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INFLUENCE OF CLIMATIC OSCILLATIONS IN THE ARCHAEOLOGICAL SEQUENCE ON MARAJÓ ISLAND, BRAZIL

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ABSTRACT

Thermoluminescence dates define the durations of five succes sive archaeological complexes or phases on the island of Marajó, providing a chronology extending from about 3400 B.P. to Euro - pean contact. A hiatus of 930 ± 300 years coincides with a period of aridity between about 2700 and 2000 B.P. inferred from pollen sequences in various parts of the neo-tropical lowlands, sugges- ting that Marajó may have been abandoned by pottery-making groups during this interval because of subsistence stress.

ABSTRACT

Thermoluminescence dates define the durations of five successive archaeological complexes or phases on the island of Marajó, providing a chronology extending from about 3400 B.P. to European contact. A hiatus of 930 ± 300 years coincides with a period of aridity between about 2700 and 2000 B.P. inferred from pollen sequences in various parts of the neo-tropical lowlands, suggesting that Marajó may have been abandoned by pottery-making groups during this interval because of subsistence stress.

Recently, the growing evidence that short-term oscillations in temperate climates correlate with the rise and fall of civilizations, geographical expansions, and human migrations has led some historians to entertain the possibility of a causal relationship[1,2]. In South America, coincidences between environmental and demographic changes have been noted in the Peruvian highlands[3] and the Colombian Sabana de Bogotá and eastern lowlands[4]. Periods of aridity have also been postulated as the impetus for population movements implied by the far-flung distributions of languages and ceramic traditions in the neotropical lowlands[5,6a,6b].

Prior to 1948, the archaeology of Marajó island, the largest at the mouth of the Amazon river was known principally from museum collections consisting of large painted anthropomorphic vessels and elaborately excised urns, which had been removed from artificial earth mounds erected by prehistoric inhabitants on the eastern half of the island (Fig. 1). Survey on the north coast during 1948 revealed sites representing four previously undefined pottery-making groups[7]. Thirteen village sites were recorded, of which five were assignable to the Ananatuba Phase (PA-JO-7,8,9,10,13), one to the Mangueiras Phase (PA-JO-5), two to assimilation of Ananatuba Phase villages by the Mangueiras Phase (PA-JO-7,13), two to the Formiga Phase (PA-JO-4,6), and two to the Aruã Phase (PA-JO-2/3,11). Similar reconnaissance during 1949 on the upper Rio Anajás in the center of the island revealed another site of the Mangueiras Phase (PA-JO-16), and two groups of large mounds of the Marajoara Phase (PA-JO-14,15).

Subsequent investigations[7] west of Lago Arari and on the upper Rio Anajás produced two more sites of the Ananatuba

Phase (PA-JO-19,20), one of the Mangueiras Phase (PA-JO-17), and one of the Formiga Phase (PA-JO-18). Survey east of Lago Arari[8a] added 17 sites, including one of the Ananatuba Phase exhibiting Mangueiras Phase contact (PA-JO-26), four of the Formiga Phase (PA-JO-29,30,32,33), and 12 of the Marajoara Phase.

Pottery from surface collections and stratigraphic cuts in these sites was classified into plain and decorated types and their relative frequencies by level were calculated. The trends in popularity revealed by this procedure permitted establishing a relative chronology for each phase.

In the absence of carbon-14 determinations, the inception of the Ananatuba Phase, the earliest in the relative sequence, was estimated after the beginning of the Christian era[7].

Carbon-14 date obtained subsequently showed that the time depth for the introduction of pottery making was drastically underestimated. The sample from a level corresponding to the Ananatuba-Mangueiras transition at PA-JO-26 produced the date of 2930 B.P. $\pm$ 200 years (SI-385), implying that the Ananatuba Phase began prior to this time[8b].

Since potsherds were available from most of the excavations, thermoluminescence was an obvious technique for desirable additional dating.

All ceramics were dated at the Centre de Faibles Radioactivités, Gif-sur-Yvette, as described in ref.(9), using the fine-grain method. Well reproducible thermoluminescence glow curves yield good plateau responses. Internal doses were calculated from the concentrations of U, Th and K of the samples obtained from gamma spectrometry measurements. Environmental doses were evaluated from gamma spectrometry of soil samples from Marajó

Island. Errors were calculated as given in ref. 10 and the overall accuracy (1σ) of the ages is estimated at about 7% to 10% according to the sample.

All three Ananatuba Phase TL results were slightly older than the uncalibrated carbon-14 determination, extending from 3410 B.P. ± 270 to 3040 B.P. ± 270 years. The Marajoara Phase measurements range from 1730 B.P. ± 200 years to 630 B.P. ± 70 years[9]. Additional sherds representing the early, middle, and late parts of the relative sequence for each phase were analysed and the resulting chronological pattern is compatible with the stratigraphic evidence (fig. 2). Unexpectedly, a hiatus of 930 ± 300 years separates the latest/TL date for the Mangueiras Phase from the earliest one for the Formiga Phase.

Mangueiras Phase occupations are superimposed on those of the Ananatuba Phase at two sites, one on the north coast (PA-JO-10) and the other near the east coast (PA-JO-26). The TL date of 3000 P.B. from the transitional level at PA-JO-10 is close to the carbon-14 date of 2930 B.P. ± 200 years obtained for the transition at PA-JO-26. The youngest TL date for the Mangueiras Phase is 2870 B.P. ± 190 years and corresponds to the abandonment of the most recent site in the existing seriated sequence for the phase.

The oldest TL date for the succeeding Formiga Phase is 1940 B.P. ± 230 years. Eight samples from four sites between Lago Arari and the east coast (PA-JO-29,30,32,33) form a progression to 1550 B.P. ± 170 years. Two samples from PA-JO-6 on the north coast date 1430 and 1340 B.P. These bracket the initial carbon-14 date for the Marajoara Phase from PA-JO-36 and imply an overlap that is in keeping with the presence of decorated sherds of Marajoara Phase origin in the upper levels at PA-JO-6 (Ref. 7, p. 240). Another chronological overlap

between the terminal Marajoara Phase TL measurement of 630 B.P. ± 70 years and the initial Aruã Phase TL measurement of 800 B.P. is compatible with the archaeological evidence for contact in the form of Marajoara Phase pottery at an early Aruã Phase site on the island of Mexiana (Ref. 7, p. 457).

Although the gap between the terminal TL date for the Mangueiras Phase and the initial TL date for the Formiga Phase may reflect insufficient field investigation, several considerations mitigate against this interpretation. First, all sites known to the local population in each region were examined regardless of size and composition. Second, the non-Marajoara Phase sites are similar in surface expression, consisting of relatively small scatters of pottery fragments, few of them decorated, making it unlikely that those representing any phase would be encountered more readily or recalled more accurately than any other. The only notable distinction is the location of sites of the Formiga Phase in open savanna, whereas those of the Ananatuba, Mangueiras, and Aruã phases are in patches of forest. Third, the estimated durations of the phases with the largest number of sites (Formiga, Marajoara, Aruã) are about 700 years. The Ananatuba Phase, with an estimated duration of about 400 years, is represented at nine sites. Even the Mangueiras Phase, which has TL dates spanning only about 200 years, is represented at six sites. In this context, a different pottery-making group occupying the eastern half of the island between 2700 and 2000 B.P. would be expected to have left a sufficient number of sites that at least one would have been encountered.

The evidence that this interval was caracterized by aridity makes it important to consider the possibility that Marajó may have been abandoned temporarily by pottery-making groups

because of subsistence stress. Indications that the period between about 2700 and 2000 B.P. was dryer than today are provided by pollen studies in Colombia, both in the lower Magdalena-Cauca region and on the eastern llanos (Ref. 4, p. 63); and from various parts of the Brazilian Amazon[11a,11b,12,13]. A pollen profile recently obtained from Lago Arari shows a pronounced change in the local vegetation indicating a dry period on Marajó about the beginning of this inverval (Absy, pers. commun.).

Under present climatic conditions, 88 percent of the eastern half of Marajó is judged unsuitable for agriculture[14] (OEA 1974:11). Similar aridity would have made it difficult for even a small prehistoric population to remain sedentary. The Mangueiras Phase villagers might have abandoned the island or they might have fragmented into nuclear families and subsisted as roving hunter-gatherers, much as surviving Amazonian tribes such as the Kayapó still do during part of each year[6a]. Either option would have left a hiatus in the archaeological record.

More transitory arid episodes have been postulated from palynological changes about 1500 B.P., 1000 B.P., and 700 B.P., both in Amazonia and in the lower Magdalena-Cauca basin of Colombia[11,12b]. The coincidence of the first estimate with the oldest date for the Marajoara Phase and the last with the first evidence for the Aruã Phase suggests that climatic fluctuations

may also have contributed to the population movements implied by these intrusions.

Geoscientific, biogeographical, and palynological evidence have been accumulating during the past years in support of climatic oscillations in the neotropical lowlands during and since the Pleistocene. Although many Holocene episodes were probably too brief and localized to affect most other animals and plants significantly, human groups depending on cultivated plants are likely to have been vulnerable to crop failure. We hope that the detection of a possible hiatus in the occupation of Marajó by pottery-making agriculturalists that appears to coincide with an interval of aridity will stimulate both paleoclimatologists and archaeologists to search for additional evidence to strengthen or refute the existence of a cause and effect relationship.

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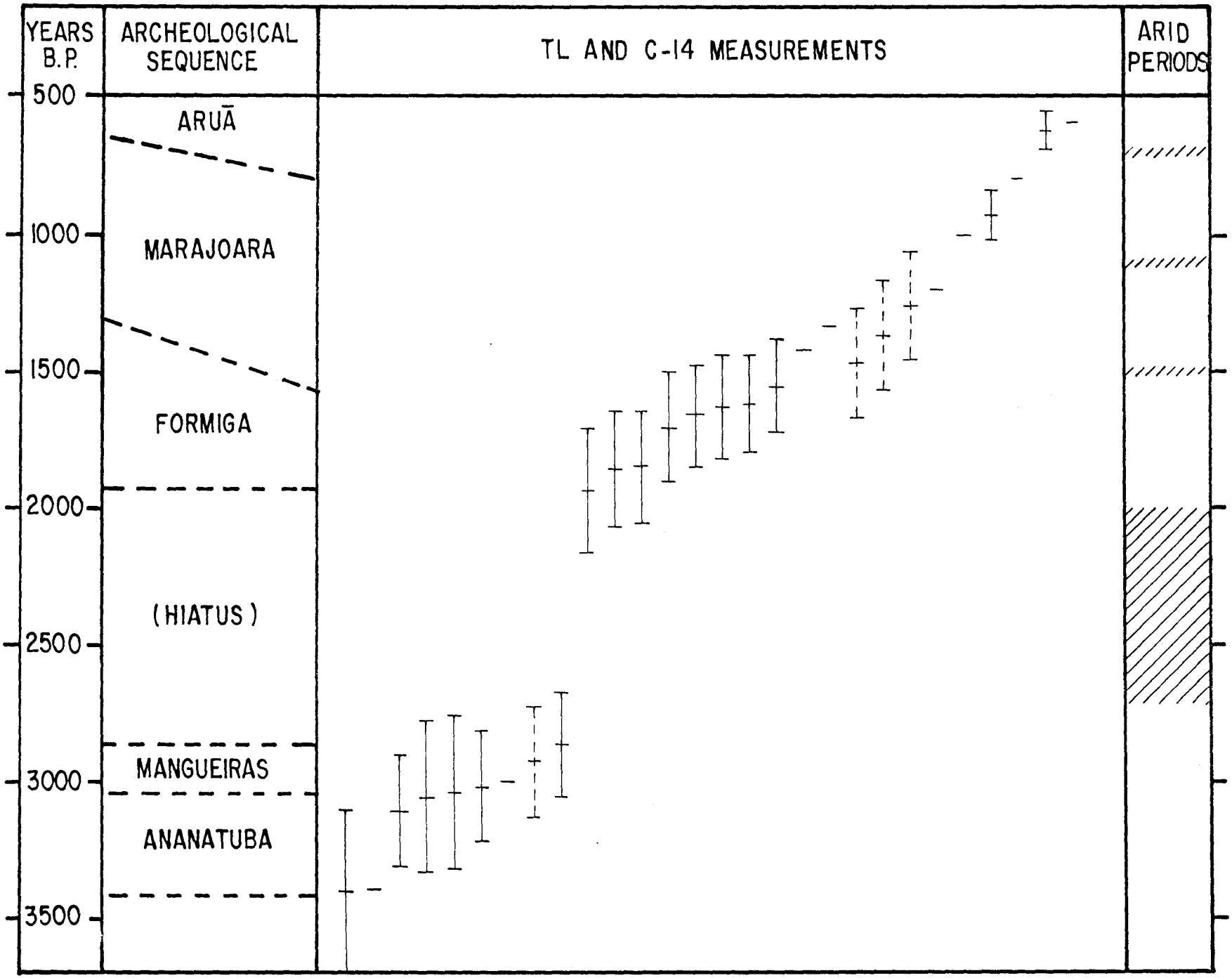
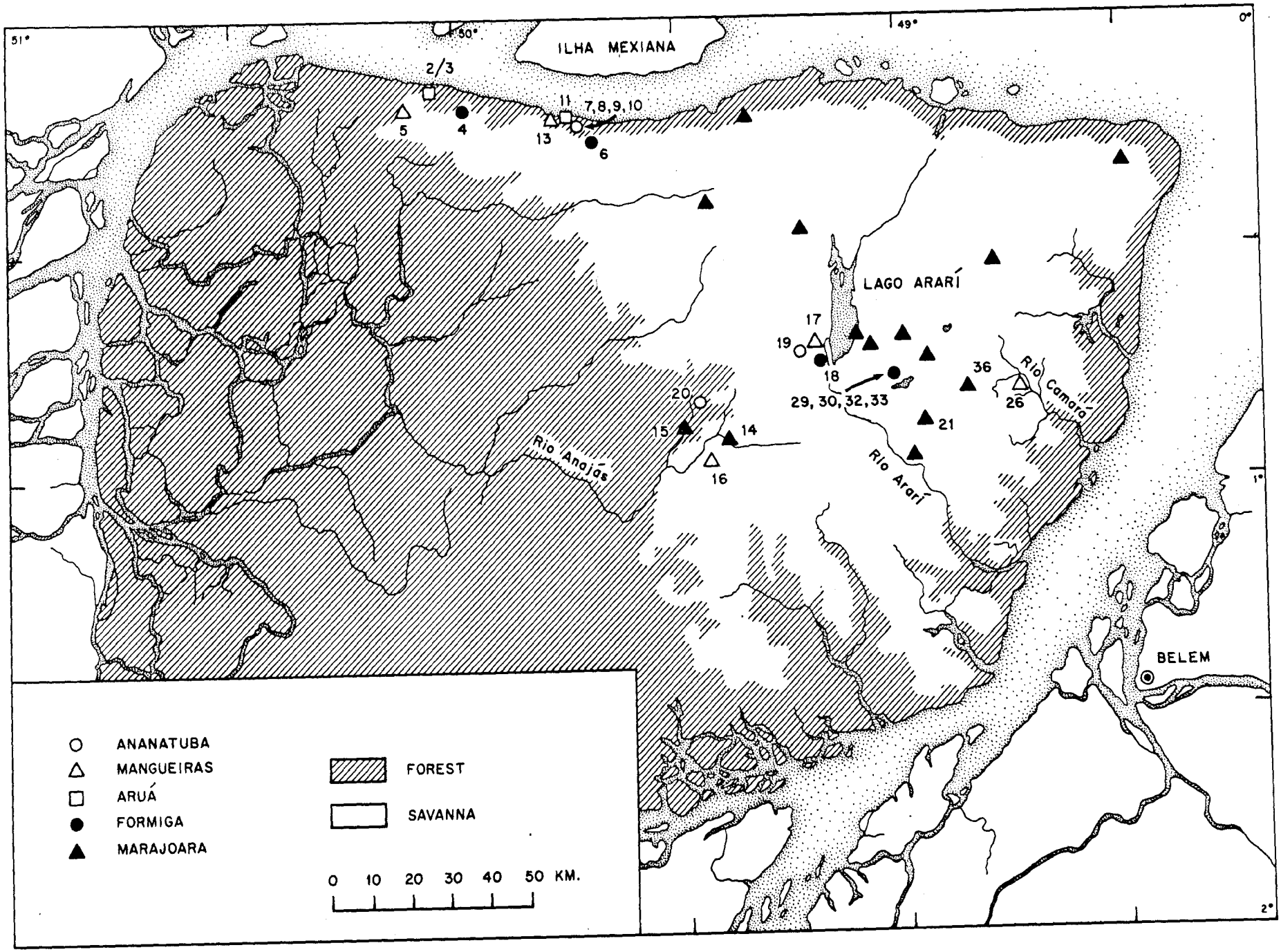
FIGURE CAPTIONS

Figure 1 - Marajó Island, showing the distribution of the principal kinds of vegetation and the locations of all known sites of the Ananatuba, Mangueiras, Formiga, and Aruã phases. The Marajoara Phase is represented by a sample of sites that define its geographical distribution. (After OEA 1974, Meggers and Evans 1957, Simões 1965).

Figure 2 - Comparison of the archaeological sequence on Marajó Island with episodes of aridity since the end of the Pleistocene. A hiatus of 930 ± 300 years between the end of the Mangueiras Phase and the beginning of the Formiga Phase correlated with a dry interval between about 2700 and 2000 B.P. Broken lines indicate carbon-14 dates; solid lines TL dates. TL dates with no plus-minus represent measurements for which the average (internal + external) doses were used for calculating ages.


YEARS B.P.
ARCHEOLOGICAL SEQUENCE
TL AND C-14 MEASUREMENTS
ARID PERIODS
500
1000
1500
2000
2500
3000
3500
ARUÃ
MARAJOARA
FORMIGA
(HIATUS)
MANGUEIRAS
ANANATUBA


51°
50°
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0°
ILHA MEXIANA
2/3
11
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LAGO ARARÍ
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Rio Camará
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Rio Andajás
Rio Arari
BELEM
2°
ANANATUBA
MANGUEIRAS
ARUÁ
FORMIGA
MARAJOARA
FOREST
SAVANNA
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