PROCEEDINGS OF

1st INTERNATIONAL CONGRESS ON: "SCIENCE AND TECHNOLOGY FOR THE SAFEGUARD OF CULTURAL HERITAGE IN THE MEDITERRANEAN BASIN"

November 27 - December 2, 1995
Catania, Siracusa - ITALY

The Grotta Grande of Scario (Salerno - southern Italy): stratigraphy, archaeological finds, pollen and mammals

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Abstract

Stratigraphical, Palethnological, Palynological and Paleontological analyses are carried out on the Grotta Grande of Scario. Provisional results concerning test Pit A are presented. The integration of bio-stratigraphical data and provisional dating of unit «c, stalagmite» (^{230}th/^{234}U, 135 ka) indicates a chronological settling of the deposit between a late Middle Pleistocene and the beginning of the Late Pleistocene. Pollen spectra of the continental, archaeologically sterile deposit (units "b-c" correlated with ^{18}O isotopic stage 6) shows a more forested landscape than the spectra of the archaeological deposit, and some shifts in vegetation belts, forced by minor climate changes. Archaeological deposit (unit «d») overlapping the erosion surface (related with the marine ingression of isotopic stage 5e, due to the record of *Strombus bubonius*) contains Middle Paleolithic industry displaying some evolution in the upper levels (cuts 12-10). Integration of pollen and mammal data of the musterian levels suggests correlating the archaeological deposit to a cold-temperate oscillation of isotopic stage 5, ending (pollen spectrum of cut 10) with the beginning of a steppe-like vegetation.

Some «tertiary» pollen records (cf. Taxodiaceae) which might suggest an older chronological settling of the deposit, could however be alternatively explained by a conservative character of the environment, possibly offering chance of survival in the surrounding area.

Introduction

The Grotta Grande opens directly onto the Tyrrhenian Sea, on the Cilento coast between Palinuro and Sapri, about 2 km Southwest of the village of Scario (S. Giovanni a Piro, Salerno) (Fig. 1, on the left). The Mediterranean vegetation of the surrounding area is largely modified by man, as well as the higher deciduous broadleaf vegetation belt of Mount Bulgheria, raising to 1225 m a.s.l., ca 8 km inland (1). The cave, which develops along a fault running perpendicularly to the coast, is formed by two large chambers joined by a short corridor: an external one, set on two levels, and an internal one, with a vaulted roof. After a first, limited, intervention by Milan University at the beginning of the 1960s excavation was resumed by Siena University in collaboration with the Soprintendenza Archeologica of Salerno, and is still in progress (2).

Six test pits have been excavated in several areas of the cave: in the lower level of the entrance chamber (pits A-D-F), along the corridor (pits B-C) and inside the inner chamber (pit E) (Fig. 1, on the right).

The most interesting are pits A and F, both concerning residues of eroded deposits at the walls. In the internal area (pit E), without prehistoric finds, a Roman Age burial (3th-4th century AD) was found in the upper levels.

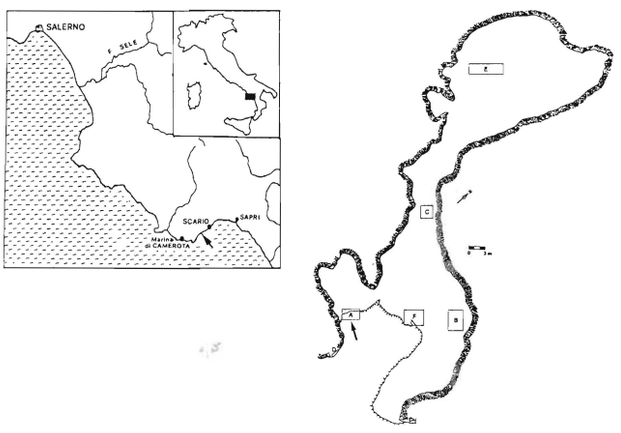

Fig. 1 - Site location (on the left); plan of the cave (on the right).

Stratigraphy

Test pit A, which is the subject of this paper, shows the stratigraphic series as follows (from the bottom) (Fig. 2):

a) marine conglomerate with *Cladochora coespitosa* and *Spondylus* probably related to isotopic stage 7 ($^{230}Th/^{234}U$,datings in progress); it outcrops 3 m above sea-level;

b) continental red sandy-silty deposit (1,9 m), densely laminated;

c) stalagmite (20 cm) ($^{230}Th/^{234}U$ SCA5, 135 11 Ka, Schwarcz *in litteris*);

d) red cemented breccia with alternating concreted archaeological and hearth levels (1 m), lying above the previous series and subdivisible in three horizons: lower (cuts 22-18), middle (cuts 17-13) and higher (cuts 12-10).

Between c) and d) there is a surface of erosion attributed, due to the presence of *Strombus bubonius*, to the marine transgression of isotopic stage 5e.

The evolution of the deposit in the cave is deeply influenced by oscillations of sea-level.

After a first marine transgression (unit a), which completely invaded the cave (lithodomous burrows at 13 m above sea-level), a sterile continental deposit (units b-c) followed. It probably filled a large part of the external chamber.

A second marine transgression (isotopic stage 5) eroded these levels, leaving behind a deposit of beach rock, plated onto the older marine conglomerate, still visible in other areas of the cavity.

The following regression allowed man to enter the cave (unit d), where he left traces of his presence. Probably during the versilian transgression, the sea entered again and removed most of the archaeological deposit. Only a few cemented plaques are preserved in sheltered areas of the cave.

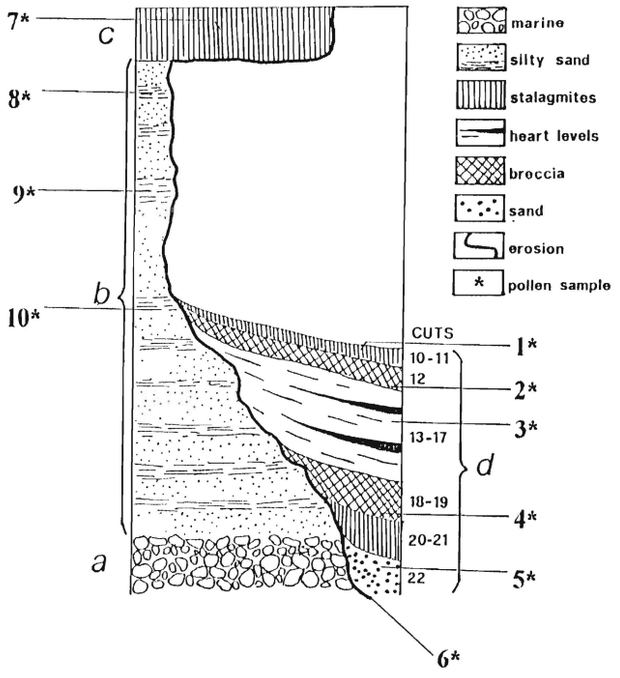

Fig. 2 - Test pit A: stratigraphic scheme and pollen samples (*).

Lithic industry

Studies on artefacts and sediments are still in progress; to our present knowledge it seems that the palethnological deposit (unit d) dates back to the beginning of the Middle Paleolithic.

The raw material used by prehistoric man was mainly flint and also quartzite or jasper.

The lithic industry consists of sidescrapers (more than 70%), above all laterals (Fig. 3, nn. 1, 2), some made on blades (Fig. 3, nn. 3, 5), followed by transversal (Fig. 3, n. 6) and lateral-transversal; the shape of the retouched margin is mostly convex, the second most common shape is straight. The other implements are points (Fig. 3, n. 4) and, to a lesser degree, denticulates. Carinated types are present, too.

A main difference appears between the middle levels (cuts 17-13), and the upper ones (cuts 12-10): long scrapers and denticulates increase towards the top. The lower horizon (cuts 22-18) is very poor in archaeological finds.

From a technological point of view, the "demi-Quina" retouch is well represented, but also plate retouched pieces are present. On the whole, "débitage" is of non Levallois technique and faceted platform index is medium.

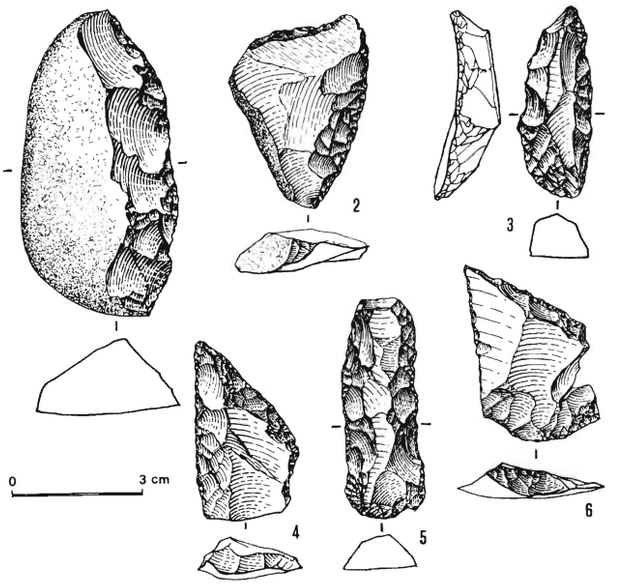

Fig. 3 - Test pit A: lithic industry (nn. 1, 2, 5: sidescrapers; n. 3: "limace"; n. 4: point; n. 6: transversal scraper).

Palynology

An assay of pollen analysis was carried out on about forty samples taken from pits A, C, D, F, and from surface soil samples both at the top of the pits and along the cave. Samples were treated with a routine method which includes cold HCl 37%, HF 40%, hot HCl 37%, NaOH 10%, acetolysis. Float/sink treatment by means of Thoulet liquid was employed when required. The residue was included in water/glycerol 50/50, and permanent slides were prepared. *Lycopodium* spores were added to obtain pollen concentration values. Pollen

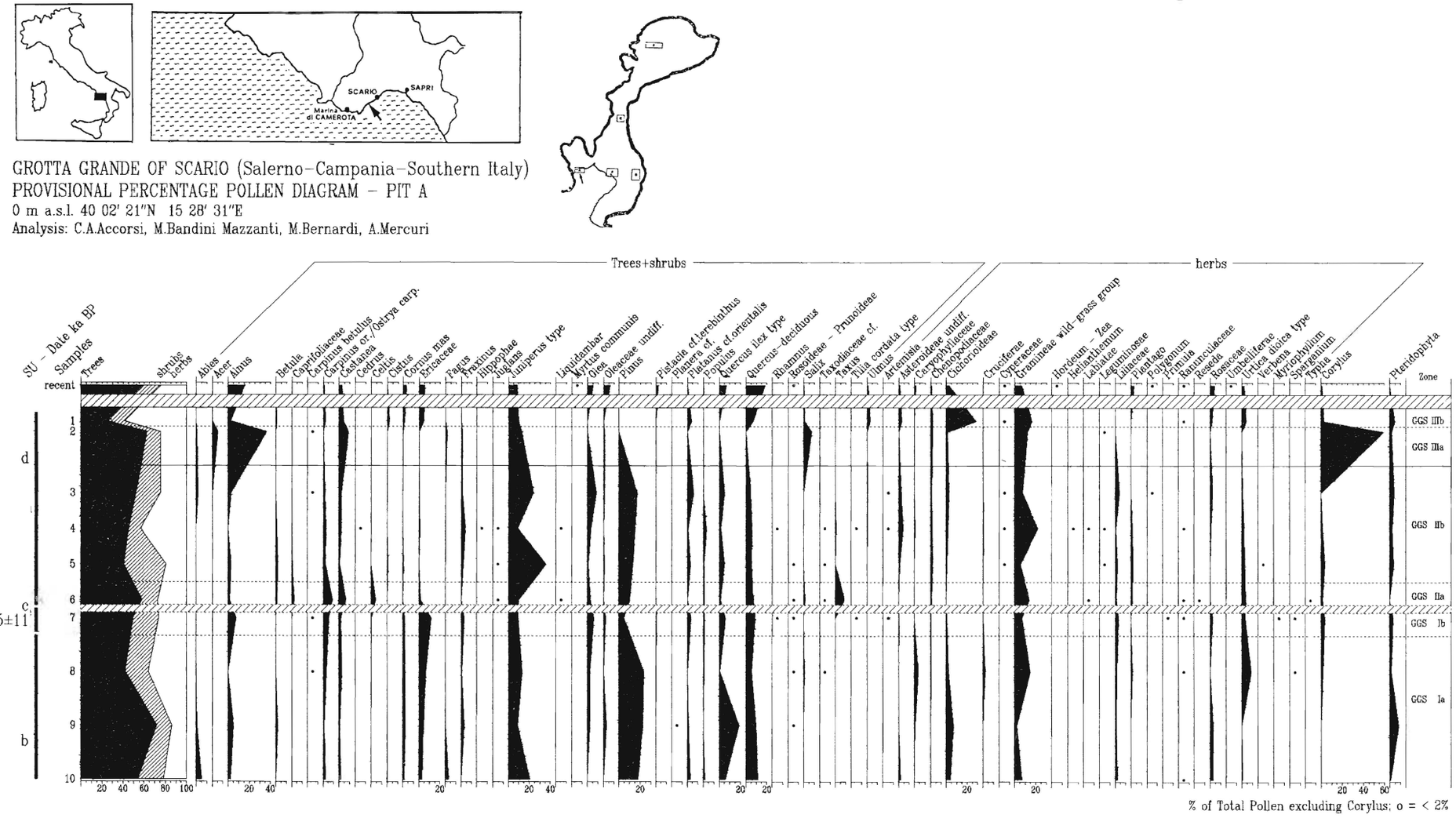

Fig. 4 - Percentage pollen diagram of the pit A; part I: analytical diagram.

was found in 24 samples from pits (10 from A, 5 from C, 5 from D, 4 from F), and in all surface samples.

In this paper a preliminary pollen diagram of pit A is presented. The 10 samples were taken in the stratigraphic units (Fig.2) as follows, from the bottom: samples 10-8, unit b; sample 7, unit c; samples 6-1, unit d; recent sample, surface soil.

Pollen preservation was good, but pollen concentration was very low (recent sample= 450 p/g; past samples= 42-512 p/g, mean= 132 p/g; p= pollen and Pteridophyta spores). The total number of counted Tracheophyta grains was 1663 (recent sample= 225; past samples= 82-232, mean= 144/ sample). The total number of recorded Tracheophyta pollen types was 80 (recent sample= 33, past samples= 18-42), 43 AP (tree+shrub) types, 33 NAP (herb) types, 4 Pteridophyta types. The pollen sum includes AP+NAP pollen; Pteridophyta spores were calculated in percent on the pollen sum plus the Pteridophyta spores themselves. Floristic Richness Index (= pollen type number of the sample/total number of pollen types recorded *100) is 41.3% in the recent spectrum, and 22.5-52.5% in the others. Ancient Age Index-per deposit (= number of «tertiary» taxa of the sample/total number of taxa recorded *100) ranges from 0 to 3,9%. Pollen diagrams show pollen taxa recording 2% plus selected taxa (Fig. 4: analytical diagram) and pollen groups (Fig. 5: synthetic diagram).

The percentage pollen diagram shows 3 main pollen zones (GGSI, II, III; GGS = Grotta Grande of Scario), each of them cut in two subzones.

GGSI pollen zone (samples 10-7; unit b,c) shows a relatively more closed forest vegetation (AP= 64-86%, mean 76%). «Tertiary» taxa (*Planera* cf., Taxodiaceae cf.) have been traced in samples 9 and 8 (Ancient Age Index-per deposit= 1.3%). In GGSIa subzone (unit b) forest cover is largely dominated by Conifers (mean 37%: mainly *Pinus* and *Juniperus* type) with some Mediterranean evergreens (*Quercus ilex* type, Olea) and deciduous broadleaf trees (*Betula*, *Fagus*, *Quercus*, *Castanea*, *Carpinus*, *Fraxinus*; mean= 12.4%). GGSIb subzone (unit c) shows an increase of hygrophilous trees (*Alnus*, *Salix*, *Platanus*, *Populus*), and of deciduous broadleaf plants (16.5%), while conifers decrease.

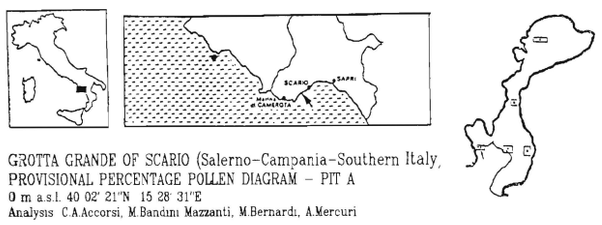

Fig. 5 - Percentage pollen diagram of the pit A; part II: synthetic diagram.

GGSII pollen zone (sample 6-3, unit d) shows a little decrease of forest cover (AP= 57-74%, mean 71%) which is dominated by Conifers again (mean= 37%; mainly *Juniperus* type, and *Pinus*). «Tertiary» taxa was also found here (*Cedrus*, *Liquidambar*, Taxodiaceae cf.) in samples 6, 5 and 4 (Ancient Age Index-per deposit= 1,3-3.9%). In GGSIIa subzone deciduous broadleaf trees have still noticeable values, especially *Ostrya/Carpinus orientalis* and *Castanea* (>5%); in GGSIIb subzone deciduous broadleaf trees decrease (mean= 10.3%) while Mediterranean evergreens increase and herb pollen rises too (maximum NAP in sample 4= 43%).

GGSIII pollen zone (sample 2-1, unit d) shows a drastic drop in Mediterranean evergreens (0-2%) and an increase in forest opening (AP= 75-43%, mean 59%, excluding *Corylus*); in GGSIIIa subzone the high percentage of *Corylus* (59%) is probably due to a casual overrepresentation (natural or possibly anthropic); in GGSIIIb subzone an open vegetation (NAP = 57%) dominated by Cichorioideae and Gramineae, seems beginning to spread. «Tertiary» taxa are absent.

The vegetal landscape surrounding the cave was quite forested before paleolithic man settled in it (GGSI), and was organized into vegetation belts (Mediterranean evergreens, submediterranean deciduous oak wood, *Pinus* p.p./*Abies* mountain belt) under a temperate climate which underwent changes in temperature and humidity. Forest cover was first dominated by Conifers (Pines and *Juniperus* type pollen producing trees/shrubs, mostly Junipers and Cypresses, probably), followed by several deciduous summergreen trees and oscillating Mediterranean evergreens; then it grew richer in broadleaf deciduous trees and hygrophilous trees under a wetter climate (unit c= stalagmite). During the span time when Paleolithics took shelter in the cave, the landscape was not much different, but some forest clearance was in progress, touching all forest belts, and especially the Mediterranean one, and finally ending, at the top of the anthropic deposit (GGSIII, samples 2-1, cut 11-10) with a colder climatic oscillation, first wetter (sample 2, cut 11) and then drier when a steppe-like vegetation began (samples 1, cut 10).

The recent pollen spectrum, clearly modern in age (corn pollen was found) more or less matches the seminatural/anthropic vegetal cover of the area. It shows a pollen-landscape in some way similar to that of the stalagmite, but wet environment plants are more abundant in it, while on the contrary, Conifers are fewer (8.1%) and among them, in particular, Pinus is absent.

The provisional character of the diagram and the lack of contemporary reference data in the area make the chronological settling of our data difficult. Taking into

account some diagrams more or less near the area, though most are more recent or ancient than ours (3,4,5,6,7), we can place the cave diagram between the Middle Pleistocene and the beginning of the Late Pleistocene. Nevertheless the record of cf. Taxodiaceae might disguise the age of spectra, making them look older; alternatively this could be attributed to the chance of survival in the surrounding area.

Mammals

A fairly diversified faunal assemblage occurs in the archaeological levels (unit d) of pit A, above the erosive surface. A total of 378 remains were identified, of which 138 to micromammals and 240 belong to macromammals (Tables 1, 2; Figs. 6, 7). Only one record of *Apodemus sylvaticus* comes from the clays of the unit b (cut 6).

Table 1
Absolute and percentage abundance of small mammals. Minimum number of specimens

cuts	Chiropetera indet.	*Talpa europaea*	*Crocidura suaveolens*	*Glis glis*	*Eliomys quercinus*	*Apodemus sylvaticus*	*Arvicola* aff. *terrestris*	*Microtus (Terricola) savii*	*Microtus (Terricola) subterraneus*	Tot. Gliridae	Tot. Rodentia	Total remains (M.N.I.)
10-11	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	2 (33.3)	0	1 (16.7)	2 (33.3)	1 (16.7)	0	2 (33.3)	6 (100.0)	6
13	0	0	0	1 (4.2)	0	15 (62.5)	1 (4.2)	5 (20.8)	0	1 (4.2)	24 (100.0)	24
14	0	0	0	0	0	9 (45.0)	2 (10.0)	8 (40.0)	0	0	20 (100.0)	20
15	1 (7.7)	0	0	0	0	4 (33.3)	5 (41.7)	3 (25.0)	0	0	12 (92.3)	13
16	0	1 (5.0)	0	2 (10.5)	0	7 (36.8)	2 (10.5)	7 (36.8)	1 (5.3)	2 (10.5)	19 (95.0)	20
17	0	0	1 (4.0)	3 (12.5)	1 (4.2)	12 (50.1)	3 (12.5)	5 (20.8)	0	4 (16.7)	24 (96.0)	25
18	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	1 (100.0)	0	0	0	0	1 (100.0)	1 (100.0)	1
20-21	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	1 (50.0)	0	1 (50.1)	0	0	0	1 (50.0)	2 (100.0)	2

Table 2
Absolute and percentage abundance of large mammals. Total number of determinations

cuts	*Stephanorhinus hoemitecus*	*Sus scrofa*	*Bison priscus*	*Capra ibex*	*Rupicapra pyrenaica*	*Cervus elaphus*	*Dama dama*	*Capreolus capreolus*	*Ursus arctos*	*Lepus europaeus*	Tot. Caprinae	Tot. Cervidae	Ungulates	Total numer of remains
10-11	0	0	0	9 (33.3)	1 (3.7)	2 (7.4)	13 (48.1)	2 (7.4)	1 (3.6)	0	10 (35.7)	17 (60.7)	27 (96.4)	28
12	1 (1.3)	0	0	39 (50.0)	0	5 (6.4)	25 (32.1)	8 (10.3)	0	0	39 (50.0)	38 (48.7)	78 (100.0)	78
13	0	1 (1.5)	1 (1.5)	33 (48.5)	0	5 (7.4)	18 (26.5)	10 (14.7)	0	0	33 (48.5)	33 (48.5)	68 (100.0)	68
14	0	0	0	27 (43.5)	1 (1.6)	6 (9.7)	8 (12.9)	20 (32.3)	1 (1.6)	0	28 (43.8)	34 (53.1)	62 (96.9)	64
15	0	1 (9.1)	0	6 (54.5)	0	0.0	4 (36.4)	0.0	0	1 (1.6)	6 (54.5)	4 (36.4)	11 (100.0)	11
16	0	0	0	15 (55.6)	0	2 (7.4)	8 (29.6)	2 (7.4)	0	0	15 (55.6)	12 (44.4)	27 (100.0)	27
17	0	0	0	2 (66.7)	0	0	0	1 (33.3)	0	0	2 (66.7)	1 (33.3)	3 (100.0)	3
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	2 (66.7)	0	0	1 (33.3)	0.0	1 (25.0)	0	2 (50.0)	1 (25.0)	3 (75.0)	4
20-21	0	0	0	1 (100.0)	0	0	0	0	0	0	1 (100.0)	0 (0.0)	1 (100.0)	1
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0

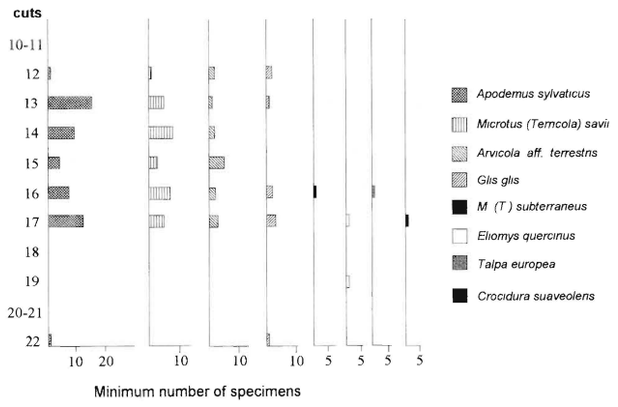

Fig. 6 - Distribution of small mammals within unit d.

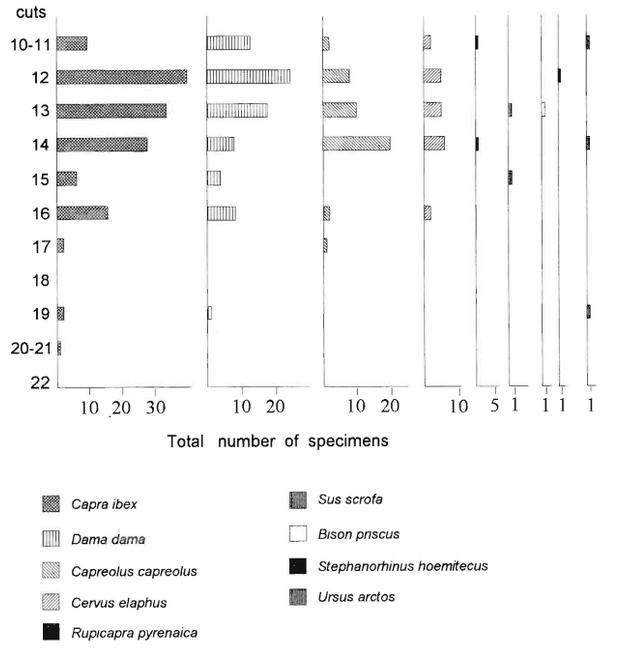

Fig. 7 - Distribution of large mammals within unit d.

Large mammals are represented by abundant *Capra ibex*, *Dama dama* and *Capreolus capreolus*, while *Cervus elaphus* and *Sus scrofa* are less represented. Scarce fragmented remains indicate the occurrence of *Bison priscus* (cut 13), *Rupicapra pyrenaica* (cuts 14 and 10-11) and of the rhino *Stephanorhinus hoemitecus* (cut 12). Carnivores are represented by *Ursus arctos*, recovered from cuts 19, 14 and 10-11. The occurrence of *Lepus europaeus* is testified by a sole remain from cut 14.

The assemblage of small mammals includes abundant *Apodemus sylvaticus*, *Microtus* (Terricola) savii and *Arvicola* aff. *terrestris* (Fig. 8). *Glis glis*, Eliomys quercinus, *Crocidura suaveolens*, *Talpa europaea* also occur. Scarce remains belong to a bat.

The large mammal assemblage indicates a cold-temperate climate and a prevailing forested environment, as shown by the abundance of the fallow and roe deer, and by the occurrence of the boar and of the brown bear. The dominance, among the herbivores, of *Capra ibex*, a taxon generally considered an indicator of open landscape, can be explained by the topography of the surrounding area. *C. ibex* spreads in presence of relief

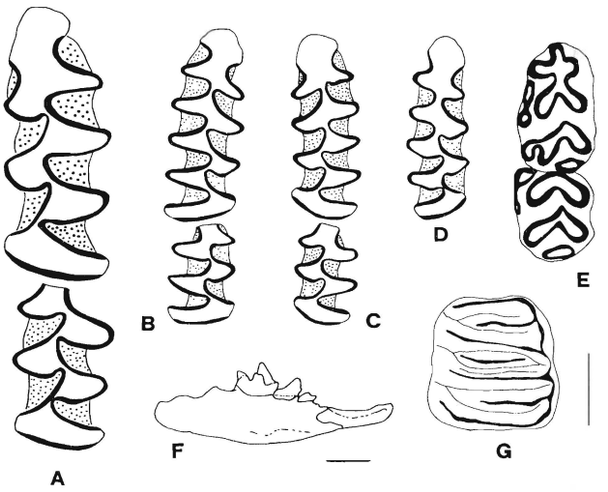

Fig. 8 - A) *Arvicola aff. terrestris*, left first lower molar; B) *Microtus* (Terricola) *savii*, right first lower molar; C) *M.* (T.) *savii*, left first lower molar; D) *Microtus* (Terricola) *subterraneus*, right first lower molar; E) *Apodemus sylvaticus*, left first lower molar; F) *Crocidura suaveolens*, left mandible; G) *Glis glis*, left first lower molar. The scale is 1 mm. Horizontal bar for *Crocidura suaveolens*; vertical bar for the other specimens.

with rocky, rough terrain, and of locally arid conditions (8). Mount Bulgheria behind the cave, could have been a suitable habitat for this goat.

The occurrence of *Microtus* (Terricola) and the absence of *M.* (*Microtus*) within micromammals, indicate a climate with temperate-Mediterranean affinity. *M.* (*Microtus*) *agrestis* and *M.* (*Microtus*) *arvalis* are in fact well represented species during the Middle to Late Pleistocene in the northern regions of Italy, while they became widespread taxa among rodents only during stadial phases in southern parts of the peninsula (9,10). *Microtus* (Terricola) *savii* is, on the contrary, a very common vole in interglacial and interstadial phases and is always present also in colder or cooler phases in the southern regions that were a refuge area for this taxon.

The temperate character of the climate is confirmed by the occurrence of Crocidura, which is at the present time the most widespread insectivore in the southern regions of Italy. The dominance of *Apodemus* with respect to *Microtus* (Terricola), and the occurrence of dormice (*Glis* and *Eliomys*) indicate forested environment with Mediterranean steppe-like patches. The significant presence of the water vole (Arvicola) shows that humid fresh-water environments occurred in the neighbourhood of the cave.

From a biochronological stand point the fauna could indicate either the end of Middle Pleistocene or the beginning of Late Pleistocene. The association of taxa with temperate-Mediterranean characters as *D. dama* and *M.* (*Terricola*), and taxa indicative of a cooler climate as *Rupicapra* suggests the deposits can be referred to a minor climatic oscillation, within an interstadial or a not particularly severe stadial climatic phase.

Conclusion

The whole set of analysis carried out so far on the deposit of the cave is substantially consistent and

indicates the deposit dates back to a period between the late Middle Pleistocene and the beginning of the Late Pleistocene, though pollen could be consistent with a more ancient age.

The chronological settling is substantiated by: 1) the correlation, based on *Strombus bubonius* record, of the erosive surface at the base of unit «d» with the marine ingression of stage 5e (Tyrrhenian sensu strictu); 2) the correlation of unit «c»(stalagmite) with 18O isotopic stage 6, based on $^{230}Th/^{234}U$ 135 ± 11 ka provisional dating; 3) the hypothesis of correlation of the marine conglomerate with *Cladochora coespitosa* and *Spondylus* (unit «a») with isotopic stage 7 ($^{230}Th/^{234}U$, datings in progress). Relying on this chronological framework the following environmental reconstruction can be outlined in brief.

Before the arrive of the Paleolithics in the Cave (unit b-c) the landscape shown by pollen flashes was more forested than when they lived in it. In this time span some shifts of vegetational belts occurred, forced by climatic oscillations in temperature and humidity which possibly belong to ^{18}O isotopic stage 6. When, time after the marine ingression of stage 5e, Paleolithics found shelter in the cave, pollen and mammals suggest that little more prominent climate-depending changes occurred in vegetal landscape, which could be correlated with a temperate-cold oscillation of ^{18}O isotopic stage 5. Some forest clearance was in progress, and at the top of the anthropic deposit a colder period began, first wetter and lastly drier, when a steppe-like vegetation appeared.

Anyway, throughout the time concerned in biological records, the vegetal landscape underwent not very severe modification, even if important environment changes occurred, as the stratigraphy testifies. So the area appears to have possibly been a conservative one for biodiversity. If this was the case, the suspicion of a more ancient age, coming from some «tertiary» pollen records (cf. Taxodiaceae) could be slighted. Thus at the end of Middle / beginning of Late Pleistocene, Taxodiaceae (if confirmed by analysis in progress) could have been a tertiary relict, paleoendemic in the area, as for example *Primula palinuri* Petagna is at present.

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