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Why clam? Why clams? Shell Mound construction in Southern Brazil

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ABSTRACT

Bivalve shells comprise a significant portion of shell mounds, so mollusks have always been seen as fundamental to shell mound societies. The importance of these animal resources to shell mound societies in Brazil has been intrinsically connected to diet and subsistence since research began in the 19th century. For nearly 150 years, researchers have considered the faunal assemblages from shell sites as a direct reflection of their builders' meals. Alternate explanations for the presence of mollusks at the mounds were usually disregarded, but results of isotope analyses from human bones are changing the scenario. Incongruences between the assemblages and isotopic analyses compel researchers to rethink the role of the faunal remains deposited in shell sites.

1. Introduction

Mollusks are a fundamental part of shell mound archaeology, after all these sites are basically composed by bivalve, and in less number, gastropod shells. The origin of the Brazilian term for this type of site: *sambaqui*, derives from the native Tupi language word for clam, *Tamba*. The importance of these animals for hunter-gatherer-fisher societies was seen solely in dietary terms since the beginning of research in these sites during the 19th century. However, theoretical and methodological changes brought about in the last decades elicit evidence about alternative positions clams and other aquatic resources had for these societies.

The series of advances in Brazilian shell mound archaeology transformed the research field, mainly regarding site construction, settlement patterns, funerary ritual, and the diet of these societies (DeBlasis et al., 2007; Gaspar et al., 2014; Scheel-Ybert, 2013; Villagran, 2014). None of these advances could have been made without the contribution of zooarchaeology. Among the questions recently discussed, results from coastal mound builders isotopic data (Colonese et al., 2014; De Masi, 1999, 2009; Klokler, 2008, 2014; Villagran et al., 2011) bring new issues to scholars interested in studying the relationships between animals and hunter-gatherer-fisher societies.

Debate concerning the subsistence of shell mound populations was always central in Brazilian archaeological literature (Gaspar, 2000; Klokler, 2017a). Studies were largely based on faunal remains recovered from small-scale excavations, trenches and/or profile analyses, and the main distinctions among researchers results are connected to theoretical perspectives and, by extension, the methods employed in the field or at the lab. But scholars are mostly united by the normative view that archaeologists have in relation to faunal materials (Gaspar et al., 2014; Klokler, 2014, 2017b).

The dominant normative view is strongly inspired by processual perspectives that frame faunal remains as reflecting the diet of past communities (Claassen, 1991; Waselkov, 1987). However, social zooarchaeology and isotopic studies simultaneously raised and shed light about issues connected to diet and funerary rituals performed in regions of the southern coast of Brazil.

2. Mollusk gatherers, or also fishers?

For most of the history of shell mound archaeology researchers explained the accumulations of shells that characterize mounds as arising from the consumption of clams or mussels by populations of coastal shellfish collectors. Following the traditional view, studies based on faunal remains invariably treated the deposits' components as dietary remnants of the sites' builders. The major point of contention was whether the groups' diets were based on mollusks or on a mix of shellfish and fish. Authors usually consider the second as a later development of the first.

Fisher-hunter-gatherers occupation along the Brazilian coast began at least 7000 years ago, potentially earlier since older sites may be submerged. At approximately 4000 BP in Santa Catarina state (where we find the largest concentration of monumental sites and consequently the largest amount of archaeological data), site construction increases progressively. Mounds grew larger in size and number forming clusters. After this spur, the coastal landscape (or seascape) in southern Brazil

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Fig. 1. View of Espinheiros II site (note the house on the top left) (Photo by Paulo DeBlasis).

Fig. 2. West Indian pointed venus collected in Florianópolis - Santa Catarina.
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was noticeably altered with structures that were conspicuous in the mostly flat terrain (Fig. 1).

West Indian pointed venus (*Anomalocardia flexuosa*) (Fig. 2), dominate the matrix of the major part of Brazilian sites, particularly the largest mounds located on the southern shores of the country. It is in fact a very common species found in mollusk beds along most of the coastal estuaries. Along with the practicality of the selection of an easily obtainable clam, the West Indian clam is attractive to gatherers since it reproduces at a young age, can sustain changes in water salinity and temperature and undergo heavy exploitation without lowering its population numbers (Pezzuto et al., 2010; Rodrigues et al., 2010). In today's commercially driven clam and mussel fisheries, the extraction of West Indian beds in Florianópolis has not yet been able to dramatically affect the stock's density and fertility rates (Pezzuto et al., 2010).

In nutritional terms, West Indian clams are a reliable source of protein and essential minerals but provide few calories and lipids (Pedrosa and Cozzolino, 2001) so it would not be a good option as a diet staple for hunter-gatherer-fishers groups. In many traditional coastal communities, families collect West Indian clams to sell at markets (Gaspar et al., 2011). The meat sold is generally used as complement in dishes, filling for diverse pastries, and sauces (and largely added whole – with shells - to miso soups). And the remaining shell valves are used as filling in roadwork and in small backyard earthworks. The collectors also commonly use the leftover shells for paving (Gaspar et al., 2011). Such attitudes towards West Indian shell valves attest to their suitability as raw materials for construction and the continuity in the perception of valves not as leftover or refuse but as valuable supplies and resources.

The sheer quantity of shells necessary to build the structures influenced the hypothesis that shell mound groups overexploited the mollusk beds and with this explanation justified changes identified in many sites in which the last occupation or construction phases had fewer quantities of West Indian shell valves and more fish bones. Measurements of shells from three sites (including a monumental mound) indicate that the average size of valves did not decrease with time, instead it remained largely stable (Oliveira, 2015). Notably, at the site Garopaba do Sul, approximately 20 m of mound construction layers contained similar sized West Indian clam specimens.

Based primarily on the proportion of shells versus fish bones researchers defended the idea of a coastal lifeway based solely on the consumption of mollusks, later substituted by the consumption of fish. More recently, with use of conversion rates to estimate biomass of shellfish and fish resources, diversity, and equitability indexes it is clear that mollusks were never the main staple for these fisher-hunter-gatherer groups and estuarine fishes were the most sought-after foods (Figuti, 2008; Klokler, 2008). In an effort to verify the reliability of these results I present here another line of data that is a better indicator of actual individual human diet to shed light on the debate around the consumption of shellfish by the Brazilian shell mound builders.

3. Materials and methods

Analyses of stable isotopes from human collagen have been broadly used in archaeological research to infer diet in pre-colonial times. Carbon and Nitrogen isotopes are especially useful in the determination of the relative contribution of marine and terrestrial resources to the diet of prehistoric populations (Richards and Hedges, 1999; Richards et al., 2005), and also particularly helpful at establishing a distinction between the use of C_3 and C_4 plants (Tykot, 2002), and in this way detecting the possible consumption of maize. The proportion between Carbon and Nitrogen can verify the importance of distinct consumed resources based on the enrichment or decrease in isotopes (Reitz and Wing, 1999).

Carbon is the most common isotope used in diet studies. As carbon passes through the food chain the fractioning of $\delta^{13}C$ changes, facilitating the distinction between plants and animals (Reitz and Wing, 1999). Additionally, it is also possible to distinguish marine and terrestrial diets since carbon has only two sources (marine and terrestrial) and due to the CO2 intake in the ocean, maritime organisms contain more 13C (Jelsma, 2000; Richards et al. 2001:718). Therefore, δ^{13} C values close to $-12‰$ indicate diets that are not exclusively terrestrial. Additionally, the higher the trophic level of the item, the heavier the δ^{13} C in the samples, albeit the variation due to climate and other factors also can influence the δ^{13} C values (Richards and Hedges, 1999).

Protein is the only significant source of nitrogen for living organisms. The nitrogen concentration level increases along the food web from plants to herbivores and then carnivores. Due to that, the δ^{15} N levels are more influenced by the diet's trophic level, however they are

also affected by the soil, vegetation and climate conditions (Richards and Hedges, 1999). Generally, the lower the δ^{15} N value, the lower the trophic level of consumed animals. Nitrogen values are not significantly affected by the geography in animals occupying similar trophic levels, allowing researchers to use values from animals from distinct areas, especially when local values are not available. δ^{15} N values in humans are enriched in 3–4‰ above the consumed animal resources (Richards and Hedges, 1999). Marine resources give values between 10 and 22‰ while terrestrial values cover between 4 and 10‰.

3.1. The human components

The discussion concentrates on results from sites located in two major research regions: Garopaba do Sul Paleobay and Guanabara Bay respectively located in Santa Catarina and Rio de Janeiro states. The areas were selected based on the availability of complementary data (published or from reports) from isotopic and faunal analyses, however in varying degrees of detail (Bastos et al., 2014; Colonese et al., 2014; De Masi, 1999, 2009; Scheel-Ybert, 2012).

The Jabuticabeira II site (Fig. 3) is the Brazilian shell mound with the most literature available to archaeologists (Gaspar et al., 2014). It was the subject of extensive multidisciplinary and international research since the mid-90s with results that promoted a paradigm shift in the topic. Jabuticabeira II was the first Brazilian shell mound recognized as a cemetery.

In an area with sites that reached up to 30 m in height, Jabuticabeira II is an average-sized mound (approximately 9 m high) with no evidence of habitation structures constructed by repeated funerary feasts (Table 1) (Klokler, 2014). Fourteen individuals were selected for isotopic analysis. They belong to four distinct funerary areas spanning approximately 1000 years (between 2500 and 1500 years BP). Jabuticabeira II faunal material have been analyzed and published extensively (Klokler, 2001, 2008, 2014, 2016a; Nishida, 2007).

The second source of isotopic data for this study is Cabeçuda (Fig. 3). The site is the 1950s equivalent of Jabuticabeira II in its impact for Brazilian shell mound archaeology. Research at Cabeçuda marked the beginning of the application of systematic methods in archaeological studies at shell mounds and the spread of the debate about the significance of these sites. Approximately 100 years ago, the estimated size of the site was 22 m in height and 400 m in diameter, however its original dimensions could have been (and probably were) bigger (Table 1). The name Cabeçuda, which means “big head”, is said to have been given to the site because of its similarity with a large head (Zamparetti, 2014). Others say that the name derives from the quantity of human heads from burials found in the mound during shell exploitation in the 20th century.

Cabeçuda, was more notable within the field of physical anthropology as a result of the large burial population approximately 280 human individuals, recovered from the site. These remains have been studied by generations of researchers. Cabeçuda is considered a funerary site and has been recently subjected to renewed research and excavations by a team led by Rita Scheel-Ybert and Claudia Rodrigues-Carvalho from Museu Nacional focusing on the study of function, site formation processes, and funerary ritual (Rodrigues-Carvalho et al., 2011; Scheel-Ybert and Rodrigues-Carvalho, 2016). In total the isotopes values for five skeletons from Cabeçuda were analized. The temporal amplitude of the samples is about 400 years. I completed a preliminary zooarchaeological analysis of the recently excavated faunal materials and studied the samples recovered during the earlier fieldwork.[1]

Sernambetiba is located in Rio de Janeiro state, near Guanabara Bay (Fig. 3). At the bay's northeastern area approximately 20 more sites were identified. Sernambetiba is the tallest mound, at approximately 5 m in height. It was previously studied in the 1970s and 1980s. These studies identified a series of burials located in different loci (Estanek, 2016). Recent research characterized the site also as a cemetery (Bianchini, 2015). Six individuals, all retrieved in certain proximity of one another (during fieldwork done in 2011 and 2012) were analyzed. No new faunal samples were analyzed in detail but published articles and unpublished reports contain valuable information (Beltrão et al., 1978, 1982).

4. The isotopes speak

Results from fourteen individuals recovered from Jabuticabeira II (Table 2) confirmed that individuals had a diet based on marine resources (Table 3). No major differences were detected between sexes or occupational period. However, there are differences noted in two individuals (115 and 121) buried in Locus 6. Their values are very high in ^{15}N, distinguishing them from the other members tested. Did these individuals have access to a distinct diet, or were they new additions to the group? This area marks a moment – around 1800 years BP - when the mound is built primarily with fish, and we can also identify changes in the funerary ritual (Nishida, 2007; Villagran et al., 2011).

At Cabeçuda the isotopic values are extremely similar (Table 2), demonstrating that the individuals had access to the same types of resources. Again we see a diet that is primarily maritime, with consumption of high trophic level fish or marine mammals. At Cabeçuda, in contrast to Jabuticabeira II, there is the recurring presence, albeit small, of marine mammals in the samples collected in the 1950s by Castro Faria (1955) and later analyzed by Klokler (2016b). In any case it is important to calibrate the dates and get more detailed information about the location of the burials to better understand the meaning of the strong similarities in the isotopic values.

Sernambetiba, the first shell site in Rio de Janeiro to yield results from isotopic analysis, revealed interesting elements for discussion regarding the similarities and differences between shell mounds in Rio de Janeiro and Santa Catarina. The ^{13}C Carbon values of its six individuals indicate the use of mixed terrestrial and marine resources (Table 3), distinguishing them from the results from Santa Catarina individuals who relied heavily in marine resources (Table 2). ^{15}N Nitrogen values are lower than those from the Santa Catarina sites (including mounds and middens studied by De Masi in 2009). Results suggest that the group's diet was based on fish consumption; however, the values indicate the use of lower trophic estuarine fishes, terrestrial mammals and a larger input from plant materials.

Isotopic analyses of human bones from four sites in Florianopolis (De Masi, 1999) demonstrate that the daily food of the populations consisted mostly of fish instead of mollusks, reinforcing research that hypothesizes that mollusks were more important as building materials or items served at celebratory events (Klokler, 2014).

Analysis of several other sites (15) in 2009 by Marco De Masi demonstrated that three mounds in southern Santa Catarina (Carniça I, Caieira and, Congonhas I) also have values similar to Jabuticabeira II and Cabeçuda. The remaining investigated sites in the region, however, have lower nitrogen values. De Masi's isotopic research in 1999 with sites from Florianópolis region (central coast of Santa Catarina state) demonstrated for the first time the low influence of mollusks in the shell mound groups diet. The nitrogen values are higher than expected for shellfish consumption, but low in comparison with the sites presented here (Table 4).

As demonstrated in Table 4 the average values of Nitrogen in shell sites from Florianópolis region are inferior to the ones from Cabeçuda and Jabuticabeira II sites, suggesting the consumption of lower trophic levels in some sites from Santa Catarina.

Isotopic studies of human skeletons from shell mound sites located in southern Brazil (Santa Catarina state) suggest the basis of the daily diet of coastal populations is not completely reflected in the deposits of sites where they are buried, forcing researchers to reconsider their

[1] A PhD student at Museu Nacional is currently analyzing the remaining faunal materials from Cabeçuda.

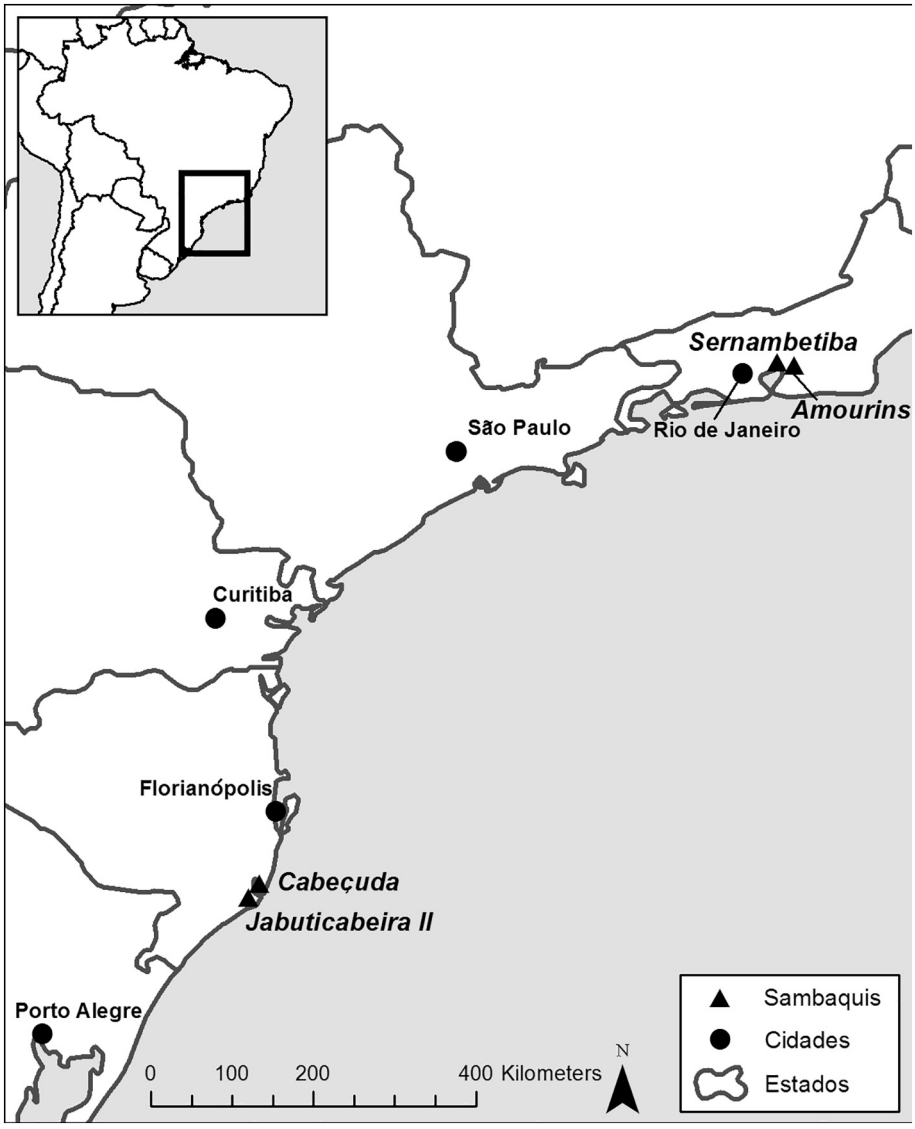

Fig. 3. Map with the location of sites studied (Credit: David Mehalic).

Table 1
Basic data on archaeological sites mentioned in the text (* ranges based on charcoal radiocarbon dates calibrated by the authors using Calib 7.1, SHcal13–Stuiver and Reimer, 1993).

Site	Height (in m)	Ranges of occupation (cal years BP)*	Source
Jabuticabeira II	8	3171–1537	Deblasis et al., 2007
Cabeçuda	15	5079–3972	Deblasis et al., 2007; Rodrigues-Carvalho et al., 2011
Sernambetiba	5	1571–1748	Bianchini, 2015
Carniça I	50	3971–2153	Deblasis et al., 2007; Kneip, 2004
Caieira	Na	3731–515	Deblasis et al., 2007; Kneip, 2004
Congonhas I	15	3727–3179	Deblasis et al., 2007; Kneip, 2004; Rohr, 1962

views of the relationships between fauna and coastal groups.

Incongruencies between archaeofaunal and isotopic data also occur in other contexts (geographically and temporally). We need to assess faunal, artifactual, and most importantly contextual evidence to adequately address the entirety of the archaeological record and develop more comprehensive knowledge of the past.

Subsistence system, food, meals, and diet have been repeatedly used as synonyms, particularly in Brazilian Archaeology. But these terms refer to distinct domains that intersect the human experience. Subsistence corresponds to social relations (intra- and intergroup) and the environment, and it is related to the economic sphere of the feeding domain, including the selection, acquisition, processing, and production of food. Meals, on the other hand, refer to human behaviors related to commensality and the timing, venues, events, and products selected for consumption (the social sphere). Diet is restricted to the products actually ingested that provide sustenance to the human body (biological sphere). In Brazilian shell mound archaeology, the social sphere has rarely been a focus of studies. Our research tries to understand the intersection between these spheres, with particular interest in the social sphere.

Formation process analyses based on faunal remains allied with isotopic data from large-scale shell mounds provide insights regarding the importance of mollusks for reasons beyond subsistence. The internal analyses of the arrangement of layers, matrix composition, deposition of the dead, and associated features, clearly suggest that the construction of shell mounds followed sets of rules instead of resulting from random aggregations of dietary by-products and incidental

Table 2
Carbon and Nitrogen Isotope values (values from Jabuticabeira previously divulged in Klokler, 2008, 2014 and Villagran et al., 2011, values from Sernambetiba (Bianchini, 2015) and Cabeçuda available in Scheel-Ybert (2012)).

Site	Individual	$\delta^{13}C$	$\delta^{15}N$	Sample ID
Jabuticabeira II	B 10b, Locus 1	−10.01	17.71	S-EVA 4172
Jabuticabeira II	B 15, Locus 1	−11.17	16.39	S-EVA 4173
Jabuticabeira II	B 17, Locus 1	−10.95	16.99	S-EVA 4174
Jabuticabeira II	B 41, Locus ½	−10.19	17.85	S-EVA 4171
Jabuticabeira II	B 43, Locus 1	−10.02	17.47	S-EVA 4176
Jabuticabeira II	B 34, Locus 2 (layer 2.15.13)	−10.41	17.77	S-EVA 4177
Jabuticabeira II	B 36, Locus 2 (layer 2.15.13)	−10.54	17.58	S-EVA 4178
Jabuticabeira II	B 40, Locus 2 (layer 2.15.13)	−11.01	17.22	S-EVA 4179
Jabuticabeira II	B 37, Locus 2 (layer 2.15.13)	−10.9	18.9	CR 114539
Jabuticabeira II	B 2a, Locus 6	−11.9	17.9	AA77105
Jabuticabeira II	B 114, Locus 6	−11.6	18.5	AA77106
Jabuticabeira II	B 115, Locus 6	−11.9	21.5	CR114540
Jabuticabeira II	B 121, Locus 6	−10.6	20.9	CR114538
Jabuticabeira II	B 131, Locus 3	−11.7	15.1	Beta 234201
Cabeçuda	B 6, Locus 1	−10.8	18.6	Beta 280009
Cabeçuda	Sample 1682	−11.1	19.1	Beta 297831
Cabeçuda	Sample 1712	−10.2	19.3	Beta 297832
Cabeçuda	Sample 7833	−10.4	19.1	Beta 297833
Cabeçuda	Sample 7834	−10.7	19.9	Beta 297834
Sernambetiba	B 3, Locus 3	−14	13.1	Beta 341743
Sernambetiba	B 5, Locus 3	−14.3	12.9	Beta 341744
Sernambetiba	B 8, Locus 3	−11.9	14.3	Beta 341745
Sernambetiba	B 9, Locus 3	−11.4	15.3	Beta 341746
Sernambetiba	B 10, Locus 3	−14.9	12.8	Beta 341747
Sernambetiba	B 13, Locus 3	−13.7	13.5	Beta 341749

Table 3
Carbon and nitrogen isotope values from some of the recovered (or depicted in zooliths) aquatic resources from shell mounds.

Resource (common name)	Resource (scientific name)	$\delta^{13}C$	$\delta^{15}N$	Source
West Indian pointed venus	*Anomalocardia flexuosa*	−20.23	5.66	De Masi, 1999
Bluefish	*Pomatomus saltatrix*	−11.39	13.32	De Masi, 1999
Guri sea catfish	*Genidens genidens*	−16.45	12.03	Garcia et al., 2007
Whitemouth croaker	*Microponias furnieri*	−11.3	13.9	Colonese et al., 2014
Mullet	*Mugil brasiliensis*	−10.37	10.44	De Masi, 1999
Subantartic fur seal	*Arctocephalus australis*	−11.4	16.42	De Masi, 1999
South American fur seal	*Arctocephalus tropicalis*	−10.95	16.03	De Masi, 1999
Shark	Selachimorpha	−18.8	15.2	Colonese et al., 2014

Table 4
Average nitrogen values.

Site/region	^{15}N	N	Source
Jabuticabeira II	17.98	14	Klokler, 2008
Cabeçuda	19.01	5	Scheel-Ybert, 2012
Sernambetiba	13.65	6	Gaspar, 2013
Florianópolis	15.84	18	De Masi, 1999

inhumations. Research indicates the selection and intensive exploitation of mollusks (and fish) with the specific intention of elevating the sites to promote their prominence along the coastal plains.

In some sites the elevation had the sole purpose of receiving the dead, acting exclusively as cemeteries. Jabuticabeira II is the most known example. As previously mentioned was the first site to be recognized as such (Fish et al., Gaspar et al., 2014). Its construction occurred during and through the performance of funerary rituals and feasts (Klokler, 2014, 2017a).

Expansion of the research through re-analyses of other large sites (in Santa Catarina and Rio de Janeiro states) indicates that the fauna recovered was selected exclusively for funerary events, and therefore are part of the ritual domain. The faunal items were eaten at mortuary feasts and could have been offered to the dead or other entities that were part of the belief system of fisher-gatherers that inhabited the Brazilian coast (Klokler, 2017a; Klokler, 2017b).

We identified two types of deposits with distinct origins: construction and funerary. These deposits are distinct in relation to their composition, content and physical characteristics. Identifying the processes that generated certain deposits has helped us investigate their functions. The construction layers are mollusk-dominated and do not contain features, while the funerary layers are generally fish-dominated (particularly catfish – *Genidens barbus* and *G. genidens* - and whitemouth croakers – *Micropogonias furnieri*), their components are heat-affected (burned) and contain several features, all related to mortuary contexts.

We assume that part of the mollusks were only gathered for accumulation and that consumption was incidental (Klokler, 2014, 2017a, 2017b). For example, at Amourins site, the base of the mound was composed almost exclusively of oysters, and some individuals were never opened or consumed - and other bivalves (*Phacoides pectinatus*) were used as a container for fish and other animals' portions.

The funerary layers represent specialized, temporally-limited use of food. In the construction layers we can see a similar context, with deposits formed by faunal remains selected for their symbolic and constructive importance and not following strictly culinary directives.

Perusing the literature available on Brazilian sites, one can notice that most, if not all, evidence of activities in shell sites are correlated with funerary contexts (Klokler, 2014; Klokler and Gaspar, 2013). These specific aspects related to southern Brazil's large-scale shell mound construction demonstrate that faunal remains do not necessarily represent the resources exploited during daily consumption. The latest research suggests that the site's contents represent more than the refuse of daily meals and a complex scenario of faunal use.

The studies presented here suggest that among the investigated sites some have individuals with restricted access to some marine resources or distinct food preferences. Generally, it appears that individuals buried in smaller sites appear to have had different diets than those buried in large mounds. But results from De Masi (2009) do not support that assertion.

In order to deeply address the results, the sample from all sites (but particularly Cabeçuda and Sernambetiba) should be widened with individuals from funerary areas farther apart spatially and chronologically. Also, details from the contexts of individuals analyzed in 2009 have to be explored. Examples from burials in diverse areas of sites can demonstrate if the results are related to the specific behavior of a group or the totality of the population. Also, the expansion would help to indicate if there are temporal distinctions in choices regarding the diet of individuals.

Particularly in the case of large shell mounds, we suggest that aquatic resources such as fish and mollusks were selected, captured, processed, consumed and deposited during activities connected to recurrent instances of funerary ritual. At these events, elements considered ordinary become charged with meaning, by being part of the rituals, therefore assuming different roles, being re-signified as part of the belief system connected with the transcendence of life and death.

5. Missing bones, invisible animals

While fish and mollusks are the focus of shell mound zooarchaeological studies, other taxa are also present in the sites deposits. The limited quantities of these taxa seem to be accompanied by the lower interest by researchers (with rare exceptions). Mammals, birds, reptiles and more scarcely amphibians, can be recovered in association with graves and are typically considered as offerings.

At Jabuticabeira II, quantities of less common taxa vary greatly within funerary areas. The distinct affinity groups buried in distinct

Fig. 4. Examples of zooliths recovered from the southern coast of Brazil (image of pieces belonging to Museu Nacional - UFRJ).

areas (the areas encompass members of social units organized according to: family ties, activities performed, residential proximity, and/or others) could be associated with specific animals or groups of animals, and such associations related to clans, economic activities, or prestige.

Scholars have found that the issue of social differentiation within groups is difficult to access using as evidence solely the artifacts found in graves. Faunal materials, such as feasting remains, offerings, modified or not, directly associated to graves or not, seem to provide a better and more successful way to evaluate and discuss intergroup distinctions.

Mammals, birds and other animals are recorded in association with graves represented in elaborated rock and bone sculptures (Fig. 4). The latter are the more obvious indications of the symbolic importance of animals to fisher-gatherer groups associated with mound construction. Approximately 240 of these sculptures were recovered from 40 sites (Gomes, 2012; Prous, 1977). The vast majority of this funerary paraphernalia represents animals, hence they are known as zooliths. Unfortunately, most were recovered out of context during commercial mining of sites and today belong to private collections.

The sculptures present a concavity, usually in the ventral facet, and more rarely on their side. The concavity suggests their use as a vessel or surface for the preparation of some substance in special occasions. So far, there is little evidence regarding the nature of the substances prepared, but two zooliths had traces of ochre (Gomes, 2012).

Most studies focus on manufacture and stylistic aspects of the zooliths, along with biological identification of the species represented by the sculptures. The possible associations of these sculptures and their representations with the ritual realm have only been briefly alluded to. However, we can observe coincidences and absences in relation to the animals represented in bone and rock. Fish, terrestrial and marine mammals, birds and reptiles were depicted in zooliths, but mollusks and crustaceans were not.

Bird zooliths are more commonly identified (22%), following by mammals (16%), fish (12%), and reptiles (5%) (based on Gomes, 2012). Unfortunately, half of the animals represented could not be identified unequivocally. Interestingly, but not surprisingly, aquatic animals are usually more carefully reproduced. They were manufactured with great detail, and in some cases species and even sex can be identified (Gonzales and Milheira, 2005; Prous, 1977). On the other hand, terrestrial animals and birds are depicted without clearly recognizable attributes. In other words, they are highly stylized.

The time and effort devoted to the depiction of aquatic resources can be interpreted as an indication of the greater influence of these animals in the profane and sacred lives of shell mound people. As expected the great majority of taxa sculpted by shell mound builders were also recovered from funerary contexts, used in the feasting menus (sheepshead – *Archosargus probatocephalus*, bluefish - *Pomatomus saltatrix*, mullet – *Mugil* sp., snook – *Centropomus* sp.) and deposited as offerings (turtles - Chelidae, dolphins - Pontoporiidae, armadillos - *Dasypus novemcinctus, Euphractus sexcinctus,* and pacas – *Agouti paca*). Up to now it was not possible to establish explicit correlations between certain animals and the sex and/or age of individuals to which they are associated. At Jabuticabeira II, however, there are indications that the association of certain taxa are connected to affinity groups and individuals, and not necessarily linked to age and sex categories.

For example, at the funerary area 2.30.8, near complete bird skeletons in anatomical position were recovered, and at the area 2.15.13, whole fish skeletons were in association with burials and one individual (41) was interred with offerings including at least 6 mammals and one bird (Klokler, 2008, 2016a). The nitrogen values of this individual indicate that the animals deposited in the grave or in its vicinity were not part of the usual diet, having their importance related to other realms of life.

The absence of any mollusk represented in zooliths is remarkable, since their shell valves form the bulk of the sites. This could implicitly indicate the secondary role of mollusks in rituals, on the other hand, maybe their importance is evident through their use in seasonal festivals and for the construction of massive structures, and with that the need to represent them in zooliths would be unwarranted. Thus, the structure itself would signify the deference of shell mound builders to mollusks. Or maybe the mollusks' role was distinct from other animals so their representation in sculptural form were not required. The same can be thought about catfish and whitemouth croakers, important fish in funerary feasts and in construction layers, but not found as zooliths. More studies with these artifacts focusing on the relationships between the coastal communities and the animals certainly will answer these questions.

Dolphins (Pontoporiidae) and sea lions (Otariidae) were identified in some Santa Catarina sites, attesting to the capture and possible consumption of marine mammals but their numbers are never substantial (Castilho, 2005, 2008). These results demonstrate the need for researchers to be cautious when considering zooarchaeological remains as equivalent to remains of daily meals. Even though their consumption might be incidental, their depiction in zooliths suggest that they had special significance for sambaqui builders.

Given the new advances in research it is pressing that scholars move away from the unilinear economic discourse. Feasts with croakers,

catfish and mollusks involve resources to which many members of the community could have access, however, this does not mean that they were ordinary or devoid of importance for the groups. Funerary feasts are often competitive in nature and can create debt for the guests (Dietler, 2001; Hayden and Villeneuve, 2011). In the case of shell sites evidence shows that the events increased the community cohesion, cooperation ties and social solidarity.

It is necessary to deepen the studies in this topic since there are still few examples of feasts in hunter-gatherer-fisher societies. Revisiting faunal collections and adding specifically designed sampling strategies for ritual contexts in shell mounds are essential for advancing the studies about relations between these populations and animals, and the role of the last in a variety of ritual and daily practices.

6. Loaded sites, loaded bones and shells

As previously affirmed by Klokler (2017b:99) “fisher-hunter-gatherers that inhabited Southern Brazil neither live in nor were buried in trash resulting from daily meals, but were surrounded by powerful animals”. Clams, croakers, and catfish, considered by many today as “ordinary” fauna, most probably had special importance for these coastal societies. They were part of the menu served in funerary gatherings and raw materials specifically selected to erect structures where community members were going to be buried.

Ethnographic evidence indicates mollusk shells share symbolic associations with fertility and rebirth in many regions of the world; such associations may have been part of the cosmological view of shell mound groups, thus affecting the decision to use shell valves to construct mortuary structures that modify the landscape, bringing a little of the aquatic world to the terrestrial (Klokler, 2017b). These fishing communities had a very close connection with aquatic resources, and they chose to bury their dead among beings from the aquatic realm. Klokler's assertion is that shell mounds could be seen as proxies of the aquatic world on land.

At first, the selection of catfish and croakers for feasts, was interpreted as being connected to the relative ease of capture with nets of large quantities of juveniles at estuaries (Klokler, 2008). But a closer look at the deposition of their otoliths in graves has caused the reassess of this previous interpretation. Croaker otoliths have a long-standing history of being used as medicine, and as amulets. Were these fishes considered auspicious for consumption during moments of grief and celebration of the dead?

Where are the bones from carnivorous fishes or marine mammals?

Not all shell mound sites are funerary sites or were constructed during funerary rituals, and modern teams are involved in clearly identifying the habitation sites. So far, even the sites considered to be multifunctional have few vestiges of marine mammals and high trophic level fish, suggesting that differential processing could have limited the representation of such animals in the assemblage. These animals probably were processed and their bones deposited in different locales, away from the mounds, resulting in scarcity or absence of their elements at sites.

We need to further investigate whether the differences in isotopic values are related to chronology, later occupations rely more on lower trophic animals as suggested by De Masi (2009), or if we have populations with very distinctive consumption patterns. The increase in the use of isotopic analyses, allied with changing perspectives in faunal studies (due to the influence of social zooarchaeology) will surely support advances in our comprehension of social practices of shell mound builders. The more widespread use of isotopic data will help shed light and allow more robust interpretations on issues regarding subsistence, social organization, and site function, among others.

Seeing faunal remains not only as random refuse but also as construction material imbued with symbolic meaning advances our understanding of sites, their components, and their respective roles in the lives of hunter-gatherer-fishers.

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