Foraging Assemblages

Volume 1

Edited by Dušan Borić,
Dragana Antonović, and Bojana Mihailović

Columbia University
The Italian Academy
for Advanced Studies in America

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Front Cover Illustration: Sculpted sandstone boulder named ‘*Chronos*’ (inv. no. 5) from Lepenski Vir (National Museum in Belgrade)
Back Cover Illustration: Lepenski Vir during excavations (Photograph courtesy of Alan McPherron)

VOLUME I

45. The Late Mesolithic of the south-western coast of Portugal: The lithic industry of Vale Marim I in focus

Joaquina Soares, Niccolò Mazzucco, and Carlos Tavares da Silva

In this paper, we present a synthesis of the technological and functional patterns (micro-wear analysis) of the chert knapped industry from the Late Mesolithic site of Vale Marim I. The site is located directly on the cliff of the Atlantic shore, close to the harbour of Sines. The results of the lithic assemblage study are discussed in the wider context of the Late Mesolithic of the south-western coast of Portugal in order to shed light on the subsistence marine adaptations and on the complex hunter-gatherer social organization during the period immediately preceding the appearance of the food-producing economy and domestic mode of production.

Keywords: Late Mesolithic, Portuguese south-western coast, lithic industry, micro-wear analysis, marine adaptations

The regional context

Settlement pattern of the Late Mesolithic on the south-western coast of Portugal

On the south-western coast of Portugal one finds evidence of hunter-gatherer societies (Soares 1995, 1996; Soares and Tavares da Silva 2004; Soares *et al.* 2005–2007) characterized by broad-spectrum subsistence strategies and a logistical mobility pattern (*sensu* Binford 1980) around the mid-seventh to the mid-sixth millennium cal BC (*c.* 6500 to 5500 cal BC). Their settlement system was constituted of base camps and small, seasonal multi-layered sites (Fig. 45.1).

1. Large base camps, such as Vale Marim I, Samouqueira I, and Fiais, probably occupied all year round. Samouqueira I and Vale Marim I are located on the Atlantic shore, perched on cliffs of schists from the Carboniferous basement and overhanging the ocean, but during the transition to the Middle Holocene (Fig. 45.1) they faced a large coastal plain approximately a kilometre wide, now submerged by the Flandrian transgression (Dias *et al.* 1997; Vanney and Mougenot 1981). Fiais is located about 10 km away from the modern coastline, on a stream bank tributary of the Mira River, in the innermost fluvial sector of the Mira Basin, probably with tidal influence.

The acidity of sediments has not allowed the preservation of organic remains at Vale Marim I (except for charcoal and teeth of *Sparus aurata*), but at the contemporaneous sites of Samouqueira I and Fiais, fauna assemblages were preserved. Both sites contained land mammals, fish, and shellfish remains. At Samouqueira I, mammals were represented by *Cervus elaphus*, *Sus scrofa*, *Bos primigenius*, *Lepus capensis*, *Vulpes vulpes*, and *Canis lupus familiaris* (?). Based on their weight, terrestrial mammal remains constitute about 8.7 percent, fish remains 1.3 percent, and shellfish 90 percent of the sample (Soares 1996). The marine invertebrate fauna in the sample was constituted mainly by mussels (*Mytillus* sp.) at 40 percent, followed by whelks (*Thais haemastoma*) at 28 percent, limpets (*Patella* sp.) at 26 percent, and cockles (*Cerastoderma edule*) at 4 percent, with a residual presence of small marine gastropods, *Paracentrotus lividus* and *Pollicipes cornucopia* (Soares 1996, Table 3).

The faunal record of Fiais included the same marine molluscs species present at Samouqueira I and also oyster shells, more adapted to estuarine environment. There were also fish bones and a very dense bone dump with several thousand terrestrial mammal specimens: red deer (*Cervus elaphus*) at 70 percent, wild boar (*Sus scrofa ferus*) at 14 percent, roe deer (*Capreolus capreolus*) at 10 percent, and auroch (*Bos primigenius*) at 6 percent (González Morales and Arnaud 1990; Rowley-Conwy 2015). These faunal assemblages highlight the practice of hunting (that might have occurred mainly in autumn and winter, from October to March), fishing, and shellfish harvesting, practiced probably in summer and springtime.

2. Small and seasonal multi-layered sites, such as Montes de Baixo (Tavares da Silva and Soares 1997) and Castelejo (Soares and Tavares da Silva 2003, 2004), with shell middens of mass captures of shellfish (no remains of mammals, fish, or birds). In those temporary campsites, task groups returned recurrently to exploit resources possibly brought back to the base camp for consumption and/or storage. At Armação Nova (Algarve), an embedded strategy of shellfish gathering and flint exploitation of the Lower

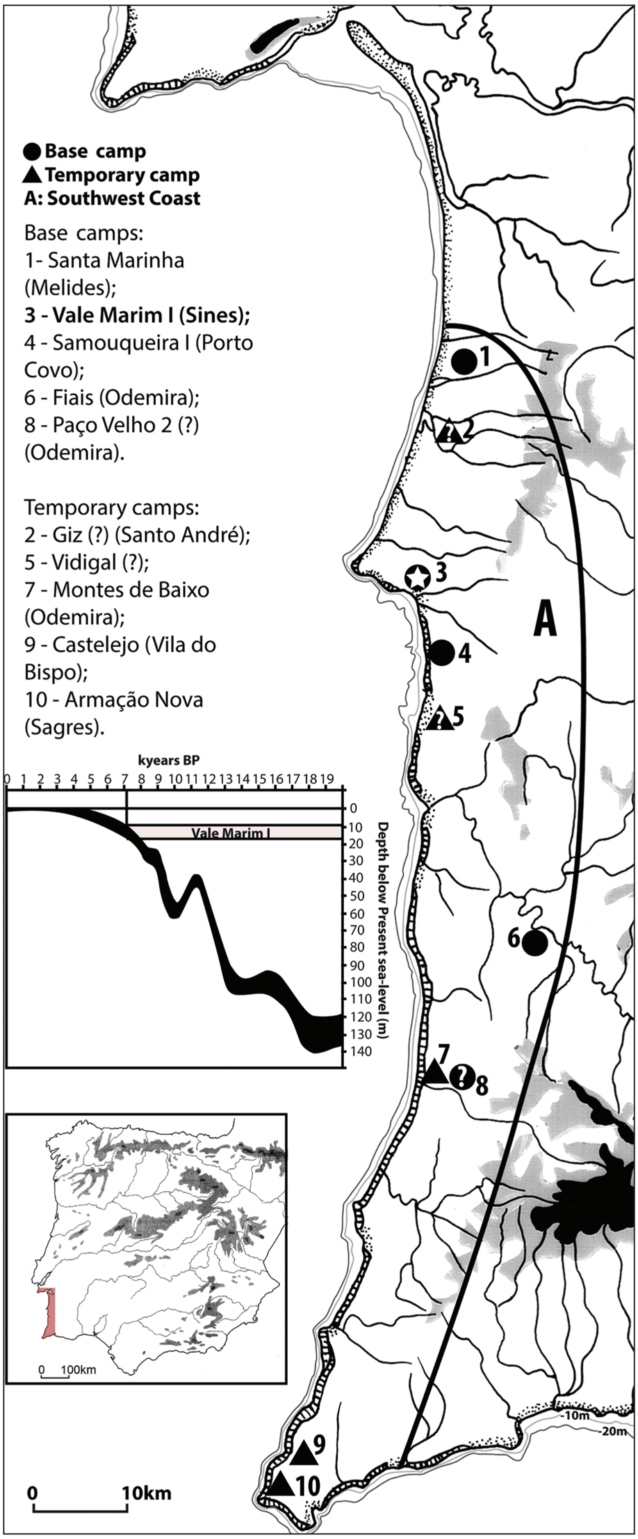

Fig. 45.1. Distribution of the main Late Mesolithic sites along the south-western coast of Portugal and probable sea levels during the Mesolithic occupation of Vale Marim I, inferred from the curve of sea level fluctuations proposed for the Portuguese continental shelf over the past 18,000 years after Dias *et al.* (1997).

Jurassic limestones from the Cabo de São Vicente outcrop has been recognized (Soares *et al.* 2005–2007; Ribeiro and Terrinha 2005–2007, 2007).

The Mesolithic broad-spectrum economy created a stable and reliable subsistence strategy based on a large diversity of food resources, big and small, high-ranked and low-ranked prey items (Soares 2013, Fig. 4), and further enlarged by logistical exploitation of the territory. Besides, increasing sedentarization and associated demographic increase might have created problems for a stability of the economic system. Late Mesolithic hunter-gatherers could further intensify their economic base by means of storage, which might have been applied to smoked and salted fish and to other low-risk storable foods, such as acorns of *Quercus ilex* and pine nuts of *Pinus pinea,* available in autumn and winter (October–January). Thus, Late Mesolithic costal groups reorganized their foraging tactics and technology in association with a supposed increasing reliance on stored foods. They were beginning to think of the advantages of the delayed return of human labour (Testart 1982).

Lithic industry

The lithic assemblage composition and characteristics differ notably depending on the site type and its function within the settlement system:

1. The temporary campsites, with a narrow range of exploited resources, display low artefact densities and expediently organized lithic assemblages constituted by cobble tools and flakes from non-siliceous raw materials available locally.

2. In the base camps, where a broader range of activities were carried out in accordance with a more complex subsistence strategy (*i.e.* hunting + fishing + shellfish-gathering + storage), more 'curated' procedures of raw material procurement and lithic artefacts have been documented.

Along the Alentejo littoral the main mineral resources being exploited were poor quality cherts from the acid siliceous-volcanic complex of Cercal. The lithic technology corresponds to a laminar knapping method (mostly *Montbani* style) directed towards the manufacture of geometric microlithic tools (mainly trapezes and occasionally triangles) by the microburin technique.

South-western coast as a diverse marine ecosystem: Fishing in the Late Mesolithic

There is a dominant rocky seabed that generates a greater diversity of habitats than the sandy substrates. The Mira Estuary provides shelter and feeding conditions for spawning and first stages of growth of juveniles of many species. Some watercourses, like Ribeiras de Melides, Azinhal, Seixe, and Aljezur would have small active estuaries in the Mesolithic (Freitas 2012; Freitas *et al.* 2003)

TAXA	Nº FISH REMAINS	
	N	**%**
Chondrichthyes class	**139**	**55.6**
Chondrichthyes indeterminate	41	16.4
Lamnidae family	**2**	**0.8**
Atlantic porbeagle (*Lamna nasus)*	1	0.4
Mackerel porbeagle (*Isurus oxyrinchus)*	1	0.4
Triakidae family	**94**	**37.6**
Dogfish (*Galeorhimus galeus*)	62	24.8
Indeterminate triakidae	32	12.8
Sphyrnidae family	**2**	**0.8**
Hammer shark (*Sphyrna zygaena*)	2	0.8
Osteichthyes class	**111**	**44.4**
Muraenidae family	**22**	**8.8**
Moray (*Muraena helena*)	22	8.8
Moronidae family	**1**	**0.4**
Sea bass (*Dicentrarchus labrax*)	1	0.4
Serranidae family	**3**	**1.2**
Blacktip grouper (*Epinephelus fasciatus*)	2	0.8
Indeterminate serranidae	1	0.4
Sciaenidae family	**3**	**1.2**
Meagre (*Argyrosomus regius*)	3	1.2
Sparidae family	**75**	**30.0**
Indeterminate sparidae	19	7.6
Snapper (*Pagrus* spp.)	18	7.2
Gilt-head bream (*Sparus aurata*)	23	9.2
Others species	15	6.0
Mugilidae family	**1**	**0.4**
Thick-lipped grey mullet (*Chelon labrosus*)	1	0.4
Scombridae family	**4**	**1.6**
Mackerel (*Scomber scombrus*)	4	1.6
Soleidae family	**1**	**0.4**
Sole (*Solea sp.)*	1	0.4
Pleuronectidae family	**1**	**0.4**
Flounder *(Platichthys flesus)*	1	0.4
Total	**250**	**100**

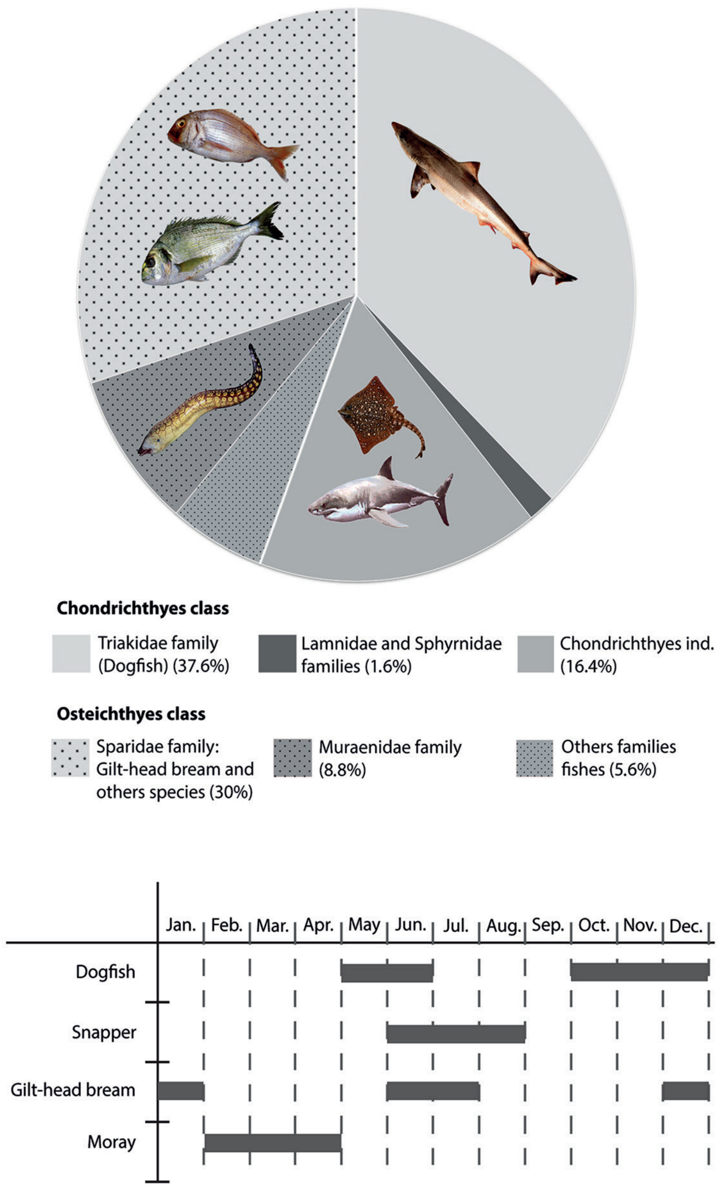

Fig. 45.2. Ichthyological fauna from the Late Mesolithic site of Samouqueira I (Sines). Taxonomic classification after Sónia Marques-Gabriel (2015).

that contributed positively to biodiversity and biological productivity of this littoral. Atmospheric circulation in summer provides the upwelling of cold and nutrient-rich waters along the coast.

The diversity and year-round availability of fish on the south-western coast (Fig. 45.2), complemented by shellfish, was a key factor in the subsistence diversification against the declining foraging returns of higher-ranked resources, mainly red deer (Davis and Detry 2013), and it required complex technologies and composite tools to reduce costs and increase capture rates. To evaluate fishing (Marques-Gabriel 2015) in the subsistence of the Late Mesolithic coastal groups (Fig. 45.2), it is useful to observe the ichthyological taxa from layer 3 of Samouqueira I, located in the same ecological setting of Vale Marim I at the distance of 10 km (Fig. 45.1). The layer is dated by ICEN-729 on marine shells to 7520±60 BP and calibrated to 6181–5906 cal BC at 95 percent confidence using the marine calibration curve 09 ΔR=0 (Soares and Tavares da Silva 2004, Table 3).

The site of Vale Marim I

Ecological setting and chronology

Vale Marim I is a large open-air site (about 1 ha) in the Sines Municipality, located on the southern slope of the igneous hill of Chãos, facing S. Torpes Bay (Tavares da Silva and Soares 1981). Today, the site is overlooking the ocean, but in the early phase of the Middle Holocene, it was located about 1 km away from the coast (Fig. 45.1). The site has several residential units, and the excavated area (260 square metres) corresponds to one of them. The sandy cultural layer, due to its high acidity, did not preserve organic materials, with the exception of charcoal and gilthead molar teeth, which highlights the importance of fishing, as already indicated.

The anthracological analysis by Paula Queiroz and José Mateus (unpublished report) revealed the existence of littoral pinewoods (*Pinus pinea*) in the archaeological site's surroundings. *Pinus pinea* is the overwhelmingly predominant species, well adapted to warm and dry atmospheric conditions of the Mediterranean climate, confirmed by the presence of *Olea* sp. In more exposed and windy areas (Westerlies), there was *Pinus pinaster*. *Pinus sylvestris* was abundant in the region during the cooler Tardiglacial climatic conditions but then became very residual.

The archaeological layer has been dated by three radiocarbon measurements on charcoal samples (Beta-417016, 7180±30 BP; Beta-373853, 7170±40 BP; Beta-417015, 7020±30 BP), which together cover a calibrated timespan of 6075–5840 cal BC at 95 percent confidence.

Lithic industry

A random sample of 1321 artefacts has been analyzed from a total assemblage of 8900 flaked lithics, 7614 of which are from the curated technological subsystem on chert raw materials. The analyzed sample is quite representative of the variability of the curated technological sub-system. Lithics were widely distributed across the entire excavated area (Sectors F8, F9, G8, G9, G10, H9). The production of lithic artefacts was concentrated close to some hearths where cores and schist chisels were found. Lithic blanks were produced on site by reducing small, non-local chert cores. All operational phases of the production sequence are represented. Despite this, the overall low cortical/non-cortical ratio indicates an emphasis on the later stages of core-reduction and tool-production at the site. This raw material originated from nodular sources mostly from S. Luis Hill (acid siliceous-volcanic complex formation of Cercal) about 30 km from the site (Oliveira 1984).

Chert cores are mostly bladelet cores. They are in general single-platformed with a prismatic (conical) shape, reduced to a single-face. The platform type is cortical, non-faceted or finely faceted. Debitage products are mostly bladelets (average width: 7–9 mm; average thickness: 2–3 mm). Standardization in the process of tool blank production, which included decreasing the variation in bladelet size/shape and increasing investment in core preparation, could be used as a means of reducing tool production and maintenance costs. From a typometric point of view, no differences have been noted between unused and used bladelets. Despite this, from a technological point of view, it is clear that the most regular blanks, the parallel-sided bladelets with a straight profile (mostly trapezoidal, but also with triangular cross-sections) were preferentially used for trapeze production, while cutting tools were often made on bladelets with more concave profiles, often cortical ones and/or those with less regular edges. Flakes revealed some differences between unused (average width: 11.4–16.4 mm; average thickness: 3.4–5.9 mm) and used blanks (average width: 14.8–22.2 mm; average thickness: 5–8.2 mm). Flake blanks were mainly used for scraping activities employing edges with obtuse angles, such as naturally steep edges, fractures, and ridges. Edge-retouching is always minimal. All but two of the geometrics were made on bladelet blanks. Vale Marim I, like other Late Mesolithic base camps produced a geometric-based tool assemblage, dominated by trapezes, using microburin technique (Soares 1995; Vierra 1992). In some cases, asymmetrical trapezes have a shape similar to a *trapèze de Vielle* (Barrière *et al.* 1969). Another common asymmetrical trapeze type has a concave small truncation while the long one is quite straight. There is also a trapeze type with a small base slightly retouched, which seems to mark the transition to the segment shape, the type that becomes dominant in the Early Neolithic.

The use-wear analysis has been carried out employing a stereoscopic microscope (from 5x to 40x) for the analysis of the edge-scarring patterns, and a reflected-light microscope (from 50x to 400x) for the analysis of the micro-features (Mazzucco *et al.* 2015). In the selected sample, 132 used (or active) zones were detected, leaving a high percentage of unused blanks. Even if in some cases the scarce development of the traces could have prevented their recognition through microscopic observation, in general terms, items classified as 'unused tools' should be considered effectively unused. Indeed, we often underestimate our actual capabilities of use-wear trace detection. At Vale Marim I, most of the detected micro-traces were scarcely developed and only clearly recognizable as human-use induced wears at 400x. This means that lithics were rarely used, if the overall number of flaked blanks is considered, but also that they were briefly used, for short working tasks. One possible explanation for this behaviour is that flaking activities mainly took place during intervals of downtime in anticipation of specific peak periods of resource exploitation, eventually following a *replacement prior to failure* tactic (Kuhn 1989) that seems well-adapted to a foraging strategy directed toward specific target species; however, this tactic would result in an overproduction of potentially utilizable blanks in respect to the real needs of the group.

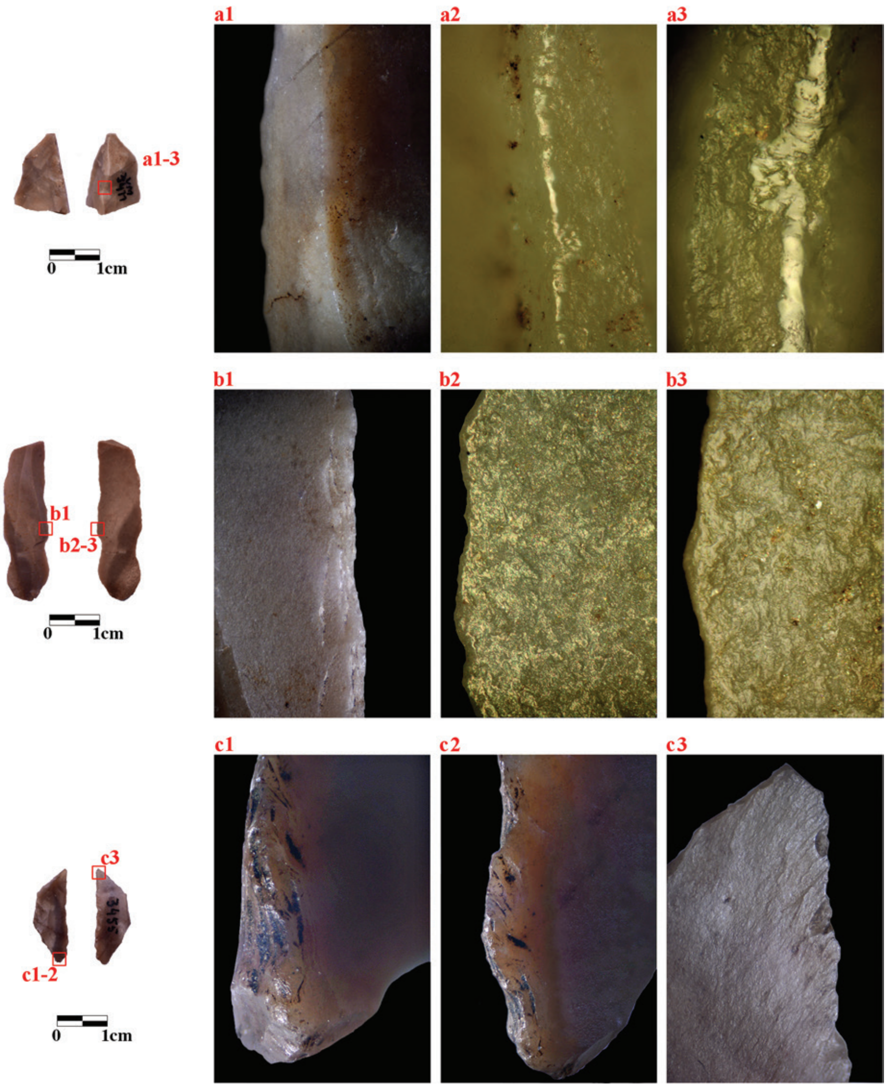

Fig. 45.3. **Selection of use-wear from the Vale Marim I lithic assemblage. 3a: flake used for scraping bone/antler materials; a1 – used ridge at 10x, note the absence of macro-scarring; a2 – bone bevel at 200x; a3 – bone bevel at 400x. Note the presence of scratches and pits on the polish. 3b: blade used for cutting soft animal substances, probably fish; b1 – used edge at 10x, showing overlapping fractures; b2 – polish at 200x, note the irregular distribution of the polish, which penetrates into the tool's surface; b3 – polish at 400x, note the greasy appearance, with a pronounced edge-rounding. 3c: geometric tools showing edge-rounding and scarring on one tip; c1–2: bifacial overlapping fractures, with a strong edge-rounding, 10x; c3: opposite tip, much less rounded and damaged, 10x.**

Among used tools, there are traces of functional management on hard materials (n=33): wood (n=13, 9.8 percent), bone (n=9, 6.8 percent), and hard indeterminate (n=11, 8.3 percent). The blanks used are mainly flakes (n=20, 15.2 percent) and bladelets (n=13, 9.8 percent). As stated above, use-wear traces are always little developed, suggesting very short tasks, eventually related to the maintenance and re-sharpening of bone/wood tools. Natural fractures and ridges are commonly used for those tasks, providing very high edge angles for working resistant materials (Fig. 45.3a).

The working of animal and indeterminate soft materials was also recognized mostly on bladelets (n=46, 34.8 percent), and on a portion of the flakes (n=12, 14.4 percent). Observed traces indicate the processing of animal carcasses, while the association of macro edge-rounding and scarring with 'greasy' micro-polish of irregular distribution and longitudinal striations (Fig. 45.3b) resemble experimental traces produced by fish processing (García and Clemente 2011).

Traces of foraging activities are present on geometric projectiles, with two different types of use-wear: 'canonical' bending/step and burin-like impact fractures, which were probably related to hunting and were observed in 19 cases; and edge and point rounding and scarring, probably due to the use of projectiles as harpoons for fishing, observed on 14 geometric artefacts (Fig. 45.3c). Moreover, several geometric tools (n=16) not showing any wear were recovered, with fresh, undamaged edges and points, confirming that the observed edge-rounding and scarring on the other tools was not due to taphonomic factors, but to human-related uses. More detailed experiments focused on projectile tool functionality are needed to explore the hypothesis of the use of geometric points for harpoon manufacturing, but it could be envisaged that faced with a lack of more appropriate raw materials, hunters might have used lithics to manufacture fishing gear.

Discussion

The use-wear associated with the working of soft animal materials is dominant (41.1 percent), highlighting the importance of animal substance processing (for storage?). Traces of bone- and wood-working are found in low frequencies. Projectile tools played an important role (25 percent), corresponding to intense foraging activities, apparently balanced between hunting and fishing. Yet, the scarcity of hide-working activities is not compatible with an emphasis on hunting, and this finding also corresponds to the use-wear data obtained from other Late Mesolithic assemblages (Perales 2015; Philibert 2002). To the contrary, fishing might have been the main economic activity, which is also supported by the fact that the scarce faunal remains preserved at the site were fish teeth (*Sparus aurata*), even though mammal bones are much more resistant to taphonomic agents and soil acidity.

Another question concerning the interpretation of this site is about its seasonality. Could it be a summer fishing camp? Or a base camp occupied year-round? Once again, the limited size of the preserved charcoal assemblage limits our interpretation. However, the gathering of pine wood and even pinecones of *Pinus pinea* (for the collection of pine nuts?) might suggest the occupation of the site not only during summer, but also during the fall season.

Conclusion

Combining the zooarchaeological information from Samouqueira I with the results of lithic use-wear analysis of Vale Marim I, it is likely that on the Alentejo coast the first communities of true fishermen developed at the end of the seventh and during the first half of the sixth millennium cal BC. The increasing subsistence dependency on intense fishing might have been a key factor for the evident territorial and semi-sedentary behaviour of the Late Mesolithic groups, facilitating the earliest assimilation of Neolithic innovations on the south-western coast compared to the rest of the Portuguese territory (Soares 1997). This hypothesis requires and inspires more research to further explore Late Mesolithic technological and subsistence systems.

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Foraging Assemblages is the publication of the proceedings of the Ninth International Conference on the Mesolithic in Europe, held in Belgrade in September 2015. The two volumes of these proceedings gather 121 contributions on Mesolithic research in Europe, covering almost every corner of the continent. The book presents a cross-section of recent Mesolithic research, with geographic foci ranging from the Mediterranean to Scandinavia, and from Ireland to Russia and Georgia. The papers in the volumes cover diverse topics and are grouped into 11 thematic sections, each with an introduction written by prominent Mesolithic experts. The reader will learn about changes in forager lifeways and the colonization of new territories at the end of the Ice Age and the beginning of the Holocene warming; the use of diverse landscapes and resources; climatic instabilities that influenced patterns of settlement and subsistence; the organization of settlements and dwelling spaces; the formation of regional identities expressed through various aspects of material culture and technologies of artefact production, use, and discard; aspects of social relations and mobility; symbolic, ritual, and mortuary practices; diverse ways in which Mesolithic communities of Europe were transformed into or superseded by Neolithic ways of being; and how we have researched, represented, and discussed the Mesolithic.

Volume 1

- Transitions – Beginnings
- Colonization
- Landscapes
- Settlement
- Regional Identities

Volume 2

- People in Their Environment
- Technology
- Social Relations, Communication, Mobility
- Rites and Symbols
- Transitions – Endings
- Representing and Narrating the Mesolithic

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