best sequence of Holocene beach ridge succession in Peru.

There are three raised Pleistocene marine floors fronting the Amotape Mountains—the Mancora (61–330 m high), the Talara (49–90 m
high) and the latest, the Lobitos Tablazo (14–41 m high). These former marine floors overlie a truncated surface of the Cenozoic and the rocks of the Pennsylvania Amotape formation and are composed of a thick sequence of marine quartz sands, shelly and calcareous sands, marls, coquinas, and pebble beds. Each of these tablazos represent a period of marine encroachment, followed by vertical uplifts along the Pacific fault line, bordering the continental shelf.

Of interest to this discussion is the Lobitos Tablazo, little of which remains at present. The main section, still extant, is a thin ridge fronting the Holocene beaches acting as a barrier behind which mangrove vegetation, during the late Pleistocene and early Holocene, thrived (Richardson, 1978). The Lobitos ridge consists of a wave cut beach on its western margin. The mollusks of the western edge, facing the ocean are salt water species, whereas the mollusks on the eastern face consist of mangrove and other warm species reflecting a shallow lagoonal environment.

The nine beach ridges emanate out of the Chira River and stretch 30 km to Punta Balconas and Punta Pariñas at the modern town of Negritos. Parallel to the Lobitos Tablazo, there are nine Holocene beach ridges which can be divided into two groups. The first four, with sharply defined profiles, are separated by broad swales and which are easily discernable, whereas the second group of five, presents a complex series of hummocky ridges with intermittent swales upon which there are active barcan dunes. In the central section of their distribution, the oldest four ridges are continuous, but as they near Punta Pariñas, the first two disappear and the remaining two become a series of isolated mounds. During this first episode of Holocene beach ridge development, Punta Balcones and Punta Pariñas were islands off the coast and only during the emergence of the second group of ridges did these two islands become landlocked.

These nine beaches were formed by the carrying of sediments from the mouth of the Chira River, northward with the prevailing direction of the current which were then implanted by wave action shoreward. The rate of discharge of the Chira is second only to the Santa and the Tumbes rivers and the sediment grains are uniform in size and have the same constituents as the Chira River alluvial deposits (Chigne, 1975). The beach ridges were then raised by tectonic uplift and as a consequence, a stranded beach system of 2.7 km wide resulted (Fig. 2).

The archaeological sequence for the Piura-Chira Region has been detailed elsewhere and the cultural associations of each ridge will be briefly discussed but not elaborated upon (Lanning, 1963; Richardson, 1973, 1978). The following cultural sequence, based on forty radiocarbon dates, will be used in this presentation: Amotape (11,500–
8000 B.P.); Siches-Estero (8000–5000 B.P.); Honda (5000–3500 B.P.); Paita (3500–2500 B.P.), Sechura (2500–1200 B.P.); and Piura (1200–1532 B.P.).

The shell capping of the beach ridges is the product of both natural and human agencies. On all ridges there are fireplace units and small middens of heated and discarded shells. On ridges 2–7, sherds are present, and on ridges 8 and 9 lithic tools prevail. Many of these ceramic fragments represent the breakage of whole vessels, due to wind erosion. All of the complete vessels recovered were placed mouth downward and buried, presumably for later reuse, and these are continually being uncovered by the wind and rapidly eroded. Except for a market basket handled Sechura pot and a badly eroded section of a Piura stirrup spout, all of the pottery represents utilitarian ware; water storage jars and a small percentage of wide mouthed cooking vessels. All of the utilitarian ceramics have been tied into the ceramic assemblages of each phase by comparison with nearby village sites and encampments.

The present population in Negritos and a small settlement on the present beach dunes at the southern edge of the ridges, still exploit the shellfish resources. Offshore fishing is also a major economic mainstay of San Pedro, the small fishing village outside of Negritos (Sabella, 1974). Sabella (personal communication) has made the following comments on the shellfish utilization by the Negritos population:

The main mollusk gathered is the concha blanca (Tivela hains) and when they are in abundance, one man can fill an entire burlap sack in 45 minutes. Concha blanca is gathered at low tide, gatherers move into the shallows, first feeling for the shells with their feet. Once located, they reach down and dig them out by hand, often pulling several out at a time. The shells are relatively close to the surface, in two or three inches of sand . . . these small clams are the preferred bait for almost all types of fish, offshore as well as inshore species. The second type of shell is very small and is referred to as rique (Donax peruvianis). They are gathered with a “cafan” (a simple frame scoop with a net bag attached, much the same as the “muy muy” or sand crab scoop). The “cafan” is raked through the sand at low tide several times, and then the bag is agitated to remove the sand, leaving only the rique shells.

The beach ridges have been in continuous use since circa 5000 B.P., (Fig. 3). Prior to the beach ridge formation, the Lobitos Tablazo was occupied by the preceramic Siches populations exploiting the mangrove mollusks in the protected lagoon on the east side of the tablazo. The small Siches site below Petro Peru marker 280 on the tablazo should date between 8000–7000 B.P., because a Siches site (PV9-31) on the
Talara Tablazo near the mouth of the Chira River is dated to 7485 ± 120 (SI-1416) B.P.

With the emergence of the first Holocene shore line, the oldest ridge was utilized by preceramic populations after the disappearance of mangrove vegetation in the Talara region (Richardson, 1973, 1978). The dates on ridge 9 are 3985 ± 80 (SI-1456) B.P., 4485 ± 90 (SI-1450) B.P., and 4255 ± 65 (SI-1420) B.P., which places the occupation of this earliest ridge in the preceramic Honda phase. The base camp sites
Fig. 3. — The Chira beach ridges and associated radiocarbon dates.
(PV7-16 and PV7-19) are situated on the Mancora Tablazo, north of Quebrada Pariná and although no major Honda sites have been discovered in the Chira Valley, they were certainly present and may have been subsequently destroyed by later intensive irrigation farming.

Of the next three oldest ridges, ridge 6 is definitely correlated with late Paita ceramics, 2685 ± 105 (SI-1422) B.P. and on ridge 7 and 8 dates of 3500 ± 160 (GX1565) B.P. and 3490 ± 80 (SI-1421) B.P. are fully acceptable for early Paita. Two dates, 3610 ± 145 (GX1136) B.P. and 3390 ± 125 (GX1003) B.P. from the enormous Paita (PV8-7) site at the south end of the ridges supports this interpretation. The hearth, on ridge 8, from which the charcoal sample was secured, contained two sherds of the Paita period, probably representing the reuse of this ridge by Paita inhabitants of ridge 7. It is probable that ridge 8 may also prove to be preceramic in its occupation.

The dates on the four oldest ridges, of course, refer to the period of occupation and not to the date of the building or emergence of the former beaches. The temporal formation for the first set of four ridges spans over 3000 years.

Between this group of older ridges there is a 175 m wide separation before encountering the youngest group (Fig. 4). The five youngest ridges, including the present standline, begin their ceramic history during the Sechura period. Ridge 5, first of this group, associated with Sechura ceramics dates to 1955 ± 100 (SI-1423) B.P., whereas ridge 4 dates to 1550 ± 110 (GX1556) B.P. and ridge 3 at 1405 ± 75 (SI-1424A) and 1305 ± 100 (SI-1424B) B.P. It is interesting to note that the Sechura ridges were as intensively occupied as the Piura ridges, but that few village sites are known for the region versus the hundreds of sites known for the Piura period. The Sechura sites on the Chira River have most probably been destroyed through river channel changes and modern agriculture in the floodplain zone. Ridge 2 dates to the Piura phase at 805 ± 60 (SI-1457) B.P. A circa 2000 year period is indicated for the formation of this younger beach series. The width of these ridges as compared to the older set are between 125 and 225 m wider, which can be interpreted as the consequence of the Chira sediment load spreading northward in conjunction with the development of dune formations, not present on the older 4 ridges (Fig. 4).

The point to be stressed here is that the Chira beach ridges began forming only when modern sea level was attained at circa 5000 B.P. Certainly, beach lines were formed prior to 5000 B.P., but these were either submerged as the ocean rose or were destroyed by wave action as the sea encroached landward.

The beach ridges south of the mouth of the Chira River at Colán are composed of pebbles which were distributed from a small canyon
Fig. 4. — Cross section of the Chira beach ridges at survey marker 280. Adapted from Chigne (1975).
cutting into the Talara Tablazo. The pebbles from the Talara formation were eroded from the Canyon into the ocean at the southern edge of the present Holocene deposits at Colán and distributed northward by the current. The only mechanism of massive erosion in this desert region are the El Niños and there is a distinct possibility that the Colán ridges were formed by flooding as a result of catastrophic El Niños, yet to be dated.

CONCLUSIONS

Our knowledge of the impact that natural forces had upon prehistoric Peruvian cultural development is practically nil and until extensive oceanographic, geological, and paleoclimatological work is done in the Central Andes, the explanatory value of reconstructing Peruvian cultural development, strictly from the archaeological record, may prove misleading.

The date of 5000 B.P. is crucial to our understanding of the rise of complex maritime societies on the coast of Peru, for it is at this time that modern climate patterns had been established and modern coastlines formed. It was at this point in Peruvian cultural development that complex maritime adapted societies were established. It is now time for landlubbers to adapt themselves to the ocean and to interpret maritime origins from a seaward position rather than to continue to explain the establishment of maritime societies on the Peruvian coast, strictly from a landward position.

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LITERATURE CITED

Bosworth, T. O. 1922. Geology of the Tertiary and Quaternary periods in the northwestern part of Peru. MacMillan and Company, London, 346 pp.

Chigne Campos, N. 1975. Movimiento de arenas y antiguas lineas de costa en el noroeste Peruano. Unpublished B.A. thesis, Univ. Nacional de San Marcos, Lima, 77 pp.

Campbell, K. E. 1982. Late Pleistocene events along the coastal plain of northwestern Peru. Pp. 423–440, in Biological diversification in the tropics (G. Prance, ed.), Columbia Univ. Press, New York, 289 pp.

Cardenas Martin, M. 1978. Columna cronologica para el desierto de Sechura. Instituto Riva—Aquero Seminario de Arqueologia, Pontificia Univ. Catholica del Peru, Lima 2:1–63.
Chostowski, M. n.d. The coastal morphology between Pariñas and the Chira River. 12 pp.
DeVries, T. 1979. Nekton remains, diatoms, and Holocene upwelling off Peru. Unpublished M.A. thesis, Oregon State Univ., 67 pp.
Lanning, E. P. 1963. A ceramic sequence for the Piura and Chira coast, north Peru. Univ. California Publ. Anthropology, 46:135–284.
Lemon, R. R. H., and C. S. Churcher. 1961. Pleistocene geology and paleontology of the Talara region, northwest Peru. Amer. Sci., 259:410–429.
Richards, H. 1962. Studies on the marine Pleistocene. Trans. of the Amer. Phil. Soc., 52:1–141.
Richardson, J. B. III. 1973. The preceramic sequence and the Pleistocene and post-Pleistocene climate of northwest Peru. Pp. 199–212, in Variation in anthropology (D. Lathrap and J. Douglas, ed.), Univ. Illinois Press, Urbana, 277 pp.
——. 1978. Early man on the Peruvian north coast, early maritime exploitation and the Pleistocene and Holocene environment. Pp. 274–289, in Early man in America from a circum-Pacific perspective (A Bryan, ed.). Univ. Alberta Press, Edmonton, 327 pp.
——. 1981. Modeling the development of sedentary maritime economies on the coast of Peru. Ann. Carnegie Mus., 50:139–150.
Rollins, H. B., D. Sandweiss, and J. B. Richardson III. 1981. A thermally-anomalous assemblage (TAMA) from archaeological sites along coastal Peru: paleoecological implications and biostratigraphical utility. Geol. Soc. Amer., 13:545.
Rollins, H. B., J. B. Richardson III, and D. Sandweiss. n.d. New evidence and implications of a major change in the structure of the east Pacific water mass about 5000 B.P.
Sabella, J. 1974. The fisherman of Caleta San Pablo. Latin American Studies Program Dissert. Ser., Cornell Univ., 57:1–342.
Sandweiss, D., H. B. Rollins, and J. B. Richardson III. 1983. Landscape alteration and prehistoric human occupation on the north coast of Peru. Ann. Carnegie Mus., 52:277–298.
Woodman, R., and M. Polia. 1974. Evidencia arqueologica del levantamiento continental al norte del Peru en los ultimos 4 mil anos. Bol. Soc. Geografica de Lima, 43:63–66.
Richardson, James B. 1983. "The Chira beach ridges, sea level change, and the origins of maritime economies on the Peruvian coast." Annals of the Carnegie Museum 52, 265–276.

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