

Current perspectives on the transition from the Mesolithic to the Neolithic in Portugal

The classical Mesolithic shell middens of Muge were first excavated in the mid-nineteenth century. Their main features were already established by 1970, when the first synthesis on the Early Neolithic of Portugal was published. The number of sites has significantly increased since then. The Portuguese Early Neolithic is no longer considered an essentially coastal phenomenon, and its full definition is now becoming clearer.

The same applies to the Mesolithic-Neolithic transition. Recently obtained data from several sites indicate the following models as the most convincing:

- *the regions in northern Portugal became depopulated after the end of Upper Palaeolithic; the first farmers arrived from the Spanish Meseta by the early 5th millennium cal BC with a complete «Neolithic package» including pottery and polished stone, along with cereal agriculture and ovicaprids;*
- *in central Portugal there is evidence for 500 years of coexistence of the last hunter-gatherers exploiting the estuarine environments of the lower Tagus, on the one hand, and the first farmers settling in the limestone massifs of the Estremadura from the mid-6th millennium cal BC onwards, on the other. There is no archaeologically visible interaction between the two during that time;*
- *the picture is less clear in South Portugal: the gradual neolithization of Mesolithic groups in the Alentejo province is certain, although issues of chronology are still under discussion; an early Neolithic settlement in the Algarve in the second half of the 6th millennium cal BC seems likely, but further research is needed to define it more accurately.*

One should note, however, that the Portuguese evidence is still scarce. Any current model may change drastically as the available data accumulate.

Key words: Portugal. Mesolithic. Early Neolithic. Interactions.

The Mesolithic has been well-documented in Portugal since the pioneering work on the shell middens of Muge began in the middle of the 19th century. The mapping and partition of the Early Neolithic of Portugal into two successive phases (the Cardial Neolithic and the Epicardial Neolithic) was only proposed 30 years ago, by Guilaine and Ferreira (1970). This work was based on the inventory of various ceramic collections and their comparison with French and Spanish contexts that were well-established stratigraphically and chronometrically. Until now, the investigation of these issues has produced a progressive accumulation of data, above all in the last decade. For the Mesolithic period, this development is due to the re-ex-

cavations of the shell middens of the Sado valley, the discovery of new contexts in the Alentejo coast, as well as the reevaluation of data from old excavations. The study of the Early Neolithic has undergone a similar progress, which resulted in the publication of important site monographs, among which stand out the open-air sites of Sines (Silva and Soares, 1981), the cave site of Gruta do Caldeirão (Zilhão, 1992), and the rockshelter of Buraco da Pala (Sanches, 1997). Various summary articles and interpretive models of the neolithization of Portugal have been published abroad, principally by Arnaud (1982, 1989, 1990), Silva and Soares (1982, 1987; Silva, 1997; Soares, 1995, 1997) and Zilhão (1990, 1993, 2000).

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This work aims to provide a summary of the Mesolithic-Neolithic transition in Portugal, presenting the current state of knowledge and the principal models under discussion. All the dates mentioned refer to years before Christ and derive from the calibration of radiocarbon dates (and not from the subtraction of 1950 years); thus, the repetition of the term «cal BC» has been dispensed with.

1. NORTH PORTUGAL

In the northern half of Portugal, the Early Neolithic is evidenced in two principal concentrations, one in the upper basin of the Mondego river, and the other in the Upper Douro (fig. 1). These are mountainous interior regions of medium elevations (over 700 m), bisected by various watercourses. The

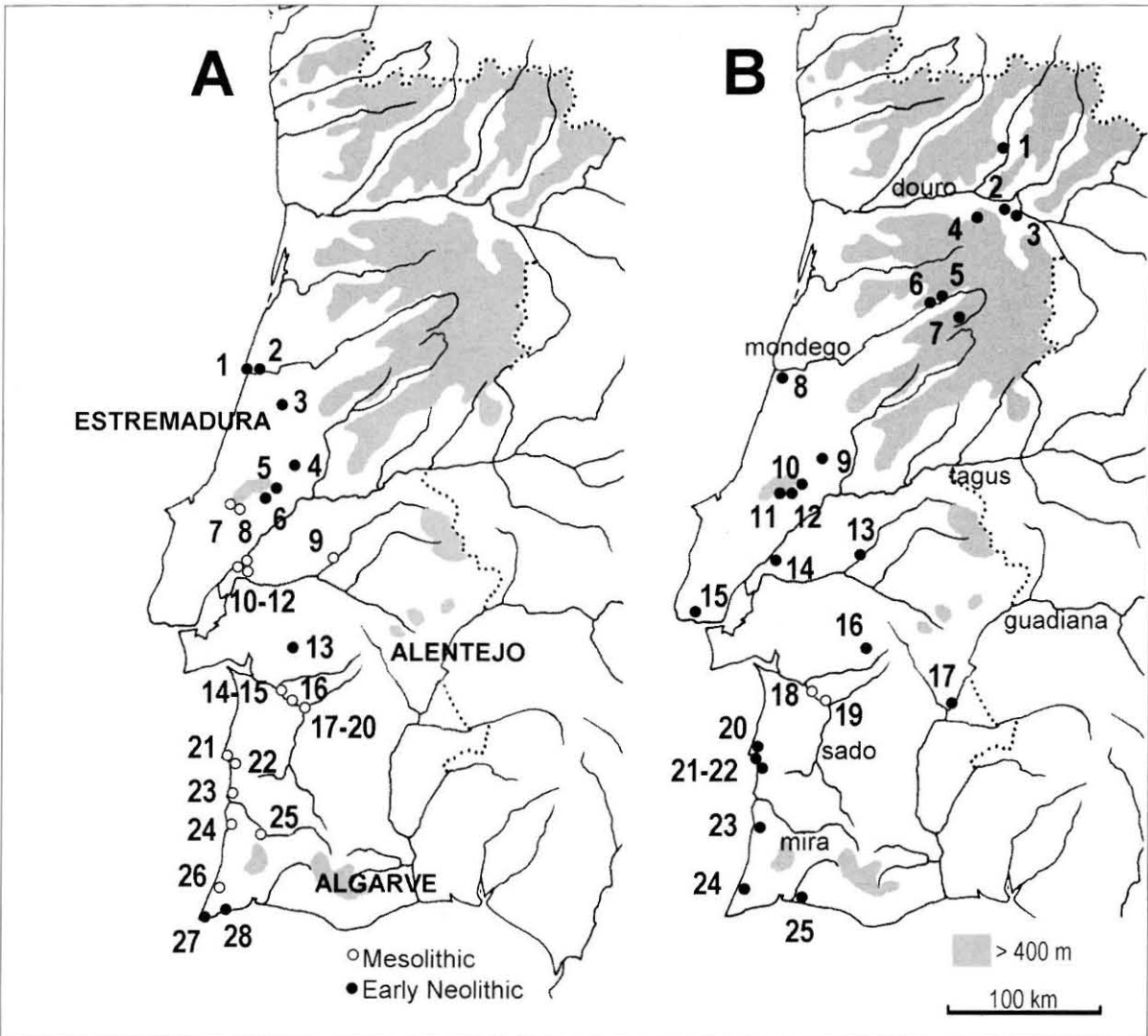


Figure 1. Portugal, at the 6th millennium (map A), and at the first half of the 5th millennium (map B) (Sites mentioned in text).
 Map A: 1. Várzea do Lfrio; 2. Junqueira; 3. Buraca Grande; 4. Gruta do Caldeirão; 5. Pena d'Água; 6. Gruta do Almonda; 7. Bocas; 8. Forno da Telha; 9. Bernardo; 10-12. Moita do Sebastião, Cabeço da Arruda, and Cabeço da Amoreira; 13. Escoural; 14-15. Arapouco, and Cabeço do Rebolador; 16. Poças de S. Bento; 17-20. Amoreiras, Cabeço do Pez, Romeiras, and Várzea da Mó; 21. Vale Pincel; 22. Samouqueira I; 23. Vidigal; 24. Medo Tojeiro; 25. Fiais; 26. Castelejo; 27. Cabranosa; 28. Padrão.
 Map B: 1. Buraco da Pala; 2. Prazo; 3. Quebradas; 4. Fraga d'Aia; 5. Folhadal; 6. Penedo da Penha; 7. Buraco da Moura de S. Romão; 8. Forno da Cal; 9. Caldeirão; 10. Pena d'Água; 11. Cabeço das Pias; 12. Forno do Terreirinho; 13. Bernardo; 14. Moita do Sebastião; 15. S. Pedro de Canaferrim; 16. Valada do Mato; 17. Pipas; 18. Cabeço do Pez; 19. Amoreiras; 20. Salema; 21-22. Vale Pincel and Samouqueira II; 23. Medo Tojeiro; 24. Castelejo; 25. Caramujeira.

climate and vegetational cover present important variations, owing to the region's intermediate position between the Atlantic and the Meseta.

The Early Neolithic has been known through recent discoveries, which, in their turn, forced the re-evaluation of old excavations. In this way, it has been possible to sketch out a preliminary characterization of these communities. The available data indicate an economy defined by the herding of ovicaprids and the production of cereals and legumes. These macrobotanical remains have been recovered in Buraco da Pala (Sanches, 1997) and constitute, at the moment, the only evidence for plant domestication in the Early Neolithic of Portugal.

The Mesolithic, on the other hand, is not yet known. The definition and chronology of the Ancorean culture of the Minho coast remain open questions. The recently discovered aceramic levels at the site of Prazo, whose study is still in a preliminary phase, have produced one date on charcoal of around 6100. Its interpretation is difficult, since there have not yet been identified until now diagnostic elements, such as backed bladelets or geometrics (Rodrigues, 2000). Owing to the questions inherent in the dating of charcoal of indeterminate species, one should remain guarded until new dates are obtained to securely evaluate this singular context.

The Neolithic material culture shows strong parallels with neighboring regions, which has led several authors to establish a diverse picture of influences during neolithization (Sanches, 1997; Valera, 1998; Carvalho, 1999). Ceramics appear to be broken down into two distinct typological associations: one, characterized by bottle forms, with or without conical bases, double perforated handles, and abundant decoration; the other, characterized by channeled ceramics and less complex forms. Owing to the lack of stratigraphies and absolute dates, the determination of whether these differences have chronological (as appears to be the case in the northern Meseta) or cultural significance, is impossible at the moment. The flaking industry employs rocks that are locally available (quartz, rock crystal, quartzite), with flint less often used. This rock is more abundant in the sites of the Mondego basin, a fact that should not be strange given the proximity of the limestone massifs of the Estremadura. Lithic tools are, above all, made from flakes and present very simple typologies (edge retouch, notches). The armatures, which occur in percentages of 15-20%, are exclusively segments, occasionally obtained by the microburin technique.

The number of available absolute dates is still very low, but the results from Buraco da Pala and Fraga d'Aia point to the beginning of the 5th millennium or slightly earlier. The dating of various contexts in the Spanish basin of the Douro attests to the appearance of a fully defined Neolithic in technological and economic terms, by the end of the 6th millennium, of which the Portuguese sites are a part.

2. THE ESTREMADURA AND THE TAGUS VALLEY

The Estremadura and the Tagus valley are the two principal geographic units of the central coast of Portugal. With the exception of the eruptive massif of the Serra de Sintra, the Estremadura is formed by limestone massifs with altitudes that exceed 500 m, from which extend drainage basins to the Atlantic or to the Tagus. The vegetational cover of xerophytic species reflects the Mediterranean climate and the geological substrate. The Tagus valley is of an arenitic substrate, and is highlighted by extensive Holocene alluviations. On the left margin, these formations contact directly with Quaternary terraces which extend along the river.

The Mesolithic is dated to between 6200 and 5000. Sites are concentrated on the left margin of the lower Tagus, next to Muge and Magos, showing a clear adaptation to estuarine environments. This fact is well-evidenced by the accumulation of fish remains, crustaceans, and molluscs, the most visible elements of the archaeological record. *Scrobicularia plana* is the dominant species. The mammal inventories (Lentacker, 1986), which are exclusively wild, are dominated at Cabeço da Arruda and Cabeço da Amoreira by *Bos primigenius*, *Cervus elaphus*, and *Sus scrofa*, with *Equus ferus* and *Capreolus capreolus* less well-represented. *Canis familiaris* is the only domestic mammal. Estimates for the caloric weight of the remains found indicate that the aquatic and terrestrial resources had been exploited in identical proportions, a deduction corroborated by the analysis of the isotopes ¹³C and ¹⁵N extracted from fossil human bone collagen (Lubell et al., 1994). It is probable that these communities had a very significant level of sedentism. The sites situated along the tributaries of the Tagus (the Maior and Sorraia rivers), as well as the Mondego (the Anços river), could be the result of logistic, episodic exploration of the interior. These interior sites are dated to the initial phase of the Mesolithic (Bocas, Forno da Telha, Buraca Grande), which reflects changing strategies in the exploration of the territory throughout this period, accompanied by a reduction in mobility (Carvalho, n.d.).

The Early Neolithic occupies in a general way the various biotopes of the Estremadura region. The available data reveal strategies of mobility of the residential type, with possibly some specialization in hunting and herding occurring, as at Gruta do Caldeirão (Zilhão, 1992), or storage, such as at S. Pedro de Canaferrim (Simões, 1996). Open-air sites are situated on flat areas, on sandy soils, and next to watercourses. Such is the case of Cabeço das Pias and Forno do Terreirinho in the Serra d'Aire (Carvalho, n.d.), or the sites in the surroundings of the mouth of the Mondego (Rocha, 1900). Up to this moment, no evidence for agriculture is yet known, and faunal remains have only been found at the rockshelter of Pena d'Água and Gruta do Caldeirão, where the mixed practice of hunting and herding is attested. The domestic species are

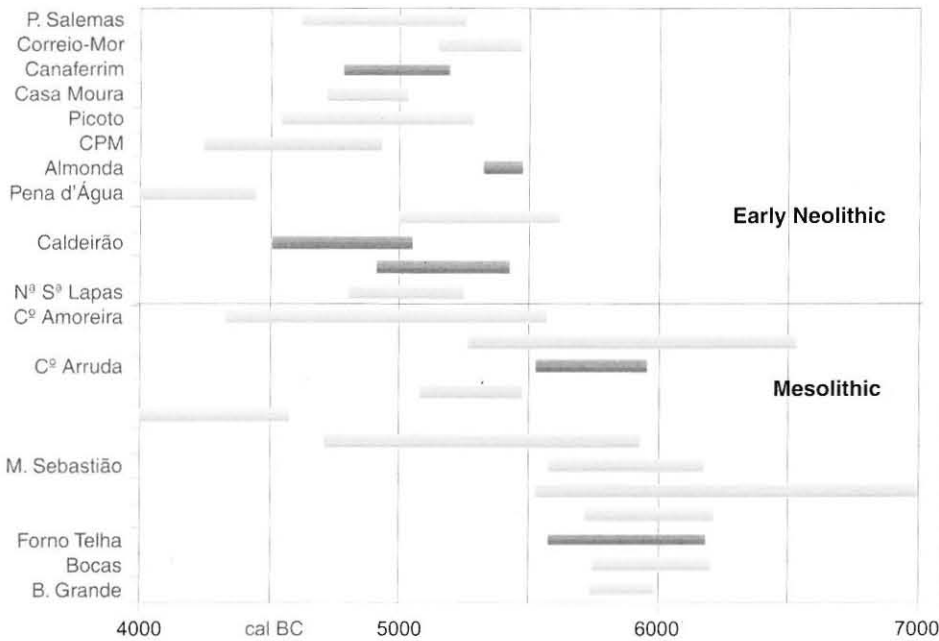


Figure 2. Radiocarbon chronology for Mesolithic and Early Neolithic contexts of the Estremadura and lower Tagus valley. The darker bars refer to cal BC ranges from sum of probability distributions of two or more dates at 2 *sigma*, using the CALIB program.

Capra hircus, *Ovis aries*, and *Bos taurus*, with which are principally associated *Cervus elaphus* and *Sus scrofa*. Lubell et al, (1994) demonstrated that the subsistence of the individuals buried at Gruta do Caldeirão was exclusively of terrestrial origin, a fact which raises the possibility of the existence of agriculture in the Early Neolithic. This possibility is reinforced by the regular presence of sickle implements made from the segmenting of flint blades (Carvalho, 1998b).

The dating of these contexts revealed the contemporaneity of Gruta do Almonda, Gruta do Caldeirão and Pena d'Água with the last hunter-gatherers of Cabeço da Amoreira (period III) and Cabeço da Arruda during the second half of the 6th millennium (fig. 2). Zilhão (1992, 1993, 2000) interprets this evidence as the existence of two distinct cultural contexts, one a local Mesolithic, another an intrusive Cardial Neolithic restricted to an enclave in the north of the Estremadura. This can be considered, in essence, a dual model equivalent to the «Valencian Model».

Various criteria of comparison point in the direction of a differentiation between the two human groups, which is reflected as much in the subsistence economy as in the respective material culture:

- The subsistence economy of the two is contrasting, both with respect to the faunal remains and the isotopic content of the human skeletons.
- The approximately 300 burials identified at Muge present rituals characterized by the deposition of the indi-

viduals in supine position, the use of ochre, and the inclusion of perforated shell ornaments and composite tools (of which are preserved the geometric microliths). The funerary practices of the Early Neolithic are much more poorly understood owing to the lack of good conditions of preservation or of adequate excavations. However, the funerary ritual interpreted by Zilhão (1992) for the Cardial Neolithic of Gruta do Caldeirão includes offerings composed by geometrics, shell ornaments, and ceramic vessels, with the ceramics constituting the signal difference from Mesolithic burials.

- According to Ferreira (1974), the ceramics in the Muge sites are typologically late and occur always at the top of the shell middens; that is to say, they are not associated with the occupations responsible for the accumulation of the malacological remains.
- The bone artifacts are very characteristic of the shell middens of Muge (spatulae on bovine ribs, bevils on long bone fragments of cervids and bovids, tubular bones of birds, awls and points on bone fragments, etc.), principally at Moita do Sebastião and at Cabeço da Arruda (Roche, 1967). There is not, however, any artifact on bone found yet in Early Neolithic contexts.
- Both groups used principally perforated shells as adornments. The species selected, however, are quite varied. In the shell middens they are, above all, *Neritina fluviatilis*, *Cypraea europaea* and *Nassa reticulata* (Roche,

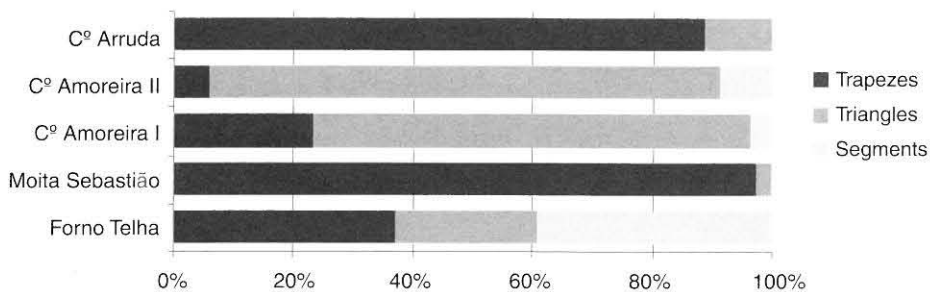


Figure 3. Variability in the typology of geometrics in Mesolithic sites of the Estremadura and Tagus valley.

1972a); in the Early Neolithic funerary contexts of Gruta do Almonda (Zilhão, 1990) and Gruta do Caldeirão (Zilhão, 1992), the perforated shells of *Hynia reticulata* and *Theodoxus fluviatilis* and drop-like ornaments on *Glycymeris glycymeris* dominate. The ornaments on bone pieces of terrestrial mammals also demonstrate distinct choices: in the Mesolithic, they are made on the phalanges of *Cervus* and *Sus*; and in the Early Neolithic they are on canines of *Cervus* and of carnivores.

- The physical anthropology of the populations is still an area of debate. This theme has been the object of analysis by Jackes et al., who used both genetic and osteological data (craniometry, dental traits and postcranial non-metrical traits) to conclude: «In summary, while we would not deny the possibility of sporadic transcoastal incursions from any direction around the Iberian Peninsula, we see no evidence for immigration at the levels required to alter the gene pool» (1997:647). Nonetheless, Zilhão (1998b) contests these conclusions, and uses the same evidence to arrive at the opposite conclusion.

The study of Mesolithic flaked tools recovered in modern excavations owes itself to Roche (1972a, 1972b), who focused almost exclusively on the analysis of flint. With the exception of Forno da Telha (Araújo, 1993), the sites of the interior have not yet been published extensively. The contemporary Neolithic contexts (Gruta do Almonda, Abrigo da Pena d'Água, and Gruta do Caldeirão) constitute the key sites of any comparative exercise. Their lithic industry was the object of a general study in which the principal characteristics of Neolithic lithics were defined (Carvalho, 1998b).

Roche (1972a, 1973) proposed an evolutionary scheme for the industries of Muge, as well as a comparison of these with the sequence of La Cocina (Fortea, 1971). This model, later developed by Silva and Soares (1987), is based on the structure and transformations of the microlithic assemblages, since the other tool types do not present notable variations (the most frequent are the denticulated or notched pieces, which occur in a proportion of 50%).

According to this model (fig. 3), Moita do Sebastião is considered the older site. Trapezes make up 97% of its geometric component, a trend comparable to that at Cocina I. At Cabeço da Amoreira, which is partially contemporaneous with the Neolithic, the large predominance of triangles in all occupational periods has been verified: 73% in the initial phase (period I), and 85% in the final (period III). Among these are notable the «Muge triangles», with percentages that increase from period I (7% of total armatures) to period III (15%). The segments reach, at this moment, the higher percentage (9%). Cabeço da Amoreira is comparable to Cocina II. The backed bladelets denote also a notable increase, from 2% of the total tools of Moita do Sebastião, to 12% in the final phase of Cabeço da Amoreira. However, one should place reservations on this evolutionary model for the Muge lithic industry:

The two absolute dates for Forno da Telha (Araújo, 1993) are the same as those for the shell midden of Moita do Sebastião; however, among the geometric components of Forno da Telha there is not a predominance of any type in particular, with the «Muge triangles» being well-represented (fig. 3).

Cabeço da Arruda did not furnish significant material, in view of which Roche (1967) studied only the material from the old excavations where the smaller pieces (like geometrics) are underrepresented. The trapezes total, however, 89% of the geometrics, which means that they had been dominant in the large part of the occupations (fig. 3). This fact is not in keeping with the chronology of the shell midden - which in large measure is contemporary with Cabeço da Amoreira -, but is comparable to Moita do Sebastião - which predates it. The same author points out the similarities between the trapezes of this site with those of Cabeço da Arruda: «*Par leurs caractéristiques typologiques et techniques, ils sont très semblables à ceux étudiés à Moita do Sebastião*» (Roche, 1967:226).

The armatures of the initial Early Neolithic of Gruta do Almonda, Gruta do Caldeirão, and Pena d'Água are composed almost exclusively of segments (Carvalho, 1998b), but can not be viewed as the natural end of this evolution for the above-

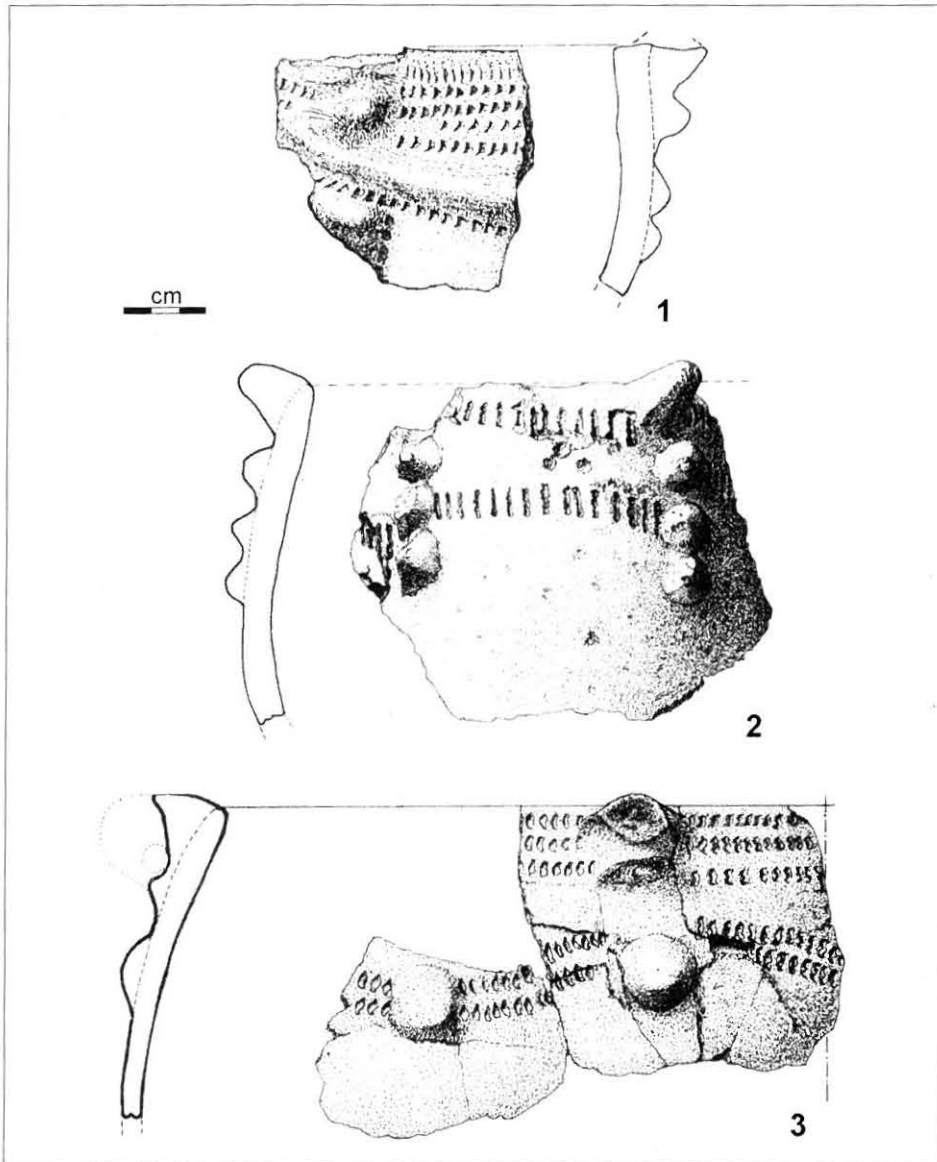


Figure 4. Cardial ceramics of the Estremadura (in Zilhão, 2000, adapted). 1. Buraca Grande; 2. Gruta do Almonda; 3. Gruta do Caldeirão.

mentioned reasons. Other factors suggest even the existence of significant differences between the two groups of sites:

- The métric patterns of Mesolithic blade production were never verified, but the data of Roche (1972b) for Moita do Sebastião and those obtained for the Estremadura (Carvalho, 1998b) indicate similar tool sizes: 30-40 mm in length, and 8-10 mm in width. However, Neolithic blade production was carried out by pressure and indirect percussion with the use of heat treatment (30-35% of the blades), while the Mesolithic industry was carried out only by indirect percussion, and

heat treatment was unknown (Aubry et al., 1997; G. Marchand, pers. com.). Although more data are necessary, these are important differences between the Mesolithic and the Early Neolithic blade production technologies.

- The type of retouch used in the production of microliths is always abrupt, whether in the Mesolithic, or in the Neolithic. The differences are found in their relative representation and the techniques of blade segmentation. In effect, microliths make up 50-80% of all the tools of the Mesolithic, which decrease to val-

ues lower than 20% in the Early Neolithic; the microburin technique is abundantly present in Mesolithic contexts (40-60%) and is unknown in the initial Early Neolithic. In this period, the intentional segmentation of blades is carried out by flexion and percussion (Carvalho, 1998b).

- Some tools present a mutually exclusive distribution. The «Muge triangles» are the typical tool of Mesolithic sites, yet they are unknown in Neolithic contexts. In this period, the typical tools are borers, sickle blades, and truncated blades. Neolithic borers are morphologically distinct from the Mesolithic perforators (they are on pointed blades, with abrupt or semi-abrupt retouch on both edges) and represent 5-10% of tools. The sickle blades are made of the middle sections of long blades segmented by flexion or percussion. They are always very common (around 25%). Their function has been suggested by the technology and parallels with pieces studied through traceology (Carvalho, 1998b). Although known in the Mesolithic, truncated blades are more common in the initial Early Neolithic (reaching 10-20% of the total, versus 5% in the Mesolithic).

We have, thus, during the second half of the 6th millennium, a picture of cultural duality. In the lower Tagus valley, there existed communities of hunters and gatherers, with a material culture of long-lasting tradition. In the calcareous regions of the Estremadura there lived the first communities practicing an agropastoral economy and bearing a distinctive material culture. Any interaction between the two did not leave a notable archaeological expression.

3. THE ALENTEJO AND THE ALGARVE

The most evident geographic features in the landscape of the Alentejo are the schistose plains, crossed by the wide basins of the Sado, Mira, and Guadiana rivers. The Guadiana defines the natural limit of the Iberian Southwest, separating Portugal from the Spanish provinces of Extremadura and western Andalucía. The Algarve is notable, on the other hand, for the limestone massifs that line the coast of southern Portugal.

Similar to Muge, the Mesolithic sites of the Sado valley (fig. 1) are also the result of adaptations to an estuarine environment, in whose malacological inventories *Cerastoderma edule* is the most abundant species (Arnaud, 1987). On the coast (fig. 1), environmental diversity is greater, which resulted at times in the predominance of species adapted to rocky environments (Soares, 1997). With the exception of *Canis familiaris* discovered in Samouqueira I and Amoreiras, the macromammals are all wild. In the shell middens of Cabeço do Pez, Amoreiras, Romeiras, and Poças de S. Ben-

to (Sado valley), *Cervus elaphus* and *Sus scrofa* dominate, with *Bos primigenius*, *Capreolus capreolus* and *Equus ferus* more poorly represented (Arnaud, 1989). The faunal inventory of the coastal sites repeats that for the Sado, although the current data do not yet permit the establishment of relative quantities (Soares, 1997; Straus *et alii.*, 1990). Arnaud (1987) suggested, for the Sado shell middens, a settlement system organized by seasonal movements along the river, to allow for the exploration of distinct ecological niches: upriver hunting, in the fall and winter; the collection of shellfish downriver, in the spring and summer. This strategy would have used as base camps Cabeço do Pez - upriver - and Arapouco - downriver -, around which orbited shell middens with a more functionally specialized character. Soares (1995, 1997) proposes for the Mira and the coast of the Alentejo a model of logistic mobility, with semi-sedentism made possible by the abundance and stability of aquatic resources.

The only direct evidence for a food production economy in the south of Portugal is limited to the Algarve, and is dated to the third quarter of the 6th millennium (fig. 5). Remains of ovines and/or caprines have already been identified at Cabranosa (Silva and Soares, 1987), and the recent excavation of Padrão by M.V. Gomes revealed a small faunal assemblage composed of *Bos taurus* and *Ovis aries/Capra hircus*. These were found in association with *Cervus elaphus* and malacological species. The mammals represent, however, the principal source of calories, and the type of economy of this site can not, for this reason, be compared to the Mesolithic shell middens.

Silva and Soares (1981, 1987; Silva, 1989; Soares, 1995, 1997) interpret the transition to the Neolithic in the south of Portugal as a process of acculturation of the Mesolithic substrate. This process began in the mid-6th millennium (according to the dating of Vale Pincel and some shell middens) and developed through the gradual acquisition of Neolithic elements (ceramics, polished stone tools, agriculture). This model has received various critiques by Zilhão (1993, 1998a, 2000), who questions the stratigraphic positioning of the ceramics in the shell middens, and proposes a taphonomic model for Vale Pincel, according to which the dates obtained refer to a previous aceramic Mesolithic occupation. The opposition between the Alentejo and the Algarve sites is seen by this author as the existence of a «Neolithic enclave» similar to that known in the Estremadura (Zilhão, 1998a, 2000).

The process of neolithization in the south of Portugal can be analyzed, not only by determining the stratigraphic position and significance of the Neolithic features, as Zilhão did, but also by comparing the aforementioned sites of the Algarve with their contemporaries in the Alentejo. This proposal has, however, some limitations: (1) the only known Neolithic contexts are limited to two; (2) funerary rituals are largely known only in the Sado shell middens - thus, the phys-

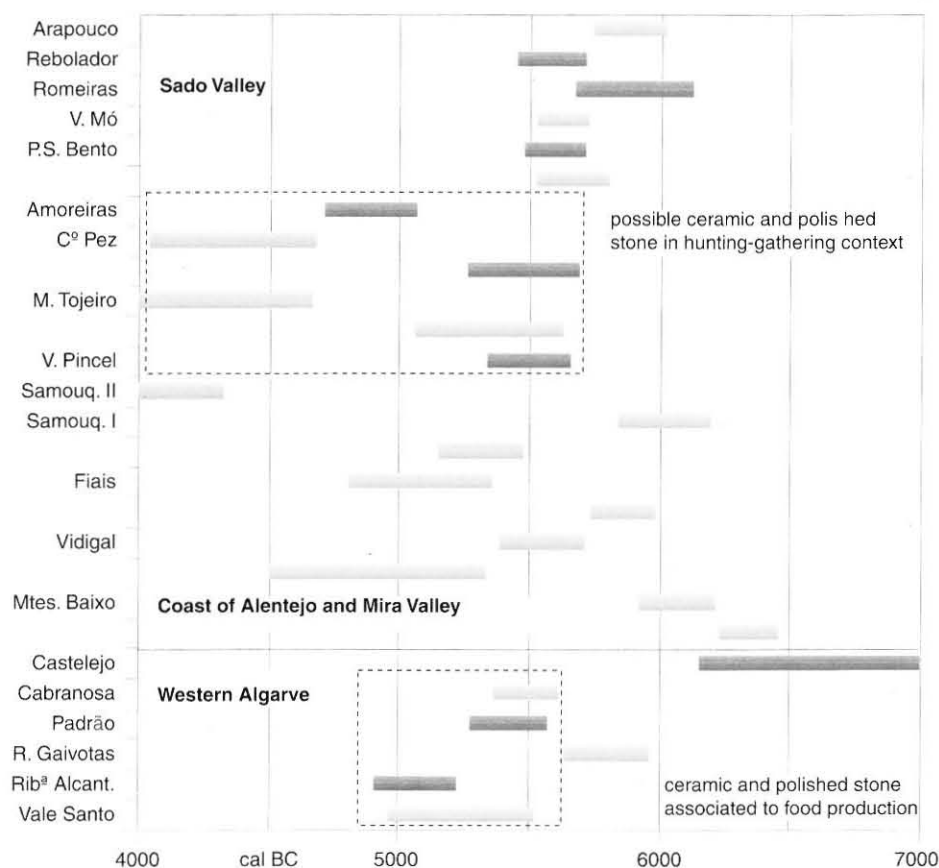


Figure 5. Radiocarbon chronology for the Mesolithic and Early Neolithic of the Alentejo and Algarve. The darker bars refer to cal BC ranges from sum of probability distributions of two or more dates at 2 sigma, using the CALIB program.

ical anthropology of the populations, as well as the respective votive artifacts, reflect only the «Mesolithic side» of the transition -; and (3) the bone industry is limited to some spatulae and carved deer antlers at Cabeço do Pez (Arnaud, 1987). In this way, only the ceramics and the polished and flaked stone can be used as elements of comparison.

The positioning of ceramics and polished stone in the shell middens must undergo a taphonomic interpretation for this type of archaeological site. The excavations by Arnaud (1987) demonstrate that the Sado sites were formed by the juxtaposition of successive accumulations of remains, and not by superposition. If the Neolithic elements resulted only in re-occupations, they would be found *on the top and in the depressions of the mounds* formed; if, on the other hand, they were part of the Mesolithic artifactual components, they should be found *in the body of the shell middens*. The observed situations in modern excavations permit both situations to be considered:

- In Vale de Romeiras and Poças de S. Bento (Sado valley) and Castelejo (coast of the Alentejo), Neolithic ar-

tifacts are limited to surface levels (Arnaud, 1987; Soares and Silva, 1997); unfortunately, in all these cases only the middle and lower levels were dated (fig. 5).

- The only site where ceramics and polished stone were recovered in a clear shell midden context is Amoreiras, dated to the beginning of the 5th millennium (Arnaud, 1990).

Field data from Medo Tojeiro, Cabeço do Pez, and Vale Pincel, on the other hand, can only be used with the following reservations:

- At Medo Tojeiro there is not a consensus between the excavators with respect to the ceramics and polished stone: Silva et al. (1985) state that they are dispersed throughout the three levels of occupation; according to Lubell (cit in: Zilhão, 1998a) they are limited to the upper level.
- The excavation carried out in 1958 at Cabeço do Pez by M. Heleno employed a methodology that today would be considered inadequate, which is the excavation of *talhões* («sections») by artificial horizontal lev-

els of 25 cm, without attention paid to stratigraphy. In this way, the presence of ceramics and polished stone in the bottom levels of this sequence remains to be clarified. According to Santos et al. (1974:174), «a complexidade estratigráfica de um concheiro [...] jamais poderia ser apreendida por uma escavação como a do Cabeço do Pez. Eis porque o tratamento dos materiais que provieram desta estação, realizado em função da estratigrafia estabelecida, terá de ser feito com a maior das cautelas e as conclusões extraídas deverão ser encaradas com grandes reservas».

- Vale Pincel is an extensive settlement, with structures of various types, located in sands. It did not preserve significant organic remains, and the Neolithic elements were found in all the stratigraphic units (Silva and Soares, 1981, 1982). According to Zilhão (1998a), the published dates, from the mid-6th millennium, refer to a Mesolithic occupation, and the ceramics, which could be later, would have been mixed with the previous, Mesolithic remains. Thus, only the publication of new fieldwork can overcome this impasse.

The undisputable presence of Neolithic artifacts in the context of a shell midden is, thus, limited to Amoreiras. This site dates the earliest evidence of interaction between Mesolithic and Neolithic communities to the 5th millennium. To accept the presence of ceramics at Medo Tojeiro, Cabeço do Pez and Vale Pincel, one would have to push back the chronology of these contacts to the third quarter of the 6th millennium. This chronology, however, overlaps with that for Cabranosa and Padrão (fig. 5) and suggests the possibility of interaction between the two groups of sites.

Unfortunately, the typological comparison between the ceramics of these sites and those of the Alentejo is not conclusive. Decoration use incised and impressed motives, which are generally common in both regions. Cardial ceramics, although present, have low percentages. The only exception is the ceramic assemblage of Cabranosa (fig. 7), where some features distinguish it both from the Alentejo sites and Padrão: composite forms; extensive decorations including 20% cardial ware; and the exuberance of the plastic cord designs (Cardoso *et alii*, 1998.).

Mesolithic chipped stone, on the other hand, has rarely been studied in detail, with the work of Arnaud (1987, 1989, 1990) in the Sado valley including only general references. The study of Poças de S. Bento by Araújo (1995/97) offers an important perspective at this level. Of the various sites of the coast and of the Mira, only Samouqueira I (Soares, 1995), Fiais and Vidigal (Vierra, 1995) reveal significant assemblages and were studied in detail. The locally accessible rocks predominate in all these sites, though they are often of poor quality for flaking (rhyolites, gabbros, quartzites, quartzes, graywackes). When better quality rocks

are abundant (flint, chert, jasper schist, rock crystal) there is an increase in the blade component. The available metric data (Vierra, 1995; Soares, 1995; Araújo, 1995/97) indicate that the mean lengths of blades are around 20-30 mm; widths and thicknesses have a mean of 7-8 mm and 2-3 mm, respectively. Heat treatment is not known. The techniques of debitage, strongly conditioned by the very variable quality of the rocks exploited, are difficult to determine. The most frequent non-geometric tools are of very simple types (notches and marginally retouched pieces). Armatures represent 43% of the total of tools at Fiais, 52% at Vidigal and 67% at Poças de S. Bento. The segmentation of blades are carried out usually through the microburin technique; at Fiais and Samouqueira II microburins even outnumber geometrics. The typological variation of the geometrics demonstrates the following general tendencies (fig. 6):

- The trapezes dominate at Cabeço do Rebolador, Fiais and Poças de S. Bento, with 38%, 37% and 53% of the total of tools, respectively. According to Arnaud (1987), they are also the dominant type at Arapouco and Vale de Romeiras.
- The segments dominate at Várzea da Mó (60%) and at Vidigal (35%), and are also the majority at Amoreiras (Arnaud, 1990).
- The triangles are always the minority in Mesolithic contexts, never reaching the proportion found at the Muge sites.

Vierra and Arnaud (1996) and Araújo (1995/97), basing their conclusions on the analysis of the geometrics of Fiais, Vidigal and some of the Sado shell middens (Arapouco, Cabeço do Pez, Amoreiras, and Poças de S. Bento), concluded that geometric variability corresponds to long-term changes in technology. According to this model, the supposed evolution for the Mesolithic of Muge is repeated in the south of Portugal: initially predominant, the trapezes cede their place to the segments in the final phases of development of these sites. However, once again, a detailed analysis of Fiais along with the study of Várzea da Mó and Cabeço do Rebolador, place strong reservations on this general scheme:

- Fiais produced segments and trapezes in almost equal proportions, if the three excavated sectors are added (fig. 6). However, the variation by sector is the following (Vierra, 1995): trapezes dominate in the North sector (9 out of 19 geometrics); triangles and trapezes dominate in the central sector (16 of each type with 9 segments); and all types of geometrics are represented in identical proportions in the South sector (5 triangles, 6 trapezes, and 6 segments). As the spatial provenience of the several absolute dates obtained for this site, which are distributed along more than one thousand years (Arnaud, 1993), are not yet known, it is impossible to de-

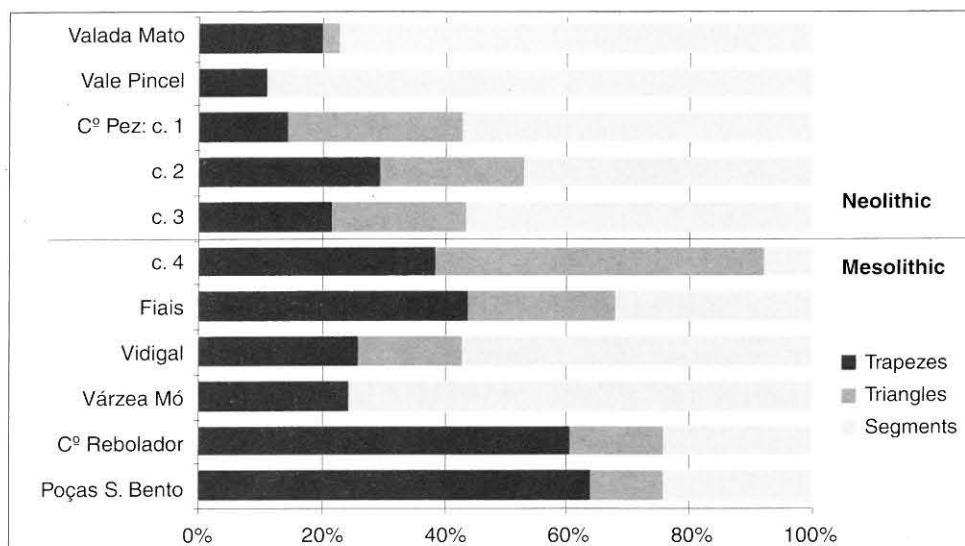


Figure 6. Variability in the typology of geometrics in the Mesolithic and Early Neolithic of southern Portugal. Note that for Vale Pincel, Medo Tojeiro and Cabeço do Pez (layers 1 to 3), doubts about the presence of ceramics and polished stone have been raised (see text).

termine if these associations are the result of a technological evolution or if they represent distinct functions.

- The dates obtained by Arnaud (1989) for Várzea da Mó and Cabeço do Rebolador indicate that both shell middens were occupied in the second quarter of the 6th millennium. All the same, the study of the materials, presently in progress, have revealed a marked opposition between the two (G. Marchand, pers. com.): the segments predominate in the first and the trapezes in the last (fig. 6).

The Early Neolithic settlements of the Algarve have revealed lithic assemblages with important differences in relation to the Mesolithic of the Alentejo. Flint is the rock most commonly used, with 98% at Cabranosa (Cardoso *et alii.*, 1998) and 95% at Padrão, in terms of quantity. The mean dimensions of the blades show values that are close, or slightly greater, than those known for the Estremadura. Heat treatment is present in 5-10% of the pieces, and the flaking techniques used are pressure and indirect percussion. The most common tools are flakes and blades with edge retouch or notching (67% of the total of the tools at Cabranosa, and 73% at Padrão). However, at Cabranosa there have not been identified any armatures, and at Padrão only one backed bladelet and a segment were recovered. This characteristic signals a strong break with the Mesolithic of the Alentejo, and finds corroboration in the lack of microburins. This low armatures index can also be observed in the Evolved Early Neolithic of Caramujeira, where only one trapeze and two backed bladelets were found (Gomes *et alii.*, 1978). The «Muge triangles», on the other hand, are restricted to Mesolithic contexts.

These observations indicate the coexistence of two distinct technological systems in the south of Portugal. Integrating these with the chronometric data and the available palaeoeconomic evidence, the existence of two distinct human groups in the second half of the 6th millennium seems likely: one, Mesolithic, located in the Alentejo, with a hunting-gathering economy well-adapted to coastal and estuarine environments, and with a long tradition of stone-working; another, Neolithic, located in the western Algarve, practicing herding and possibly agriculture, and as much as the data allow us to deduce, with a different material culture. The ceramics and polished stone (and possibly elements of the Neolithic economy) identified in the sites of the Alentejo do suggest the existence of contacts that, whatever their real chronology, did not transform the Mesolithic economy nor the technological tradition.

This technological tradition is still present in the local Evolved Early Neolithic. At the site of Valada do Mato (M. Diniz, n.d.; pers. com.) flints and cherts predominate, which resulted in a good representation of blades and bladelets. The numerous armatures are dominated by segments (fig. 6). In contrast, at the site of Pipas (Soares and Silva, 1992), the lithic material is dominated by quartzite, which was used, above all, for pebble tools. The flint component was limited to the armatures (a segment and a backed bladelet). In Valada do Mato, the geometrics were obtained by the microburin technique, which indicates a clear continuity of the Mesolithic flaking techniques. Some transverse arrowheads with bifacial retouch were identified at the Evolved Early Neolithic levels of Vale Pincel (Silva and Soares, 1981), Samouqueira II (Soares, 1995), Pipas (Soares and Silva, 1992) and Valada

do Mato (Diniz, n.d.). Their existence was first noted in Gruta do Escoural (Santos, 1971) and at Cabranosa (Guilaine and Ferreira, 1970). However, the more recent studies of these sites (Araújo et al., 1993; Cardoso *et alii*, 1998, respectively) concluded that they were erroneous attributions. The find of a transverse arrowhead at the site of Bernardo, next to the Sôr river (*Pontis*, pers. com.), indicates that this armature was also present in the regions of the northern Alentejo (fig. 1). Unfortunately, the material from other evolved contexts, such as the important site of Salema (Silva and Soares, 1981, 1982), has not been published yet, and can not, for this reason, be used for comparison.

4. THE ORIGINS OF THE NEOLITHIC IN PORTUGAL

The Early Neolithic of Portugal presents cultural affinities to other Iberian areas. The modalities by which the transition in the Atlantic coast of Iberia operated were not uniform and can be explained according to a regional mosaic of unique situations. These modalities were determined by four principal factors: (1) the role of the Mesolithic population substrate; (2) the mode of emergence and cultural filiation of the Neolithic; (3) the establishment of interactions between different «Neolithics»; and (4) the environmental potentials of diverse regions.

The chronology, material culture, and economy of the Early Neolithic of northern Portugal indicate that it was part of a vast cultural group which included the northern Meseta. The burials at La Lámpara (Kunst and Rojo, 1999), the oldest levels of La Velilla (Delibes and Zapatero, 1996), and La Vaquera (Estremera, 1999) are the best examples. The origin of this culture is not yet well-defined, but it could have been the result, according to various authors, of a rapid process of colonization originating from the Ebro valley. Some painted and engraved rock art of a subnaturalistic style recently discovered in the Côa valley (Faia, Canada do Inferno, Vale de Cibrões) resemble Levantine prototypes (Baptista, 1999; Carvalho, 1999), which may reinforce this possibility. In the aforementioned regions of Portugal, the Early Neolithic arises quickly in the archaeological record, fully formed, and does not appear to be the result of communities in the process of transition. These regions were unoccupied or occupied sporadically by groups of hunters-gatherers established elsewhere.

In the center of Portugal, the first Neolithic groups inhabiting the limestone massif of the Estremadura coexisted with communities of hunters-fishers-gatherers established on the lower Tagus valley. There is no significant material evidence of interaction between the two groups for 500 years, and the Mesolithic communities appear to have been absorbed in the transition from the 6th to the 5th mil-

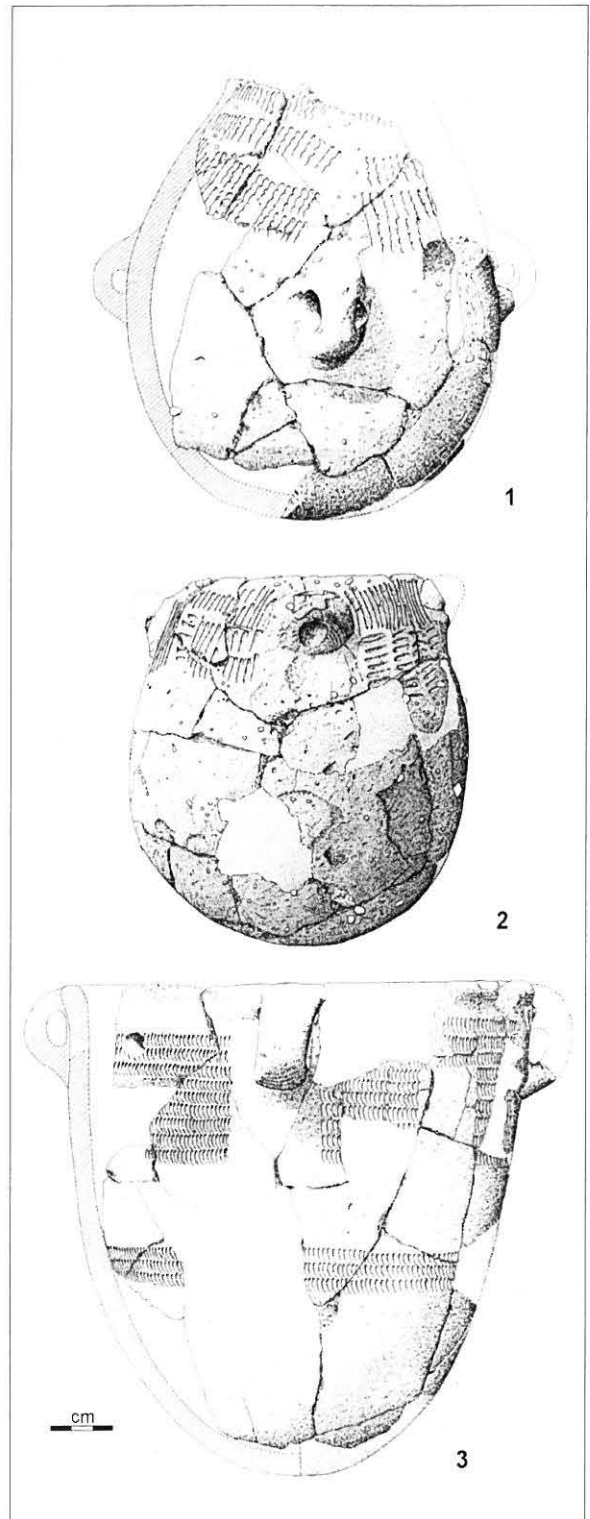


Figure 7. Early Neolithic ceramics from Cabranosa (in Cardoso et al., 1998, adapted).

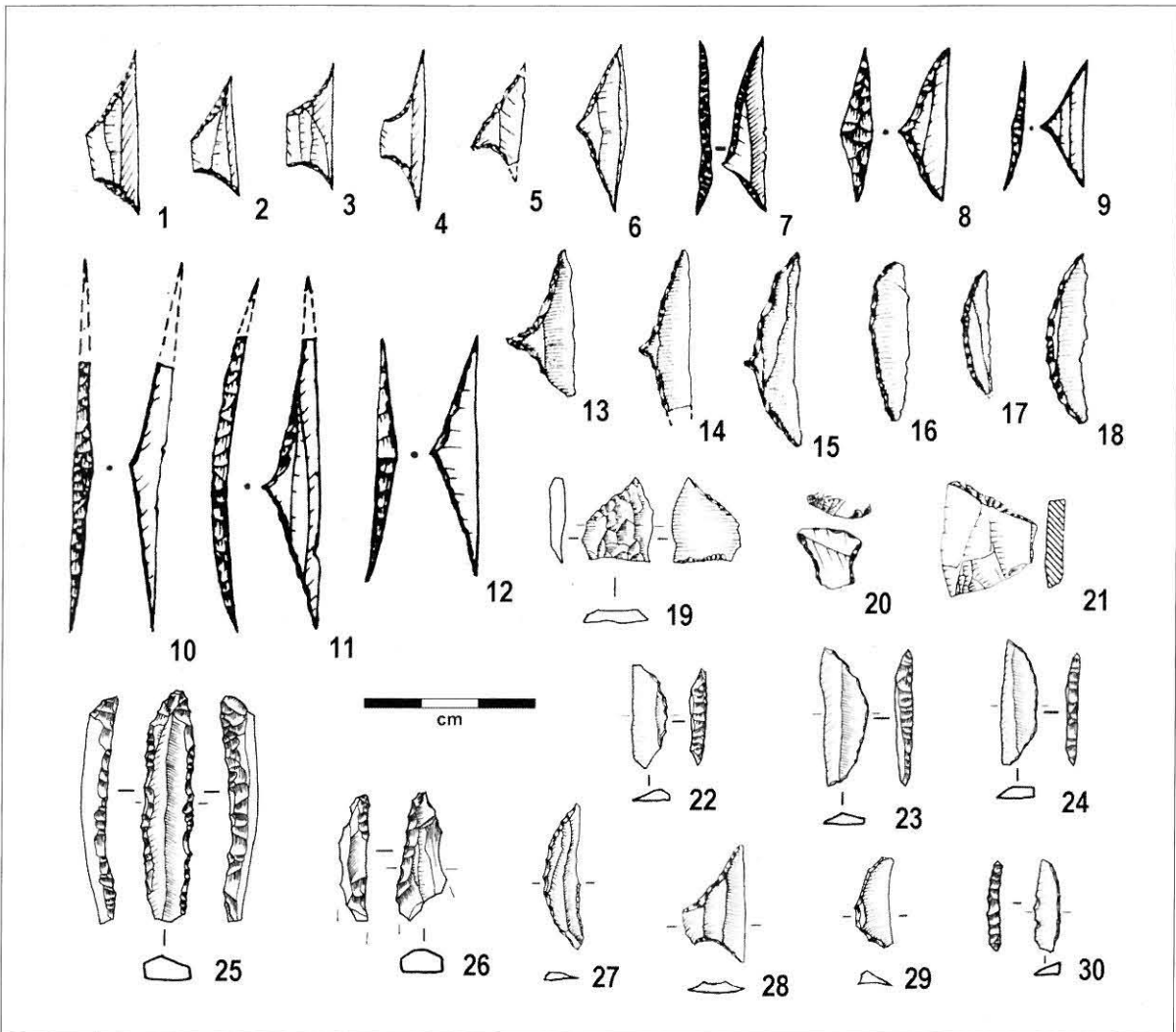


Figure 8. Mesolithic and Early Neolithic lithic tools (armatures and borers). Mesolithic: 1-4: trapezes; 5-15: triangles; 16-18: segments. Early Neolithic: 19-21: transverse arrowhead; 22-24, 27-30: microliths; 25-26: borers.

1-4. Moita do Sebastião (Roche, 1972b); 5-6. Cabeço da Arruda (Roche, 1967); 7-12. Cabeço da Amoreira (G.E.E.M., 1969); 13-18. Forno da Telha (Araújo, 1993); 19. Bernardo (unpublished); 20. Pipas (Soares and Silva, 1992); 21. Vale Píncel (Silva and Soares, 1981); 22-24. Gruta do Almonda (Carvalho, 1998b); 25-26, 30. Pena d'Água (Carvalho, 1998a); 27-29. Gruta do Caldeirão (Zilhão, 1992).

lennium. The initial phase of the Early Neolithic of the Estremadura is not yet well-characterized. Recently studied sites include only the cave sites of Gruta do Almonda (Zilhão, 1990) and Gruta do Caldeirão (Zilhão, 1992), and the rockshelter of Pena d'Água (Carvalho, 1998a). Similarities to the Early Neolithic of València are, however, notable in the following regards: (1) flaked stone is based on flint for the production of a blade industry with the same typologies and specific technologies (Fortea *et alii*, 1987);

only the geometrics differ - the segments predominate in the Portuguese region, and the trapezes in Eastern Spain; (2) the incised and impressed ceramics include cardial ware in reduced percentages; this typical ware is of a late style (fig. 4), placeable within *phase IA2* of the proposed scheme of Bernabeu (1989); and (3) the ornaments, although scarce, also include shells (namely *Theodoxus fluviatilis*) and perforated canines of cervids and carnivores (Pascual-Benito, 1996). These undeniable similarities with València were

emphasized by Zilhão (1993), who concluded that an effective process of demic diffusion on a small scale occurred.

In the Evolved Early Neolithic (first half of the 5th millennium), the decorative typology of ceramics diversified, and the incised decorations predominated. In contrast to the preceding period, flaked stone tools were principally produced on local rocks, such as quartzite and quartz. This tendency is only not verified in the contexts of more specialized occupations, where the use of flint can be exclusive. There are examples of these situations at funerary sites and at the habitat of S. Pedro de Canaferrim, on the eastern slope of the Serra de Sintra, which was occupied as a temporary shelter and as a place of storage in the beginning of the 5th millennium (Simões, 1996). In the stages of transition to the Middle Neolithic, lithics may include trapezes and the microburin technique.

In the south of Portugal, there appears also to have been an opposition between the long-established communities in the coastal or riverine ecosystems of the Alentejo, practitioners of an economy of hunting-fishing-gathering, on the one hand, and agro-pastoral communities established on the limestone massifs of the Algarve, on the other. The artifactual definition of both groups is not definitive, but it does suggest differences at the level of flaked stone technology and typology, as with the ceramic forms and decorations at Cabranosa. However, the existence of interactions between Mesolithic communities of the Alentejo and the Neolithic is a fact. What remains to be determined is when this process began - whether in the middle of the 6th or only in the 5th millennium (fig. 5).

Another possible explanation for the neolithization of the Alentejo, which does not exclude the former, is the arrival of Neolithic influences through the Guadiana valley (Diniz, 1996). However, the Neolithic of the Guadiana and the Spanish Extremadura is not well-known yet, and does not allow us to evaluate definitively this possibility. Only a few ceramic assemblages of simple shapes, decorated with incisions and impressions (with *boquique* and very rare cardial), associated with lithic industries with segments, are known (for example, Peña Aguilera, Los Barruecos, Cerro de la Horca, Boquique or La Cañadilla). These assemblages seem to predate the Late Neolithic, but there are no available stratigraphies nor absolute chronologies (Enriquez, 1996; González, 1996, 1999). In the contiguous regions of western Andalucía (Serra Morena, lower Guadalquivir and Cádiz peninsula), the Early Neolithic levels of cave sites such as Cueva Chica, Parralejo and Dehesilla present ceramic characteristics which suggest some kind of interaction with the Alentejo - semi-spherical vases or ovoids, with incised decorations, impressed (cardial is rare), channeled, and *almagra* (Pellicer and Acosta, 1982; Acosta, 1986). However, the early dates (7th millennium, *grosso modo*), which are the basis for an interpre-

tation of autochthonous neolithization in Andalucía, deserve strong methodological objections (see Fortea and Martí, 1984/85; Zilhão, 1993). The correlation of these contexts with the Early Neolithic of the Alentejo will only be possible through the dating of short-life elements (fauna, seeds) coming from well-defined contexts of both regions.

More recently, open air sites on the Atlantic coast of Cadiz have been discovered, with evidence of herding and hunting associated with fishing and shellfish collection: El Estanquillo (Ramos et al., 1995/96) and El Retamar (Lazarich *et alii.*, 1997). According to these authors, these are sites of medium size with episodic occupations, related to semi-sedentary camps located in the interior. This model appears to be comparable to the Early Neolithic of the Algarve. However, the material culture of these Spanish sites is not identical to their supposed Portuguese counterparts. Despite the presence of cardial ware at El Retamar, its geometric component makes up a third of the tools, is composed mostly by trapezes, and was produced by the microburin technique.

The multiplicity of modalities of the transition observed on the Atlantic coast of Iberia can be summarized in the following way:

- the arrival of fully Neolithic communities to the North of Portugal, which themselves could be the result of the neolithization of Mesolithic groups settled in the Ebro valley that subsequently expanded to the northern Meseta;
- the coexistence in contiguous territories of central Portugal of intrusive Neolithic communities (in the limestone massifs of the Estremadura) and Mesolithic autochthones (in the lower Tagus) apparently without interaction, and the absorption of the latter in modalities not yet understood;
- the introduction of Neolithic artifactual items (ceramics and polished stone) in the Mesolithic of the Alentejo, through contact with Neolithic communities established in the Algarve and/or western Andalucía, and the survival of Mesolithic traces - mainly some stone working technologies - during the Evolved Early Neolithic.

In view of this evidence, Price's synthesis can be considered the best general explanation for the transition to farming in Portugal: «The very rapid expansion of the Cardial culture certainly suggests the prior existence of routes of communication and exchange. The question remains as to who carried domesticates and ceramics along these routes. The evidence (...) indicates that the mechanisms for the spread of the Cardial Neolithic were varied and may have included both colonization of uninhabited regions by small enclaves and local adoption of farming or other aspects of the Neolithic in other parts of the Mediterranean shore.» (Price, 2000:13).

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NOTES

1. «The stratigraphic complexity of a shell midden (...) could never be understood by an excavation such as that at Cabeço do Pez. This is because the treatment of the materials that came from this site, carried out with the stratigraphy established, would have to be done with the greatest of care and the conclusions extracted should be treated with serious reservations.»

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