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# COPPER METALLURGY AND THE IMPORTANCE OF OTHER RAW MATERIALS IN THE CONTEXT OF CHALCOLITHIC ECONOMIC INTENSIFICATION IN PORTUGUESE ESTREMADURA\*

by

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**Abstract:** In this work, the origin and development of the copper metallurgy within the Chalcolithic of Portuguese Estremadura is discussed. In the portuguese territory, the southern origin of copper metallurgy is supported by absolute chronology. This situation is compared with the one related to the trade of external material sources, like anfiboloschists, that compose the majority of polished stone artefacts of estremaduran region. There is thus an evidence of a trans-regional commerce of these materials in exchange for silex, which is abundant in Estremadura. In fact, silex is the prime material of many artefacts in Alentejo and Beira Interior, where this rock does not exist. All these facts suggest the existence of a trade net for long distances, stable and time lasting, related to the chalcolithic economic intensification.

**Key-words:** Copper metallurgy and other materials; chalcolithic economic intensification; Portuguese Estremadura.

**Resumo:** Neste trabalho discute-se a génese e o desenvolvimento da metalurgia do cobre no contexto calcolítico da Estremadura portuguesa. A origem meridional da metalurgia do cobre no actual território português, apoiada por dados arqueológicos e elementos de cronologia absoluta, é comparada com o desenvolvimento do comércio de outras matérias-primas que então também afluíam à Estremadura, como os anfiboloxistos, rocha de que são feitos a maioria dos artefactos de pedra polida recuperados em Leceia. Deste modo, encontra-se comprovado comércio trans-regional de tais matérias-primas, permutadas sobretudo pelo sílex, abundante na Estremadura, o qual ocorre, manufacturado, tanto no Alentejo como na Beira Interior, regiões onde é desconhecido.

A situação descrita configura a existência, no actual território português e no decurso do Calcolítico, de uma rede de intercâmbios a longa distância, estável e duradoura, com paralelos coevos noutras regiões europeias, a qual se compreende no quadro da intensificação económica que caracterizou o Calcolítico.

**Palavras-chave:** Metalurgia do cobre e outras matérias-primas; intensificação da economia calcolítica; Estremadura Portuguesa.

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## 1. THE STATE OF THE DEBATE

In Estremadura all the evidence indicates that copper metallurgy can only have begun, or at least developed, in the Middle Chalcolithic. This is shown in Leceia, and the emphasis given to this site is clearly justifiable, for of the three great Estremaduran chalcolithic fortified sites – Vila Nova de São Pedro, Zambujal and Leceia – it is the only one with a stratigraphy of credible cultural significance, based on artefact content (Fig. 1).

In fact, in Vila Nova de S. Pedro, the finds of copper pieces in the pre-beaker bell pottery layer seen as a whole, Vila Nova I (PAÇO & SANGMEISTER, 1956a; PAÇO & ARTHUR, 1956, p. 536), besides being rare, prove nothing about the existence of metallurgy in the early Chalcolithic because, for the authors, that layer includes all of the pre-beaker bell pottery period of that site. The same thought is explicitly stated by SAVORY (1970, p. 136; 1983/1984, p. 20 of the Portuguese translation) "... the 1959 sections do have a special importance in that they demonstrate that what has now become established in the literature as 'Vila Nova I' really consists of two distinct and successive cultures which can be distinguished on other Portuguese sites". Savory says that no copper artefacts were found in the layer with the *copos*, corresponding to the first occupation of the site. In subsequent reports, PAÇO himself (1964, p. 144) was categorical on the total absence of metal in this layer, considering it "without any metallic mixture". The same situation may not have been true for Zambujal, for in the excavation campaign of 1994, dedicated in part to the exploration of the internal nucleus of the fortification (under the modern farmhouse), a structure of a metallurgical nature was identified, associated with a fragment of a *copo* with fluted decoration (KUNST & UERPMANN, 1996); however, the distribution of that type of pottery would have covered practically the entire period of use of the fortification.

According to the stratigraphical data obtained in Leceia (CARDOSO, 1989, 1994, 1997) it can be concluded that metallurgic activity, very often vital in diverse sites of Lower Estremadura, would definitely have been introduced only in an advanced phase of the Chalcolithic.

In Vila Nova de S. Pedro, an accumulation of close to 13.5 kilograms of limonithic mineral with encrustations of as yet unprocessed malachite (PAÇO & JALHAY, 1945) was discovered. In Zambujal, foundry areas were excavated, made up of hearths grouped in a circle around a flat surface of fired clay, with high edges still showing hundreds of drippings of copper (SCHUBART & SANGMEISTER, 1987).

Other Estremaduran sites bear abundant witness to such an activity, including drippings and scum, these being especially found in Leceia. Here, in special parts of the dwelling area, inhabitants would have produced a variety of tools, principally small ones such as puncturing needles, cutters and punches. The preference given to these artefacts must have been due to the scarcity of the then precious metal, making it unsuitable for the manufacture of heavy items, while at the same time small implements would have served specific functions more efficiently than their stone equivalents.

Some ingots, resembling small, shapeless sticks of copper, were collected in Leceia (Fig. 2); one of them was the subject of a metallographic study (CARDOSO & FERNANDES, 1995). Like others, this object had lost some of its original mass by a cold cut aimed at obtaining copper for making small artefacts, preceded by hot hammering in a forge. This conclusion is supported by the fact that the part which has thicker scum is only at one end of the object. These ingots document the existence of a copper trade, certainly coming from the Alentejo, since no copper sources in Estremadura were sufficient

to satisfy the needs of the chalcolithic sites there, a fact already mentioned by others with reference to Zambujal (SCHUBART & SANGMEISTER, 1987).

## 2. SOURCES OF RAW MATERIALS

A few kilometres in a straight line from Leceia, near Asfamil, Rio de Mouro, various copper mines were mentioned in the past (BOLÉO, 1973). We do not know, however, the characteristics of the minerals or the importance of the mines, if indeed they really existed, so that it would be preferable, until proven otherwise, to assume that copper arrived by the trans-regional trade mentioned above.

The existence of organised commerce, then, is easily admissible with the Lower Alentejo band of metallic polysulphides, extending from Cercal to the Huelva area, where copper could have been found in its natural state, either in the zone of superficial oxidation of philonian bodies or in the 'iron hats'. Even though the possibility of exploitation of zones of secondary enrichment of the 'iron hats' has been denied by ROTHENBERG & BLANCO-FREIJEIRO (1981), the truth may have been different. BENSÁUDE (1899, p. 123) stated that "appreciable quantities of native copper are still found even today, after a long period of exploitation, such as, for example, in the ancient mines of Aljustrel, and the former (Portuguese) Geological Survey Commission has samples of native copper from Aljustrel, Alandroal, Silves and especially from the region of Barrancos". These facts lead us to rethink the meaning of so-called chalcolithic arsenic copper as opposed to the almost pure copper from which the majority of artefacts of that epoch were made. DOMERGUE (1990, p. 106) admits that the nearly all-pure artefacts could have resulted from the mining of native copper, whereas those of arsenic copper would have originated from the reduction of copper carbonates. FERREIRA (1970, p. 100) had earlier admitted such a hypothesis, declaring that "the copper of the instruments where the arsenic percentage is high is extracted from carbonates, oxides or even sulfurs", suggesting, in the case of Vila Nova de S. Pedro, that the mineral came from the region of Óbidos, Estremadura, as PAÇO (1955) had already concluded.

It is obvious that the pure copper of these pieces could not have competed in hardness and resistance with any axe made of amphibolite, much less expensive to obtain.

In fact, the big copper 'axes' – of which no complete example was collected in Leceia – would possibly have been prestigious pieces, of limited practical use, or perhaps simple metal ingots (Fig. 3), as previously suggested for the chalcolithic sites of Porto Mourão (SOARES *et al.*, 1994) and Perdígões (VALERA, *in* LAGO *et al.*, 1998, p. 138), both belonging to the Southwest group.

Thus it is valid to admit the essentially non-functional nature of such pieces, perhaps reserved for special uses apart from serving as ingots, and, reinforcing earlier considerations, to view them as genuinely prestigious objects. It is interesting to note in Leceia two blades from cut axes (CARDOSO, 1989, fig. 108, 13; CARDOSO, 1994, Fig. 136), to which we can add other pieces from Zambujal (SANGMEISTER, 1995, Tf. 6), as well as from the Southwest group – Monte da Tumba (SILVA & SOARES, 1987, fig. 4). What is the significance of such pieces? We believe that they may be considered as intentionally extracted portions of axe-bricks (Fig. 3), destined for later processing. If the purpose had been sharpening edges dulled with use – a situation not observed in either of the two pieces from Leceia – then this objective would have been easily achieved by a new hammering (knowing that this operation also leads to an additional hardening of the metal), without the need to destroy the blade

itself. In the act of producing the cut, however, as one of the two examples shows, enough copper could be obtained for the making of small, specialised artefacts of evident functional purpose.

### 3. ECONOMIC AND SOCIAL INDICATIONS

The use of copper can be seen, in this way, as simply one more step in the Revolution of Secondary Products (RSP), tending towards improved efficiency of determined instruments of production or processing, and leading to increase and diversification of goods consumed, mainly food products. In this context, we do not believe that its role as an agent of socio-economic change should be emphasised. Much less can it be offered as proof of the social differentiation of its users. In truth, apart from use on special occasions, the copper axes, punches, cutters and saws, obviously utilitarian items, can never be considered as 'objects of prestige'.

In fact the importance of copper, even in copper-bearing regions such as the lower Guadiana basin, should not be overestimated. There, waterways and agricultural soils, rather than mineral resources, structured Chalcolithic settlement (SOARES, 1992, fig. 1 & 2; SOARES & SILVA, 1992). Only in the eastern Upper Algarve has the search for copper been considered a factor in the choice of sites (GONÇALVES, 1989/1991). The late introduction of copper in Estremadura, in the mid-Chalcolithic, simply accompanies other new technologies typical of RSP in the middle of the third millennium: spinning (spindle weights were practically unknown in layer 3 of Leceia, from the early Chalcolithic) or the processing of milk products (cheese presses were similarly lacking). Bearing in mind that neither the excavation methods nor the archaeological analysis was sufficiently accurate, it is interesting to observe what PAÇO (1964, p. 146) stated, with reference to Vila Nova de S. Pedro: "Economic conditions, changing with the advent of copper, now show indications of spinning and weaving and the manufacture of dairy products". This is in full agreement with the findings in Leceia.

### 4. SOUTHERN ORIGINS OF COPPER METALLURGY

The movement of *tholoi* builders – identified with groups of copper prospectors and metal workers – was in the 1950s linked to the diffusion of the use of the metal, from Andalusia over to Portuguese Estremadura, passing through the Lower Alentejo (FERREIRA & VIANA, 1956; VIANA, ANDRADE & FERREIRA, 1961). The recent datings of the Chalcolithic sites of the Southwest Group – Cerro de Castelo de Santa Justa, Alcouthim and Monte de Tumba, Alcácer do Sal – all seem to confirm such a proposal, considering that copper was used earlier in that region than in Estremadura (SOARES & CABRAL, 1993). In the Southwest, as in Estremadura, according to JORGE (1994, p. 476), "it is impossible to connect [the use of copper] systematically with the fortifications known there".

In fact, copper (both native and in the form of composites from which the metal could be obtained) was scarce or non-existent in Estremadura, apart from the already mentioned occurrences, inadequately described but certainly poor and limited. It is therefore particularly important to undertake systematic, non-destructive analyses by X-ray

Flourescence (XRF) and Fast Neutron Activation Analysis (FNAA), using rapid cyclotron neutrons, a technique not yet available in Portugal or Spain. This entails a rigorous quantitative process which does not harm the pieces, and it has been used systematically in the analysis of the metallic material unearthed in Leceia (CARDOSO & GUERRA, 1998). We have carried out systematic XRF analyses of nearly 130 artefacts gathered from the site up till the present – one of the largest prehistoric metallic sets with homogeneous chronological-cultural characteristics originating from one single site in the Peninsula – as well as conducting FNAA analyses on some 22 pieces from that set. Some general conclusions were reached:

- Native copper is invariably the original raw material. The analyses in fact revealed characteristics compatible with almost pure coppers.
- Nothing suggests the existence of alloys.
- Arsenic varies between 0.15% and approx. 5% (FNAA analyses). This distribution indicates the accidental nature of the presence of arsenic (Fig. 4), related to the composition of the minerals used and not to any deliberate addition. This conclusion is in complete agreement with the earlier opinion of FERREIRA (1961, 1970).
- Secondary superficial enrichment by arsenic, as well as by iron, can be seen when comparing the FNAA results of the non-altered interior of the pieces with the XRF results of the surfaces.

The use of malachite as a copper mineral is proven in the Chalcolithic in the south-east of the Peninsula: the chalcolithic site of El Malagón (Granada), where all the phases of copper manufacture are documented, is located precisely above a malachite mining area (ARRIBAS *et al.*, 1989, p. 72). Nevertheless, the above demonstration that native copper with variable arsenic percentages formed the main source of the raw material in Leceia reinforces the hypothesis that mining could have been carried out in the 'iron hat' zone of the deposits of metallic polyssulphides in the pyrite band belt (Fig. 5), besides quartz filons mineralised with native copper. In this way the various copper bricks from Leceia, mentioned above, can be explained.

According to ROTHENBERG & BLANCO-FREIJEIRO (1981, p. 174), "a reduced fusion of minerals was carried out close to the mines, the metal being transported to the fortified sites where it would be processed into artefacts". The occurrences of Chalcolithic copper bricks recorded up to now: Leceia (CARDOSO & FERNANDES, 1995; CARDOSO, 1997, p. 92); Santa Justa (GONÇALVES, 1989-91, 228, No. 7); Perdigões (VALERA, in LAGO *et al.*, 1998, p. 138) and Porto Mourão (SOARES *et al.*, 1994) – not counting that of Penha Verde (FERREIRA, 1970, p. 103), which does not correspond to a brick, and even less to the Chalcolithic – can easily be connected with the copper deposits in the area surrounding these chalcolithic sites. Their discovery serves, then, to illustrate the trade in copper in the form of bricks from the area of mining, where they would be made, to the settlements where they would be processed into diverse artefacts, relying heavily on the technique of hammering. This is particularly true to those settlements situated far away from the copper mining areas, like Leceia.

## 5. THE TRADE IN AMPHIBOLITES AND OTHER RAW MATERIALS IN THE CHALCOLITHIC IN ESTREMADURA

This transregional trade in strategic raw materials is also illustrated, even more vividly than by copper, by the finds of amphibolites in the fortified sites of Estremadura, where this mineral does not occur. It is still too early to discuss here the mechanisms whereby this material arrived: was it traded to merchants at the source of production, or did prospective buyers themselves travel here, or was it traded through a vast chain of intermediaries, forming part of a business?

In Leceia amphibolites make up nearly 70% of the total of hard rocks used (CARDOSO & CARVALHOSA, 1995). The characteristics of hardness and resistance of these rocks justified their massive importation in the form of stone ingots – some examples gathered in Leceia with little or no processing illustrate this. They came mainly from the Upper Alentejo, where this rock occurs in several places, and the trade presupposes supply routes that were stable and long-lasting.

Copper and alentejan amphibolites would then be exchanged for silex obtained in numerous small estremaduran mining areas such as Barotas (CARDOSO & COSTA, 1992) and Monte do Castelo (CARDOSO & NORTON, 1998), around Leceia. Its presence is generously documented in the Upper Alentejo at several sites (Late Neolithic and Chalcolithic necropoli and fortifications), along with untouched blocks, documenting trade in ready-finished artefacts or in the unprocessed raw material. We cannot however rule out other possible sources of silex, such as Spanish Extremadura and Andalucia.

The possibility that some of the amphibolites, however small a quantity, might have come from the Beiras, using the important communication route of the River Tagus, should not be completely rejected (SENNA-MARTINEZ, 1994; CARDOSO, CANINAS & HENRIQUES, 1996). This trade could explain the occurrence of artefacts made of whitened silex, plentiful in Estremadura, as well as influences observed in pottery decoration (indented decoration on vases) in the Final Neolithic sites in the south of the Lower Beira region (CARDOSO *et al.*, 1996). We are dealing, in fact, with a process of product exchange, very similar to that described between Estremadura and the Alentejo. Also, in Castro de Santiago in the valley of the Upper Mondego, the presence of “prepared amphibolite blocks” (VALERA, 1994, p. 157) for the manufacture of axes and scrapers was documented. They certainly resulted from mining in the region, with an equivalent in the Upper Alentejo sites.

In Leceia, only about 30% of the hard rocks are of regional origin, and they include a wide variety of petrographic types (igneous, metamorphic and sedimentary), all available in the region of Sintra – Mafra – Loures, 30 kilometres or less in a straight line from Leceia. Observations carried out allow us to conclude that rocks like basalts, dolerites, gabbros, sienites and andesites – frequent in the earliest occupation of the site – become scarce in the course of the Chalcolithic, but that amphibolites are increasingly preferred, due to their superior mechanical characteristics (CARDOSO & CARVALHOSA, 1995). Such observations indicate an evident specialisation in the making of polished stone artefacts, which can be interpreted as one more index of the ‘revolution of secondary products’.

Economic abundance, resulting from an accumulation of agricultural surpluses, must have enabled these chalcolithic communities of Lower Estremadura to establish, maintain and strengthen transregional trade. This would have led to the storage of strategic raw materials – in this case amphibolites – on which depended activities vital to the survival of the community (making of axes, hoes, scrapers, hammers and cutters). Due to the great

distances involved, over 100 kilometres, this is one of the most important and interesting examples of specialised trade in and storage of a particular raw material in the whole of the prehistory of the Peninsula, or even of Europe.

The non-amphibolitic hard rocks also document the existence of an important though more limited trade, ensuring the supply of products essential for daily life, such as grains of minerals used in degreasing ceramic pastes. In fact, a preliminary analysis of a large number of ceramic fragments from Leceia showed a predominance of grains of quartz and feldspars, and also of mica, minerals incompatible with the geology of the site. These materials could only have been obtained in the region of Sintra, given the granitic nature of the dominant rocks there, and they were deliberately added to the local clays in order to make them resistant to heat. It is noteworthy here that mineralogical analyses carried out on a set of chalcolithic pottery fragments from various estremaduran sites (BLANCE, 1959) led to the identification of other rocks only found in this region, namely lithoclasts of granite and sienite. We can conclude that the characteristics of these minerals caused them to be traded throughout the Lower Estremadura region, a trade which continued into the Bronze Age, judging from minerals found in ceramics from the Sesimbra area (CARDOSO & CUNHA, 1995).

Other materials whose presence in Leceia can be explained as objects of regional trade are the several blocks of siliceous sandstone – in some cases weighing several dozen kilograms – used for the making of grindstones for hand-mills. Again, this is a type of rock unavailable in the immediate locality, but found only 5 kilometres to the north, around Cacém and Belas, or to the West between Cascais and Sintra.

Exotic raw materials, used in the manufacture of special objects, also occur in sites in Lower Estremadura, in the Early as well as the Middle Chalcolithic. This is the case with fibrolite, a rocky aggregate made up of fibrous silimanite, under high metamorphic conditions of pressure and temperature. These masses are unknown in Portuguese territory, at least in sufficient quantities for manufacturing axes and hoes (FERREIRA, 1953). Products virtually unobtainable in Portugal were also used in decorative or prestigious artefacts. A case in point are green mineral beads, especially those belonging to the group of variscite, far too rare in Portugal for making the large number of beads found here. Indeed, recorded occurrences consist only of thin veins in metasedimentary Silurian rocks in the north of the country (MEIRELES, FERREIRA & REIS, 1987). Fluorite is another rare mineral (occurring however in granitic pegmatites in the centre and north), represented in Leceia by a sizeable tubular bead. Another example is ivory, used for hair pins and cylindrical idols; there are examples of both in Leceia. Ivory, obviously of North African origin, has perhaps been the raw material most frequently used to illustrate long distance trade in raw materials during the Chalcolithic in the Peninsula.

Such products, then, bear witness to the economic power of these communities, open to the establishment of short, medium and long distance trade and favoured by their ideal location, dominating the main traffic routes which penetrated the interior of the country along the valleys. For JORGE (1994, p. 475), compared with other areas she studied, “in the variety of raw materials exchanged, Estremadura holds first place” in the Chalcolithic.

Even materials that were plentiful in Lower Estremadura, and at the site of Leceia itself, such as silex, would, rather paradoxically, have come from the Alentejo, even though in small quantities. This explains the occurrence of arrow points of jaspoid slate that could have arrived along with the trade in amphibolites, and whose presence in Estremadura can be accounted for on aesthetic rather than functional criteria (the coloration of jasper is a possible example). Moreover, such criteria could explain the importation of rose-coloured

silex from the Rio Maior region, close to 100 kilometres to the north, used in the making of arrow points and of oval blades with a bifacial covering retouch, even though grey silex was mined a few hundred metres away in Barotas as in Monte de Castelo. Like the polished amphibolite artefacts, these pieces, demanding delicate retouching and finishing, would have been produced in the settlements from rudimentary outlines imported in an unfinished state, probably in part from the Rio Maior region where several work areas were identified (such as Arneiro and Passal); these were first attributed to the Solutrean (ZILHÃO, 1987) and then to the Neo-Chalcolithic, like others since identified (ZILHÃO, 1994). In Leceia, we can recognise all the stages of manufacture of foliaceous tools, a fact that fits in with the existence of the raw material in the area of the site itself. The nuclei from which the unfinished outlines were obtained, however, have not been found, as is the case in Zambujal (UERPMANN, 1995): there, as in Leceia, nuclei occur only in relation to laminar pieces. These observations lead to one conclusion: that the larger pieces were created from pre-existing bases, while the smaller pieces were totally prepared in the settlements, as the presence of the nuclei indicates.

Reinforcing the commerce in these raw materials, there are occasional examples in the Lower Alentejo of pottery pieces for everyday use of Estremaduran origin. An example of this are the fragments decorated with 'acacia leaf' and 'four-petalled flower' motifs, found in Monte de Tumba (SILVA & SOARES, 1987, fig. 25, 10 & 11), as well as on the site of Cabeço da Velada, Herdade de Vidigal, Montemor-o-Novo, on exhibition in the town's Museum of Archaeology, characteristic of the Estremaduran middle Chalcolithic. Also, some fragments with fluted decoration, similar to and contemporary with the *copos*, were uncovered in Monte da Tumba phase I (SILVA & SOARES, 1987, fig. 25, 5).

Commercial exchange, moreover, materially supported the diffusion in both directions of influences related to a magical-religious superstructure. This is how the regular though small-scale occurrence of slate plates in the most important Estremaduran Chalcolithic sites (Vila Nova de S. Pedro, Zambujal and Leceia) can be explained. Even at relatively minor settlements like Pedrão, the early Chalcolithic site has produced a complete example (SOARES & SILVA, 1975). Such plates must have come from the Alentejo or from the furthest reaches of the Tejo, in view of the discovery of a Chalcolithic workplace for the preparation of slate plates on the hill of Pé-da-Erra, Coruche (GONÇALVES, 1983/1984). Inversely, a small limestone vase with striped decoration, probably of a ritual nature, was found in Monte da Tumba, in the Lower Alentejo, along with several limestone cylinders (SILVA & SOARES, 1987, fig. 28, 1, 3 & 4), illustrating magical-religious concepts common in Estremadura; these could however have arrived from the Algarve, along the valleys of the Sado and the Guadiana, or from Spanish Extremadura.

The importance of forms and decorative motifs as indicators of transregional trade can be seen not only in the examples already described between the south-west and Estremadura, but also in others that provide evidence of a similar trade in both directions on the North – South axis. In the direction North – South, combed Chalcolithic pottery is noteworthy (for a map of its distribution, see VALERA, 1993, fig. 8). These vessels, predominately spherical vases, very frequent along the Portuguese section of the River Douro, occur also to the south, in the upper Mondego valley, even reaching Upper Estremadura (GONÇALVES, 1991, fig. 7), but leaving only vestigial remains in Lower Estremadura (CARDOSO, 1995). On the other hand, numerous influences from Estremadura or even from the south-west, in both form and decoration, can be recognised in Chalcolithic pottery remains from sites in the region of Chaves and Vila Pouca de Aguiar. The most outstanding example, unearthed at the site of S. Lourenço, shows the Chalcolithic Goddess,

with eye and ray features (JORGE, 1986, vol. 2, CVI). Such southern influences go back in time, at least to the final Neolithic; we may recall the small Almerian idol of black pith coal, uncovered in the dolmen of Corgas de Matança, Fornos de Algodres (CRUZ *et al.*, 1988/1989, IV, 3).

## 6. THE ESTREMADURAN CHALCOLITHIC IN THE CONTEXT OF THE SOUTH OF THE PENINSULA

If we can see mutual transregional influences between the Chalcolithic cultural areas of the Upper and Lower Alentejo, or between Estremadura and the central and northern interior of the country, we are able to detect a similar exchange between much more remote areas. We have referred to the ever-present Chalcolithic female divinity, of obvious Mediterranean roots, but we cannot use her presence in Lower Estremadura as evidence for the actual arrival of foreign populations. In a world of profound social change, partly resulting from its openness to outside influences, the diffusion of habits and customs and the concepts that accompany them would not only be possible but inevitable. Sporadically, artefacts are found that give us an idea of the diffusion of such magical-symbolic concepts within the Peninsula from the final Neolithic onwards. The most impressive example is two remarkably similar decorated slate plates, one found in Chelas and the other in Huelva (ZBYSZEWSKI, 1957), which, if not made by the same person, at least copied a common model. They might have originated in the Alentejo, not only considering the discovery there of a third plate in a dolmen near São Marcos, Évora (GONÇALVES, 1992, fig. 27), but mainly since we know that was the nuclear zone of these ideo-artefacts. Another example can be seen in the geographical distribution of the 'Almerian idol' from its region of origin as far as northern Portugal, with several well-known examples from Alentejan megaliths to Estremaduran burial sites.

Nevertheless, objects imported in the real sense, which could lend support to the idea of the presence of a foreign population, have not been found up to the present (SILVA, 1990). Anyway, it would be dangerous to overstress this issue: on the one hand the presence of a single artefact in these conditions could demolish the argument for absence, but on the other hand, even if such were to be found it would not be proof in itself of the direct presence of foreign elements among a population, since such an artefact could have arrived through a long chain of trade, using several intermediaries. This is how we may interpret, for example, a recent discovery of Chalcolithic pottery from Anatolia (of the early Bronze Age II, *c.* 2600-2200 BC) in Andalucía, in "a context characteristic of the south-eastern Copper of the Millares El-Malagón type, associated with beaker bell pottery" (GONZÁLEZ PRATS *et al.*, 1995).

Nevertheless, such faraway Mediterranean stimuli are admissible, even if they are indirect. In addition to the representation of the Goddess, the very nature of the substance chosen seems in most cases expressive of such influences. In fact, these are pieces of sacaroid limestone, a rock common in Lower Estremadura. Dealing with artefacts of great symbolic value, it would be reasonable to have expected the choice of a more 'noble' raw material. We must conclude, on the contrary, that what would count in such pieces would be the meaning given to them rather than the material used or its cost. We can refer again, for example, to the case of the slate plates.

Finally, aspects of form should not be ignored. There are cases of unique pieces, like the 'idol-weight' from the cave of Correio-Mor (CARDOSO *et al.*, 1995b), or that of the

green mineral amulet bead from the *tholos* of Tituaria (CARDOSO *et al.*, 1987) in which it would not be difficult to visualise an influence, however indirect, from the coastal region of Anatolia or from the Aegean, comparing their formal similarity with Trojan examples. But the hypothesis of simple convergence is also possible: we are stepping on the ever slippery terrain of strictly formal parallels.

A diffusion of ideas and concepts, facilitated or encouraged by trading contacts, by means as yet little known: this is the model that we consider adequate at present to explain these strikingly exotic artefacts, present since the very beginning of the Chalcolithic. This being so, we defend the hypothesis that such contacts enabled the arrival, not only of new technologies, such as copper metallurgy, but also of new magical-religious concepts, adopted by diverse populations of the southern Peninsula from the late Neolithic onwards (RAMOS MILLAN, 1981). In Leceia, starting with the late Neolithic, some prototypes, later to become widespread, have been recognised. Examples are the two 'idol-bottles' and a cylindrical idol, all of terracotta and found in Layer 4 (CARDOSO, 1989, fig. 110, 2), which may be considered as preludes to direct chalcolithic limestone examples, also found there.

The general Mediterranean type of environment prevailing throughout the Chalcolithic in Lower Estremadura, reinforced by its geographical position, would have favoured identical internal evolution and phenomena of convergence in diverse regions. This would not have been incompatible with the diffusion of ideas and concepts evidenced throughout the Mediterranean during the third millennium. In addition, the importance of the commercial component in the diffusion of metallurgy and of symbolic or prestigious objects has to be emphasised (PARREIRA, 1990, p. 29).

In conclusion, the outstanding economic position of Estremadura throughout the Chalcolithic, besides being shown in population density, is reinforced by the existence of numerous and diverse ideo-technical artefacts that testify to a complex network of economic and cultural relations, extending far beyond the locality or region.

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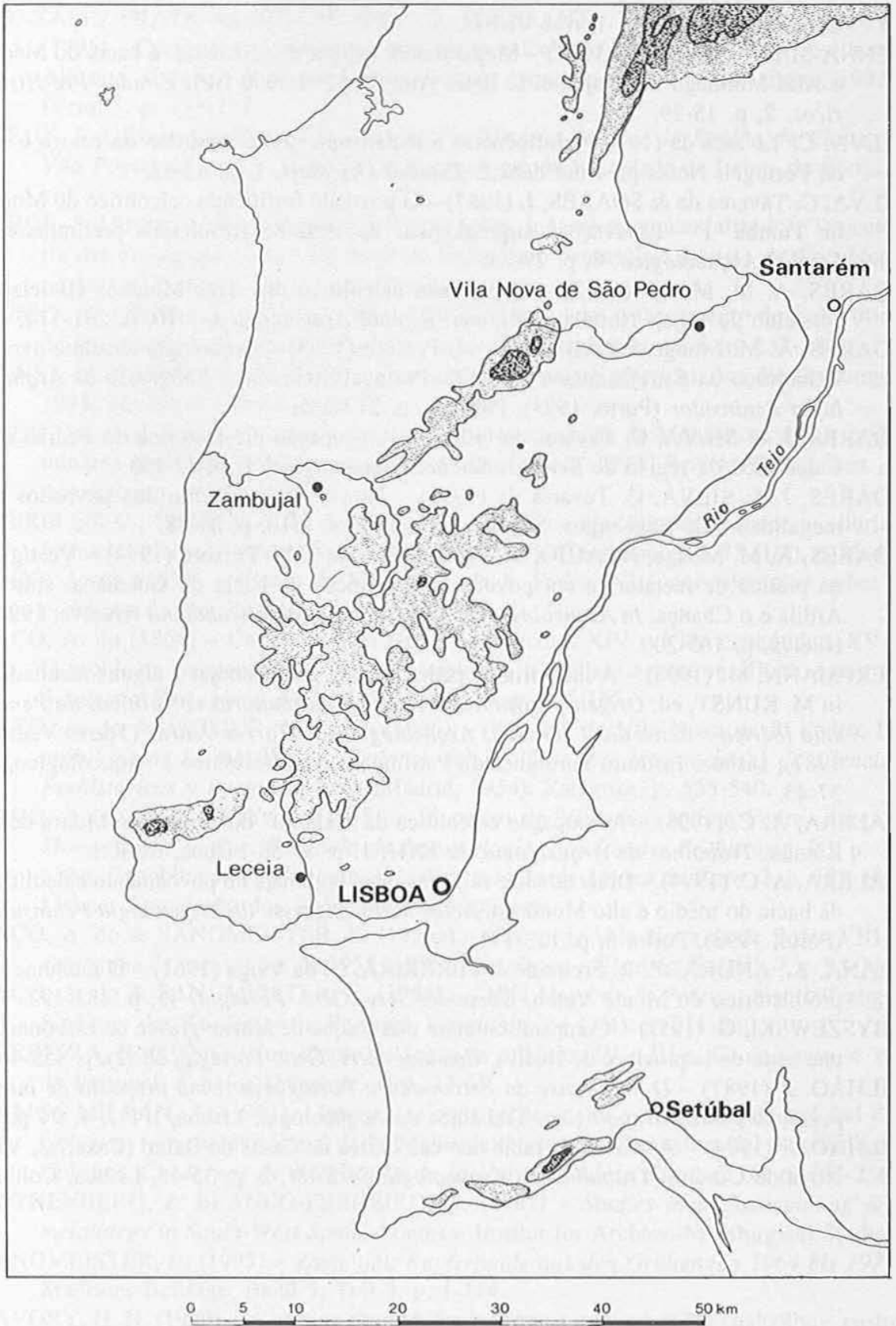
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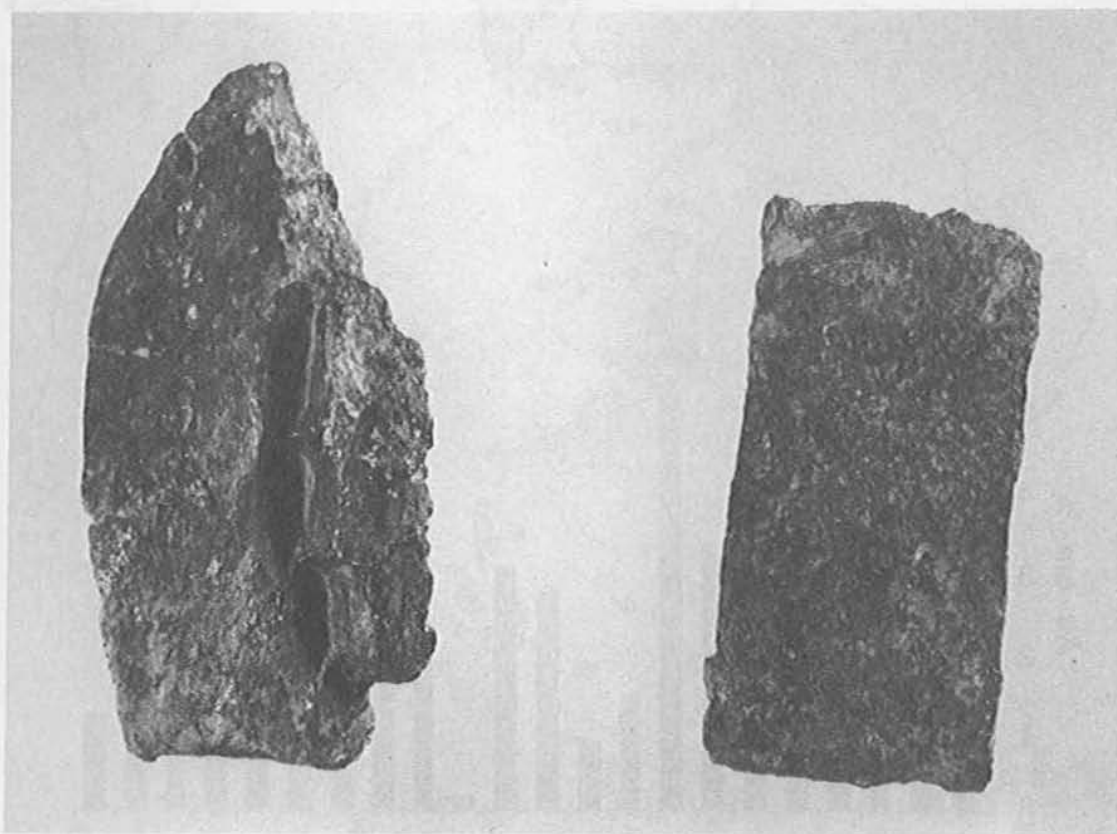
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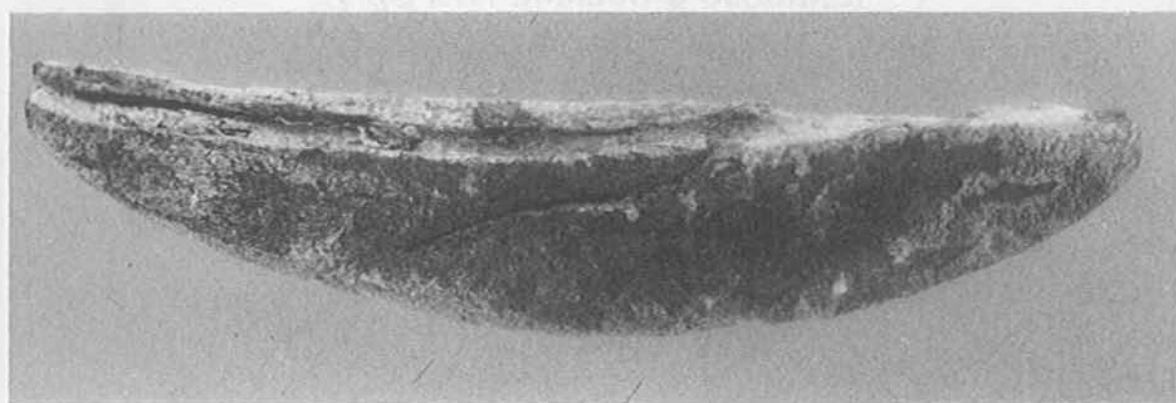
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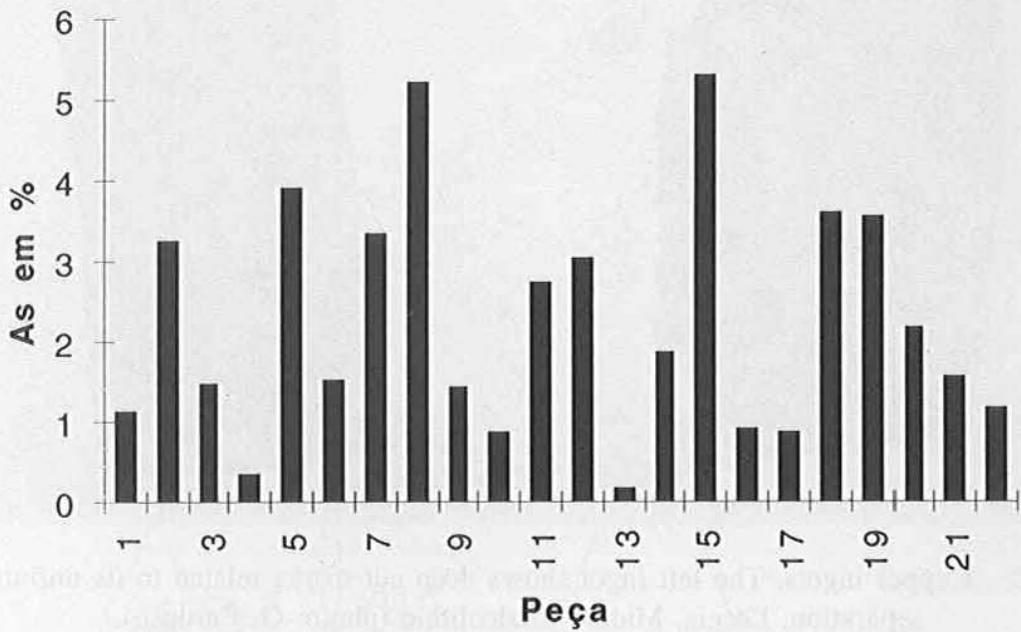
**Fig. 1** – Location of the three most important chalcolithic settlements of Estremadura/ Lower Tagus region (in KUNST, 1996, Fig. 3, adapted).



**Fig. 2** – Copper ingots. The left ingot shows deep cut marks related to its unfinished separation. Leceia, Middle Chalcolithic (photo: G. Cardoso).



**Fig. 3** – Distal extremity (blade) of a large copper axe intentionally sawed. Length: 90 mm. Leceia, Middle Chalcolithic (photo: G. Cardoso).



**Fig. 4** – Variation on the amount of arsenium in copper artefacts from Leceia determined by FNA (Fast Neutron Activation Analysis) (CARDOSO & GUERRA, 1998, Fig. 9).

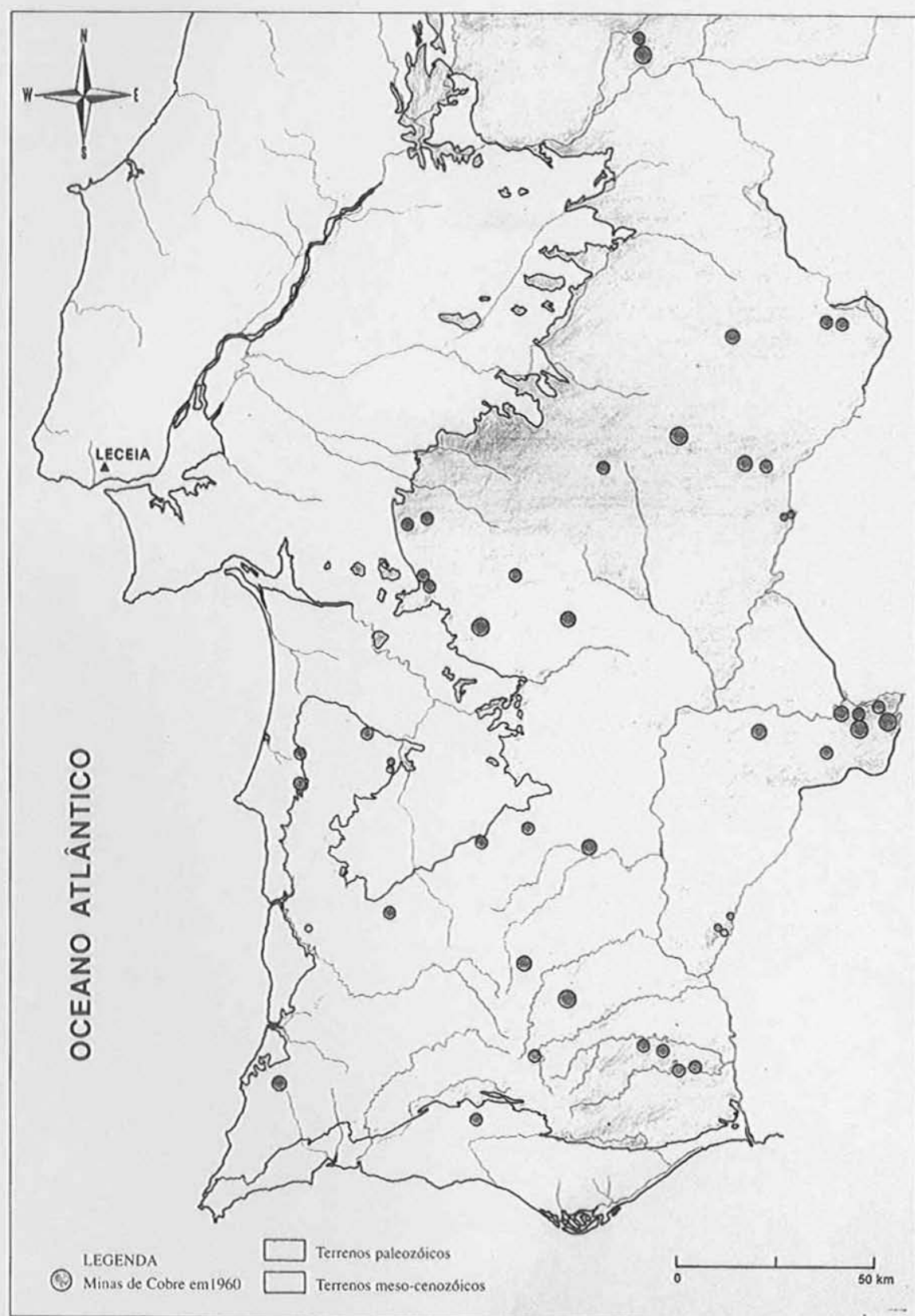


Fig. 5 – Copper mines of South Portugal registered in 1960 (Geological Survey, map of mine exploitations – originally 1/500 000 – Lisbon 1960).