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TEETH, NUTRITION, ANEMIA, INFECTION, MORTALITY: COSTS OF LIFESTYLE AT THE COASTAL BRAZILIAN SAMBAQUIS

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Abstract: The bioarchaeology of Brazilian sambaqui peoples has been improved in the last 30 years. An increasing number of papers is published and new data about nutrition, mobility, health, taphonomy and cultural data are produced. Dental pathology and other information about health is abundant, and subjects such as infections, stress markers, anemia among other are being explored. Paleodemography still depends on the future bigger excavations providing better samples. Difference in lifestyle, along the coast, is suggested by different pathocenoses. In general, anemia is very frequent, chronic infections are endemic and caries rates are low, while tooth abrasion is intense. Stress indicators (LEH and Harris lines) are also frequent, suggesting that in spite of a diet rich in protein, there was physiologic stress following the weaning and infancy. New data about the use of carbohydrates in the diet start to elucidate special cases with high prevalence of dental caries.

Key words: Shell mounds, paleoepidemiology, South America, Prehistory, bioarchaeology

Resumé: Les derniers 30 ans virent un vrai avance à la recherche bio-archéologique aux sambaquis brésiliens et une grande quantité d’articles fut publiée. Même si la pathologie dentaire reste le sujet plus recherché, il y a aussi articles publiés aux infections, aux signes d’estress, a l’anémie, etc. Pour la paleodemographie il faut encore former des ensembles funeraires plus nombreuses et représentatives. Si la pathocenose de ces groupes signale les différences d’style de vie au long du littoral, il y a un cadre general caractérisé pour l’endemicité des infections chroniques, l’haute fréquence de l’anémie et basse prevalence de carie. Les hypoplasies d’email dentaire et les lignes de Harris sont aussi frequentes et suggèrent que la diète hyperproteic n’empechait pas l’existence d’stress physiologique pendant l’infance et l’adolescence dans ces populations.

Mots clés: Amas de coquilles, paleoepidemiologie, Amerique du Sud, Prehistoire, bioarchaeologie

INTRODUCTION

Skeletal morphology points to health and disease among other bioarchaeological information, helping to reconstruct the lifestyle of past populations (Larsen, 1999). The interest for understanding life conditions has been pointed out decades ago (Hooton, 1930), and since them paleopathology is also paleoepidemiology (Angel, 1966; Buikstra & Cook, 1980; Cohen & Armelagos, 1984; Souza, Carvalho & Lessa, 2003, among others). Skeletal and teeth stress indicators as well as disease indicators in their proper context provide hypothesis, biocultural models (Goodman et al., 1988; Souza, 1999) and Health Indexes (Steckel, Sciulli & Rose, 2002). Bioarchaeology of sambaquis has been using big and also small numbers in order to explain how prehistoric coastal populations lived and died. In Brazil more and more papers about bioarchaeology of sambaquis are being published in the last 30 years.

Until the seventies there was no systematic information about paleopathology of the sambaqui people, except for some data on dental health (Cunha, 1963a, 1963b; Ferraz & Mendonça de Souza, 1973). Since them a lot of information was provided on paleopathology. Anemia, dental loss, dental caries, dental calculus, periosteal reactions on bones and infection are the most popular studies (Machado & Kneip, 1994; Souza, 1999; Storto, Eggers & Lahr, 1999, 2001; Wesolowski, 2000; Souza, Wesolowsky, Rodrigues-Carvalho & Lessa, 2006).

Trauma and workload came to be subject of research very recently (Lessa & Medeiros, 2001; Rodrigues-Carvalho, 2004). Thanks to this refreshing discussion paleopathology of coastal populations is now more integrated to the archaeological models, opening new windows to the understanding of the past. The studies concerning food remains, isotopic analysis of bones, demography and others are still at the beginning. New insights help testing hypothesis about the adaptative cost of different lifestyles along the shore line.

The present literature survey includes 119 papers, 56 sites (21 from Rio de Janeiro State, 12 from São Paulo State, 4 from Paraná State, 19 from Santa Catarina State) and a total amount of 1546 skeletons. To this was added some unpublished data. Not all the bibliographic references are cited here but the data summarizes the main results of the revision. An increasing amount of information on paleopathology, more comparisons between sites, and new insights and hypothesis about prehistory as well as lifestyle and health is now available. Despite the overall similarities among the sambaquis it is already possible to confirm that those coastal groups had different life conditions, depending on time, ecology and culture. Sharing many aspects of the environment, subsistence strategies and material culture, they also had substantial differences in diet, physical activity and settlement. Cultural differences are not very well known though it can actually explains part of the diversity pointed by paleopathology.
The aim of the present paper is to bring general information about biological variability of Brazilian *sambaqui* people under the point of view of dental pathology, nutrition, infection and mortality.

**WHAT DO WE KNOW ABOUT SAMBAQUI PEOPLE?**

*Sambaqui* people were considered well adapted, well nourished, robust and living on a diet rich in protein (fish and also shellfish, fruits/roots/seed collected along the restingas, swamps and Atlantic forest along the coast). No caries and low rates of teeth loss are described for the main sites, reinforcing the idea of good health conditions. Their low to medium stature was not quite different from the stature of other groups in Brazil. Their very thick bones were suggestive of well calcified and developed skeletons. Their long bones marked by muscular insertions suggested strong complexion. For decades, Physical Anthropologists considered the *sambaqui* people the very model of a well adapted, strong and healthy people living in an affluent environment for millennia.

When specialists in paleopathology finally started to dedicate themselves to the study of those groups, new insights came to give more precise idea of their varied health and lifestyle. Perhaps not all those groups had good health, or perhaps we should review the concepts and methods in paleopathology. Perhaps the adaptability along the time and space in the coastal areas is such as to create a great variety of life conditions. At this very moment data show us a rich bioarchaeological scenario to be investigated.

**TEETH**

The first paleopathology studies on *sambaqui* people were focused on teeth. Between the fifties and the seventies Ernesto de Mello Salles Cunha (Cunha, 1963a; 1963b) published surprising low rates of caries in *sambaqui* series, including some cases of caries absence, suggesting they could had naturally resistant teeth for genetic or dietary reasons. Their low dental loss during life, the expressive dental calculus and dental wear were also considered typical of those harvesting people. More recent papers definitely proved a very unequal picture concerning teeth decay, suggesting that not all the coastal *sambaqui* people had the same pattern of oral health (Wesolowski, 2000; Haubert et al., 2004).

The three main indicators in published and unpublished data are caries, tooth wear and “in vivo” dental loss. Caries prevalence per person vary from 0% to 2% in sites such as Cabeçuda, Rio Vermelho, Laranjeiras I, Cabeça do índio, Forte Marechal Luz and Jaboticabeira II, to 43-60% in sites such as Enseada I and Rio Comprido. A few sites have high prevalence of caries (Neves, Unger & Scaramuzzza, 1984). The explanation to this fact is not clear yet, but the first studies proved that caries are definitely not associated to the ceramics that occur in a few *sambaquis*, at least in Santa Catarina State (Wesolowski, 2000). In Rio de Janeiro *sambaquis* have a medium prevalence of caries, for instance, 22% of caries per teeth in Beirada site (Machado & Kneip, 1994).

The alveolar abscesses are highly prevalent (40-70%) even in the absence of caries, possibly associated to intense tooth wear and periodontal trauma. The non mastigatory wear caused peculiar spiral and beveled forms in teeth also occurred in specific sites, possibly caused by the processing of some raw material. It is described in the sites of Jaboticabeira, Forte Marechal Luz, Cabeçuda (Santa Catarina State), Piaçaguera and Tenório (São Paulo State) and Beirada, Embratel, Zé Espinho (Rio de Janeiro State). Dental loss during life is rare, perhaps because of the sticking effect of hypercementosis. Dental calculus varies in prevalence and intensity, and the study of microfossils in calculus (Reinhard et al., 2001) is confirming different prevalences of starch, phytoliths and processed parts of plants such as fibers, epidermis and spikes. In the Cabeçuda *sambaqui* tooth loss of the incisors in males (17%) was associated to trauma and possible use of lip ornament (Rodrigues-Carvalho & Souza, 1998).

Information about periodontal disease is scarce, except for the report of apical cavities generally not associated to dental loss or caries. Masticatory trauma caused by bones, minerals, fragments of shells and possibly plant remains such as phytoliths fit well the explanation of infection and cavities.

Mandibular and maxillary *tori* are also usually frequent at the skulls. Although they could be explained by mechanical as well as infectious stimulus (Alvim & Soares, 1984; Souza, 1999) most of the Brazilian literature still considers them as epigenetic traits. Auditive *tori* are also frequent and their interpretation is that of an epigenetic trait, as well as the mandibular and the maxillary *tori* (Alvim & Soares, 1984; Alvim, Soares & Cunha, 1984). An alternative etiologic explanation is that they could be associated to low temperatures of the water – diving – or the air – exposure to strong cold winds. A perioseal response to local infection can be an alternative explanation (Souza, 1999), although Peixoto (1989) in his study of Cabeçuda skulls proposed that the position of the *tori* in the inner part of the ear was suggestive of a genetic etiology. The actual prevalence of external auditive *tori* in Santa Catarina State collections is between 22% and 36% of the individuals, and could be explained either by cold waters or winds (Eggers et al., 2006). In Rio de Janeiro and São Paulo *sambaquis*, where the environmental conditions are less severe and the waters less cold there is almost no *tori*, except in Condomínio do Atalaia, a site placed at the only point of frozen resurgent deep sea waters along the Rio de Janeiro coast.

Comparing *sambaqui* people to modern people, we realize that along the Brazilian coast low carie rates, intense wear
and medium to high periodontal reaction have also been observed among the traditional fishermen communities (Pourchet & Alvim, 1975), who share some aspects of their environment and lifestyle with the *sambaqui* people.

**ANEMIA**

During the eighties the Brazilian *sambaquis* started to be studied also for anemia, with the help of indirect indicators such as porotic hyperostosis (PO) and *cribriform orbitalia* (CO). The first description of high prevalence of PH and CO in a Brazilian skeletal series was published by Alvim & Gomes (1989), this study was followed by others. Data to some of the biggest *sambaqui* collections like Piaçaguera and Cabeçuda, is today available. PH and CO were found in high prevalence in *sambaqui* skeletons, suggesting that anemia was a real problem in infancy, only surpassed after the 10th year of life. Once the diet of those prehistoric foragers did not lack iron, only the imbalance between iron intake and consumption would explain the data. Parasitism, infections, diarrhea and other factors could be associated to iron loss. Iron consumption by parasites, iron loss associated to blood loss, or adaptive response to infections during childhood (Alvim & Gomes, 1989; Souza, 1999) can be alternative explanations to anemia in such a well nourished people.

The first interpretation of anemia in Brazilian *sambaqui* people also considered that the accumulation of such a discarded pile of carcasses at the settlement induced a poor sanitation area. According to Alvim & Gomes (1989), in a tropical environment such a condition would cause people to be exposed to high infestation risks. This interpretation proposed that anemia could be a direct consequence of massive parasitism, although no coprolites from sambaquis could ever be analyzed. In the nineties, an alternative hypothesis was proposed by Souza (1999). Following Stuart-Macadam & Kent (1992) model it was suggested that anemia could be just a consequence of the daily exposition to infections, especially salt water bacteria of the genus *Vibrio*, universally present in the coastal environments. Objects, materials, food and body surfaces in contact with salt water are generally colonized by that *Vibrio*, especially during the warm season, potentially causing gastroenteritis and other infections of the ear, eyes and skin, as described for modern populations living by the sea or using sea food (Daniels *et al.*, 2000). A permanent infectious stimulus from the early infancy, universal and constant, could explain anemia as an adaptative response in children living a *sambaqui* lifestyle.

Piles of discarded remains or intentionally built, as suggested by Gaspar (2003) and other archaeologists, the lifestyle associated to the *sambaquis* would be consistent with the permanent exposition to bacteria. In such a condition it is possible to assume an adaptative response of iron consumption and sustained low level in the blood, as proposed by Stuart-Macadam & Kent (1992).

Differences in the prevalence of anemia in the sites possibly point to different environmental exposition and risks, and that is consistent changing lifestyles along the coastal environments.

Besides the salt water *Vibrio*, other pathogens are proposed to have been present among Brazilian *sambaquis* groups. In fact, under the paleoepidemiologic point of view data point to the fact that endemic infections spread out among the *sambaqui* people in different places and periods, bones are affected in the form of periostal reactions, occasional osteitis and osteomielitis, as discussed ahead, what could also explains anemias and other stress indicators.

**NUTRITION**

For a long time nutrition has been considered good among *sambaqui* people. Supposed to live affluent lives, the coastal groups were supposed to feed on coastal environments. Diet was supposed to be hyperproteic, based on fish and shellfish, and this was generally associated to good health. Although their stature was medium to low (Alvim, Vieira & Cheiuche, 1975) their skeletons were robust and marked dimorphic, suggesting a good development of the genetic potential. Added to low rates of dental decay, this general description to *sambaquis* people was supposed to point to good health (Souza, 1995). Variation in *sambaqui* series was not discussed except for one comparative study of skeletal series suggesting more than one morphological type (Alvim, 1978). On the other hand, the archaeologists agreed that the *sambaquis* expressed different cultural manifestations in different places and times (Prous, 1992) leading to think about different feeding strategies. Lima (1991) proposed that the differences among the sites could express different access to resources, competition and some level of complexity in those societies. Hierarchy between sites along the same coastal area has been suggested by Gaspar (2003) and Lima (1991). Living at the coast was supposed to be living in an affluent environment, and *sambaqui* people were not hypothesized as people having big health problems. Natural risks of their lifestyle were not discussed until the nineties (Souza, 1995; 1999).

Nutritional stress was also suggested by the finding of expressive linear enamel hypoplasia. The first results indicating high prevalence of that stress indicator among the *sambaqui* people was also a surprise (Souza, 1999). According to Goodman & Capasso (1992) a low carbohydrate intake even associated to a hyperproteic diet could have physiologic impact and produce considerable physiologic stress. This possibility of low carbohydrate intake unbalancing diet was first considered to explain the prevalence of hypoplasias in *sambaquis* for the site of Cabeçuda (Souza, 1999). Starch in dental calculus (Reinhard *et al*., 2001; Wesolowski *et al*., 2007), isotope studies in bones (De Masi, 1999) and also charcoal
analysis (Scheel, Gaspar & Ybert, 1996) will certainly be helpful in the future to give us a full picture of health and disease. The enamel defects are generally formed between 2 and 4 years in coincidence with the weaning period. Otherwise, in Enseada I the stress causing enamel defects comes later, between 4 and 6 years of age. But indeed, polishing of the enamel surfaces, specially in those samples with non masticatory wear, makes much more difficult to compare the results among different sites. More detailed microscopic analysis is needed to improve the results.

In Cabeçuda sambaqui 64% of the incisors have LEH (Souza, 1999). In Rio Vermelho, with a diet based on fish, 53% of the women and 26% of the men have linear enamel hypoplasias (Hube, 2005). In Morro do Ouro LEH rate is 33-42%, in Enseada I 51%, both are sites with high prevalence of caries and possibly higher carbohydrate intake. Both the archaeological analysis of animal remains (Figuti, 1993), and the isotopic analysis of bones (de Masi, 1999), point to fish as the main protein source, contrary to the former interpretation of mollusks being the staple food.

Perhaps diet was more balanced in the sites where starch plants were used. Studies on isotope, as well as investigation of microfossils from teeth, now in course suggest the differences in diet among the sites can be greater than previously supposed. The more we think about the differences in nutrition, anemia and adaptation in the Brazilian sambaquis.

**INFECTION**

Infection is proved to be very frequent among the sambaquis people, especially periosteo reactions. Although most of the papers reporting periostitis do not distinguish wich lesions could be traumatic, the infectious etiology can be barely inferred by the report of systemic, symmetrical and/or poliostotic lesions. The tropical climate, the concentration of people and groups, and the exposure to specific coastal risks such as salt water vibrios make the infections etiology – either specific, or inespecific – a strong epidemiological hypothesis (Souza, 1995, 1999). Considering the prevalence of infections, including systemic/poliostotic ones can help understand if not all the infections, the main endemic ones. Focal periosteo reactions are also described for in sambaqui skeletons. Their possible infectious etiology can be explained by hematological dissemination, or contiguous dissemination from skin for instance. Excluding the focal periostitis as possibly traumatic can cause understimation of the prevalence of infections, excluding occasional, minor focal lesions.

Periostitis, osteites and osteomiellitis are described in the sambaqui skeletons, suggesting that inespecific as well as specific infections affected the bones. Periosteo reactions, either laminar or fibrous, and chronic periostitis associated to osteitis affect the long bones, mainly the lower limbs. At least one case of osteomyelitis is present in each site. Reactions at the outer table, vault scars and porosity are also describe in rare cases. Focal periosteo reactions in maxilla and mandibular, are generally associated to dental foci.

In Rio de Janeiro State, Messias (1977) described, “discrete hyperostosis” in tibias from Sambaqui do Forte. Rodrigues et al. (2001) mentioned one individual with osteomeiti. Souza (1995) describes more cases of chronic poliostotic osteomeiti in a skeleton from the Arapuã, where other individuals with signs of infection have been identified. Infections are also mentioned for the Condominio do Atalaia. In Zé Espinho sambaqui about 60% of the skeletons have periostitis, one of them has disseminated lesions including osteitis. In Ihote do Leste 90% of the skeletons also have periostitis, half of them are systemic lesions. In Beirada, Boa Vista and Algódão, 50 to 80% of the individuals have periosteo reactions suggestive of infection, as in other sites, at least one skeleton of each site has more disseminated or severe lesions. Most of the skeletons described for periostitis are adults, the immature not being mentioned. In São Paulo there is no systematic study, but initial descriptions by Silva (2005) mention skull and ribs periosteo reactions in Buracão and Tenório.

In Santa Catarina 60% of the skeletons from Jaboricabeira have periostitis/ osteitis/osteomielitis, 47% of them are severe (Storto, Eggers & Lahr, 1999, 2001). Cabeçuda are symmetrical lesions in tibias (Souza, 1995). In Forte Marechal Luz periosteo reactions were also mentioned and the authors suggest a different prevalence for the level with ceramics (Silva & Souza, 2001). In Rio Vermelho (Hube, 2005) periosteo reactions and bone infections affect at least 50% of the individuals, children included, 15% of them have osteomielitis.

Prevalence of 60 to 80% of infections in Rio de Janeiro sambaquis contrast with 30 to 60% in Santa Catarina. The more severe cases including vault scars, osteitis and osteomielitis are in Rio de Janeiro. Mild cases of fibrous periostitis are in Santa Catarina. In most of the cases benign infection affecting the adults, and there is no relationship with chronology or size of the sites is clear. This first epidemiologic approach is suggestive of a more severe condition in Rio de Janeiro than in Santa Catarina, despite the fact that the bigger sites and populations are in the last region. Climate differences, as well as the natural history of the endemic condition may help to explain the differences. Treponematosits has been suggested as a possible diagnosis.

Under the epidemiological point of view, either different infections or different manifestations of the same infection must also be considered. Detailed comparative studies of the periosteo lesions in different sites will certainly help to propose a paleoepidemiological model. The existence of big groups, low mobility and tropical
settlements would favour endemization of a treponemal disease (Powell & Cook, 2005).

**MORTALITY**

Population size of the *sambaquis* has been proposed on different basis … and estimated on the amount of shells and other archeological remains. A literature survey in 1973 (Ferraz & Mendonça de Souza, 1973) listed 638 burials in 48 coastal sites, most of them with no children under 5, possibly a taphonomic bias. Although many *sambaquis* have been excavated, part of them are big sites with hundreds of skeletons but were only partially excavated. The substrate usually rich in shells and other calcified debris, is sometimes cemented by the calcium carbonate, making it difficult to recover the bones, especially the fragile and small bones of the youngest ones. Taphonomic factors, among others, possibly explain why the numbers of mortality are so contradictory, and why the children are generally missing, although it is not possible to exclude age related cultural practices in some *sambaquis*.

One of the sites that has been almost completely excavated, providing good data for a paleodemographic study is the *sambaqui* of Piaçaguera, in São Paulo State. Paleodemography of the skeletal series was published by Uchoa, Alvim & Gomes (1987). According to the radiocarbon dates, the site was used for a short period of about 40 years, from 4890 + 110 to 4930 + 110, providing 87 skeletons of adults and children of both sexes, a natural population. 24 are youngs less than 2 years old, 60% of the skeletons are older than 15; 8.7% are older than 55. Life Expectancy (Ex0) was estimated in 21 years, Crude Mortality Rate was 48% and Total Fertility 4.4. Populational Growth was estimated in 0,0015 per year, and the Sex Ratio was well balanced. A bigger mortality of young women between 20-25 years (15,2%) when compared to men of the same age (2,17%) is suggestive of special risks possibly associated to pregnancy and delivery (Hassan, 1981). Once the dates for Piaçaguera are accepted, the short period of use of the cemetery expresses a populational cohort. But undoubtedly other big well dated *sambaquis* must still be excavated before we can be conclusive about demographic studies.

The *sambaqui* people is supposed to have lived an affluent life of low mobility, abundant food resources, grouped along the coast in big communities. Perhaps they had some domesticated plants, perhaps mortality has changed during coastal adaptation.

**HEALTH AND LIFESTYLE ALONG THE COAST**

Neves & Wesolowski (2002) studied eleven *sambaquis* from Babitonga Bay, Santa Catarina State, and used the Health Index proposed by Steckel, Sciulli & Rose (2002). Their results allowed to rank *sambaquis* people as very healthy, reaching between 22,97 and 23,22 points, that is to say about 90% of the maximum health rank to that Index. The results can be a natural consequence of living in a very affluent economy, supported by predictable and productive tropical environments, adding to the fact that living areas would be naturally cleaned by the tidal movements. The economic arguments are apparently correct but the prevalence of infections and stress indicators in published and unpublished data force to think a little more about this interesting problem. It is obvious that a Health Index brings a methodological problem, and the concept of health and disease is subject to discussion as Hubbe (2005) remembers in his thesis. Perhaps the expressive prevalence of infections, the possible endemic condition, the risks of natural infections in salt waters, and the low carbohydrate intake, even in the condition of a hyperproteic diet should be good reasons to be conservative about considering *sambaqui* healthy people.

Paleoepidemiologic data confirm that *sambaqui* groups could have lived in quite different conditions, depending on space and time, suffering from different diseases or biological costs. Living for such a long time and expanding along the coast, they were possibly well adapted, as far as adaptation and health are not necessary together. Anemia, infection as well as other problems could be part of their adaptation. Pathocenosis and more detailed biocultural models for sites or groups of sites will be useful to compare different situations for those prehistoric groups and to know more about their health and disease.

**FINAL REMARKS**

Poor material, a few studies and the lack of curatorial programs are the biggest difficulties to study bioarchaeology of the *sambaqui* people.

Cultural and ecological diversity are the starting points to discuss adaptability and differences in health and adaptative costs among the *sambaquis*. Diachronic approaches and spatial comparison can help to understand change in lifestyles and in disease. Although big numbers are good, in the case of *sambaqui* sites, small numbers and specific approaches can enlightening specific circumstances before the big numbers are tryied. Some final remarks emerge form this initial data:

1. Caries prevalence is low in most of the *sambaquis* (0 to 2%), lesions are small, inside the fissures and pits, not associated to ceramics. The highest prevalence reach 60%.

2. Tooth wear is intense and can be plane or beveled. In sites with ceramics it is generally anterior. Non mastigatory wear occurs in specific sites.

3. Prevalence of abcesses varies from 12,5 to 70%, there is no correlation with caries or wear/pulp exposure. It may be related to other factors of trauma to periodontal tissues.
4. Dental loss is generally low, except in some cases of possible use of lip ornaments or tembetás.

5. Phyoliths and starch of different species including in dental calculus are suggestive that high carbohydrate intake could be part of the diet, perhaps domestication, perhaps the exploration of specific natural resources.

6. Anemia as indicated by porotic hyperostosis and cribra orbitalia is more prevalent in some sites (86.7%) but rare in others (2 to 5%). The lesions have been active during the first years of life, but they are healed in most of the individuals. There is no sex predominance.

7. Harris’ lines are not studied, in Cabeçuda sambaquis they confirm a stress period during infancy.

8. The prevalence of linear enamel hypoplasia vary too much, from 64% to 9%. They also confirm physiologic stress between 2-4 years or 4-6 years, depending on the site. This may suggest variation in the weaning period and/or different transitions to the adult nutrition.

9. Infection is represented by periostitis, osteites and osteomielitis affecting 60 to 80% of the individuals in Rio de Janeiro sites, and 30 to 60 % of the individuals in Santa Catarina sites. Endemic patterns, symmetrical lesions, mostly represented by periosteal reactions, and some vault lesions are strongly suggestive that treponemal disease could explain part of the infections at the coastal sambaquis.

10. Mortality is not based in consistent numbers, because most of the skeletal series are strongly biased, but the results in Piąaguera sambaqui suggests the mortality was high, among young children (Ex0=21) and young adult women (15.2%).

Under the bioarchaeological point of view, it is possible to confirm the existence of at least two different groups of sambaquis. The group of sites in Rio de Janeiro has skeletons with few hypoplasia, low anemia, no torus, paramastigatory wear and high prevalence of infection. The goup of sites in Santa Catarina has skeletons with few hypoplasia, low anemia, no torus, paramastigatory wear and high prevalence of infection. The first data is suggestive that despite time and space, sambaquis can be quite different also in biocultural aspects.

Regional difference in paleopathology seems to fit well to differences in archaeological areas. More local pathocenosis should be tested before general models can be proposed, and local differences can be explained by differences in lifestyle.

Bibliography


