The Mesolithic–Neolithic transition in the Trieste Karst (north-eastern Italy) as seen from the excavations at the Edera Cave

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Abstract

This paper is a preliminary report of excavations carried out between 1990 and 2000 at Edera Cave in the Trieste Karst. The cave is 3km from the present coast. It was first occupied during the Boreal period by Mesolithic (Sauveterrian) hunter-gatherers. The remains of this occupation comprise pits and hearths, abundant faunal remains, and typical chipped stone and bone tools, many of which were recovered *in situ* on an almost intact palaeosurface (layer 3c). A hearth in layer 3a above belongs to the Late Mesolithic Castelnovian culture, and has yielded a few potsherds of non-local production, as well as bones of domesticated animals. Layer 2a consists of several superimposed charcoal lenses attributed to the local Early Neolithic Vlaška group on the basis of characteristic vessel shapes and a series of four radiocarbon ages that date this horizon to *c*. 6500 BP (5450 cal BC). Although the cave continued to be used sporadically until the Migration Period, this paper is concerned mainly with the problem of the relationship between the last hunter-gatherers and the first food producers who used the cave during the mid-seventh millennium BP. So far, layer 3a of Edera Cave is the only evidence from this part of the Adriatic of interaction between the last Castelnovian bands and the first Neolithic farmers.

Key words: Edera Cave, Italy, Trieste Karst, Mesolithic, Neolithic, transition

The excavations carried out in the caves of the Trieste Karst during the last forty years have produced particularly interesting evidence of both Mesolithic and Early Neolithic occupation. Nevertheless, all the sequences so far excavated are very incomplete, mainly as regards the beginning of the Atlantic, Mesolithic Castelnovian. This period is currently known only from the Cavernetta della Trincea in the Rosandra Valley (Andreolotti & Stradi 1963), from the upper layers of the Grotta della Tartaruga (Cremonesi 1984) and from the Benussi Cave (Broglio 1971). At Benussi Cave, the Castelnovian levels have been dated between 7050±60 BP (R-1043) and 7620±150 BP (R-1044). Other sites, such as the Grotta dei Ciclami and the Grotta Azzurra di Samatorza (Ciccone 1992), yielded Mesolithic sequences that are abruptly interrupted between the end of the Boreal and the beginning of the Atlantic, according to the flint assemblages (Cremonesi *et al*. 1984*a*, 1984*b*; Montagnari Kokelj 1993).

The Trieste Karst is a limestone ellipsoid whose Italian territory, after the Second World War, has been reduced to some 850km^2. The Karst upland that rises gradually from the north west to the south east, is a hilly landscape the highest peak of which is Mt Concusso at 672m above sea level. The coast that borders it to the south west is characterized by high cliffs that drop vertically into the Gulf of Trieste. The cliffline is interrupted by two alluvial plains, those of Grignano and Trieste (Biagi & Voytek 1994).

Edera Cave

The cave opens at the bottom of a doline close to the Aurisina marble quarries (Fig. 1), some 15km north west of Trieste and 3km from the present coastline. The opening, which faces north east, is at 230m above sea level (Fig. 2). Local amateurs discovered the cave in 1969 and carried out preliminary excavations between 1969 and 1975. These revealed the importance of the archaeological sequence, which extends from the beginning of the Mesolithic to the Medieval period (Marzolini 1970; Boschian & Pitti 1984).

The excavations were resumed in 1992 by the Department of Historical–Archaeological and Oriental Sciences of the University of Venice (I) and by the Archaeological Research Facility of the University of California, Berkeley (USA) and will continue until at least 2001. The new research revealed a stratigraphic sequence some 4m thick with occupation layers attributed to the Migration and Roman periods, the Bronze and Copper Ages, the Middle and Early Neolithic, as well as the Sauveterrian and Castelnovian Mesolithic. Even though the sequence is discontinuous, it is the most detailed so far discovered in the upper Adriatic region (Figs 3 & 4).

In order to retrieve as complete and accurate a record as possible, we adopted wet-sieving, using a 2mm mesh screen, as part of our recovery technique. As a result, we have had exceptional success in collecting archaeological evidence, including specimens of small dimensions such as bioar-

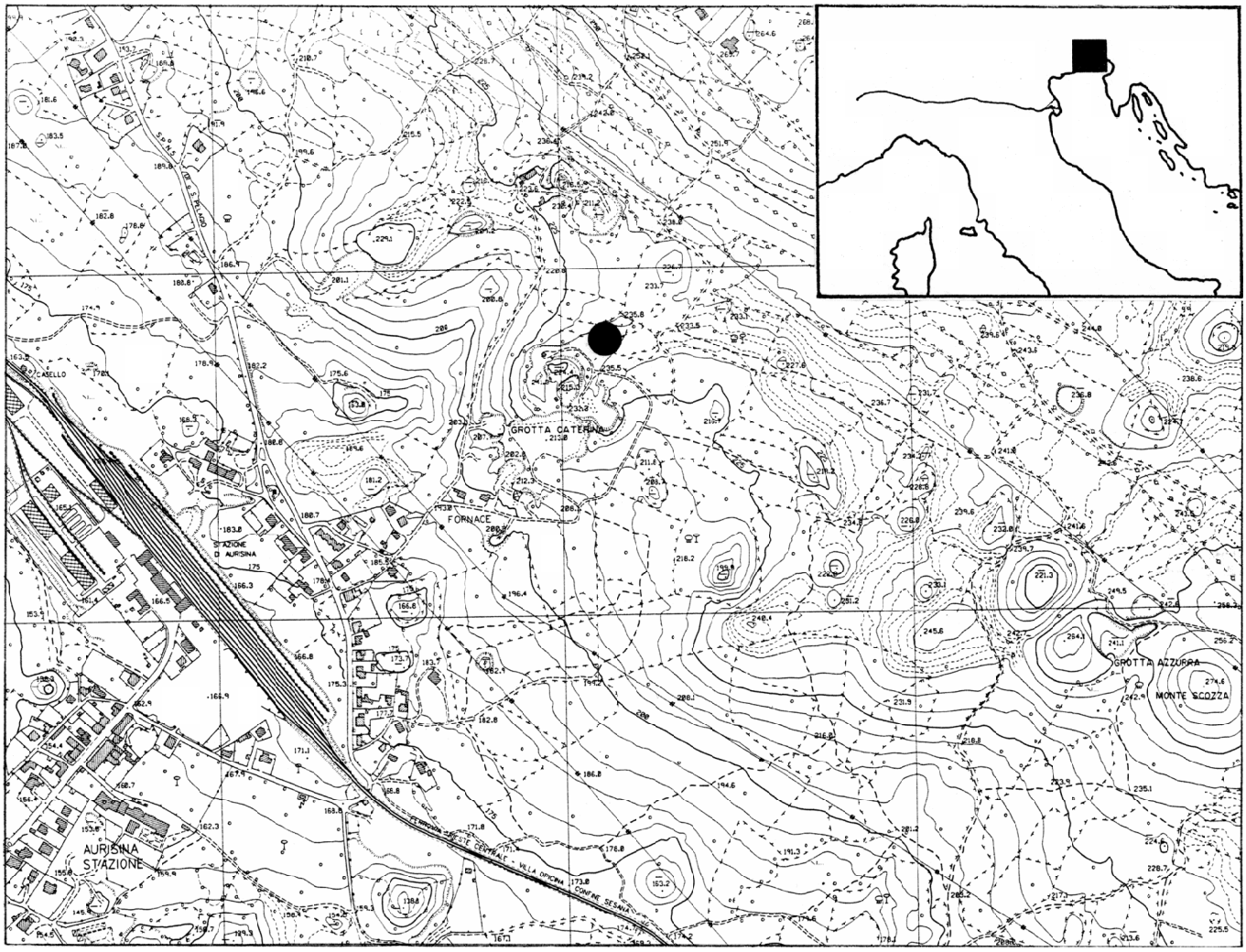

Figure 1 Location of the Edera Cave, north east of the Fornaci di Aurisina, in the Trieste Karst.

chaeological remains (*i.e.* microfauna, fish bones, charred seeds, and land snails) and artefacts (*i.e.* Mesolithic stone tools, débitage and shatter). Edera is the first archaeological project in the Trieste Karst to be conducted with complete wet-sieving of all excavated soil. It will allow us to evaluate the degree of excavation technique bias in comparison with the previous research during which only dry sieving was employed. The excavation was carried out following the natural stratigraphic layers, which are designated by numbers and letters. Each layer has been further subdivided into horizontal unit levels ('spits') of 10cm thick, in order to be able to better appreciate the variability of human activity within each layer.

The earliest deposits excavated so far belong to the Early Neolithic and the Mesolithic. The Early Neolithic of the Trieste Karst is characterized by the Vlaška group, which has always been considered a local, impoverished variant of the Danilo culture. Layer 2a can be attributed to this phase. It is a silty layer, some 0.90m thick, with evidence of six superimposed ash and charcoal lenses. Three of these have been radiocarbon dated. In stratigraphic order, from the lowermost upwards, they produced the following results: 6615±390 BP (GX-19568) and 6590±100 BP (GrN-23129) from the same charcoal sample, 6445±210 BP (GX-19567) and 6305±285 BP (GX-19022) (Fig. 6).

Although the results of palaeopedological and soil thin section analyses are still in progress, the variations in texture and nature of the sediment are easily observed from layer 3 downwards. The deposit assigned to layer 2 is essentially a fine-grained grey-buff silt, while the deposit of layer 3 is a compact reddish clay. Layer 3 is *c.* 20cm thick, within which we uncovered a quantity of very small potsherds as well as a few very small flint flakes obtained from local raw material (rounded river pebbles).

A hearth about one metre in diameter was discovered in layer 3a (Fig. 5A), associated with a typical, though very small, Late Mesolithic, Castelnovian flint assemblage chipped from local pebbles. The assemblage comprises 538 artefacts among which are 2 trapezes, 1 denticulated bladelet, 2 truncations, 1 short end-scraper, 1 core fragment, and 61 microburins (Fig. 8: 1–5). A total of 17 potsherds, most of which are very small, come from this layer 3a. Two of the potsherds are diagnostic pieces that can be reconstructed. Thin-section analyses of the latter indicated that they had

Figure 2 Aerial view of the doline where the Edera Cave is located (the entrance of the cave is visible in the upper part of the picture, below the white roof of the protection gate). The picture was taken before the spontaneous reforestation of the Karst caused by the progressive abandonment of land management for agricultural purposes (photograph by G. Marzolini).

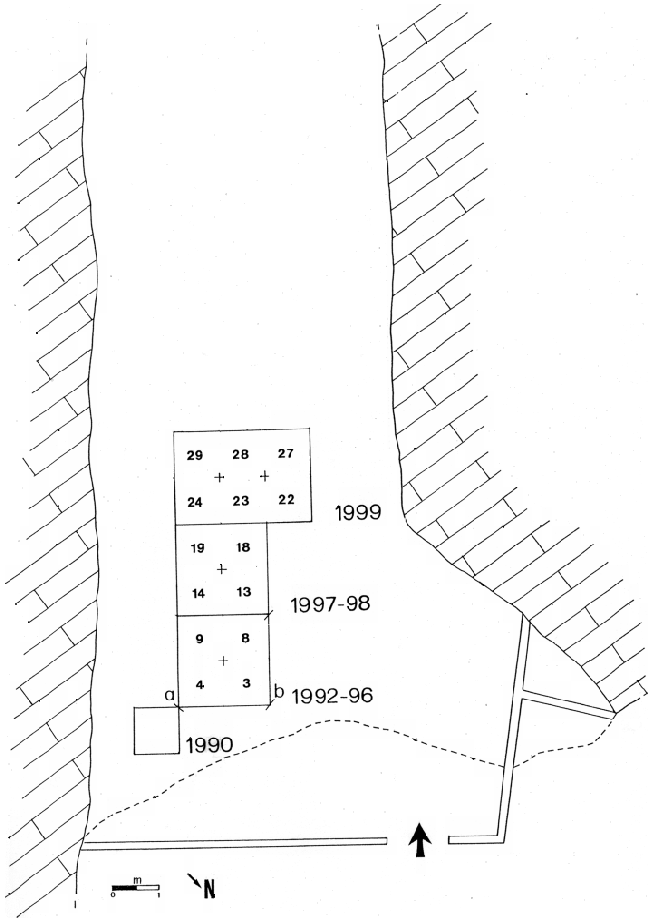

Figure 3 Plan of the cave with the position of the excavation grid, the principal profiles (a–b, b–c) and the squares excavated in each campaign. The dashed line represents the limit of the modern drip line (drawn by E. Starnini).

been manufactured of clay with different mineral inclusions from those detected in the potsherds of layer 2a above, suggesting that they had been imported from outside the karstic area (Spataro 1998: 72). A charcoal sample from this hearth has been ^{14}C dated to 6700±130 BP (GX-19569), which is very similar to the age of the lowermost Vlaška group charcoal lens of the overlying layer 2a.

Layer 3b has three radiocarbon dates, two on charcoal (GrN-25137: 8060±70 BP and GrN-25138: 8110±90 BP) and one on an animal long bone fragment (GrA-14106: 8045±40 BP). On the basis of both the ^{14}C ages and the flint assemblage this layer may be attributed to the very beginning of the Atlantic/end of the Boreal period. Only a small percentage of the flint assemblage from layer 3b has been studied so far.

Layer 3c is an almost intact palaeosurface with *in situ* lenses of ash and charcoal as well as faunal remains, flint artefacts, and a single human tooth. Four square metres of this palaeosurface have been investigated (Fig. 5B). Two radiocarbon dates of 8350±120 BP (GrN-25139) on a charcoal sample and 8250±50 BP (GrA-11818) on a charred hazelnut shell indicate that this feature belongs to the Boreal period.

Layer 3d below seems to mark the beginning of the Holocene sequence of the cave. Radiocarbon ages of 9930±50 BP (GrA-14108) and 9810±70 BP (GrN-23130) from pine charcoal date this layer to the Pre-Boreal period (Fig. 6).

The Material Culture Assemblages

The finds from layer 2a are clearly attributable to the Vlaška group, whose appearance in the Trieste Karst is dated *c*. 6500 BP (5500 cal BC). Similar dates are known for the earliest sites of the Danilo culture along the Dalmatian coast (Müller 1994) as well as for the Early Neolithic of the Friuli Plain (Improta & Pessina 1999) west of the Trieste Karst. For example, at Sammardenchia di Pozzuolo in Friuli, Danilo culture materials have been recovered in the shape of vase fragments, a rhyton and a clay phallus (Pessina *et al*. 1999).

The archaeological material from layer 2a comprises typical Vlaška potsherds including large pedestalled vessels with restricted mouth and incised linear patterns below the rim, open black burnished bowls, fragments of a characteristic four-footed rhyton, and a small pipe-spoon (Biagi *et al*. 1993: 50). The number of potsherds and their weight, cut by cut, is presented in Figure 7, which shows that the state of

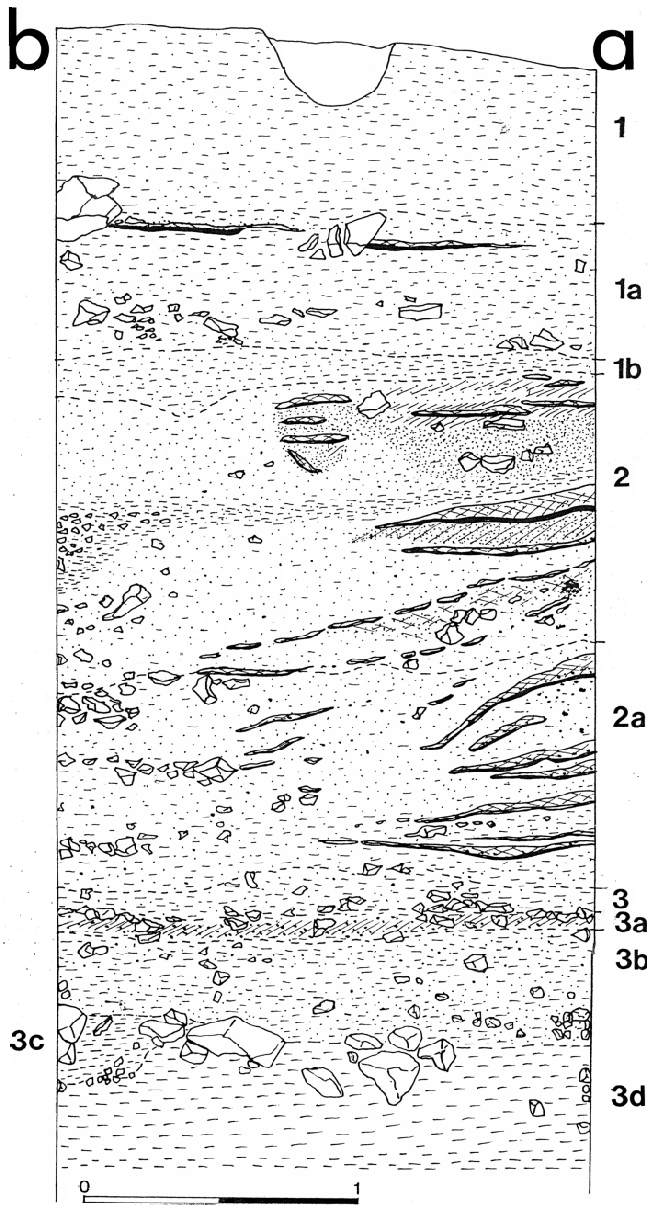

Figure 4 Edera Cave: section a–b through the deposits in the northern sector with the indication of the radiocarbon dates (drawn by N. Ilic, V. Muncan and P. Biagi).

fragmentation and the quantity of ceramic sherds vary throughout the entire Vlaška sequence. Given the small quantity of pottery and its very fragmented state, it is at present impossible to recognize any variation in the pottery assemblage through the *c*. 300 radiocarbon years that this part of the Neolithic sequence appears to represent. Nevertheless, it should be noted that most of the pottery from this layer, including the rhyton and the pipe-spoon, is most probably of local manufacture. This is demonstrated by thin section and x-ray diffraction analyses of 20 potsherds, which revealed the presence of spathic calcite in the fabric — a characteristic filler used in pottery production in karstic areas (Spataro 2001).

Layer 3a produced a very similar radiocarbon date. It contained a hearth with a typical Late Mesolithic Castelnovian but very specialised lithic assemblage (Fig. 8), a few potsherds (Biagi *et al*. 1993: 50) and bones of both wild and domesticated animals. The faunal assemblage also includes a significant quantity of shells of edible marine molluscs, including topshell (*Monodonta* sp.) and limpet (*Patella* sp.). The lithic industry, which is produced from pebbles of good quality local flint, may indicate that this was an area where a specialized activity of manufacturing trapezoidal arrowheads was undertaken. This is suggested by the very high frequency of microburins and small flake débitage. Of great interest is the presence of three very small perforated beads made of sandstone, a raw material that is unknown in the area. The occurrence of both potsherds of non-local origin and domestic animals, as well as the radiocarbon date of 6700±130 BP, point to a very late phase in the development of the Castelnovian culture. Similar, and sometimes more recent, dates are known from some of the Impressed Ware culture open-air settlements of the Istrian and Dalmatian coasts (Müller 1994, 2000).

The lithic assemblages from layers 3c and 3b show strong similarities both in the tool inventory and in the raw material used. The materials from just a few square metres have been examined so far. From layer 3c comes an assemblage mainly on poor quality material, that is, on bands of black chert found in the local limestone. Cores are mainly tabular, but there are also discoid and pebble cores from which very small flakes had been struck. The most common tools are long, scalene triangles with straight or concave truncation. Smaller, isosceles triangles with three retouched sides are also represented. Other typical tools are the circular and short, rarely nosed, end-scrapers, as well as the long, very narrow bilaterally backed points. The microburin technique is represented by a few specimens. The bone assemblage includes one long, narrow bone point polished all over its surface (Fig. 8).

The flints from layer 3b comprise the same types as described for the palaeosurface of layer 3c, except for the absence of isosceles triangles and the occurrence of a few tools on straight bladelets, namely three trapezes and one truncation. It is important to note that two bone points polished all over their surface come from this layer (Fig. 9).

The length–width–thickness diagrams of the triangles from the two layers based on the finds from six square metres excavated during the 1999 field season, do not suggest any great difference between the two assemblages. In fact the measurements taken from 43 triangles of layer 3b and 52 of layer 3c show an almost identical elongation index, while the triangles of layer 3b are slightly thicker than those from layer 3c (Fig. 10). The blanks from which these armatures had been manufactured consist mainly of fine burin spalls (*i.e*. very thin blades with triangular section that had been struck using a burin technique) and, to a lesser extent, microblades.[1] The average length of the triangular armatures ranges in both cases between 10 and 20mm. Some of the microburins are even smaller. This fact highlights once more the importance of the retrieval methods, above all the wet sieving technique. No artefacts have so far been analyzed from layer 3d.

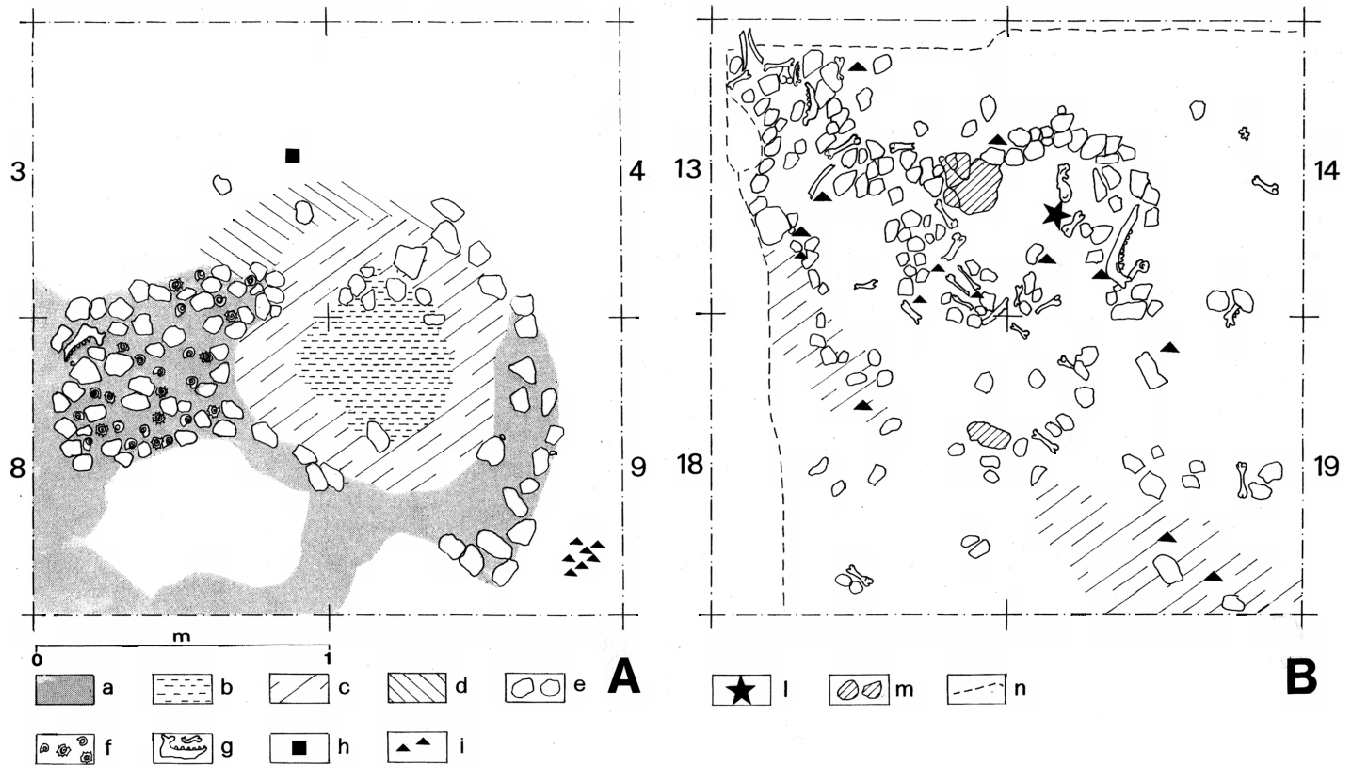

Figure 5 Edera Cave: A. plan of the Castelnovian hearth of layer 3a; B. plan of the Sauveterrian palaeosurface uncovered in the Boreal layer 3c. Key: a – yellowish ash, b – ash and charcoals, c – ash, d – black and yellowish soil, e – rocks, f – marine shells, g – mammalian bones, h – potsherd, i – flints, l – tortoise shell, m – burnt rocks, n – limit of the palaeosurface (drawn by N. Ilic and E. Starnini).

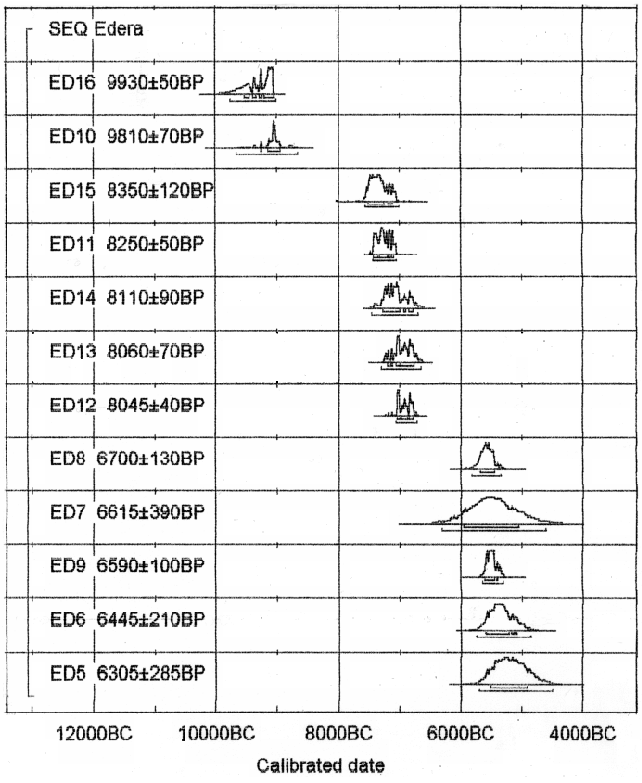

Figure 6 Edera Cave: graph of the radiocarbon dates calibrated using the OxCal (version 2.18) calibration program. The dates plot into three distinct groups: Pre-Boreal (ED16, ED10), Boreal (ED15–ED11) and Early Atlantic (ED9–ED5).

The Archaeobotanical and Archaeozoological Assemblages

The identification of some 700 charcoals from different layers of the cave recently published by Nisbet (2000) helps reconstruct the history of the woodland environment of the Karst plateau during the last 10,000 years. Charcoals are recorded since the Pre-Boreal layer 3d, from which a pine (*Pinus sylvestris/montana*) forest is documented with rare birch (*Betula* sp.). A very different situation is represented in the Sauveterrian layers 3c and 3b, where a pine forest is still dominant accompanied by other species such as oak (*Quercus* sp.) and hazel (*Corylus* sp.). A rapid change seems to have occurred from layer 3 and the subsequent Early Neolithic Vlaška occupation where the main species represented is oak, followed by ash (*Fraxinus ornus*). Of special interest is the first appearance of *Cotinus coggygria*, a shrub that is common in the local vegetation today.

So far, identification of the animal bones has been limited to the Late Mesolithic, Neolithic and Copper Age assemblages (Boschin & Riedel 2000). An exception is the analysis of the amphibian and reptilian remains for which a detailed report is already available (Delfino & Bressi 2000), while the study of the fish bones, which are extremely common from the Sauveterrian levels upwards, is still in progress. The identification of the reptiles has shown the relative importance of the freshwater tortoise (*Emys orbicularis*) which was hunted exclusively during the Mesolithic. The presence of many, sometimes burnt, shell fragments suggests

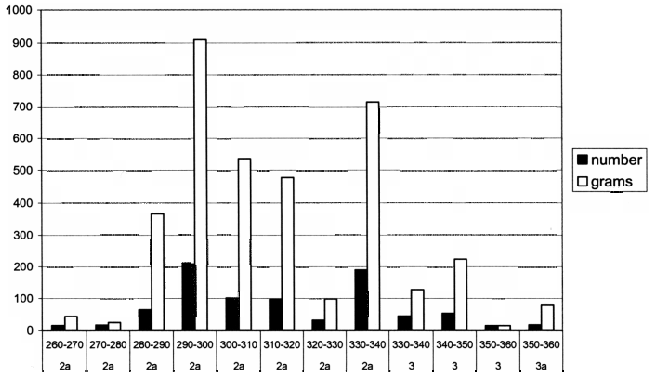

Figure 7 Edera Cave: histograms of the number and weight of the potsherds according to layer and depth.

utilization of this small reptile for dietary purposes. Of great interest are the mammal bones from the late Castelnovian hearth in layer 3a. Here, hunting of red deer, pig and roe deer is attested together with the presence of caprines, cattle and badger. The occurrence of bones of domestic animals in this layer is of great interest, even though represented almost exclusively by caprines (6 individuals).

The marine shells identified so far come from the upper part of the sequence down to layer 3b excavated between 1992 and 1996 in grid squares 3–4 and 8–9. They are particularly concentrated in layer 3a (between 350 and 360cm depth), whilst a smaller amount is recorded in the hearth and in the underlying layer 3b. As regards the land snails, a very high number of specimens per square metre have been recorded between 360 and 390cm depth.

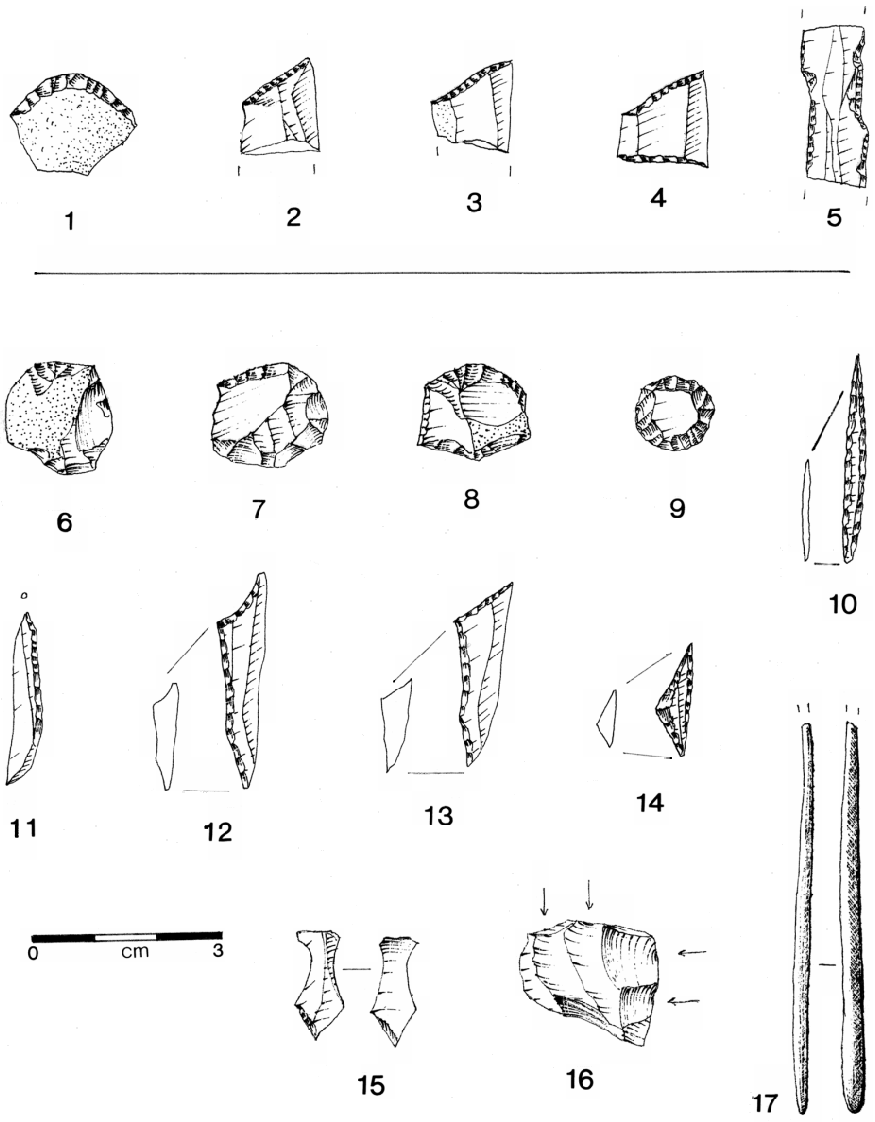

Figure 8 Edera Cave: flint and bone tools from layer 3a (1–5) and layer 3c (6–17). End-scraper (1), truncations (2, 3), trapeze (4), denticulated bladelet (5), end-scrapers (6–9), backed blades (10, 11), scalene triangles (12, 13), isosceles triangle (14), microburin (15), core (16) and bone point (17) (drawn by E. Starnini).

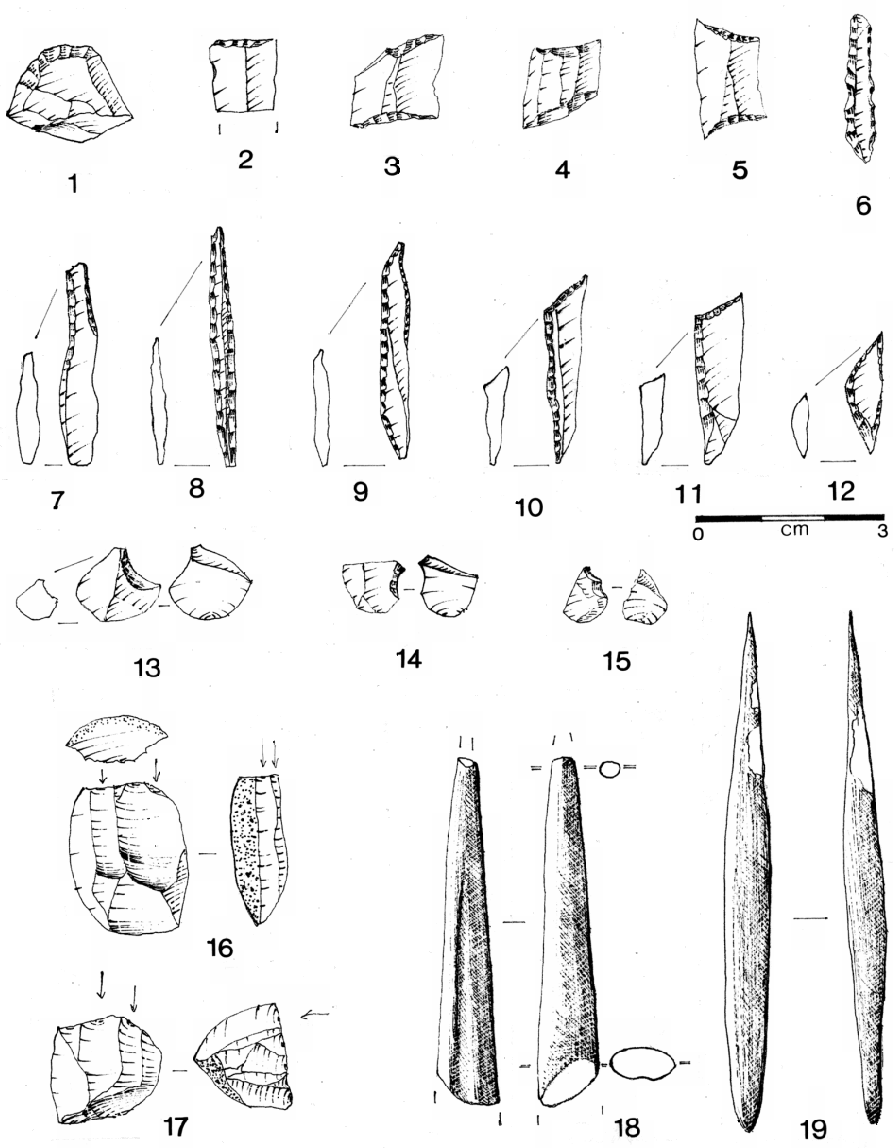

Figure 9 Edera Cave: flint and bone tools from layer 3b. End-scraper (1), truncation (2), trapezes (3–5), backed points (6–9), scalene triangles (10, 11), isosceles triangle (12), microburins (13–15), cores (16, 17) and bone points (18, 19) (drawn by E. Starnini).

Analysis of the marine shells from layer 3a reveals the importance of marine resources in the diet of this Castelnovian community. In fact, shells of *Patella caerulea* and *Monodonta turbinata* are extremely common. They are represented by hundreds of specimens, while other species such as *Gibbula divaricata* seem to have been collected only sporadically. The subsistence economy of the Early Neolithic Vlaška group community of layer 2a, on the other hand, was almost exclusively based on the rearing of caprines (24 individuals) and, to a much smaller extent, cattle (2 individuals). The collection of marine shellfish was practised sporadically and played a very minor role in the diet of the Early Neolithic occupants of the Edera Cave.

Discussion

The main aim of the new excavations at Edera Cave was to acquire data to enhance our understanding of the environmental changes and human adaptations that characterized the Trieste Karst/upper Adriatic region between the Pleistocene/Holocene transition and the Migration Period. Although the sequence represented in the cave reflects intermittent human occupation rather than continuous and systematic habitation of the site, the stratigraphic succession revealed by excavation has provided interesting new data on the Mesolithic and Neolithic periods especially.

A plot of the radiocarbon dates obtained so far from these layers clearly groups them into three main periods of occupation which can be referred to the Pre-Boreal, Boreal and Early Atlantic climatic phases, respectively (Fig. 6). Rather than showing a continuous occupation throughout these periods, the cave was consistently settled during a well-defined period of the Boreal, Sauveterrian culture. This is indicated by a horizontal palaeosurface in layer 3c with ephemeral charcoal lenses, mammalian bones and lithic artefacts.

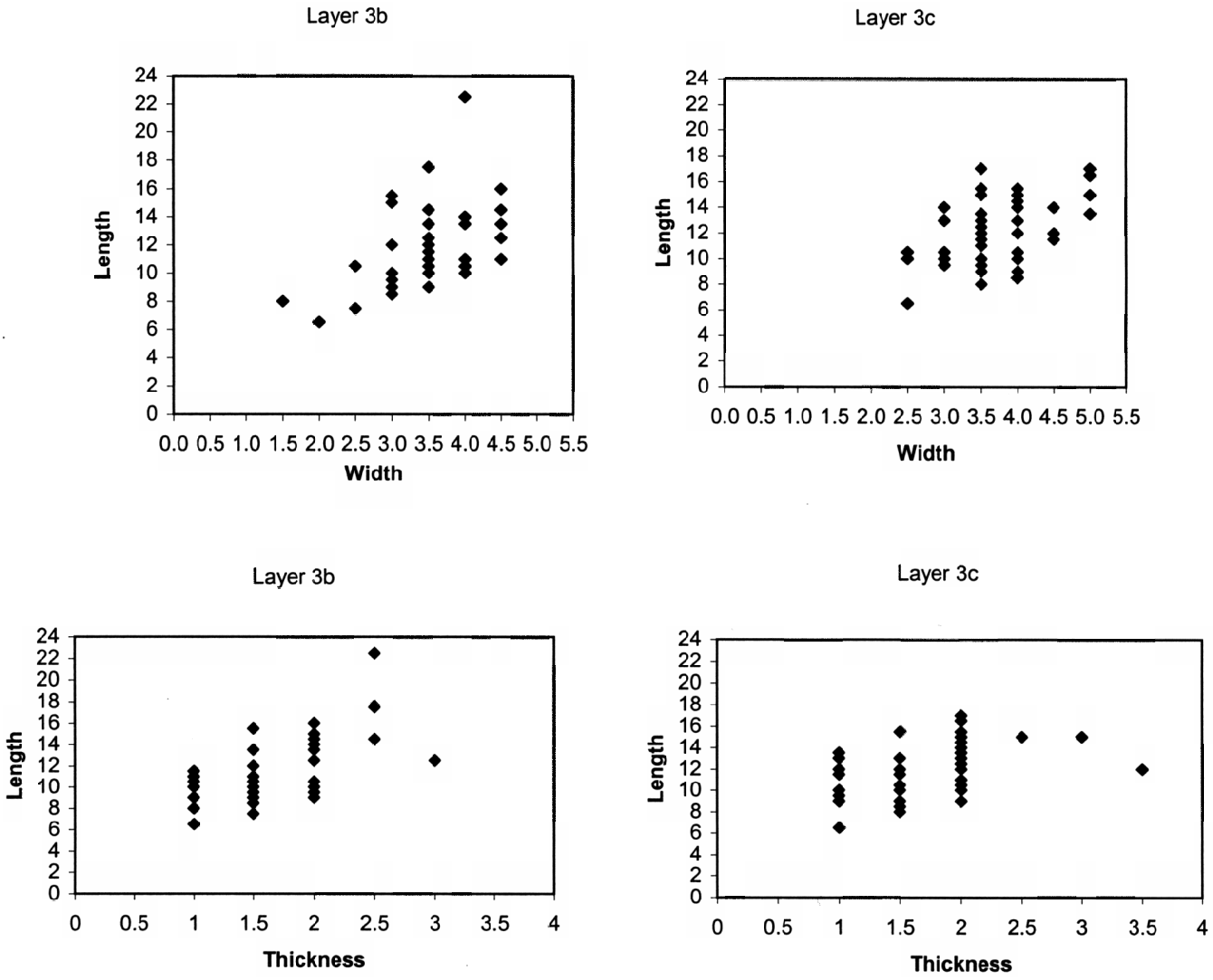

Figure 10 Edera Cave: scatterplots of length:width and length:thickness of the triangles from layers 3b and 3c.

Layer 3b, above, had no distinct palaeosurface but contained a few charcoal and ash lenses, one of which has been radiocarbon dated. Both the flint assemblage and the ^{14}C date suggest a Boreal/Atlantic transition age for this layer. Of particular importance is the presence of a limited number of trapezes with retouched truncations, which seem to mark the start of the Atlantic period at other sites in northern Italy (Baroni & Biagi 1997) and the Tusco-Apennine chain (Castelletti *et al.* 1994).

Although most of the faunal remains from these two layers are still awaiting identification, the occurrence of several bones of freshwater fishes as well as of water tortoise (*Emys orbicularis*) is remarkable. In fact, both are good indicators of the presence of abundant freshwater resources in the vicinity of the cave, such as a stream or lake basin which is absent from the present Karst landscape.

After a long chronological gap the cave was reoccupied during the beginning of the Atlantic as shown by a well-defined hearth with a stone base. A charcoal sample from this hearth gave a date of 6700±130 BP. This is very similar to dates obtained from the lowermost Early Neolithic Vlaška group charcoal lens of layer 2a. This hearth seems to represent an ephemeral occupation of the last hunter-gatherers who inhabited the Karst region just before the Neolithic. Nevertheless, some kind of interrelationship may already have existed between the last hunter-gatherers and the first farmers who settled the surrounding territory. This is indicated by the presence of a few potsherds which have no typological link with those of the Vlaška group and which do not seem to belong to the Impressed Ware culture, at least as represented in the Istrian sites (Müller 1994). In addition, the presence of domesticated fauna remains also points to connections between hunter-gatherers and food-producers. The occurrence of a large number of *Patella caerulea* and *Monodonta turbinata* marine shells confirms the presence of a rocky coastline not too far from the site, most probably almost in the same position as the present coastline.

The Early Neolithic use of the cave seems to have occurred repeatedly at the cave entrance. Six charcoal lenses representing a period of some 300 years have been partially ex-

cavated. They all contained a variable quantity of typical Vlaška group pottery and just a few atypical flints. The great majority of the pottery is of local manufacture, with the exception of one sherd of black-burnished ware, very similar to the Danilo ceramics, which seems to have been imported from elsewhere.

Although the site distribution pattern is poorly known in the Karst, and considering that we are presently hampered by a lack of open-air Mesolithic and Neolithic sites, there appear to be aspects of the use of the cave which differ through time, and which can be studied in detail. In fact, studies of the usage of the Edera Cave throughout the early Holocene should provide insights into changes in human adaptation to the environment, resource usage and exploitation of the environment surrounding the cave and, to a certain extent, of the coastline of the Trieste Gulf.

A difference was noted in terms of hearth structures and attendant fuels between the two main Mesolithic horizons. In fact, in the Boreal occupation layer hearth constructions are absent from the excavated area, although there is a palaeosurface, mentioned above, that is characterized by ashy areas, remains of red deer and wild boar, as well as debris from stone tool manufacture (Fig. 5B). In contrast, the early Atlantic layer had a structured hearth with a stone base and a probable cooking area (Fig. 5A). The hearth was created by an apparently smaller group of foragers, in what appears to have been a single and shorter episode of occupation.

The abundance of the bones of caprines (mainly sheep, then goat), the presence of charcoal lenses and of dropped deciduous teeth are evidence that the cave was utilized as a shelter for both humans and animals at the beginning of the Neolithic.

Conclusions

The northern Adriatic region (more specifically the Trieste Karst) and the Iron Gates, are two territories which, though culturally unrelated and markedly different from geographical, environmental and climatic points of view, can be seen as a type of laboratory in which one can examine the transition to agriculture and its attendant themes. Both regions have evidence for the active and effective role of Mesolithic hunter-gatherers who experienced gradual changes in their subsistence economy through time. What is to be stressed is the role of the last hunter-gatherers of the Early Atlantic period. Their distribution patterns, technology and subsistence strategies differed from those of the preceding Sauveterrian (Boreal or Pre-Boreal) foragers who inhabited the area prior to the beginning of the eighth millennium BP. Castelnovian sites are far less abundant in the Karst region than those of the preceding Sauveterrian. Furthermore, the known Castelnovian sites seem to belong to early stages in the development of the culture (Montagnari Kokelj 1993) or rather brief occupations, as in the case of the Edera Cave hearth which is the only feature of this type and age ever recorded from the Karst caves.

There is little doubt that interaction occurred between the last hunter-gathers of the Castelnovian culture and the first Neolithic farmers that might have led to an acculturation of the former or at least reduced their visibility in the archaeological record. We still face the main question of when, why and how such interaction is represented archaeologically. That is, can we recognize the possible introduction (or acceptance) of domesticated plants(s) and animal(s) as well as the presence of (single) specific objects reflecting new technologies acquired from elsewhere?

This question is complicated by the apparent fact that three distinct archaeological cultures were present in the region of Edera Cave around the middle of the seventh millennium BP (Biagi 2001): the Late Castelnovian culture, the Vlaška group, and the Impressed Ware culture. Generally, the radiocarbon dates and site distributions of the various cultures overlap in this region, but specific archaeological associations are elusive. The occurrence of potsherds of non-local production and bones of domesticated animals in the Late Castelnovian (layer 3a) of Edera Cave is such an association. Further analysis of these finds should provide a clearer interpretation and understanding of the human interactions in the prehistoric karst.

End note

1. Microblades are defined as between 12.5 and 25mm long.

Acknowledgements

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