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Article

The Mesolithic occupation at Grotta della Cala (Marina di Camerota - Salerno - Italy). A preliminary assessment

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Key words

- Mesolithic
- Sauveterrian
- Southern Italy
- palaeoenvironment

Parole chiave

- Mesolitico
- Sauveterriano
- Italia meridionale
- paleoambiente

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Summary

The Holocene human occupation of Grotta della Cala is attested only within the sonamed "internal series" (and not in the "Atrio series") and starts with Mesolithic layer 7, dating back to the time span between 7579 and 6687 (cal BC). This layer, which was excavated by Paolo Gambassini in 2004, is possibly the same as layer F investigated by Palma di Cesnola in the sixties, and is directly superimposed onto stalagmite α sealing the Pleistocene stratigraphical sequence. Layer 7 produced a lot of large and middle sized mammal remains. It also yielded a lot of malacofauna, both of terrestrial and, above all, marine types, as well as a number of chipped stone artefacts, a painted pebble, and a grindstone used for ochre processing. Outcomes from archaeozoological, malacological and anthracological studies have provided a detailed framework of the surrounding landscape and of the subsistence strategies adopted by the Mesolithic groups at Grotta della Cala during the Boreal.

Riassunto

L'occupazione olocenica della Grotta della Cala è stata individuata solamente nella cosiddetta "serie interna" (e non nella "serie atriale") ed inizia con lo strato Mesolitico 7 datato tra 7579 e 6687 (cal BC). Questo strato, scavato da Paolo Gambassini nel 2004, è molto probabilmente in rapporto di uguaglianza con lo strato F indagato da Palma di Cesnola negli anni sessanta dello scorso secolo ed è direttamente sovrapposto ad una stalagmite che sigilla la sequenza stratigrafica pleistocenica. Lo strato 7 ha fornito numerosi resti di macro e meso mammiferi. Ha restituito abbondante malacofauna, sia di specie terrestri che marine, così come industria litica, un ciottolo dipinto e una macina usata per la lavorazione dell'ocra. I risultati degli studi archeozoologici, malacologici e antracologici hanno fornito un quadro dettagliato del paesaggio circostante e delle strategie di sussistenza adottate dai gruppi mesolitici che hanno occupato la Grotta della Cala in una fase del periodo Boreale.

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Introduction

The cave

Grotta della Cala opens east of the village of Marina di Camerota, very close to the present coastline, at the foot of a wide hilly-mountainous complex characterized by short tablelands 250-500 m a.s.l. and furrowed by a main valley (Vallone dell'Isca) (Fig. 1). Amongst the numerous prehistoric sites located along the Cilento coast, this cave contains one of the widest and most detailed anthropic deposits. In fact it was inhabited almost continuously from the final Middle Palaeolithic to the Copper Age.

The cave (Fig. 2) has two main rooms with the first being the largest one. About halfway the cavity forms a bottleneck, a sort of natural door, beyond which the second room (squares D-M 20-33) opens (except for a small test trench no excavations were carried out in this second room) . To make things easier the investigated area was divided into the so-called "atrio series" (squares B-Q 3-11), "Palma di Cesnola's trench" (squares D-H 12-16) and "internal series" (squares D-L 16-20), corrisponding to different excavation seasons.

The stratigraphical sequence starts with a marine strongly cemented conglomerate possibly attributable to MIS 5. A roughly 3 m thick continental series abounding in anthropic remains overlies the eroded top of this conglomerate. The earliest evidence of human occupation, situated in the lower part of the continental deposit, is represented by a set of intercalating stalagmite and gravel layers belonging to the Mousterian. The Middle Palaeolithic horizon is sealed by a thick concretion (β) which constitutes the base of the Upper Palaeolithic sequence (Fig. 3). In the atrio series (that is not included in Fig. 3) β is covered by the Uluzzian and the Aurignacian layers (Benini *et al.* 1997), followed by a number of layers of the Early Gravettian (Boscato *et al.* 1997), of the Gravettian with Noailles-type Burins (Palma di Cesnola 1993) and of the Evolved and Final Epigravettian (there is no evidence for the Early Epigravettian). Another stalagmitic episode (α), separating the Pleisotocene deposit from the Holocene one, is superimposed onto the final Epigravettian. The Holocene occupation is limited to the internal area and includes Mesolithic (str. 7), Neolithic (str. 5) and Eneolithic (strs. 4-3) layers (Gambassini 2003).

Early investigations at Grotta della Cala were undertaken in 1966-71 by Arturo Palma di Cesnola of the University of Siena in the inner part of the cavity where a trench of around 12 square meters was dug reaching the bottom of the anthropic deposit (Palma di Cesnola 1969, 1971). The excavations of the atrio series was initiated in 1974 by P. Gambassini e A. Ronchitelli, of the same University, in collaboration with the Office for the Archaeological Heritage of Salerno, Avellino, Benevento and Caserta. Research went on until 2004 and, from 1994, also involved the internal series, with the holocenic layers, right next to Palma di Cesnola's trench. Investigations at the site have been resumed in 2014.

Fig. 1 *- Grotta della Cala - Location of the cave east of the village of Marina di Camerota. / Localizzazione della grotta ad est dell'abitato di Marina di Camerota.*

Layer 7

Within the internal series Mesolithic layer 7 occupies the same stratigraphical position as layer F in Palma di Cesnola's trench (squares D-H 11-16). It directly lies on stalagmitic layer α and is separated in patches from the overlying deposit by another, much thinner and more discontinuous, stalagmitic layer which corresponds to layer α' covering layer F in Palma di Cesnola's trench (Bartolomei *et al.* 1975).

Layer 7 is on average 15 cm thick and is formed by calcareous clasts with sharp edges mixed with iron-grey fine sand. In squares E16-E17 a very thin (maximum thickness 3 cm) silty lens less than one square m wide, called str.6, was identified between layers 5 (Neolithic) and 7. This lens yielded few lithic artefacts including a Sauveterre point and a trapezoidal microlith (Gambassini 2003).

During the fieldwork carried out from 1994 to 2004 a surface of 12 m^2 (squares C-F 15-20) was investigated from the edge of Palma di Cesnola's trench towards the inner part of the cave up to the point where layer 7 finishes against the rising of stalagmite α. Right close to the north - western margin of Palma di Cesnola's trench, there is the bottleneck leading into the second room (see above). This

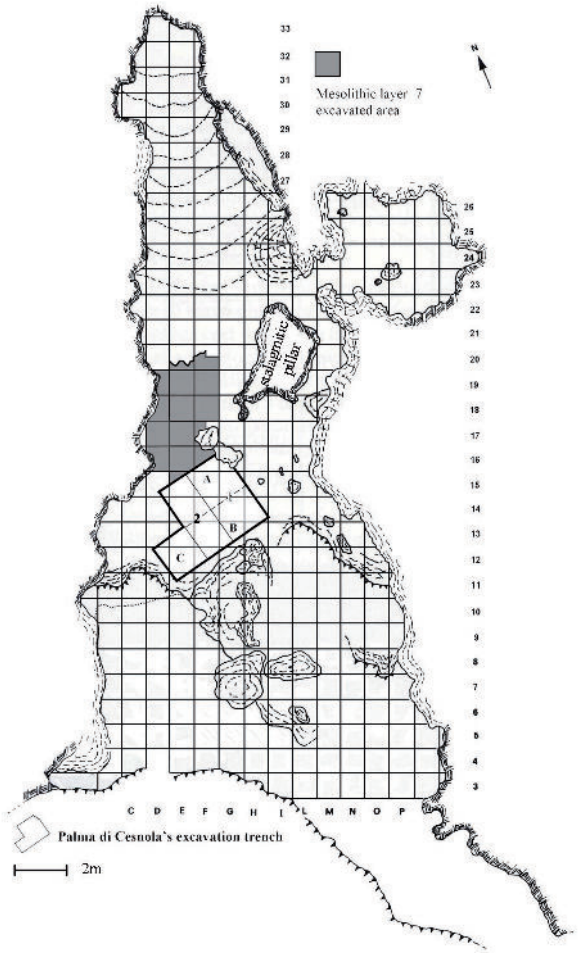

Fig. 2 *- Grotta della Cala - Plan of the cave (drawing by Andrea Benini and Paolo Boscato). In grey the 1994-2004 excavation area. / Planimetria della grotta (disegno di Andrea Benini e Paolo Boscato). In grigio l'area di scavo 1994-2004.*

passage is divided into two separate entrances of different width due to a stalagmitic pillar in between (Fig. 2). This created a sort of obligatory way-in where each layer was clearly marked by its own trampling surface. In this area (D-F 16-20) (Fig. 4) layer 7 was more or less uniformly characterized by large amounts of charcoal and burned stones. A sub-circular fireplace, 50 cm in diameter, was discovered near the wall, in square D17. Next to the fireplace (astride squares E16 and E17) there was a large stone, wedged, with a lot of smaller stones, along its whole perimeter, which was interpreted as a possible seat. A number of objects were retrieved not far from these structures: from E17 an elongated sandstone pebble whose use-wear trace pattern (a couple of roundish depressions on both faces) is very similar to that occurring on the ethnographic anvils/hammers called *quebra-cocô* and used for cracking nuts, acorns and suchlike (de Beaune 1989) (Fig. 5: 1); from D18, a limestone grindstone, showing a slightly concave face wholly covered with red ochre, and a painted pebble (Fig. 6) located right next to it (Gambassini 2003); from the same square a valve of *Ostrea edulis* (Fig. 8: 6) decorated with incised lines on its interior face.

Two 14C dates were obtained for layer 7, from charcoal samples, at the Beta Analytic Laboratory of Miami: Beta 74162 8370±80 BP and Beta 123856 8060±100 BP. These dates were calibrated using OxCal 4.2 (Bronk Ramsey & Lee 2013) and IntCal13 (Reimer *et al*. 2013), and result in an age range of 7579 to 7189 and 7314 to 6687 cal BC at 95,4% of probability. These results did not confirm the previous date of 10390 ± 180 BP obtained on charcoal from layer F at the 14C laboratory of Florence (F109) (Palma di Cesnola 1993). Since we consider this latter date quite unreliable as it was performed several years ago, this inconsistency will be disentangled only by performing a new set of dates of layer F and revisiting its whole material.

The lithic assemblage

In layer 7 a few hundreds of pieces were collected including about eighty retouched artefacts, numerous cores and a wealthy set of "macro-artefacts", namely the grindstone and the anvil described above, some percussors and several knapped stones and pebbles (Fig. 5: 2).

As their study is still in progress, only preliminary outcomes concerning the techno-typological analysis of cores and retouched tools are illustrated.

The most common raw materials are flint and radiolarite collected as small sized pebbles and water-rolled slabs in the Pleistocene alluvial and marine formations which can be found on the coast near Marina di Camerota. Rock quality is variable and several pieces exhibit cracks and/or impurities which make them difficult to be wrought. However, this characteristic favoured the natural edges and striking platforms necessary, thus reducing the core preparation time (Wierer 2008).

Production was based on two main operational sequences, which were performed independently from each other. The first one, whose cores are absent, produced blanks of larger dimensions (both flakes and blades) mostly devoted to the manufacturing of "common tools". The second system starts from raw blocks of smaller dimensions and is addressed towards the accomplishment of micro and hyper-micro bladelets and micro and hyper-micro flakes. Cores belonging to this second process are well documented. These are very small in size. Their maximum length rarely exceeds 30 mm. Striking platforms are mostly plain, obtained through the removal of a single thick cortical flake at one of the ends of the pebbles. Otherwise, when slabs or small blocks, stemming from the fracturing of larger blocks along cracks, are involved, they can be natural. The shaping out of the core is generally quite approximate. The opening of the knapping surface was predominantly due to the use of natural edges or convexities. However this procedure was rarely carried out also pre-forming the core with a unilaterally prepared crest. Production was almost exclusively unidirectional. Attempts of core re-orientation with the opening of opposite or orthogonal striking platforms, can be sporadically observed only during the final exploitation phase, after which cores were abandoned. Discarding was generally connected to the occurrence of hinged removals. Most of the original raw material blocks consisted of sub-circular or elongated pebbles. From these, two different blank types could be obtained, by definite choice. The first one, short and wide, was exploited to detach

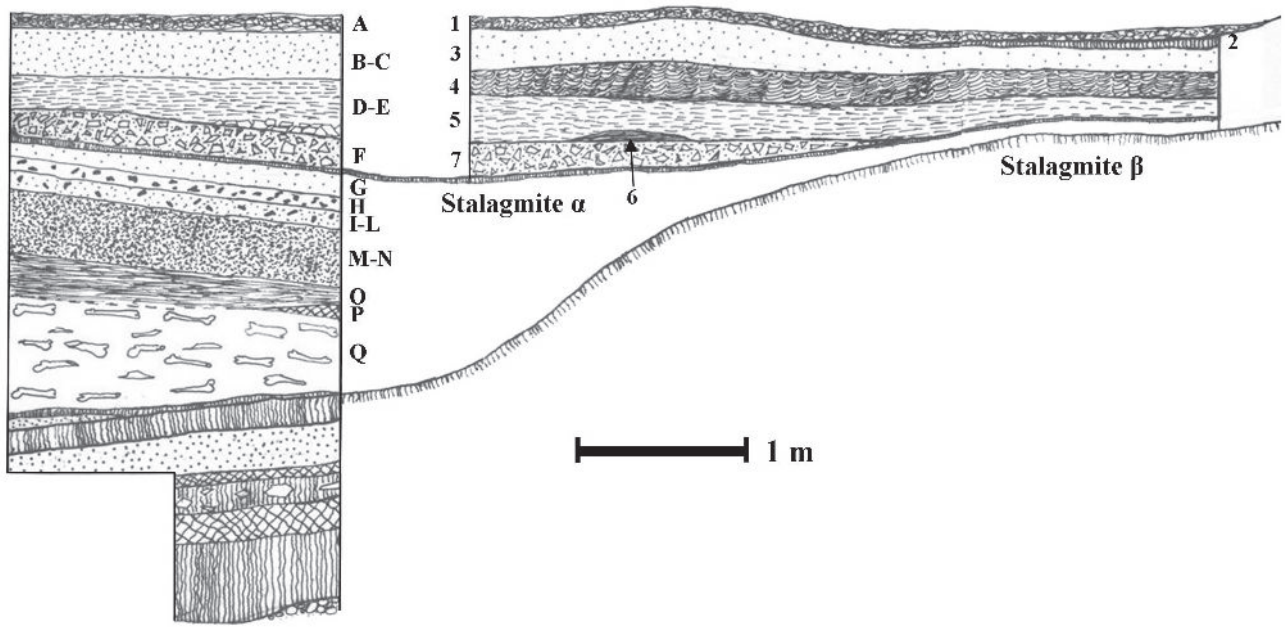

Fig. 3 *- Grotta della Cala - Stratigraphic sequence of Palma di Cesnola's trench (excavation fieldwork 1966-71) (on the left) and of the internal series (excavation fieldwork 1994-2004) (on the right) (drawing by Paolo Gambassini). / Sequenza stratigrafica della trincea Palma di Cesnola (scavi 1966-71) (a sinistra) e della serie interna (scavi 1994-2004) (a destra) (disegno di Paolo Gambassini).*

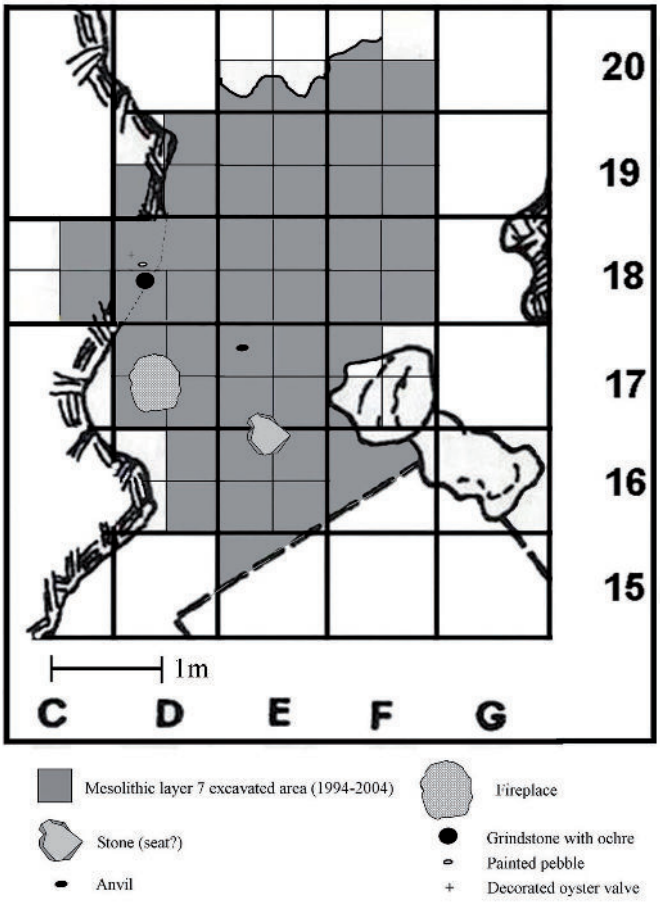

Fig. 4 - Grotta della Cala - Spatial distribution of structures and some objects of layer 7, squares D-E 16-18. / Distribuzione spaziale delle strutture e di alcuni oggetti dello strato 7, quadrati D-E 16-18.

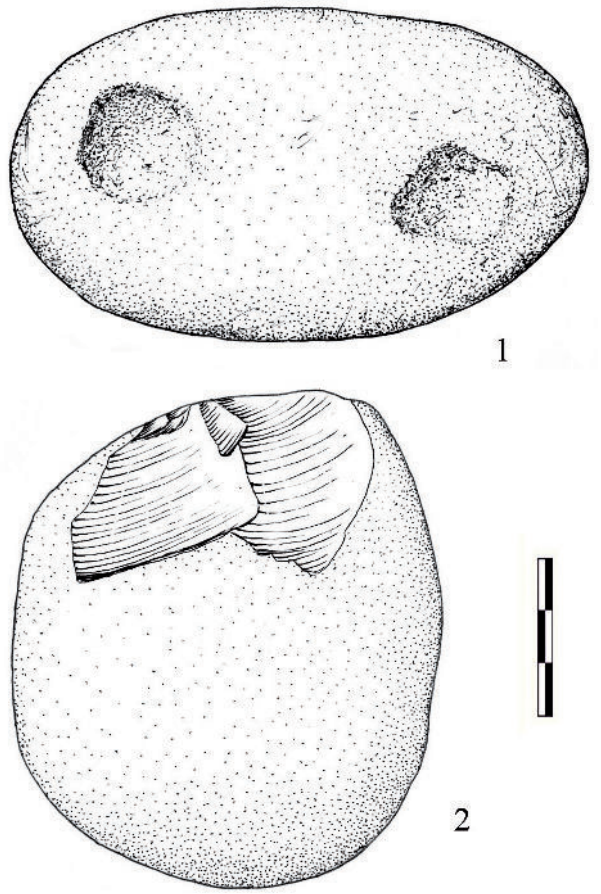

Fig. 5 - Grotta della Cala - n. 1 anvil/hammer; n. 2 knapped pebble (drawings by Adriana Moroni). / n.1 incudine/martello; n. 2 ciottolo scheggiato (disegni di Adriana Moroni).

laminar small flakes and/or bladelets within 20 mm in length (Fig. 7: 1, 4); the second one, more slender, was exclusively intended for the production of longer bladelets (Fig. 7: 2). In the former case blanks were obtained both by "uncapping" or halving sub-circular pebbles (striking platform represented by a scar or a ventral face) and "recycling" portions (the shortest ones) discarded while building striking platform of elongated pebbles (striking platform represented by a ventral face). Given the lack of core tablets, the possible stemming of the first type from the progressive shortening of larger cores is very unlikely. Exploitation was initially facial and turned later into *semitournan*t thanks to the creation of a lateral edge through the removal of a flake on the side of the core. Usually cores were abandoned at this stage of the process, even though core reduction could go on until a pyramidal *tournant* morphology was achieved. A less widespread strategy, aimed at the production of micro and hyper-micro bladelets as well, employed small blocks stemming from the breaking of slabs or pebbles. Starting from natural striking platforms, pre-existing or intentionally built edges were used for the production of a limited series of bladelets. A third system, only sporadically attested, involved the use of thick flakes as cores which could be exploited both on their dorsal and ventral face, often by means of bi-polar knapping, for the production of very short series of blanks (sometimes a single item).

"Common tools" (i.e. non backed implements - Broglio & Kozlowski 1983) were often achieved from by-products like cortical flakes and blades, crests, blanks bearing hinged removals on their dorsal face and thick blanks resulting from the correction of the laminar surface. However several blades and bladelets of "*plein débitage*" were also chosen for the manufacturing of side-scrapers and end-scrapers. These systematically display fractures at one or both ends. As noted above, dimensions of many of the so-called common tools are incompatible with the size of cores found in layer 7.

Fig. 6 - Grotta della Cala - Different views of the painted pebble found in layer 7 (photo by Stefano Ricci). / Differenti vedute del ciottolo dipinto trovato nello strato 7 (foto di Stefano Ricci).

Side-scrapers and denticulates (mainly scrapers but also notches) are the predominant groups, followed by end-scrapers and splintered pieces. End-scrapers are represented by both short and long types (Fig. 7: 3, 6). These latter are always on quite thick blades

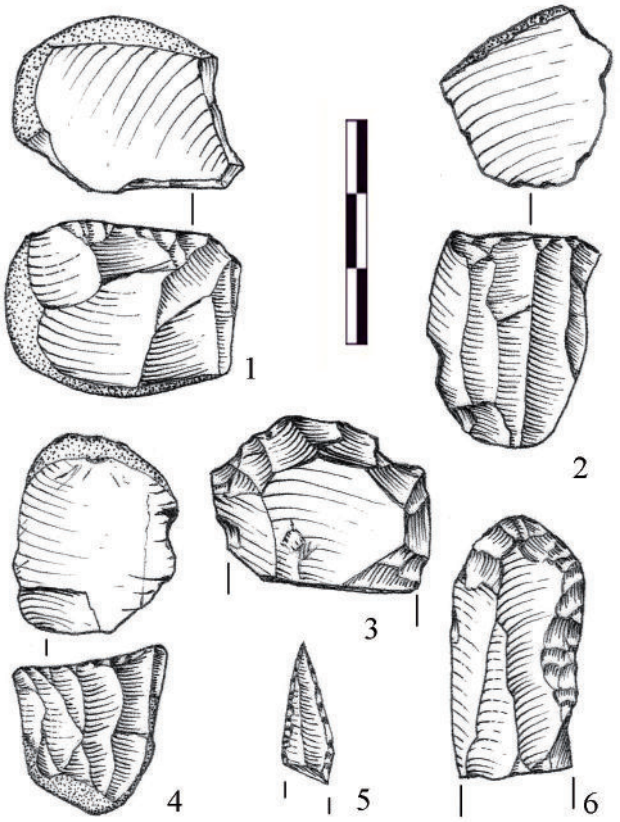

Fig. 7 *- Grotta della Cala - ns. 1, 2, 4 cores; ns. 3, 6 end-scrapers; n. 5 Sauveterre point (drawings by Adriana Moroni)./ Nn. 1, 2, 4 nuclei; nn. 3, 6 grattatoi; n. 5 punta di Sauveterre (disegni di Adriana Moroni).*

broken (intentionally?) at their proximal extremity and tend to be ogival in shape (akin to types 18 and 19 in Broglio & Kozlowski 1983). Short types feature notches which occur on one or both sides of the front and form a sort of wide nose (akin to types 61 and 63 in Broglio & Kozlowski 1983). Truncated pieces (n. 2) and beaks (n. 1) are minimally represented and burins are absent. Several artefacts show modifications formed by marginal retouches, which may be interpreted as macro-wear, and a couple of tools (an end-scraper and a splintered piece) bear tiny traces of a dark residue (glue?).

In addition to the *Sauveterre* point and the trapezoidal microlith from layer 6, microlithic implements are composed of few backed blades and backed pieces with truncation, one bilateral backed point (*Sauveterre* point) (Fig. 7: 5) and some unidentifiable fragments. Neither microburins or *piquant-triedre*-like fractures were retrieved.

Exploitation of faunal resources

Within the economic strategies implemented by the Mesolithic groups of Grotta della Cala, macro and meso mammals, birds, fishes and molluscs played a role of different weight. Remains of medium and large sized mammals are, most probably, to be wholly connected to the anthropic exploitation, whilst fishes and birds (the study of which is still in progress) might have partially been the prey of strigiforms and other raptors, which occasionally frequented the cave. The wide microteriofauna sample from layer 7 (still to be quantified and analyzed) may constitute, in fact, a sign for the presence of boli of strigiforms. Taphonomic examination of fish and macromammal remains, although useful for detecting traces due to man and animal predation, is unlikely going to provide quantitative data about the anthropic exploitation of these two groups.

In this framework medium and large mammals provided the most sizeable biomass exploited as food by Mesolithic populations of Grotta della Cala. The red deer is the dominant species followed by the wild boar and the roe deer.

Macro and meso mammals

The examined sample, recovered using 1mm sieves, is composed of 491 identified remains, among which 400 belong to ungulates (Tab.1). The majority of these remains is well preserved, as bone surfaces are not affected by specific alterations. Exfoliations are minimally present and only few materials (from squares E18 III and F19 II) are covered by concretions. High fragmentation of bones, partially due to consumption of marrow, involved also small sized elements. Out of the 33 recovered phalanxes of red deer and roe deer (recessive phalanxes excluded), only 3 are still intact. Traces of lithic tools have been detected on several skeletal elements and, on first observation, no marks of carnivore gnawing have been recognized. Consequently we may assume that the analyzed bone sample was exclusively connected to anthropic activities.

Cranial parts, mainly isolated teeth, are the most numerous anatomical elements. These parts reach 45,5% of the identified material among ungulates and 29,7% among lagomorphs and carnivores (Tab. 2). Limb bones are 47% of the identified elements within ungulates and 61,5% among lagomorphs and carnivores. Vertebrae and ribs as well as scapular and pelvis belt bones are scarcely present. As far as larger size prey are concerned, this distribution of skeletal elements may indicate that limbs and skulls were selected to be brought into the cave. Conversely skeletal parts not involved in the consumption of marrow/brain were probably abandoned at the killing sites. However two factors, which may lead to largely underestimating the quantity of identifiable elements, must be taken into account: 1) difficulties in identifying skeletal parts like ribs and vertebrae to species level 2) their bad condition of preservation. The lack of parts of the axial skeleton belonging to small species, namely hare, fox, wild cat and mustelids is most probably due to these reasons as it seems realistic that carcases of these animals were brought entire into the cave. A study of the unidentifiable material and taphonomic analyses carried out on the whole sample will provide new data and clarification.

Ungulates encompass three well documented species (wild boar, red deer and roe deer) and three species only sporadically attested (chamois, ibex and auroch). The quantitative gap between these two groups is as clear-cut as is the difference between their ecological habitats. The first ones are typical of woody environments; the ideal habitat of the auroch is the forest steppe; the ibex and the chamois are rocky environment species.

The wild boar (*Sus scrofa*) (147 identified elements) is the second species in numerical presence. Analysis of dental elements allowed us to calculate a minimum number of 8 individuals, including four juveniles, three adults and one senile. Nearly one third of the elements (deciduous teeth and cranial and post-cranial bones showing unfused parts) (32% - NISP = 47) belong to immature specimens. In particular one 4-5 month old individual, two 8 to 10 months and one 12 to 14 months have been recorded (Bull 1982; Bridault *et al.* 2000; Rowley-Conwy 2001). Unfortunately there are few data in this regard. Moreover, although they can provide some information about the killing seasons (spring, summer end and autumn) (Heptner *et al.* 1989, Apollonio 2003), different seasonal occupation phases of the cave cannot be ruled out. Butchering traces have been identified on a tibia and on a rib. Measures taken on some skeletal elements indicate that these Mesolithic wild boars were larger in size than the present Italian populations.

As said above, more frequent anatomical parts are isolated teeth and limb bones. However, in the case of the wild boar, seven vertebrae (two cervical and five thoracic) have been identified. Evidently, at least once in a while, Mesolithic hunters used to bring the whole carcases of this ungulate into the cave.

The red deer (*Cervus elaphus*) is the dominant species (identified specimens NISP = 176) and it provided the bulk of the meat supply. A minimum number of 7 individuals have been recognized (1 juvenile and 6 adults) (Mariezkurrena 1983) from dental remains and bones with unfused epiphises. Frequency of young and sub-adult individuals (9% - NISP = 16) is clearly lower if compared with the wild boar and there are no data on killing seasons. A fragment of shed antler due to a natural loss was probably found lying around and picked up as it cannot belong to a killed animal. The recovered parts encompass, although largely varied in quantity, all skeletal body parts. Among limb bones, phalanxes and sesamoids (NISP = 32) are very numerous. Phalanxes were systematically broken for marrow extraction. The identified vertebrae are 2 cervical and 1 thoracic. Mandible fragments (NISP = 8) and lower teeth are much more numerous than maxillary fragments (NISP = 1) and upper teeth. Except for incisors and canines, occurring exclusively on the mandibles, there are 31 lower jugal teeth while there are 15 upper ones.

The roe deer (*Capreolus capreolus*) is the third species in numerical presence (NISP = 70). The percentage of bones and teeth of juveniles (2 individuals) are similar to those recorded for the red deer (8,6% - NISP = 6). Skeletal parts of adults, particularly some teeth, indicate a minimum number of 3 individuals. A frontal bone with antler fragment is attributable to an adult male killed in the period between May and October (Perco 2003). A metatarsal dyaphisis displays clear cut-marks left by lithic implements. As is the case for the wild boar, the size of Mesolithic roe deer was larger than that of the present Italian specimens. The three other species of ungulates recovered in layer 7, the auroch (*Bos primigenius*), the ibex (*Capra ibex*) and the chamois (*Rupicapra* sp.), are represented by a very low number of bone fragments. The scarcity of these animals is also characteristic of the Gravettian and Epigravettian series of Grotta della Cala (Sala 1983), possibly due to the orographic conditions unsuitable to their diffusion. The occasional killing of these species occurred, perhaps, on the outskirts of the main hunting territory characterized by woods both in the hilly tablelands overlying the cavity and in the plain in front of it.

Medium sized prey (lagomorphs and carnivores) were regarded as a resource both for food and hide. An in depth taphonomic analysis will provide more information about this activity.

The hare (*Lepus europaeus/corsicanus*) is present with at least two individuals (18 remains), a juvenile and an adult. Neither cranial elements nor isolated teeth were found.

The fox (*Vulpes vulpes*) is the most representative carnivore (48 identified elements). A juvenile (three remains) and two adults (isolated teeth) have been recognized. Although fox remains are referable to the whole skeleton, its cranial parts are the most frequent. The distal articulation of a radium is pathological.

Only four remains belong to Mustelids (*Martes martes* and *Meles meles*).

A minimum number of three individuals, two adults and a sub-adult, are attributable to the wild cat (*Felis silvestris*) (19 remains). Also for this species cranial parts and isolated teeth are the most recorded elements. A single fragment (a proximal piece of radium) belonging to an adult lynx (*Lynx lynx*) was recovered.

Molluscs

Molluscan materials recovered in layer 7 include 2036 more or less complete shells and an indeterminate number of fragments belonging to 32-35 different species of molluscs (27-30 gastropods and 5 bivalves: Tab. 3).

The dominant species is the gastropod *Osilinus turbinatus*, represented by more than 800 shells, in most cases complete. The gastropod *Patella caerulea* (360 specimens) and the bivalve *Cerastoderma glaucum* (represented by more than 300 valves belonging to at least 157 specimens) follow in order of abundance. The other species are composed of a lower number of specimens, varying from one to 98 (Tab. 3).

Gastropods include around 20 marine and 9 land species while there are only five marine bivalve species. On the whole, almost all the marine gastropods found in this site belong to species associated with rocky bottoms and superficial water from supralittoral and mediolittoral to infralittoral zones (*Littorina neritoides*, *Patella* spp., *Osilinus* spp., *Gibbula* spp., *Phorcus* spp., *Stramonita haemastoma*, *Hexaplex trunculus*, *Columbella rustica*, *Bolma rugosa*). Regarding bivalves, *Ostrea edulis* comes from the same environment, while the other species (*Glycymeris violacescens*, *Acanthocardia tuberculata* and *Donax venustus*) are basically linked to sandy substrates of the infralittoral zone. Other species linked to soft bottoms are present at the site, but they are more typical of muddy substrates at greater depths (such as gastropod *Galeodea echinophora*) or shallow brackish water (such as gastropod *Cyclope neritea* and bivalve *Cerastoderma glaucum*, which are often found in lagoons or near estuaries). Finally, *Truncatella subcylindrica* is mainly linked to beached plant material and coarse foreshore gravel (D'Angelo & Gargiullo 1978; Margalef 1985).

Land gastropods include eight snails and a slug, some of which can be considered generalists (*Pomatias elegans*, *Oxychilus* cf. *draparnaudi*, *Limax* sp.) while others tend to be linked to specific habitats, such as forests (*Chilostoma planospira*), grasslands (*Rumina decollata*, *Cernuella* sp.), sites with scattered and discontinuous vegetation (*Siciliaria* sp. and *Helix* sp.) or rocky outcrops (*Marmorana* sp.) (Kerney *et al*. 1983; Welter-Schultes 2012).

Many of the marine molluscs were surely collected for food. Most of the species from rocky bottoms (*Patella* spp., *Osilinus* spp., *Stramonita haemastoma*, *Hexaplex trunculus*, *Ostrea edulis*) may have been abundant and easily accessible just below the tide line or even above it (Margalef 1985). Conversely, molluscs living in soft bottoms (*Glycymeris violacescens*, *Acanthocardia tuberculata*, *Cerastoderma glaucum* and *Galeodea echinophora*) could have been collected fresh or still alive on the foreshore after coastal storms.

It cannot be ruled out that some of these molluscs were collected from beaches for aesthetic reasons even in the absence of edible soft parts (no use-wear analysis has been performed yet). For instance, some fragments of bivalve shells show incisions (two valves of *Ostrea edulis*: Fig.8: 6), residues of red pigment (one valve of *Cerastoderma glaucum*: Fig.8: 4) or intentional piercings in the umbo attesting their use for necklaces and other ornaments (three valves of *Acanthocardia*

Tab. 1 *- Grotta della Cala - Vertebrate remains from layer 7. / I resti di vertebrati dello strato 7.*

	NISP	% NISP	MNI
Sus scrofa	147	29,9	8
Bos primigenius	2	0,4	2
Capra ibex	2	0,4	1
Rupicapra sp.	3	0,6	2
Cervus elaphus	176	35,8	7
Capreolus capreolus	70	14,2	5
Tot. Ungulates	**400**		
Lepus europaeus/corsicanus	18	3,6	2
Vulpes vulpes	49	10	5
Martes martes	3	0,6	1
Meles meles	1	0,2	1
Felis silvestris	19	3,9	3
Lynx lynx	1	0,2	1
Tot.	**491**		
Testudo sp	37		
Aves (NSP)	161		
Pisces (NSP)	79		

tuberculata and three of *Glycymeris violacescens* Fig.8: 5). Gastropods like *Columbella rustica* and *Cyclope neritea* (Fig. 8: 1,3) were certainly used for this purpose, as all the recovered specimens (35 and 10, respectively) show one or two man-made piercings. A shell of *Natica* sp. displays a circular hole and traces of a red colouring substance (ochre?) (Fig. 8: 2).

The occurrence in the cave of *Truncatella subcylindrica* and *Littorina neritoides* is more difficult to explain: they might have been introduced with other materials, since these gastropods are too small to suggest intentional collection and human exploitation for any purpose.

Finally, empty shells of terrestrial molluscs from surrounding environments may have been deposited in the cave by rainwater. The only exceptions could be *Oxychilus* cf. *draparnaudi* (a regular inhabitant of subterranean environments potentially living at the site; Kerney *et al.* 1983; Welter-Schultes 2012) and *Helix* sp., an edible snail (Negra & Lipparini 2003) that may have been collected intentionally for food.

The plant environment as shown by charcoal data

In order to reconstruct the natural environment also archaeobotanical investigations were carried out on charcoal from layer 7.

Charcoal (charred wood) surely represents a valuable source

Tab. 2 *- Grotta della Cala - Ungulates, carnivores and lagomorphs: skeletal elements from layer 7. / Elementi scheletrici di ungulati, carnivori e lagomorfi rinvenuti nello strato 7.*

	Sus scrofa	*Bos primigenius*	*Capra ibex*	*Rupicapra sp*	*Cervus elaphus*	*Capreolus capreolus*	*Lepus europaeus - cors.*	*Vulpes vulpes*	*Martes martes*	*Meles meles*	*Felis silvestris*	*Lynx lynx*
antler					5	1						
maxilla	3				1	1		1			1	
mandible	7				8						3	
cranium	14				5	1		2			1	
deciduous teeth	12			1	6	2						
upper permanent teeth	10		2		10	7		4			2	
lower permanent teeth	19			1	30	7		11			1	
teeth unident.	5	1			21	2		1				
vertebrae	7				3	2		4			3	
sternum					1							
ribs	3											
scapula	5					2	1	1				
humerus	5				1	3	2				1	
radius	2				4	1	3	4				1
ulna					2	1	1					
radius-ulna					1							
carpals	4			1	8			3	1			
metacarpals	2				5	6		3				
pelvis	3				1	3	3	3		1		
femur	3				3	1		2				
patella					1							
tibia	5				7	7	2				2	
fibula	1											
malleolar bone						1						
tarsals	5				9	4	4	4	1		1	
metatarsals	4				5	9	1				1	
metapodial	8	1			7	2						
phalanx I	7				12	3	1	3	1		2	
phalanx II	7				12	3		2			1	
phalanx III	6				4	1		1				
sesamoids					4							
Total	**147**	**2**	**2**	**3**	**176**	**70**	**18**	**49**	**3**	**1**	**19**	**1**

of information to improve knowledge both on forest species as well as on vegetation dynamics in relation both to climate changes and human impact. In particular, charcoal (*sensu* Chabal *et al.* 1999) resulting from long-term burning activities and processes, can be considered representative of local vegetation and well suitable for palaeoecological studies (Chabal *et al*. 1999; Heinz & Thiébault 1998; Figueiral & Mosbrugger 2000; Asouti & Austin 2005).

Sediment samples collected during the excavations were sieved *in situ* by water through a sieving column. All charcoal fragments from 1, 2 and 4 mm mesh size were sorted under a dissection microscope.

200 charcoal fragments were analysed using a reflected light microscope (100 - 1000X). Taxonomic determination was carried out on the basis of the reference collection of the Vegetation History and Wood Anatomy Laboratory of University Federico II of Naples and wood anatomy atlases (Greguss 1955, 1959; Schweingruber 1990). Charcoal data agree with the faunal reconstruction; indeed they attest the presence of a wooded landscape. Namely the charcoal assemblage (Fig. 9) testifies to the presence of a winter deciduous forest dominated by *Quercus pubescens* which is the best represented taxon, followed by other broadleaves mesophilous taxa such as *Acer*, *Ulmus*, *Carpinus* and/or *Ostrya carpinifolia*. This situation of maximum expansion of deciduous forest is recorded in most areas of the western Mediterranean by both pollen and charcoal data from the early to middle Holocene and is interpreted as evidence of a *climate optimum* phase, (e.g. Vernet 1974; Vernet & Thiébault 1987; Heinz & Barbaza 1998; Heinz & Thiébault 1998; de Beaulieu *et al*. 2005; Drescher-Schneider *et al*. 2007; Sadori *et al*. 2008). In the study area high level of precipitation during the early Holocene is confirmed by stable isotopes of land snail shells from the close Grotta della Serratura (Colonese *et al.* 2010). In particular the presence of *Laurus nobilis* and *Arbutus unedo* is notable and can be considered an evidence of laurophyllous vegetation, typical indicators of warm-humid climates (Quézel & Médail 2003).

Concluding remarks

The attribution to Early Mesolithic Sauveterrian groups of layer 7 anthropic occupation relies on the results of ^{14}C dating and on the general characteristics of the lithic assemblage.

Calibrated chronology (between 7579 and 6687 cal. BC) places layer 7 in the Boreal phase (Orombelli & Ravazzi 1996). During this period sea-level was 20-35 m lower than nowadays (Lambeck *et al.* 2011) and the coastline should be located a few hundred metres from the site. Therefore, a flat and not very extended land-belt was present in front of the cavity.

Outcomes from the different approaches discussed above have provided a detailed framework of the landscape surrounding Grotta della Cala during the early Holocene (Boreal) and have shown that Mesolithic groups were very well integrated with the environment as they were able to exploit as best they could all the available ecological niches.

Exploitation of faunal resources was based on a wide spectrum of vertebrates like ungulates, lagomorphs, carnivores, testudinata as well as upon fish, birds and molluscs. Ungulates were primarily represented by forest *taxa* namely red deer, wild boar and roe deer which constituted 80% of the killed meso and macro-mammals. Remains of *caprinae* and aurochs are rare. Skulls and limbs are the most represented skeletal parts. Small prey hunting was addressed especially towards fox, cat and hare. Fowling and fishing were practiced too, although to a less extent.

At Grotta della Cala the whole Early Gravettian to Final Epigravettian period features a constant and high presence of red deer which, among hunted ungulates, is between 59% and 90% (Sala 1983, Boscato *et al.* 1997). From layer H (Final Epigravettian 12.350±200 BP, 12.030±120 BP, 12.020±210 uncal BP) (Palma di Cesnola 1993) onwards (Mesolithic layer included) an important change in faunal association is recorded, given the higher numbers of wild boar and

Tab. 3 *- Grotta della Cala - Molluscs from layer 7. Taxonomy and nomenclature according to Oliverio (2008) for marine and brackish gastropods, Welter-Schultes (2012) for land gastropods and Schiaparelli (2008) for marine and brackish bivalves. Number of valves recovered for bivalves is between brackets. / Molluschi rinvenuti nello strato 7. Tassonomia e nomenclatura secondo Oliverio (2008) per i gasteropodi marini e salmastri, Welter-Schultes (2012) per i gasteropodi terrestri e Schiaparelli (2008) per i bivalvi marini e salmastri. Per i bivalvi il numero di valve rinvenute è tra parentesi.*

Marine (M) and brackish (B) gastropods		
M	*Patella caerulea*	362
M	*Patella* cf. *ulyssiponensis*	84
M	*Patella ferruginea*	4
M	*Patella rustica*	3
M	*Patella* sp.	86
M	*Bolma rugosa*	3
M	*Osilinus articulatus*	30
M	*Osilinus turbinatus*	817
M	*Gibbula divaricata*	7
M	*Phorcus mutabilis*?	38
M	*Phorcus richardi*	6
M	Trochidae gen. et sp. indet.	46
M	*Truncatella subcylindrica*	1
M	*Littorina neritoides*	3
M	*Natica* sp.	2
M	*Galeodea echinophora*	1
M	*Hexaplex trunculus*	2
M	*Stramonita haemastoma*	5
B	*Cyclope neritea*	10
M	*Columbella rustica*	35
Land (T) gastropods		
T	*Pomatias elegans*	1
T	*Rumina decollata*	1
T	*Siciliaria* sp.	2
T	*Limax* sp.	13
T	*Oxychilus* cf. *draparnaudi*	5
T	*Cernuella* sp.	1
T	*Chilostoma planospira*	2
T	*Marmorana* sp.	10
T	*Helix* sp.	98
T	Gastropod gen. et sp. indet.	1
Marine (M) and brackish (B) bivalves		
M	*Donax* cf. *venustus*	1 (1)
M	*Glycymeris violacescens*	3 (4)
M	*Ostrea edulis*	21 (21)
B	*Cerastoderma glaucum*	157 (303)
M	*Acanthocardia tuberculata*	7 (11)
		2036

roe deer. This is probably due to the humid and mild phase starting with the Alleröd interstadial, when open wood (the ideal habitat of red deer - Mattioli 2003) was possibly integrated or replaced by broadleaf complexes abounding in underwood, more suitable for the roe deer and the wild boar (Apollonio 2003, Perco 2003). Better trophic conditions may account for the larger size of these ungulates (see above).

At Grotta della Serratura, located a few hundred metres from Grotta della Cala, a very similar faunal change is recorded within the Final Epigravettian (layers 8c-8a) (Hellemans *et al.* 1993).

Comparison between these Cilento sites and the coeval layers of Grotta delle Mura (Monopoli - Bari), located on the Adriatic Apulian coast, a very arid region, gives some interesting insights. At Grotta

Fig. 8 *- Grotta della Cala - Shells with piercings, incisions or residues of red pigment: shells of* Columbella rustica, Cyclope neritea *and* Natica *sp. (ns. 1-3); fragment of a left valve of* Cerastoderma glaucum *with residues of red pigment (n. 4); right valve of* Acanthocardia tuberculata *with piercing (n. 5) and right valve of* Ostrea edulis *with incisions (n. 6). / Conchiglie con fori, incisioni, o residui di pigmento rosso: conchiglie di* Columbella rustica, Cyclope neritea *e* Natica *sp. (nn. 1-3); frammento di valva sinistra di* Cerastoderma glaucum *con residui di pigmento rosso (n. 4); valva destra di* Acanthocardia tuberculata *con foro (n. 5) e valva destra di* Ostrea edulis *con incisioni (n. 6).*

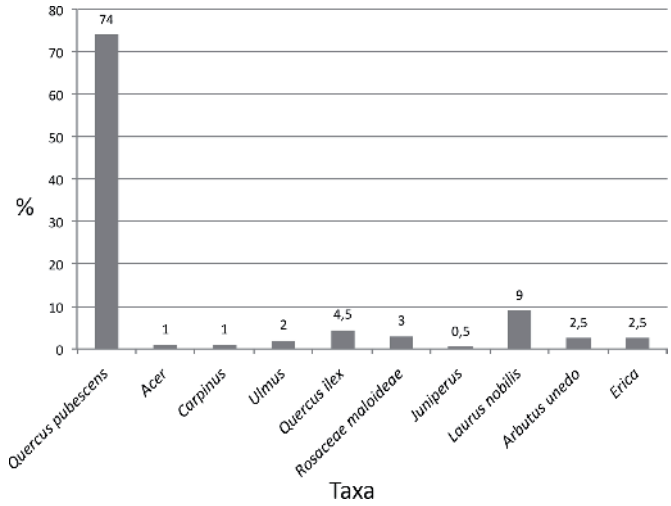

***Fig. 9** - Grotta della Cala - Percentages of identified charcoal fragments in the layer 7. Percentages were calculated from a total of 200 analysed charcoals. / Percentuali dei carboni identificati nello strato 7, calcolati su un totale di 200 frammenti.*

delle Mura open environment ungulates like the auroch (forest steppe) and the horse dominate the faunal association. The Pre-boreal to Boreal climatic improvement is attested by the progressive increasing of the auroch reaching 68% of ungulates in Mesolithic layer 2 (Bon & Boscato 1993, 1996).

People from these two areas of Southern Italy, divided by the Apennine Chain, although being at the same latitude and in the course of the same climatic phase, developed their food procurement strategies by exploiting completely different environments.

The charcoal assemblage from layer 7 shows the presence of a deciduous forest dominated by *Q. pubescens* mixed with *Acer* and *Carpinus*, while maquis vegetation, which presently characterizes this coastal sector, was nearly absent. These data are consistent with those from the zooarchaeological analysis, that is with the wide occurrence of forest taxa.

Layer 7 also yielded a lot of malacofauna composed of both of the terrestrial and, above all, marine species. Most of these species could easily be gathered without any implement help, except for *Patella* which would require *ad hoc* un-sticking tools. Even though mollusc gathering was mainly aimed at satisfying food necessity, a certain number of shells from layer 7 (principally *Cyclope neritea* and *Columbella rustica*) were clearly used as ornaments, given the occurrence of intentional piercings and colouring substances on their surfaces.

The preliminary study of the lithic assemblage has highlighted techno-typological features which are usually considered as distinctive of the Sauveterrian. Reduction sequences express a flexible production concept both by exploiting and adapting to the morphological characteristics of raw material according to a "pragmatic" approach (Walzak 1998; Fontana & Cremona 2008). Blank selection mirrors the dichotomy (see Wierer 2008; Fontana & Cremona 2008) between bladelets/small flakes for microliths on the one hand, and larger products (often by-products from a different operational chain) for "common tools" on the other. Microliths comprise two Sauveterre points and an important component of the tool-kit is embodied by macro-artefacts.

Since the study of the lithic assemblage from layer 7 is still widely incomplete (not only referring to the techno-typological analysis, but also to the use wear and residue traces) and also material from layer F should be wholly revisited, it is too early to put forward hypotheses about the function of the site during the Mesolithic occupation. Nevertheless, it is worth noting the anomaly currently featured by the low number of armatures and end-scrapers. Actually both these categories are usually much more numerous in Sauveterrian sites, reaching, even 50-70% of the retouched component and 40% of non-backed tools respectively.

If these data are confirmed by the revision of the lithic assemblage from layer F (layer 7 and F together cover an investigated area of about 24 square metres) two hypotheses might be taken into consideration: 1) microliths were moved elsewhere as either armatures or finished weapons, 2) microliths concentrated in the atrium of the cave, the area where Mesolithic and part of the Epigravettian deposits were eroded by the Holocenic sea ingression (Bartolomei *et al*. 1975).

In this view the activity area discovered in squares D-E 16-18 deserves special attention. In this area both implements for the processing of colouring substances (grindstone) like ochre and, possibly, food (anvil/hammer), and decorated objects (painted pebble and incised oyster) were retrieved in the close proximity of a fireplace, along with a series of pierced shells scattered around. This evidence does entail that the inner part of the cave was used as a place for symbolic and, perhaps, ritual practices (did they also involve processing/consumption of specific food?). The co-existence of a number of objects devoted to the symbolic/magic sphere with other elements mostly connected to day-to-day requirements (knapped cores and implements, faunal remains) may result from the different use of the same area in different times. However it is more likely that the atrium of the cave, wider and full of light, could have been the most suitable place for daily activities. This might account for the low number of armatures and, more in general, of tools recovered in the internal series.

Authors' contributions

Adriana Moroni carried out the study of the lithic assemblage and conceived the article together with Paolo Gambassini and Paolo Boscato who also performed the faunal analysis. Gaetano Di Pasquale and Emilia Allevato performed palaeobotanic investigations. Andrea Benocci, Leonardo Favilli and Giuseppe Manganelli carried out mollusc analysis. Fabrizio Di Bella collaborated as an undergraduate student to the study of lithic, faunal and malacofauna remains. Conclusions were discussed among all the authors.

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