



Article

The Mesolithic levels of Grotta del Santuario della Madonna at Praia a Mare (Cosenza, Italy): new excavations, chronological data and techno-typological features of the lithic assemblages

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Key words

- Calabria
- Cave
- hearths
- shell middens
- Early Mesolithic
- Undifferentiated Epipalaeolithic

Parole chiave

- Calabria
- Grotta
- focolari
- chiocciolai
- Mesolitico antico
- Epipaleolitico Indifferenziato

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Summary

The cave opens on a cliff at about 500 m from the modern coastline. The excavations discovered an impressive archaeological deposit, evidencing human frequentation from the Upper Palaeolithic to the Middle Ages. Since 2002 new excavations adjacent to the old trench were carried out. In the new excavations, evidences of the latest Mesolithic frequentations had been disturbed by Neolithic structures. The underlying Mesolithic layers are characterized by the presence of well-organized hearth structures, shell middens, lithic industry and bone remains of wild mammals, tortoises and malacofauna. The data on the lithic production indicate the presence of an Early Mesolithic assemblage, with very low microlithic component known as Undifferentiated Epipalaeolithic. The new dates, frame the middle Mesolithic levels between 7040 and 7310 cal. BC and the lower ones, with the hearths and the shell midden, between 7830 and 8430 cal. BC.

Riassunto

La grotta si apre su una falesia a circa 500 metri dalla costa attuale. Gli scavi hanno messo in luce un imponente deposito archeologico, che evidenzia una frequentazione umana dal Paleolitico superiore al Medioevo. Sono stati effettuati nuovi scavi adiacenti alla vecchia trincea. I nuovi scavi hanno evidenziato che i livelli con le ultime frequentazioni mesolitiche sono stati disturbati dalle successive strutture neolitiche. Gli strati mesolitici sottostanti sono caratterizzati dalla presenza di strutture e focolari ben organizzati, "chiocciolai", industria litica e resti ossei di mammiferi selvatici, tartarughe e malacofauna. I dati della produzione litica indicano la presenza di una industria del Mesolitico antico, con bassissima componente microlitica, nota come Epipaleolitico indifferenziato. Le nuove, inquadrano i livelli mesolitici intermedi tra il 7040 e il 7310 a.C. e quelli inferiori con i focolari e il chiocciolaio tra 7830 e 8430 a.C.

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Fig. 1 - Grotta del Santuario della Madonna (southern Italy) location of the cave, panoramic views of the cliffs (photo I. Fiore). / Localizzazione del sito, vista panoramica della falesia (foto I. Fiore)

Introduction

This paper presents the results of AMS 14C dating carried out on charcoal samples selected from the Mesolithic levels in an excavated area at the Grotta del Santuario della Madonna. In addition, the results of the techno-typological study of the lithic industry will be described. All the artifacts have been studied and classified in order to reconstruct the reduction processes, as well as the raw material procurement strategy and the typological features.

The cave, a single large room (2000 m² surface and 15 m high), opens on a cliff at about 500 m from the modern coastline (Fig. 1) The excavations carried out by the Istituto Italiano di Paleontologia Umana of Rome (1957-1970) have highlighted an impressive archaeological deposit, over 8 m thick, with several layers related to human occupation of the cave, from the late phases of the Palaeolithic to the Middle Ages (Cardini 1972). In fact, Grotta del Santuario della Madonna has been one of the key sites traditionally used, since the 1960s/70s, for the reconstruction of the different chrono-cultural phases in the prehistory of Southern Italy (AAVV 2000; Tagliacozzo 2000; Tagliacozzo and Fiore 2003; Fiore et al 2004a-b). Starting in 2002 the Soprintendenza al Museo Nazionale Preistorico Etnografico "L. Pigorini" carried out new excavations adjacent to the old trench, close to the NW wall of the cave (Fig. 2). Such new excavations (test trench 4x5 m) involved the upper and the middle layers of the stratigraphic sequence, corresponding to about 5.5 m of anthropic deposit referred to the Holocene period, down to the Mesolithic occupation (Fugazzola et al 2004; 2005; 2007; Tiné 2006; Scarciglia 2009).

The aim of this study is to provide an accurate chronology of the Mesolithic levels of Grotta della Madonna and to describe the main techno-typological features of the lithic industry, for a more accurate definition of the Mesolithic in South-Central Italy.

Study area

The stratigraphy of the studied area is shown in Figure 3.

Under the first layer, immediately below the surface and covered by a modern cemetery, 4 main horizons can be recognized in the new stratigraphic sequence (Cardini 1972; Calcagnile *et al.* 2010):

Horizon II. The upper levels belong to the Middle Bronze Age Apennine Culture (Middle Bronze Age, phase 3, 11th–12th centuries BC) and Proto- Apennine Culture (Middle Bronze Age, phases 1–2, 12th–14th centuries BC), showing clear anthropic palaeo-surfaces. These layers are followed by Late Chalcolithic–Early Bronze Age thin levels (Laterza culture pottery). Archaeological remains suggest an intense anthropic frequentation of the cave.

Horizon III. This is formed by thin strata showing a peculiar two-fold, black and- white, mode of soil deposition. The small amount of pottery recovered belongs to the Early Chalcolithic (Piano Conte style, second half of 4th to first half of 3rd millennium BC) and Late Neolithic (Spatarella-Diana style, end of 5th to beginning of 6th millennium BC). Archaeological remains show clearly the low intensity of human frequentation of the cave.

Horizon IVA. This horizon is characterized by a yellowish clay formation with few pottery sherds belonging to the Late Neolithic (Diana style) or to the evolved phases of the Middle Neolithic (Serra d'Alto style). This stratum clearly indicates a hiatus in the human occupation of the cave.

Horizon IVB. The bottom Neolithic level contains a large amount of the typical Bande Rosse pottery from earliest phases of the Middle Neolithic in southern Italy (second half of the 6th millennium BC). Several hearths and drainage structures recovered in this stratum suggest a residential use of the cave by Neolithic people.

Horizon V. Mesolithic. The upper Mesolithic level has been partially disturbed by the installation of Middle Neolithic structures (pits and post holes with rare pottery). The underlying Mesolithic layers are characterized by the presence of hearth structures, shell mid-

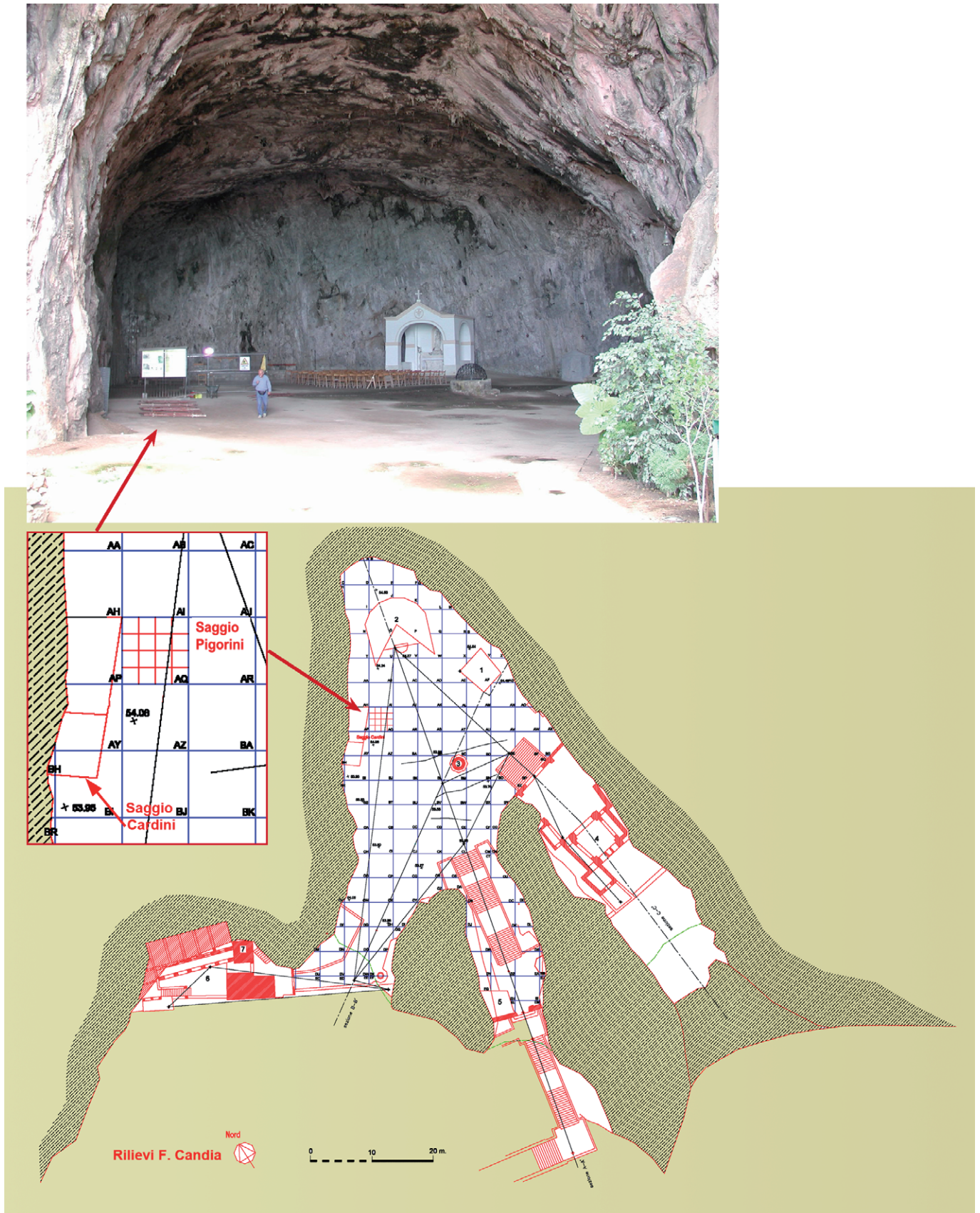
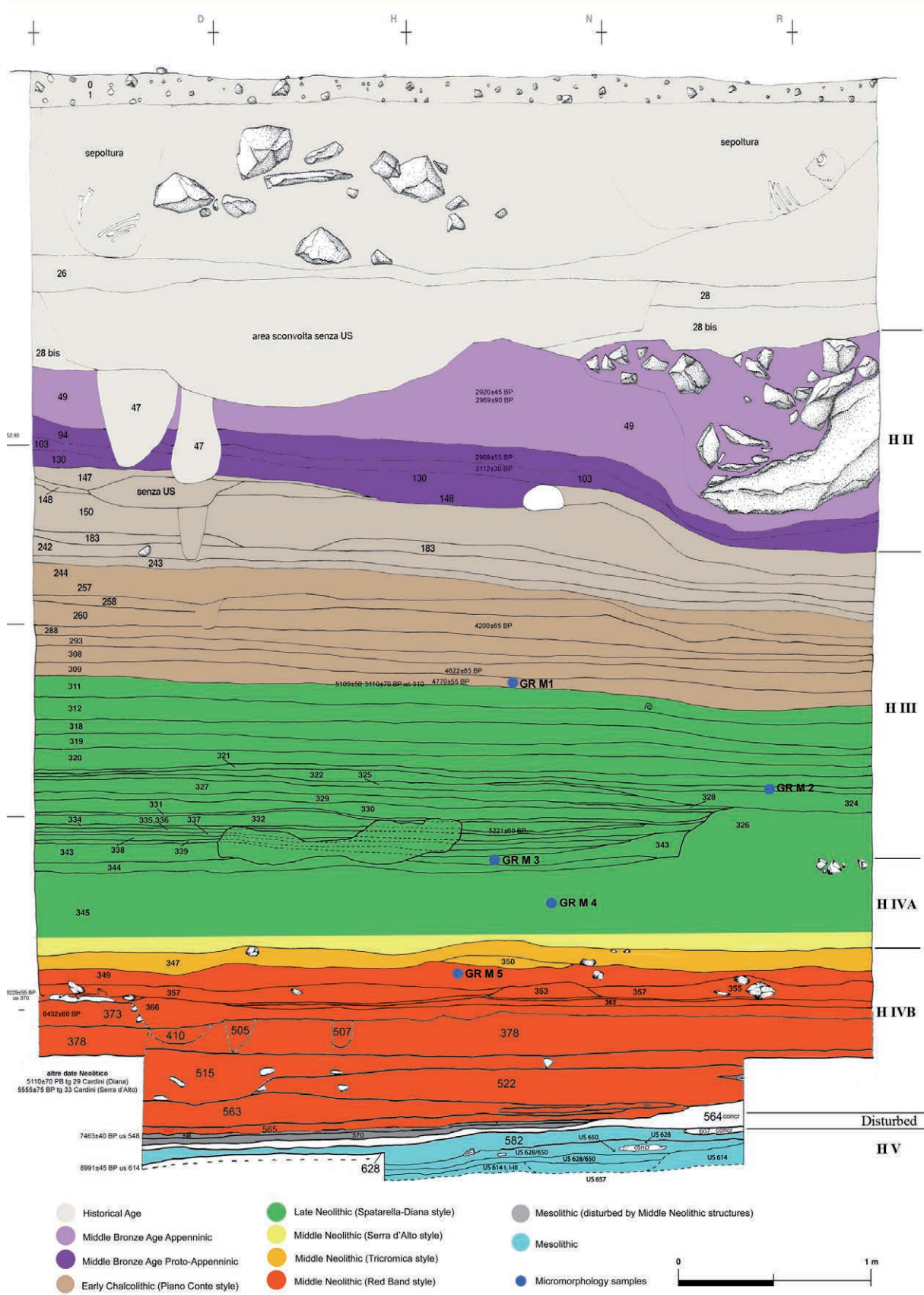


Fig. 2 - Grotta del Santuario della Madonna: view of the interior of the cave (photo V. Tinè), general planimetry of the cave (drawing F. Candia) and detail of the excavation trench. / Vista dell'interno della grotta (foto V. Tinè), planimetria generale della grotta (rilievo F. Candia) e dettaglio del saggio di scavo.



Grotta del Santuario della Madonna di Praia a Mare. Sezione C-D (Tinè 2006, modificata E. Natali, I. Fiore)

Fig. 3 - Grotta del Santuario della Madonna: new stratigraphical sequence. Five main phases has been recognized under the first layer dated to the modern age. / Nuova sequenza stratigrafica. Sotto il primo strato di età moderna, sono stati riconosciuti 5 orizzonti principali.

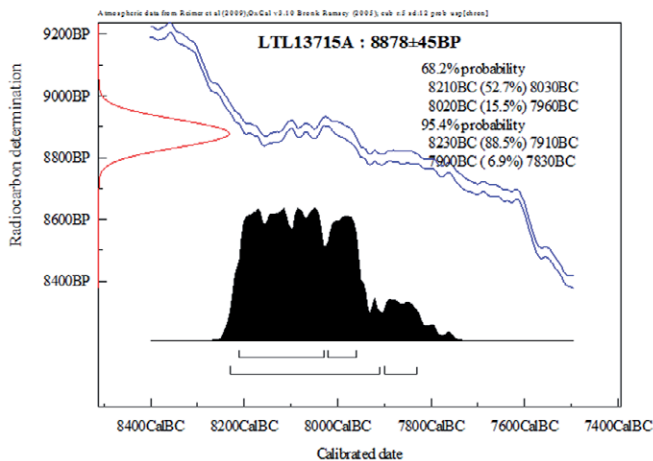


Fig. 4 - Grotta del Santuario della Madonna: calibration curve of the radiocarbon measurements from the sample LTL13715A (feature 657). / Calibrazione della data convenzionale al radiocarbonio del campione LTL13715A proveniente dall'US 657.

dens, lithic industry, bone remains and abundant malacofauna. Archaeological remains suggest an intense anthropic frequentation of the cave.

Methods

Short-lived samples, identified by palaeo-botanical analysis, were selected for AMS ^{14}C dating analyses, which were carried out at the CEDAD (Centre for Dating and Diagnostics) of the University of Salento (Calcagnile *et al.* 2004, 2010).

The samples were prepared by standard chemical processing employed for plant remains, essentially consisting in alternate acid-alkali-acid (AAA) washes and were aimed at the removal of contaminants (D'Elia *et al.* 2004). Conversion of the purified sample material to carbon dioxide was done by combustion at 900 °C in sealed quartz tubes. The extracted carbon dioxide was then converted into graphite by catalytic reduction using H_2 as reducing agent and iron powder as catalyst.

The quantity of graphite extracted from the samples resulted to be adequate for an accurate experimental determination of the age. ^{14}C measurements were carried out at the CEDAD on its 3MV HVEE 4130HC Tandemtron accelerator (Calcagnile *et al.* 2005). IA-

EA-C6 (sucrose) and IAEAC4 (sub-fossil wood) standards were used for normalization and background correction, respectively.

The conventional radiocarbon date has been corrected for the effects of isotopic fractionation by measuring the $\delta^{13}\text{C}$ term, carried out directly with the accelerator and for the background of the measurement.

Samples of known concentration of Oxalic Acid provided by the NIST (National Institute of Standard and Technology) have been employed as a control for the quality of the results. For the determination of the experimental error in the radiocarbon date, both the scattering of the data around the mean value and the statistical error deriving from the counting of the ^{14}C have been taken into account. The radiocarbon dating for the samples was then calibrated in calendar years using the software OxCal Ver. 3.10 based on atmospheric data (Reimer *et al.* 2004; Fig. 4).

The study of the lithic production was carried out following the stratigraphic sequence and the relationships between the layers belonging to the same occupation phase. For this reason, according to the stratigraphic sequence, the lithic materials were grouped into three main phases. All the artefacts have been studied and classified in order to reconstruct for each phase the reduction processes as well as the raw material procurement strategy and the typological features.

Results

Stratigraphic sequence, dwelling structures and AMS ^{14}C dating

The charcoal samples that allowed the new dates have been collected from different Mesolithic levels and structures evidenced during the 2010 and 2011 excavations (Tab. 1). A sample from the Mesolithic levels (Stratigraphic Unit 1025) had been already dated (Calcagnile *et al.* 2010) in 2006 during the works for the re-establishment of the old trench excavated by Cardini. Such sample (LTL3578A) provided the following results: 8963±60 BP (uncalibrated ^{14}C age) and 8274–8181 (38.4%); 8113–8090 (7.7%); 8076–8061 (4.6%); 8043–7994 (17.5%) (Calibrated time ranges for each sample were obtained using the OxCal model). Previously (Cardini 1972) two other dates of the middle-basal levels (cuts 45-46) of layer I (Mesolithic) of the Cardini excavations were known: the first one was obtained on charcoal (R-187: 8735±80 BP uncal), the second one on burnt bones (R-188: 9070±80 BP uncal).

The new stratigraphic record and the related ^{14}C dates allow us to detect three main phases of Mesolithic occupation. In the following paragraphs the levels yielding the charcoal samples that allowed the new dates will be briefly illustrated starting from the top

Tab. 1 - Grotta del Santuario della Madonna: AMS ^{14}C dating, the samples are listed together with their locations within the strata. / AMS ^{14}C dating, elenco dei campioni con la provenienza stratigrafica.

CODE	CEDAD CODE	RADIOCARBON AGE (BP)	$\delta^{13}\text{C}$ (‰)	CALIBRATED DATE (2 σ CONFIDENCE LEVEL)
GRM 2010 US548 TGI	LTL13713A	7463 ± 40	-22.8 ± 0.4	6420BC (95.4%) 6240BC
GRM 2011 US637 TGII	LTL13714A	8135 ± 45	-23.6 ± 0.3	7310BC (13.6%) 7210BC 7200BC (81.8%) 7040BC
GRM 2010 US612	LTL13712A	8782 ± 45	-27.8 ± 0.5	8200BC (95.4%) 7600BC
GRM 2011 US614 TGIII	LTL13716A	8991 ± 45	-31.4 ± 0.3	8300BC (72.2%) 8160BC 8120BC (23.2%) 7970BC
GRM 2011 US657 TGIII	LTL13715A	8878 ± 45	-30.4 ± 0.2	8230BC (88.5%) 7910BC 7900BC (6.9%) 7830BC
GRM 2011 US657 TGI-II	LTL13717A	9076 ± 45	-25.1 ± 0.7	8430BC (3.0%) 8370BC 8350BC (92.4%) 8220BC

of the Mesolithic sequence; furthermore, a synthesis of the data on the faunal remains recovered in these levels will be also provided¹.

The upper levels (phase 3)

SU 548 represents a residue of the most recent level of Mesolithic frequentation of the cave. It is a silty level with small charcoal fragments, lithic industry and wild mammal bones, partially disturbed by Middle Neolithic structures (Fig. 5). The only 14C date obtained so far for this level (7463 ± 40 BP, 6420 – 6240BC cal) is surprisingly more recent than the other dates known for the Mesolithic in Southern Italy and almost overlaps with the earliest dates of the Initial Neolithic in the Southeast (from around 6200 cal BC; Pessina Tiné 2008). Given the presence in these levels of post holes and Neolithic sherds from the overlying levels, this date may be the result of a contamination from these later phases or may represent a charcoal, residue of firing episodes from outside the cave, accidentally incorporated by colluviation into the filling (as ascertained in several layers by micro morphological analysis; Scarciglia *et al.* 2008). In any case, more dating of these higher levels of the Mesolithic frequentation of the site are planned in order to clarify their possible extension.

The medium levels (phase 2)

SU 582 is a level of Mesolithic frequentation with presence of combustion areas, lithic industry and wild mammal bones (with wild boar and red deer more frequent than roe deer). Several mammal specimens show butchery marks; some percussion cones, suggesting bone fracturing, occurred close to the hearth. Rare bird remains are also present: dove (*Columba livia/oenas*), common raven (*Corvus cf. corax*) and crag martin (cf. *Ptyonoprogne rupestris*). The dove ulna presents scrape marks on the dorsal face, while the radius of the common raven shows some combustion traces localized on the extremity. These traces may indicate the exploitation of the bone as raw material or be related to the procurement of feathers, rather than to butchery/consumption (Fiore *et al.* this volume). Fish remains are rare and the malacofauna is scarce, with few limpets and some land gastropods. There are also rare bone tools and some pierced shells of rustic dove snail (*Columbella rustica*).

SU 612 (in SU 582) represents the lower level, formed by stones and charcoal-rich soil, of a hearth consisting in a shallow pit filled with charcoal-rich and cineritic sediments (LTL13712A: 8782 ± 45 BP, 8200 – 7600BC cal, Tab. 1).

The lower levels (phase 1)

SU 637 is the fill of a circular pit (SU 638) excavated in the Mesolithic palaeo-surface SU 628

Such fill, silty and friable with small stones and dispersed charcoal, contained mammal bones malacofauna and lithic industry (Fiore *et al.* this volume). The 14C date obtained for this structure (LTL13714A : 8135 ± 45 BP uncal, 7310 – 7210BC cal; 7200-7040BC cal, Tab. 1) is not consistent with its stratigraphic position.

The first depositional level of the pit seems to evidence a selection of faunal elements. In fact, besides ungulate remains, there are a wolf mandible, a complete distal posterior limb of a badger and several shells of limpets and top snails. Among the ungulates, the remains of wild boar (NISP 18) are prevalent, red deer is scarcer (NISP 7) and roe deer is rare (NISP 3). Many specimens are characterized by localized burning traces, while butchery marks are represented by cuts and impacts.

The wolf (*Canis lupus*) is represented by a right hemi-mandible belonging to an adult-senile individual, probably a male, considering the large size. The most evident traces of human handling are those referred to the fracturing for the extraction of the canine, that is actually absent and to the stone tool cut marks located on the lateral face below the condyle, referable to the disarticulation of the mandible from the cranium.

The left posterior distal limb of the badger (*Meles meles*) was recovered in anatomical articulation. The completeness of the limb end and the way it was recovered suggest the intentional deposition of the paw still with part of the soft tissues and the pelt. It probably represented an ornament or an amulet rather than the residue of a pelt since sometimes the paws remain attached to it (Fiore *et al.* this volume).

Birds are represented by 3 undetermined fragments. An ulna diaphysis of a large sized bird shows stone tool cut marks that may be interpreted as related to the procurement of raw material rather than to simple butchery. Furthermore, in pit SU 638 there are large portions of carapace and plastron of both pond and terrestrial tortoises. Limpet shells are abundant, while top snails and terrestrial gastropods are rarer. A *Monodonta* specimen presents dark marks located on one half of the shell. Some limpet shells show clear-cut fracture edges that could have been produced by the use of these shells as side or end scrapers. Rare remains of fish, sea urchin and hard animal tissue artifacts are also present.

In the occupation level SU 614 (LTL13716A: 8991 ± 45 BP uncal, 8300 – 8160BC cal; 8120-7970BC cal, Tab. 1) there is a wide combustion area (USs 641-642-657). The hearth (SU 641) is made of two layers of medium-small stones, containing granular sediment, as well as numerous small charcoal fragments and burnt bones (Fig. 6). Adjacent to the hearth there is an area (SU 642) of brown-reddish granular clay, with small and medium stones, rich in charcoal, fauna (in particular large portions of tortoise carapace and plastron, some of them in anatomical connection and limpets) and lithic industry. Around the hearth there is an area (SU 657), rich in charcoal, with a concentration of food debris, in particular malacofauna (terrestrial and marine) and large portions of tortoise carapace and plastron, with rare mammal bones and some burned stones in the center. Unfortunately both the hearth and the adjacent area continue under the trench wall and therefore it was not possible to investigate them completely (Fiore *et al.* this volume).

The three different areas that form the combustion structure seem to be characterized by the presence of different animal spe-



Fig. 5 - Grotta del Santuario della Madonna: the Mesolithic level disturbed by Middle Neolithic features (pits and post-holes) (photo I. Fiore). / Livello mesolitico disturbato da strutture del Neolitico Medio (fosse e buche di palo) (foto I. Fiore).

¹ The Mesolithic layers are characterized by the presence of well-organized hearth structures, shell middens, lithic industry, bone remains of wild mammals and tortoises and abundant malacofauna. For the analytical description of the levels and the structures as well as of the faunal composition, the lithic assemblage and the archaeological interpretation of the structures see Fiore *et al.* 2016 in this volume.



Fig. 6 - Grotta del Santuario della Madonna: there the Mesolithic layers produced evidence of several well-organized fire-places and a shell midden (photo I. Fiore). / Gli strati del Mesolitico sono caratterizzati, nell'area indagata, dalla presenza di focolari ben organizzati e da un chiocciolaio (foto I. Fiore).

cies. SU 641 yielded almost exclusively tortoises, both pond and terrestrial ones, with localized combustion traces. There are also numerous fragments of terrestrial gastropods and rare limpet shells. Wild boar and red deer remains are extremely rare. Fishes are represented by 4 elements.

In SU 642 abundant remains of malacofauna are present; these include mainly limpets, with less frequent top snails and terrestrial gastropods. There are also rare remains of red and roe deer, wild boar and tortoise. The two rustic dove snail shells are pierced.

In SU 657 there is a high concentration of terrestrial gastropod fragments, numerous limpet shells and more rare top snails (LT-L13717A: 9076 ± 45BP uncal, 8430 –8370BC cal; 8350-8220BC cal. LTL13715A: 8878 ± 45 BC uncal; 8230-7910BC cal; 7900-7830BC cal, Tab. 1). Abundant remains of tortoises, mainly the pond one, are also present, frequently with clear cooking traces. Many large portions of tortoise are preserved and sometimes the limb long bones are still articulated. There are rare remains of ungulates: red deer, wild boar and roe deer. In addition, there is a fragment of badger skull with cut marks. Fish and bird remains are extremely rare. There is also a *Glycymeris* pierced shell.

Overall, the combustion structure appears as a true and typical Mesolithic shell midden, resulting from several repeated occupations of the same place, with accumulation, around a hearth, of food debris mainly related to gathering (terrestrial and marine mollusks, tortoises) rather than hunting activities (Fiore *et al.* this volume).

The lithic assemblages

Raw material

In the whole Mesolithic sequence of Grotta della Madonna the lithic assemblages are made mainly on local raw materials, as pebbles of variable shape and size, that were gathered locally in secondary deposits (marine shore and river beds). Recent researches on the raw material procurement during the Upper Paleolithic in the Calabro-Campanian region (Martini *et al.* 2003; Martini *et al.* 2007, Lo Vetro *et al.* 2011, Romagnoli *et al.* 2016) provided useful information about the lithic resource availability also for the area surrounding Grotta della Madonna². Although the study on

raw materials is still in progress and more detailed petrographic analyses are expected, we can plausibly assume that most of the rocks exploited at the site may be referred to pebbles collected in secondary deposits not far from the cave (Noce river basin and mouth, shoreline) originating from the Triassic-Jurassic formations (Lagonegro Units) located in the mountainous areas north east of the site, up to 30 km away as the crow flies (Massiccio del Sirino). These outcrops yielded mainly red, green and gray good quality radiolarites and dark to gray transparent flints, which are very abundant in the Mesolithic assemblages of Grotta della Madonna. Radiolarites and flint pebbles had not been accurately selected by the cave occupants, in fact several items (flakes, cores, small block fragments, debris) show natural surfaces or fissures and are referable to pebbles affected by internal fractures (Fig. 7, nos. 2, 16; Fig 8, nos. 6, 9, 10). Few flint and radiolarite blanks bearing residual natural surfaces, may suggest an occasional gathering also from the detritus. A considerable amount of corticated blanks comes from pebbles of low quality chert, dark brown to gray in color, with medium-grained matte texture and very smooth surfaces. The origin of a high quality transparent flint whose exploitation is evidenced by some items, is still unknown.

Radiolarites, especially the red ones, were the most frequently knapped rocks during the whole Mesolithic sequence. Among the formal tools these lithotypes occur in all typological categories of the assemblages. Flint is also abundant, this raw material consists of a wide variety of lithotypes among which semitransparent, black and light to dark gray colored ones are prevalent. Flint too covers a broad range of typologies and this rock seems to be preferred in the backed tool production. At a subordinate place there is the low quality chert, exclusively used to make scrapers, notches and denticulates, coarsely retouched, and to obtain wide flakes used without retouch.

The very few obsidian items (3 from phase 3 and 1 from phase 1) are intrusive, due to the installation of Middle Neolithic structures that partially disturbed the underlying levels.

Lithic assemblages composition

In all the sequence lithic artefacts are scarce and only in the first two phases they are enough to accomplish a statistically reliable techno-typological study. However, a comparison of the assemblage composition in the three phases indicates a similar ratio in the percentages of the different technological categories (Tabs. 2-3). The large amount of unretouched flakes compared to the paucity of laminar blanks is constant throughout the sequence and clearly evidences a flake-oriented production. The percentage of the retouched blanks indicates a moderate degree of transformation of the blanks, while the high percentages of waste products, such as debris and hyper-microflakes, are reasonably due to the knapping activity performed in the excavated area, whereas the low number of shaping and maintenance blanks is probably related to the low technical investment characterizing the assemblages.

Reduction methods and raw material economy

All along the Mesolithic sequence pebble exploitation is essentially aimed at the production of crude and unstandardized flakes by direct hard percussion. Two main *chaînes opératoires* have been reconstructed:

a) exploitation of radiolarite and flint pebbles by means of unidirectional and multidirectional methods with a low degree of pre-determination (Fig. 7, nos. 1-2; Fig. 8, n. 10), in order to obtain mainly squat and asymmetric flakes and, secondly, irregular laminar flakes. Items attributable to shaping and surface maintenance of the cores are sporadic. Blanks frequently bear more or less broad portions of the cortical surface. The blank size is variable, mainly ranging from

² The lithic samples collected during the above mentioned researches, stored at the Museo e Istituto fiorentino di Preistoria, were used as comparative material.

Tab. 2 - Grotta del Santuario della Madonna: Composition of the lithic assemblages. / Composizione delle industrie litiche.

TECHNOLOGICAL CATEGORIES/US	PHASE 1											
	641-642-657		637	650, 628, 625, 623, 620, 618		616		614		TOT		
	N		N		N	%	N	%	N	%	N	%
Flakes	16		9		75	21,9	44	19,6	100	30,9	244	25,1
Laminar flakes	-		2		4	1,2	5	2,2	8	2,5	19	2,0
Blades/bladelets	-		2		10	2,9	6	2,7	2	0,6	20	2,1
shaping/maintenance blanks	1		5		26	7,6	10	4,4	10	3,1	52	5,4
Undeterminable fragments	1		1		38	11,1	39	17,3	55	17,0	134	13,8
Debris and flakes < 1cm	14		12		161	46,9	104	46,2	112	34,6	403	41,5
Retouched blanks	7		7		24	7,0	17	7,6	34	10,5	89	9,2
Cores	1		3		4	1,2	-	-	1	0,3	9	0,9
Raw material blocks	-		-		1	0,3	-	-	-	-	1	0,1
Total	40		41		342		225		324		971	

TECHNOLOGICAL CATEGORIES/US	PHASE 2						PHASE 3					
	617-619, 615,612,607,602		582		TOT		564	570	548		TOT	
	N	%	N	%	N	%	N	N	N	%	N	%
Flakes	43	30,5	288	38,0	331	36,8	13	4	36	18,2	53	18,7
Laminar flakes	-	-	3	0,4	3	0,3	0	0	3	1,5	3	1,1
Blades/bladelets	1	0,7	15	2,0	16	1,8	1	1	10	5,1	12	4,2
shaping/maintenance blanks	4	2,8	18	2,4	22	2,4	5	0	6	3,0	11	3,9
Undeterminable fragments	6	4,3	26	3,4	32	3,6	7	5	22	11,1	34	12,0
Debris and flakes < 1cm	73	51,8	350	46,2	423	47,1	24	18	108	54,5	150	53,0
Retouched blanks	11	7,8	54	7,1	65	7,2	5	0	9	4,5	14	4,9
Cores	2	1,4	4	0,5	6	0,7	1	1	4	2,0	6	2,1
Raw material blocks	1	0,7	-	-	1	0,1	-	-	-	-	-	-
Total	141		758		899		56	29	198		283	

micro (up to 25 mm) to small (26-50 mm)³. The flake production is unimodal, micro-flakes are obtained by means of intensive exploitation of the cores (Fig. 7, n. 2), although the occasional use of smaller pebbles or blocks to obtain micro- and hyper-microflakes cannot be excluded. Very few laminar blanks may be referred to this *chaîne opératoire*: also in this case they are asymmetrical, irregular in shape (Fig. 7, nos. 9-10; Fig. 8, nos. 6, 23) and not standardized; therefore they may be considered as an occasional outcome of a reduction system not aimed at the laminar production.

b) exploitation of low-quality chert, in form of oblong pebbles with ovoid cross-section, to obtain coarse cortical and semi-cortical large flakes to be used without further modifications (Fig. 7, n. 27; Fig 8, n. 8) or after being roughly retouched (scrapers, notches and

denticulates) (Fig. 7, nos. 17, 24;). The average size of the blanks is generally larger than that of the other raw materials, with length ranging mainly from small (26-50 mm) to medium (51-100 mm). Several blanks have a cortical butt, plain, wide and inclined (sometimes less than 75°), a cortical back and a sharp edge on the opposite side (Fig. 8, n. 25). The technical procedures adopted for the blank production are rather rudimentary and do not meet any criteria of pre-determination. The pebbles were reduced without preliminary shaping, exploiting a naturally flat side of the pebble; their knapping continued without surface maintenance.

Very few micro-bladelets, mainly made of good quality flint, may suggest the occasional adoption of a lamellar reduction method; however, the general rarity of laminar blanks and the lack of blade cores and other technological elements clearly referable to a laminar method, make it difficult to recognize a reduction scheme expressly aimed at bladelet production. The slight increase in blade/bladelet percentage in phase 3 (from ca.2% to ca.4%) may be due, in part, to

3 The dimensional parameters are referred to the typometric classification by G. Laplace (1968).

Tab. 3 - Grotta del Santuario della Madonna: Typological structures (according to Laplace's 1964 analytical typology) / Strutture tipologiche (secondo la tipologia analitica di Laplace 1964).

TIPOLOGY/US	PHASE 1							PHASE 2				PHASE 3		
	641, 642, 657	637	628, 625, 623, 620, 618	616	614	TOT	%	617-619, 615, 612, 607, 602	582	TOT	%	564	548	TOT
Burins	1	2	-	-	-	3	3,2	-	-	-	-	1	-	1
End-scrapers	-	-	2	1	6	9	9,6	1	7	8	12,1	-	3	3
<i>short end-scrapers</i>	-	-	2	1	4	7	7,4	1	7	8	12,1	-	3	3
<i>nose end-scrapers</i>	-	-	-	-	1	1	1,1	-	-	-	-	-	-	-
<i>carinated short end scrapers</i>	-	-	-	-	1	1	1,1	-	-	-	-	-	-	-
Truncations	-	1	-	-	-	1	1,1	-	2	2	3,0	-	1	1
Borers	-	-	4	-	2	6	6,4	1	3	4	6,1	2	1	3
Backed tools	-	-	1	3	-	4	4,3	2	8	10	15,2	-	-	-
<i>backed points (double backed items)</i>	-	-	-	2(2)	-	2 (2)	2,1 (2,1)	2	3(1)	5(1)	7,6 (1,5)	-	-	-
<i>backed blades</i>	-	-	-	-	-	-	-	-	3	3	4,5	-	-	-
<i>Fragments of backed tool</i>	-	-	1	1	-	2	2,1	-	2	1	1,5	-	-	-
Geometrics	-	-	-	-	1	1	1,1	-	-	-	-	-	-	-
<i>crscents</i>	-	-	-	-	1	1	1,1	-	-	-	-	-	-	-
Blade scrapers	-	-	-	-	-	-	-	-	2	2	3,0	-	-	-
Flake scrapers	-	4	8	5	5	22	23,4	2	6	8	12,1	1	-	1
Abrupts	-	-	1	1	1	3	3,2	-	-	-	-	-	-	-
Denticulates	3	1	9	4	17	34	36,2	4	18	22	33,3	2	2	4
<i>notches</i>	-	1	1	3	4	9	9,6	2	5	7	10,6	2	-	2
<i>denticulated scrapers</i>	3	-	7	1	10	21	22,3	1	11	12	18,2	-	2	2
<i>denticulated end-scrapers</i>	-	-	-	-	2	2	2,1	-	2	2	3,0	-	-	-
<i>fragments of denticulate</i>	-	-	1	-	1	2	2,1	1	-	1	1,5	-	-	-
undeterminable retouched fragments	1	-	-	2	2	5	5,3	-	4	4	6,1	-	1	1
Splintered pieces	2	-	2	1	1	6	6,4	1	5	6	9,1	-	1	1
Tot	7	8	27	17	35	94		11	55	66		8	14	22

intrusive items from the above middle Neolithic levels, as in the case of the above mentioned few obsidian pieces.

Transformed blanks and typological features

Regardless of the raw material, blanks were transformed mainly to obtain common tools such as denticulates (notches and denticulate-scrapers are prevalent) and flake-scrapers (often with marginal and partial retouch)⁴. The retouch is generally not accurate, sometimes inverse (Fig. 7, nos. 10, 17, 19, 20, 21, 23; Fig. 8, nos. 22, 26); in notches and denticulates it appears frequently as a single, wide and deep detachment aimed at obtaining active edges with marked denticulation. In some cases deep adjacent notches are intended for making a short pin (Fig. 7, n. 21; Fig. 8, n. 26); sometimes a similar result is obtained by a notch adjacent to a concave unretouched margin (Fig. 7, n.19; Fig. 8, n. 28). In other cases unilateral denticulate retouch is aimed at making a point whose result is similar to

a borer or perforator (Fig. 7, nos. 22, 23; Fig. 8, nos. 21, 23). Rare small pebbles are retouched as little choppers (Fig. 7, n. 25). As far as the scrapers are concerned, the retouch is usually marginal or little invasive and partial (Fig. 7, nos. 16-17).

Thick and irregular blanks were roughly transformed to make also other types of tools such as burins (especially simple and unelaborate ones), splintered pieces (Fig. 7, n. 26) and borers (Fig. 8 nos. 4-5, 20). Rare laminar flakes or irregular blades were used to make borers and truncations (Fig. 7, nos. 9-10).

Specialized tools consist of short end-scrapers, backed tools and a geometric (one crescent). Short end-scrapers include items with or without lateral retouch; some of them tend to have a circular forms, while others are nail-shaped. The scraping edge is more or less convex. In some cases the retouch involves one or both sides. Size is exclusively hyper-micro (up to 15 mm) and micro (up to 25 mm) (Fig. 7, nos. 3-7; Fig. 8, nos. 1-2, 11-14). Backed tools consist mainly of points and secondly of blades and undeterminable fragments (Fig. 7, nos. 11-14; Fig. 8, nos. 15-19). Backed tools are both hyper-micro and micro in size and width ranges from 2 to 8 mm (2-4 mm items prevail). Among the backed points three double backed ones are present (Fig. 7, n. 11-12; Fig. 8, n. 16).

⁴ Retouched tools are described following the analytic typology by G. Laplace (1964),



Fig. 7 - Grotta del Santuario della Madonna: lithic artifacts from phase 1. 1-2. cores; 3-6. hypermicro-short end-scrapers; 7. carinated micro-short end-scrapers; 8. micro-nose end-scrapers; 9. truncation; 10. borer; 11-12. double backed points, 13. backed blade; 14. fragment of backed tool; 15. crescent; 16-17. scrapers (n. 17 with inverse retouch); 18-19. notches (n. 19 with inverse retouch); 20-25. denticulated scrapers (nos. 20, 21 and 23 with inverse retouch, n. 25 on small pebble); 26. splintered piece; 27. unretouched flake with edge-removals produced by use (photo D. Lo Vetro). / *Industria litica della fase 1*. 1-2. nuclei; 3-6. grattatoi corti ipermicrolitici; 7. grattatoio carenato frontale microlitico; 8. grattatoio a muso microlitico; 9. troncatura; 10. becco; 11-12. punte a dorso bilaterali, 13. lama a dorso; 14. frammento di strumento a dorso; 15. segmento di cerchio; 16-17. raschiatoi (n. 17 a ritocco inverso); 18-19. incavi (n. 19 a ritocco inverso); 20-25. raschiatoi denticolati (nn. 20 e 23 a ritocco inverso, n. 25 su piccolo ciottolo); 26. pezzo scagliato; 27. scheggia non ritoccata con sbrecciature d'uso sui margini (foto D. Lo Vetro).

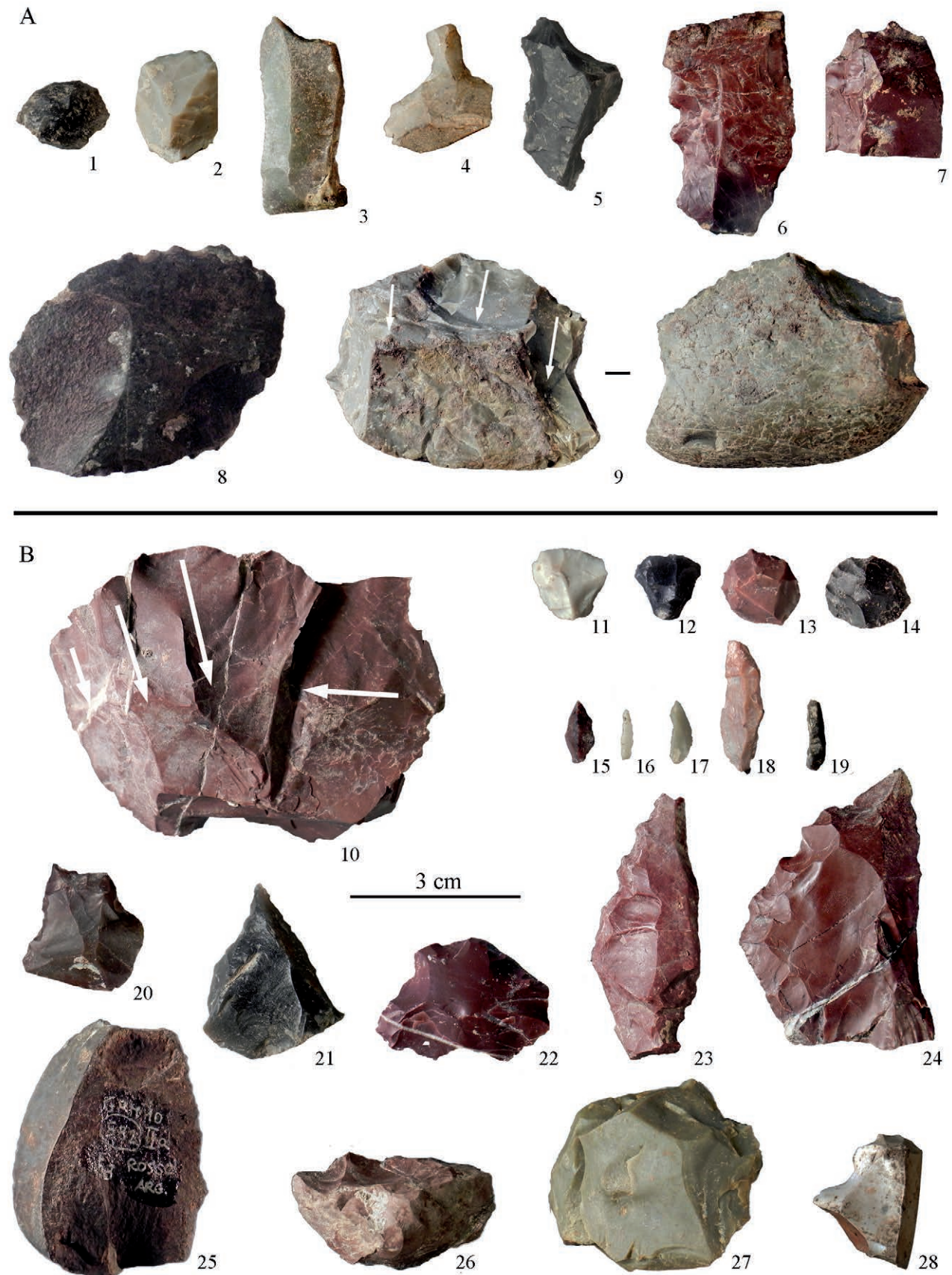


Fig. 8 - Grotta del Santuario della Madonna: lithic artifacts from phase 2 (B) and 3 (A). 1-2- hypermicro- and micro- short end-scrapers; 3- truncation; 4-5- borers; 6-7- denticulate scrapers; 8- unretouched flake with edge-removals produced by use; 9- core on pebble cap; 10- core; 11-14- hypermicro- short end-scrapers; 15- partial backed point; 16-18- total backed points (n. 16 double backed); 19- backed bladelet; 20- borer; 21- notch; 22-24, 26- denticulate scrapers (nos. 22 and 26 with inverse retouch); 25- unretouched flake; 27 and 28- denticulate end-scrapers (photo D. Lo Vetro). / Industria litica delle fasi 2 (B) e 3(A). 1-2 grattatoi corti micro e ipermicrolitici; 3- troncatura; 4-5- becchi; 6-7- raschiatoi denticolati; 8- scheggia non ritoccata con sbrecciature d'uso sui margini; 9- nucleo su calotta di ciottolo; 10- nucleo a schegge; 11-14- grattatoi corti ipermicrolitici; 15- punta a dorso parziale; 16-18- punte a dorso totale (n. 16 a dorso bilaterale); 19- lamella a dorso; 20- becco; 21- incavo; 22-24, 26- raschiatoi denticolati (nn. 22 e 26 a ritocco inverso); 25- scheggia non ritoccata 27-28- grattatoi denticolati (foto D. Lo Vetro).

The blanks used for the production of short end-scrapers and backed tools are in part compatible with the reduction systems described above for the common tools. In fact, except for those rare backed tools made on regular micro-lamellar blanks, these specialized tools are made on unstandardized micro-flakes, whose selection is based on a morpho-dimensional criterion. Short end-scrapers are made on thick micro- and hyper-microblanks ready to be easily regularized by semi-abrupt simple retouch. As regards backed tools and the geometric one, the degree of transformation is so high that it is not always possible to recognize the shape of the original blank; rare items are made on micro-bladelets (Fig. 7, n. 10; Fig. 8, n. 19), while other few specimens are made on unstandardized tiny micro-flakes (Fig. 8 n. 17).

Discussion and Conclusions

The new excavations (2002-2011) at Grotta del Santuario della Madonna confirm the absence of human frequentation during the Impressed Ware Early Neolithic period, because the Middle Neolithic levels are directly in contact with the underlying Mesolithic ones. The evidences of the latest Mesolithic frequentations have been heavily disturbed by the installation of Middle Neolithic structures (pits and post holes with rare pottery, obsidian and domestic fauna remains). The underlying Mesolithic layers (without Neolithic disturbances) are characterized, in the investigated area, by the presence of several combustion structures (simple *cuvettes*, organized hearths with deposition of stones, cooking surfaces), a shell midden, lithic industry and bone remains of wild mammals (mainly wild boar and red deer), tortoises and abundant malacofauna, mostly limpets and top snails (Fiore et al, this volume). The presence of numerous combustion structures within such limited excavation area appears particularly interesting. Furthermore, it should be emphasized that in the short report about the 1957-1970 excavations, Cardini (1972) did not mention the presence of hearths in the Mesolithic levels he investigated (that are adjacent to the new excavations). In addition, in the stratigraphy of Fig. 5 on page 41, associated to the report, no hearths are graphically reported; these are instead indicated as numerous in the underlying Epigravettian levels and in the above Neolithic ones. It is difficult to interpret such different spatial organization within a distance of few meters. However, it should be noted that the old excavations had been carried out in direct contact with the wall of the cave and therefore such area may have been used for other functions, as also the presence of a child burial seems to suggest. The only grave good in this burial was a pierced *Cardium* on the chest of the child (Cardini 1972). As a further support to the hypothesis of a non-residential function for the area excavated by Cardini, there is also the finding, close to the burial, of a pebble painted with a male anthropomorphic outline.

Considering the differences in spatial organization as well as in the quantity of animal remains recovered and in the ratios among species, the different structures discovered in the new excavations seem to have played a different role. Among the remains of medium-large sized mammals, there are rare specimens of carnivores (wolf and badger) and more frequent wild ungulates among which wild boar is prevalent, followed by red deer and, less abundant, roe deer. Complete ungulate carcasses were brought back to the cave and butchery, disarticulation and marrow extraction activities occurred close to the cooking areas.

The species identified and their ratios reflect more or less the faunal data from the Mesolithic levels excavated by L. Cardini (Cardini 1972, Fiore et al. 2004). However, it should be emphasized that in the investigated structures there is a complete absence of bovines (aurochs, ibex and chamois) and also a lower number of carnivore species, compared to the area excavated by Cardini.

Rare bird remains have been recognized; these include the dove, the common raven and the crag martin, all birds frequenting caves or cliffs. Nevertheless, the presence of anthropic traces may

be interpreted as evidence for the exploitation of birds. The Testudinata are present with two species: *Emys* cf. *E. orbicularis* (aquatic) and *Testudo hermanni* (terrestrial). Among their remains there are mainly fragments of carapace and plastron, but also limb long bones. Notwithstanding the proximity to the coast, fish remains are rare. Terrestrial gastropods are the most abundant mollusks (in particular *Helix* sp.). Among the marine mollusks there are numerous *Patella* sp. and top snail shells (*Phorcus turbinatus*). Rustic dove snail (*Columbella rustica*) shells are rare, often pierced and used as ornament.

For the association between the wolf mandible and the complete badger paw, the structure 637/638 represents an *unicum* in the scenario of the Italian Mesolithic. The presence of selected bone remains in the basal fill of the pit may indicate a propitiatory or ritual use. The structures USs 641-642 and 657, may exemplify a real and typical Mesolithic shell midden, produced by several occupations repeated over time in the same place, with accumulation of food refuses resulting from gathering activities.

As far as the subsistence activity is concerned, the wide range of animal species exploited documents a good knowledge of the territory and the resources that were systematically exploited by the Mesolithic hunter-gatherers.

The new dates of the Mesolithic levels and structures, unearthed during the new excavations, fit perfectly with the old dates (uncal. BP) of the middle-basal levels (Cardini 1972) and indicate an intense frequentation of the cave between the end of the 10th and the entire 9th millennium BP.

A strong homogeneity in the lithic assemblages of the three phases is clear in all aspects (raw materials, technical systems, typological structure and stylistic physiognomy of the formal tools). Except for the upper phase, whose sample is numerically too small for a reliable statistical evaluation, it is possible to note a variation between the first and second phase in the percentages of some techno-typological categories; nevertheless, such variation does not appear to be particularly significant (Tabs. 2 and 3). The most important change seems to be the increase in the percentage of backed tools, however, considering the low number of retouched tools, especially in phase 2, the statistical interpretation, in this case, should be considered with caution.

Absolute chronology and lithic assemblages of the Mesolithic sequence investigated in the new excavations at the Grotta del Santuario della Madonna, confirm the presence at the site of a Mesolithic stone assemblage with very few microliths, characterized by a low technical investment, as already recognized by Cardini (Cardini 1972).

The techno-typological features (in particular: crude lithic technology, production of unstandardized and asymmetric broad blanks, coarse retouched tools, especially notches, denticulates and scrapers) allow referring these lithic assemblages of the Mesolithic sequence of Grotta della Madonna to the *Undifferentiated Epipalaeolithic facies* (*sensu* Martini 1993) with a significant presence, although quantitatively limited, of specialized typologies, such as hyper-micro backed tools, a crescent and micro short end-scrapers, that in some peninsular areas strongly marked the coeval armature-rich assemblages such as the Sauveterrian and the Epiromanellian.

The presence of this *facies* at Grotta della Madonna had already been suggested (Martini 1993) on the basis of the few data published about the post-Paleolithic assemblages found by Cardini during his researches in the 60s of the last century (Cardini 1972). However, the lithic industries recovered during the new investigations allow to better define and detail the economic and techno-typological features along the Mesolithic sequence also in order to compare these assemblages with similar industries found in other Mesolithic sites in Central and Southern Italy and in its main islands.

The *Undifferentiated Epipalaeolithic* is one of the Mesolithic *facies* appearing during the Early Holocene in some areas of Central and Southern Italy, in Sicily and in Sardinia-Corsica, interpreted as the likely

Tab. 4 - Radiocarbon dates of layers with *Undifferentiated Epipaleolithic* assemblages from Riparo Blanc and Grotta della Serratura. / *Datazioni radiometriche dei livelli con industrie litiche dell'Epipaleolitico Indifferenziato di Riparo Blanc e Grotta della Serratura.*

SITE	LAYER	LAB CODE	AGE (BP)	2 σ CALIBRATED DATE
Riparo Blanc	upper level	R-341	8565 \pm 80	7811-7474 BC
Grotta della Serratura	layer 5	BIn-3568	9700 \pm 60	9288-8843 BC

outcome of techno-typological trends already in progress at the end of the final Epigravettian. This *facies* does not seem to be present North of the Latium region (Martini 1993; Lo Vetro & Martini 2012 and 2016; Martini & Tozzi 2012; , Lo Vetro *et al.* in this volume).

The available radiocarbon dates of the *Undifferentiated Epipaleolithic*, span from the last quarter of the 10th to the half of 8th millennium cal. BC; only in Sardinia this *facies* seems to persist almost until the end of the 7th mill. cal BC. The calibrated absolute chronology of the *Undifferentiated Epipaleolithic* partially overlaps with that of the armature-based assemblages (Sauveterrian-like). Both *facies* occur sometimes in the same region (Campania, Calabria⁵ and Sicily) and, in two cases, at the same site: Grotta della Serratura (Southern Campania: Martini 1993) and Perriere Sottano (Eastern Sicily: Aranguren & Revedin 1998); at these sites the two *facies* occur in distinct and superimposed levels. The cultural framework of the Mesolithic in Southern Italy includes also the Epiromanellian, a *facies* restricted to southern Apulia (Salento), characterized by the high amount of micro and hypermicro circular end-scrapers associated with abundant backed tools. The chronology of the Epiromanellian is still based on stratigraphic evidence because of the lack of radiocarbon dates (Martini & Tozzi 1996).

Unlike the other Mesolithic *facies*, whose technology is mainly aimed at microbladelet and microflake production for making backed tools and geometrics, employing quite repetitive reduction methods, the *Undifferentiated Epipaleolithic* assemblages are characterized by an expedient technology resulting in a macrolithic and unstandardized production of broad (sometimes thick) and asymmetric flakes. The retouched toolkit consists of a large amount of common tools, in particular notches, denticulates and scrapers, often made with a rough retouch, sometimes inverse. Borers and splintered pieces are generally frequent, while backed bladelets and geometric microliths are very few or absent.

The main key sites for these *facies* are: Riparo Blanc – lower levels (Southern Latium) (Taschini 1964 and 1968), Grotta della Serratura layers 5-4 (Southern Campania) (Martini 1993), Su Coloru, Porto Leccio and Sa Coa de Sa Multa (Sardinia) (see Martini & Tozzi 2012 also for the detailed references), Perriere Sottano-lower level (Sicily) (Aranguren & Revedin 1998).

The Mesolithic industries from Grotta della Madonna show some evident similarities with those of Riparo Blanc–lower levels and Grotta della Serratura–layers 5-4. According to the available radiocarbon dates, the first two phases of the Mesolithic frequentation of Grotta della Madonna are chronologically placed between the other two sites (Tab. 4) although the absolute chronology of SU 657 (phase 2) is much closer to that of Riparo Blanc.

As regards the lithic productions at these three sites some comparisons may be proposed:

1) regarding the technological features and the raw material economy a comparison is provisionally possible only on the basis of the few data inferred from the available publications. All the three sites seem to share a main common technological scheme aimed at the coarse production of unstandardized flakes through

the exploitation of pebbles (also of poor quality chert) collected not far from the site. The *chaînes opératoires* are marked by a general low investment that seems to involve raw material procurement, core reduction and blank transformation.

2) The typological structures (*sensu* Laplace) are quite similar in all the three industries: the common tool category has high percentages mainly due to the high frequencies of notches, denticulates and scrapers. Similarities are stronger between Grotta della Madonna and Riparo Blanc: the moderate presence of micro short end-scrapers, as well as the very low percentages of burins and truncations and the moderate quantity of splintered pieces. The typological structure of the assemblages of Grotta della Serratura are less similar. The presence of rare microliths (2.1% in total) is significant (a hypemicro backed point, a backed bladelet and a crescent), however the percentage is lower than the already small amount at Grotta della Madonna (5.4% in phase 1 and 15.2% in phase 2). As stated above, at Grotta della Madonna the non-occasional presence of armatures represents a peculiarity among the assemblages of the *Undifferentiated Epipaleolithic*. At Riparo Blanc armatures seem to be absent in the *in situ* deposit, even though Taschini (1964) underlines the presence of a marginal retouched microbladelet (“Dufour-like” according to Taschini). Six microliths, including a double-backed point, were found in the disturbed areas at the top of the Pleistocene deposit underlying the Mesolithic level, but the relationship with the *Undifferentiated Epipaleolithic* assemblage cannot be proved (on this topic see also Martini 1993 & Broglio 1971).

3) As regards the stylistic features, besides a general poor accuracy in tool manufacture, other specific characters, shared by most of the *Undifferentiated Epipaleolithic* assemblages, should be pointed out: marked denticulation made by single blow removals; denticulates with deep adjacent notches on the same edge forming a short pin (whose result is a sort of borer); frequent inverse retouches; marginal and partial retouch in scrapers, occurrence of sporadic very small retouched pebbles. In particular, precise comparisons between Grotta della Madonna and Riparo Blanc may be emphasized as regards the morpho-dimensional and stylistic features of the short end-scrapers that are present with sub-circular and nail-shaped types, micro and hypermicro in size.

The occurrence, during the Early Holocene, of non-laminar industries with a low technical investment and poor in microliths is also attested in several regions of the Mediterranean basin from the Iberian peninsula to Cyprus (e.g., Martini 1993; Perlès 1990, 1999, 2003; Alday 2006; Mihailovic 2009). It involves lithic assemblages that cannot be traced back to a common matrix, but are indicative of a widespread trend in lithic productions that has its roots in the different local Paleolithic substrates (Martini 2002). Although similar patterns of resource exploitation can be sometimes identified (Perlès 2003) and several of these “macrolithic” assemblages have been found in coastal sites with evidence of more or less abundant marine resource consumption, the emergence of these assemblages cannot be explained only by functional and/or economic issues, related to marine resource (molluscs in particular) exploitation, as suggested by some scholars (e.g., Bietti 1984; Perlès 2003; Kozłowski 2005; Alhague & Bietti 2007; Franco 2011). At Grotta della Serratura, for example, where the *Undifferentiated Epipaleolithic* overlies the Sauveterrian, no changes in the economic system have been noted; in both *facies* subsistence is based on hunting medium-large mammals

5 As regards the Sauveterrian in Calabria see Marini *et al.* in this volume about the new evidences of the Mesolithic industries at Riparo del Romito.

supplemented by the exploitation of marine resources. The substantial difference in the lithic industries cannot be therefore attributed to a shift in the economic strategies, but to other factors including technological behaviors referable to different cultural backgrounds. Regarding this issue, other examples outside Italy can be mentioned: in Spain, notch and denticulate industries (called Muescas y Denticulatos), similar to those of the Italian *Undifferentiated Epipaleolithic*, occur at the same time of microlith-based assemblages (e.g., Alday 2006); in this case too functional hypotheses are not sufficient to explain the coexistence of different Mesolithic stone assemblages in the same region. As in Italy, also in Spain the archaeological record from carefully excavated sites offers a more articulated picture with different Mesolithic techno-complexes, whose emergence might be due to a multiplicity of factors among which distinct cultural identities should also be contemplated.

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