

POSTMARITAL RESIDENCE PRACTICE IN SOUTHERN BRAZILIAN COASTAL GROUPS: CONTINUITY AND CHANGE

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The coastal plains of the States of Paraná and Santa Catarina, in Southern Brazil, were first settled around 6000 B.P. by shellmound builders, a successful fisher-hunter-gatherer population that inhabited the coastal lowlands practically unchanged for almost five thousand years. Shellmounds were typically occupied as residential sites as well as cemeteries, and are usually associated with rich alimentary zones. Around 1200 B.P., the first evidence of ceramics brought from the interior is found in coastal areas, and together with ceramics there is a progressive abandonment of shellmound construction in favor of flat and shallow sites. Here we consider if these changes were reflected in the postmarital residence practice of coastal groups, i.e., if the arrival or intensification of contact with groups from the interior resulted in changes in this aspect of social structure among the coastal groups. To test the postmarital residence practice we analyzed within-group variability ratios between males and females, following previous studies on the topic, and between-group correlations between Mahalanobis distances and geographic distances. The results suggest that in the pre-ceramic series a matrilineal, postmarital residential system predominated, while in the ceramic period there was a shift toward patrilocality. This favors the hypothesis that the changes experienced by coastal groups after 1200 B.P. affected not only their economy and material culture, but important aspects of their sociopolitical organization as well.

Las planicies costeras de los Estados de Paraná y de Santa Catarina, en el Sur de Brasil, fueron colonizadas hace aproximadamente 6000 A.P. por grupos pescadores-cazadores-recolectores cuya manifestación material más evidente son los sitios conchales (sambaquis), que fueron ocupados como sitios habitacionales y cementerios. Los constructores de conchales fueron grupos que ocuparon exitosamente regiones de alta productividad de recursos alimenticios, habitando la región de manera estable e ininterrumpida por casi 5000 años. Las primeras evidencias de cerámica asociada a sitios costeros ocurren alrededor de 1200 A.P. y su presencia en esta zona está asociada al abandono gradual de la práctica de construir conchales. En este trabajo se estudia si la llegada de la cerámica a la costa de Paraná y de Santa Catarina fue acompañada por cambios en la práctica de residencia post-marital de los grupos costeros, o sea, si la llegada de grupos del interior y/o la intensificación del contacto con grupos del interior resultó en cambios en este aspecto de la estructura social de los grupos que habitaron las planicies costeras. El patrón de residencia post-marital de grupos pré-cerámicos y cerámicos fue estimado a través del análisis de la variabilidad morfológica intra-grupo para cada sexo, siguiendo estudios anteriores, y de la correlación entre matrices de distancias de Mahalanobis para cada sexo y la distancia geográfica entre los sitios. Los resultados de ambos análisis sugieren que, entre los grupos pré-cerámicos, predominaba un sistema matrilineal, mientras que en el periodo cerámico ocurrió un cambio orientado a la patrilocidad. Estos resultados favorecen la hipótesis de que los cambios experimentados por los grupos costeros después de 1200 A.P. afectaron no solamente su economía y cultura material, sino también importantes aspectos de su organización sociopolítica.

The reconstruction of postmarital residential practices (PRP) from human skeletal remains has been a topic of increasing interest in the last three decades (Lane and Sublett 1972; Spence 1974; Konigsberg 1988; Neves 1988; Schillacci and Stojanowski 2002, 2003; Tomkzak

and Powell 2003; Stojanowski and Schillacci 2006). Doubtlessly, the reason why it has been so widely investigated in past populations is due to the relevance that postmarital residence practices have in the establishment of bonds among traditional human groups. PRP is a very important aspect of

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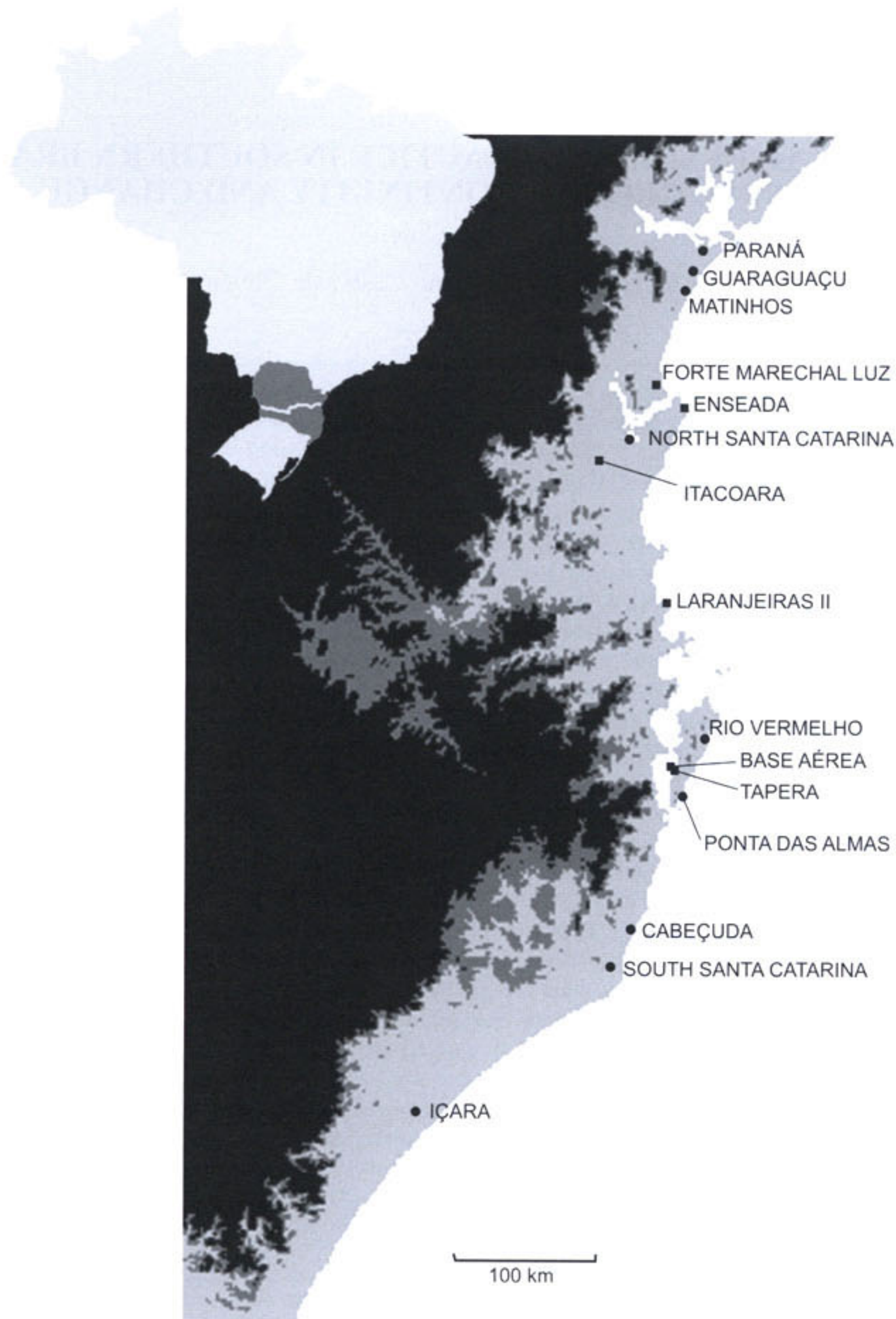


Figure 1. Geographic location of the series included in the study. The upper left map of Brazil shows the position of Paraná and Santa Catarina States. The detailed map shows the topographic characteristic of the coastal plains of these states: light gray represent altitudes lower than 250 m; dark gray represents altitudes between 250 and 500 m; and black represents altitudes higher than 500 m. Circles represent pre-ceramic series and squares represent the ceramic ones.

the organization of a society, directly associated with the establishment of solidarity networks between groups and with the expansion of the cultural networks among neighbor groups (Levi-Strauss 1969 [1949]). Besides, postmarital residence practices are a reflection of the basic sociopolitical and economical organization, and its assessment from past human populations and cul-

tures can bring important insights in the ways these societies were organized and interacted with neighbor regions (Schillaci and Stojanowski 2002).

Although PRP is rather complex and can be divided in many distinct systems, methodological advances and theoretical contributions (see review in Stojanowski and Schillacci 2006) have established a set of statistical approaches that allows

recovery of some aspects of these practices from osteological remains. Evidently, the fragmentary nature of archaeological and osteological remains limits the assessment of the entire spectrum of residential practices that can be found in living human societies. Nonetheless, previous studies have shown that from osteological material we can reasonably infer if a society had a matrilineal or a patrilineal pattern of residence (Konigsberg 1988; Stojanowski and Schillacci 2006). For these reasons, the residence pattern as defined for a past population must be seen as a simplification of the complexity of residential rules that is found in living traditional societies. Yet the assessment of the most straightforward categories, such as matrilineality and patrilineality, has proven very useful in answering basic hypotheses regarding the social, political, and economic organization of past populations (Schillacci and Stojanowski 2002, 2003; Stojanowski and Schillacci 2006; Tomkzak and Powell 2003).

In this study we analyze postmarital residence practices during two distinct periods of occupation of the southern Brazilian coast, assuming that rules of residence reflect social, economic, and symbolic elements; and, consequently, change in one of these underlying factors can trigger changes in the residential rule of a society (Murdock 1965; Dreyfus 2005). PRP of these periods is used, thus, to test if the changes seen in the archaeological record were accompanied by changes in the social structure of groups inhabiting the coastal plains in each period.

The Human Occupation of Southern Brazilian Coast

The coast of the states of Paraná and Santa Catarina (Figure 1) forms a somewhat discrete coastal region, characterized mainly by large plains with the presence of small hills and a great number of islands, ranging from very small to the Island of Santa Catarina, 80 km long and 40 km wide. The region is dominated by tropical Atlantic forest, with many areas of mangroves, all very rich in natural resources (Lima 1999–2000). The coastal plains are separated from the interior plateau to the west by a mountain range—Serra do Mar—roughly 1,000 m high. To the north, the Paraná-Santa Catarina coastal plain is delimited by an extension of the Serra do Mar that separates it from the coastal plains of the State of São Paulo. To the south, this com-

plex is delimited by a change in the landscape, which becomes more open and less rich in primary resources, associated with the displacement of the Serra do Mar away from the shores. The morphological affinities of the regional populations suggest that, probably as a result of these geographical delimitations, the human populations that inhabited it shared high biological affinities within the area and showed marked differences with neighboring coastal populations, especially those from the north (São Paulo and Rio de Janeiro; see Cocilovo and Neves 1984; Hubbe 2006; Okumura 2007). Thus, populations from the coastal plains of Paraná and Santa Catarina seem to have shared a common cultural and evolutionary history that justifies its use in our more inclusive analysis.

The prehistory of the coast of Paraná-Santa Catarina can be summarized in three distinct periods. The first and longer one ranges from around 6,000 to 1,200 B.P. and is characterized by fisher-hunter-gatherer groups that were widespread across the coastal plains and shared the practice of building shellmounds (Gaspar 1997; Lima 1999–2000; Prous 1991). Locally known as *sambaquis* (Figures 2 and 3), the shellmounds that typify this period are among the best studied Brazilian archaeological sites (Lima 1999–2000; Prous 1991). Typical *sambaquis* are ritual and habitation sites built from shells and other animal remains, sometimes intercalated with sediment layers. Usually, they do not exceed 2 m in height and 30 m at base, but larger shellmounds are known, especially in Santa Catarina, where the highest are around 30 m high and several hundred meters at the base (Beck 1972, 1974; Bryan 1993; Prous 1991).

The reason why shellmound construction was so common among prehistoric coastal groups in Southern Brazil is a topic of much debate among Brazilian archaeologists (see Lima 1999–2000 for an excellent historical review). Early hypotheses assumed that they represented garbage piles resulting from the accumulation of large amounts of shellfish consumed by local groups. However, more recent studies have discarded this idea, since the shellmounds were used as habitations, as well as ritual sites and cemeteries. Some authors (Gaspar 1991; Gaspar et al. 2004, 2008) have defended the idea that shellmounds played an important social role, serving as landscape markers that allowed for the establishment of networks around the largest



Figure 2. Sambaqui de Laguna, at the Coast of Santa Catarina. Photo: Tânia Andrade Lima.



Figure 3. Sambaqui Morro do Ouro, Joinville, Paraná. Photo: Tânia Andrade Lima.

sites. Others (Prous 1991; Lima 1999-2000; Hubbe 2006) have argued for a practical reason for the earthworks, although the exact function or vantage gained by the accumulation of such an amount of organic debris is still not clear. Gaspar and Blasis (1992), for instance, excavated one *sambaqui* that apparently was used solely as a cemetery, suggesting that these sites were not all constructed for the same functional reasons.

One of the most remarkable characteristics of the *sambaqui* builders, however, is their cultural stability. Usually *sambaquis* were in use for many generations, and some have been occupied and constructed continuously for thousands of years (Bryan 1993; Gaspar et al. 1999, 2008). In this period the coast was occupied by these fisher-hunter-gatherer groups and few changes in their life-style and/or material culture have been detected (Lima 1999-2000; Prous 1991). The presence of some artistic artifacts suggesting sociopolitical networks of regional scale, the stability of the groups living on the *sambaquis* and the evidence suggesting high population densities for these groups are an indication to some authors that they presented an emergent social complexity, with well-established hierarchies within and between groups (Gaspar et al. 2008; Lima 1999-2000; Neves 1988; Prous 1991; Schmitz 1984).

The first significant change observed in the coastal plains of Paraná and Santa Catarina occurs simultaneously with the introduction of pottery (the Itararé culture; see Chmyz 1976; Schmidt 1984) coming from the interior plateau, and its appearance marks the beginning of the second period of local prehistory. This new period, which started around 1200 B.P. and lasted until around 800 years ago, is associated with a progressive abandonment of shellmound building in favor of flat and shallow sites with no significant accumulation of shells. The sites of this period are interpreted as a consequence of the abandonment of shellfish gathering (Prous 1976, 1991; Prous and Piazza 1977), and are characterized by a refinement in the local lithic and bone industry. Although the great majority of the sites known from this period is associated with the ceramic tradition brought from the interior (Beck 1972; Chmyz 1976; Prous 1976, 1991; Prous and Piazza 1977), the presence of ceramics in the coastal plain seems not to be associated with an increase in the con-

sumption of cultivated plants (Wesolowski and Neves 2002).

The way in which pottery was introduced to the coastal population of Paraná and Santa Catarina is still not completely understood. Two possible hypotheses are (1) that pottery was brought to the coast by groups from the interior, who established settlements in the area and replaced the *sambaqui* builders; and (2) that pottery was adopted by coastal groups, after having contact with pottery of the interior, but with no demic diffusion from interior to coast. In fact, the most plausible scenario seems to be a mixture of both phenomena (Neves and Cocilovo 1984; Neves 1988; Hubbe 2006; Okumura 2007). Morphological affinities among the groups of this period show that some series present high biological similarities with earlier pre-ceramic series, while others present enough morphological distinction to suggest they are not biologically related to *sambaqui* builders.

Finally, the third period ranges from around 800 years B.P. until the arrival of the Portuguese in the sixteenth century and is characterized by the arrival of the Guarani tradition to the coast and a full adoption of a horticulturist-based life-style (Schmidt 1984; Prous 1991). Local groups seem to have been completely replaced by the Tupi-Guaranis during this period.

In this study we focus on the changes seen between the first and the second period, and test if the introduction of pottery to the coastal plains and the abandonment of shellfish gathering were associated with a rearrangement of social structure along the sea shore, reflected in changes in local postmarital residential practices. In order to test this hypothesis, we make the assumption that all pre-ceramic and ceramic groups shared the same postmarital residential system within each period (being not necessarily the same in both periods). This seems a reasonable assumption for the pre-ceramic groups, since there is evidence showing strong biological affinities among them (Neves 1988; Hubbe 2006; Okumura 2007), as well as archaeological evidence suggesting long-range sociopolitical and economic networks among the *sambaquis* (Gaspar 1997; Lima 1999-2000; Prous 1991; Schmidt 1984). For the ceramic groups, however, this assumption is more questionable. As already stated above, the ways in which pottery arrived on the coast (demic and/or cultural diffu-

sion) is still a much debated issue in Brazilian archaeology. In other words, it is possible that during the second period not all groups shared the same social rules, because they could have had distinct cultural origins.

Material and Methods

The assessment of the postmarital residential practices for pre-ceramic and ceramic groups was based on craniometric measurements of 258 skulls (121 from *sambaquis* and 137 from ceramic sites) exhumed from 15 coastal sites. Details of the sites included and sample sizes can be found in Table 1. Nine sites were used for the pre-ceramic period and six for the ceramic period. In the first period, all sites with the exception of Içara (Schmitz et al. 1999) are typical shellmounds. In some cases, sites with few individuals from one same region were pooled together (Table 1) to minimize the use of few individuals to estimate within site covariance matrices. For the ceramic period, the sites included were shallow sites, associated to the Itararé ceramic tradition, or to ceramic strata on top of shellmounds (in the cases where shellmounds were re-occupied by ceramic groups). In the later case, only skeletons clearly associated to the ceramic strata were included (Neves 1988).

From each skull 18 craniometric variables were taken, following the protocol of Pereira and Alvim (1979). Variable names can be found in Table 2. Eventual missing values were estimated with multiple regressions of the mean of all series, using the remaining measurements as independent variables. Missing values replacement never surpassed 50 percent of the variables of an individual. In total, 32.1 percent of the measurements were estimated. Although a high percentage, the replacement of this amount of missing values was necessary to have a minimum sample size that allowed estimation of the covariance matrices for each series. Prior to the analyses, size effect of all individuals was removed by dividing each variable by the geometric mean of all the variables of each individual (Darroch and Mosiman 1985). Sex of the skeletons was estimated using morphological markers from the pelvis, and where this anatomical region was not available skull markers were used (Buikstra and Ubelaker 1994).

Two analyses were conducted to estimate the

PRP of pre-ceramic and ceramic series. The first is based on the widely used test proposed by Konigsberg (1988), which compares the within-group variation of each sex. According to this procedure, the sex showing higher within-group variability is the sex that does not remain in the village where it was born, consequently allowing us to infer if patrilocality or matrilocality was the preferred postmarital residence practice in a group. The mathematic justification for the use of within-group variation as a proxy to residential pattern can be found in Konigsberg (1988). To calculate the within-group sexual variability, the determinant of the covariance matrix of each sex is calculated. To compare the variation of each sex, a natural log of the ratio between the determinant of the males' covariance matrix and the determinant of the females' covariance matrix is calculated. Values higher than 1.0 indicate higher variability in males, and consequently matrilocality, while values lower than 1.0 indicate higher female variability and, consequently, patrilocality. As proposed by Konigsberg (1988), the statistical significance of this ratio is estimated by calculating the variability ratio for 500 permutations of the individuals, generating random sex combinations for the sample. In this study, due to the small sample size of some sites, within-group covariance matrices were calculated for all groups of each period pooled together. To avoid the influence of between-group covariance, within-group pooled covariance matrices for each sex were calculated. The permutations for the calculation of the significance of the ratios obtained also respected the within-site organization, i.e., the permutations were carried out within each site, and only after this procedure were the within-group pooled covariance matrices for each sex calculated. One thousand permutations were conducted for the estimation of significance values. This procedure was conducted with Microsoft Visual Basic code written by coauthor André Strauss for this study.

The second analysis is based on the results obtained by Aguiar and Neves (1991), which demonstrated for living groups that postmarital residential practice is better reflected in between-group variability. Accordingly, the sex that shows higher affinities between groups (lower between group variance) is the sex that does not remain in the village in which it was born. If we expand this idea to a large number of groups or populations

Table 1. Archaeological Sites, Dates, Sample Sizes and Characteristics of the Series Included in the Study.

Series	Sites within series	Dates Available ^a	N males	N Females	Category/period	
Paraná	Guaraguaçu B	4128 ± 260	5	3	<i>Sambaquis</i> (pre-ceramic)	
	Macedo	-				
	Ilha dos Ratos	1540 ± 150				
	Rio da Praia	-				
Guaraguaçu A	Guaraguaçu A	4220 ± 200	6	8	<i>Sambaqui</i> (pre-ceramic)	
Matinhos	Matinhos	-	2	3	<i>Sambaqui</i> (pre-ceramic)	
North Santa Catarina	Morro do Ouro	-	11	8	<i>Sambaquis</i> (pre-ceramic)	
	Areias Pequenas	-				
	Pernambuco	-				
	Ilha de Espinheiros II					2970 ± 60
						1270 ± 60
						1160 ± 45
	Conquista					4070 ± 220
						2120 ± 220
		Pinheiros				-
		Pinheiro 8				-
		Linguado				-
		Morretinha				-
Porto do Rei		-				
Rio Vermelho	Porto do Rio Vermelho 02	1690 ± 70	3	4	<i>Sambaqui</i> (pre-ceramic)	
		1590 ± 40				
		1840 ± 50				
		1880 ± 50				
		1180 ± 50				
Ponta das Almas	Ponta das Almas	4289 ± 400	3	3	<i>Sambaqui</i> (pre-ceramic)	
		3620 ± 100				
		2400 ± 250				
Cabeçuda	Cabeçuda	4120 ± 220	26	17	<i>Sambaqui</i> (pre-ceramic)	
South Santa Catarina	Congonhas Caieira	3270 ± 70	6	2	<i>Sambaqui</i> (pre-ceramic)	
		3230 ± 155				
		2770 ± 100				
	Carniça					1240 ± 95
						3370 ± 160
						3210 ± 150
						3040 ± 50
Içara	Içara	2400 ± 110				
		1450 ± 60 ^b				
	1580 ± 50 ^b					
Forte Marechal Luz	Forte Marechal Luz (Ceramic level)	620 ± 10	10	4	Ceramic occupation on top of <i>sambaqui</i>	
		640 ± 100				
		880 ± 100				
Enseada	Enseada I (Ceramic level)	-	13	8	Ceramic occupation on top of <i>sambaqui</i>	
Itacoara	Itacoara	-	8	7	Ceramic site	
Laranjeiras II	Laranjeiras II	-	12	13	Ceramic site	
Base Aérea	Base Aérea	-	11	5	Ceramic site	
Tapera	Tapera	1140	24	22	Ceramic site	
		1030				
TOTAL			147	111		

^aCarbon years BP. Except where otherwise stated, dates were retrieved from Lima (1999–2000).

^bSchmitz et al. (1999).

Table 2. List of Variables Measured in Each Skull.

Variable Name ^a
Maximum cranial length
Maximum cranial breadth
Minimum frontal breadth
Maximum frontal breadth
Nasal breadth
Orbital height
Orbital breadth
Inter-orbital breadth
Frontal arc
Parietal arc
Lambda-inion arc
Frontal chord
Parietal chord
Occipital chord
Lambda-inion chord
Minimum ramus length (mandible)
Ramus height (mandible)
Mandible body width (mandible)

^aSee Pereira and Alvim (1979) for a detailed description of the measurements.

sharing a common postmarital residential practice (an assumption made by us) and sharing individuals among themselves (which is probably true due to the high biological affinities found among the studied samples), we would expect that the sex that does not migrate would show a stronger geographical pattern of differentiation, i.e., their biological distances would be correlated with geographical ones. On the other hand, the sex that migrates would not show strong correlation with geographic distances, since their biological differences would not be a result of their geographic isolation. To test this, Mahalanobis Distances (Mahalanobis 1936) were calculated between sites for each sex and the resulting distance matrices were compared with linear geographic distances between the sites using Mantel's test for matrix correlation (Mantel 1967). Geographic distances between series were calculated as the linear distance in kilometers between series coordinates, assuming Earth's curvature. Since all series are confined within the Paraná and Santa Catarina coastal plains, no major geographic barriers exist between them and linear distances are a good approximation to real traveling distance between them. When exact coordinates of the sites were not known, the closest reference coordinate was used (nearest village, city, or district, respectively). For the pooled samples, a center coordi-

nate of the polygon formed by all sites was calculated.

Results

The results obtained for the within-group analysis can be found in Table 3. As can be seen, the covariance ratio obtained for the pre-ceramic series are much higher than one, suggesting that pre-ceramic groups had a matrilocal postmarital residential pattern, although the permutation tests deemed this ratio as non-significant ($p = .1687$). The covariance ratio for the ceramic site, on the other hand, is only slightly higher than 1.0. Despite the fact that this ratio is higher than one, it is actually lower than the mean ratio obtained for the permutations, meaning that this ratio shows higher female variability than expected by the random combinations of the individuals, although this tendency is clearly not significant ($p = .6446$). This could be interpreted as evidence toward a mixed or transitional postmarital residence practices.

The results of the between-group analysis are depicted in Table 4. The results obtained for the Mantel correlation tests show a shift in the pattern of geographical organization of the sexes between the periods. While for the pre-ceramic only the females show significant correlations with geographic distances, for the ceramic period only the males show a significant correlation. These results favor the idea that pre-ceramic groups shared a matrilocal system, while the ceramic groups presented a patrilocal system. The results obtained for the ceramic groups in this analysis do not favor a mixed or transitional system, as observed in the previous analysis. Actually, the correlation coefficient for ceramic males is the higher of both periods ($r = .50266$), while the female correlation coefficient is the lowest of all comparisons ($r = .06205$). This strongly favors the existence of patrilocal postmarital residential practices during the ceramic period, with a widespread female migration network among coastal groups.

Discussion

The results presented in this study strongly favor the idea that the introduction of pottery to the coastal plains of Paraná and Santa Catarina also entailed new postmarital residential practices along

Table 3. Results for the Within-Group Variability Analysis. The *p* Values and the Means of Permutations Are Based on 1,000 Random Permutation of Sexes Within Each Series.

Period	Male's determinant	Female's determinant	Male/Female ratio (natural log)	<i>p</i> value	Mean of permutations
Pre-ceramic	6.045 x 10 ⁻⁵⁶	3.037 x 10 ⁻⁵⁷	2.990	.1682	1.236
Ceramic	5.572 x 10 ⁻⁵⁵	1.459 x 10 ⁻⁵⁵	1.340	.6446	2.214

Table 4. Results for the Mantel Correlations Tests (With 1000 Iterations) between Mahalanobis Distances and Linear Geographic Distances between Series of Each Period.

Period (sex)	Correlation coefficient (<i>r</i>)	<i>p</i> -value
Pre-ceramic (females)	.36984	.0133
Pre-ceramic (males)	.14949	.1602
Ceramic (females)	.06205	.3989
Ceramic (males)	.50266	.0256

In bold – significant values at the 5% level.

the southern Brazilian shore. Both of the analyses performed, considering within-group and between-group variability independently, show a shift in the variability pattern of males and females between the pre-ceramic and the ceramic periods. This shift is better supported by the between-group analysis, which resulted in significant geographical correlations for females in the pre-ceramic period and for males in the ceramic groups. The within-group analysis generated non-significant results, but this lack of significance must be seen with caution, because the postmarital residential practices have been shown for living groups to be better reflected by between-group analyses (Aguilar and Neves 1991). We consider it very suggestive that, despite the lack of significance, the results obtained by the within-group analysis are in accordance with the result obtained from the between-group analysis. It is beyond the scope of this study to argue about the degree of reliability of both methods used here (Mantel's versus Konigsberg's). However, as indicated by our results, it appears that the method based on within-group sex variability is less sensitive than between-group analyses.

For these reasons, we favor the results obtained by the between-group method that shows that the pre-ceramic groups present a variability pattern in accordance with matrilineal postmarital practices, while the ceramic groups show a variability pattern that would be expected in patrilineal societies. Although there is no archaeological or bioanthropological support for the assumption that all

ceramic groups evolved the same rules of social organization (actually the data available on the subject suggest the opposite, see Hubbe 2006; Lima 1999–2000; Neves 1988; Prous 1981), the correlations found for these groups are more accentuated than those for the pre-ceramic groups. While the not mobile sex in pre-ceramic groups (females) has a correlation coefficient of .36984 ($p = .0133$), the not mobile sex in the ceramic groups (males) has a higher correlation coefficient ($r = .50266$; $p = .0256$). Likewise, the mobile sex in the ceramic groups (females) shows a remarkably low correlation with geographic distance ($r = .06205$; $p = .3989$), and more so when compared to the correlation coefficient of the mobile sex in pre-ceramic groups ($r = .14949$; $p = .1734$). The fact that, among ceramic groups, the not mobile sex is more strongly correlated with geography than in the pre-ceramic groups and that the mobile sex is less geographically structured than what is seen in the previous period suggests that patrilocality was adopted by all ceramic groups, questioning the results obtained in the within-group analysis that favored mixed or transitional postmarital residential rules.

One possible criticism that might be raised for our between-group analysis is the fact that linear distances between sites were adopted as a valid model of relationship or migration among groups. In other words, we assumed that by drawing linear lines between sites, we explained the migration routes among them. Clearly this model does not reflect the reality of the relationships between the

sites, which must have been much more complex (Lima 1999-2000; Prous 1991). However, for the aim of this study, the linear distance model was powerful enough to discriminate differences of geographical organization between the sexes of each period, proving itself a valuable approach to test for between-group sex variability segregation.

The Introduction of Pottery on the Coast

The appearance of pottery in the archaeological records of coastal sites of Paraná and Santa Catarina marks the first remarkable change after almost five thousand years of a stable cultural continuity (Prous 1991; Schmitz 1984, 1987). The results obtained regarding the biological affinities of the ceramic groups show that, while some of them are clearly biologically distinct from classical *sambaqui* builders, others cannot be distinguished from the pre-ceramic groups (Hubbe 2006; Neves 1988; Okumura 2007). Thus, at least in some cases, pottery was probably assimilated by the original inhabitants of the coast of Paraná and Santa Catarina from ceramic groups established there.

Classically, the adoption of pottery and the abandonment of shellmound building have been said to coincide with a subsistence change from gathering of shellfish to fishing and cultivation. However, this idea has been questioned in recent years. First, the introduction of pottery was not associated with the adoption of plant cultivation as a basic subsistence strategy (Prous 1991), nor even with an increase in the consumption of carbohydrate-rich plants in the local diet (Wesolowski 2000; Neves and Wesolowski 2002). Second, fishing seems to have been the main strategy of food acquisition on the Southern Brazilian shore since the pre-ceramic period (Bandeira 1992; Figutti 1993; Lima 1991).

By showing that pottery arrived in association with a new postmarital residential practice by local groups, we undermine the idea of a simple and straightforward technological assimilation. Important shifts in social organization also characterized the transition from the pre-ceramic to the ceramic periods. In this context, the adoption of pottery could have been a consequence of the change in postmarital residential pattern per se.

However, the detailed reasons concerning why shellmound builders adopted a new life-style, postmarital residential pattern and material culture

remains to be explained. We believe this question cannot be addressed with the archaeological and osteological data since the answer is rooted in social processes that are rarely represented in the archaeological record. Ethnohistorical accounts cannot help us either, since by the time the Portuguese arrived in Brazil, the coastal plains were entirely occupied by Tupi-Guarani groups who had replaced the prior occupants of the sea shore (Fausto 2000; Lima 1999-2000; Prous 1991; Schmitz 1984). However, the nature of the cultural change seen between the two periods suggests that the transition toward a virilocal system may have involved social tension and conflict between the two traditions. It is not uncommon in South American tribes that violent conflict between groups results in processes of reconstruction and recreation of sociopolitical aspects of the subdued group, based on the cultural model or standard offered by the dominant culture (Fausto 2000).

Conclusions

After almost five thousand years of cultural continuity, the arrival of pottery on the coast of Brazil marks the first important change in lifestyle and social organization in the coastal groups of Santa Catarina and Paraná. Rather than being a mere assimilation of new technology brought by newcomers, the introduction of pottery, as demonstrated in this study, probably involved important changes in some aspects of the sociopolitical organization of the local groups, such as their postmarital residential practices. Although there are no current archaeological or ethnohistorical data to support it, we suggest that the changes observed resulted from the assimilation of the social model imposed by pottery-using people coming from the interior plateau who settled on the coastal plains around 1200 years BP.

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