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Paleoenvironmental Analysis

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A B S T R A C T

New analysis has been carried out concerning the palaeoenvironmental reconstruction of some Italian sites dating from the Middle Pleistocene to the Bronze Age. Different aspects have been investigated on each site considering the data collected. The following sites have been analyzed: Isernia La Pineta (Molise); Visogliano and Caverna degli Orsi (Trieste); Toirano Caves (Liguria); Grotta Paglicci (Gargano); Riparo del Molare (Salerno); Grotta del Cavallo (Lecce); Castellaro Lagusello (Monzambano, Mantova).

Key words: *palaeoenvironment, Middle Pleistocene, Bronze Age, Italy*

Introduction

This contribution sets out data emerging from the analysis of several prehistoric sites brought to light over the last ten years in Italy. The sites examined illustrate the palaeoenvironment in which human groups lived from the Lower Paleolithic up to the Bronze Age. This paper aims to highlight the potential offered by this category of naturalistic and archaeological evidence in order to understand the human-environment relationship during various period of the ancient Humankind history.

Isernia La Pineta: Figure 1, n. 1
(C. Peretto, B. Sala, U. Thun Hohenstein)

Isernia La Pineta is a Middle Pleistocene site. Pollen analyses carried out on the sediments containing the faunal and lithic remains of the three living floor of the first excavation sector have made it

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possible to identify the vegetable species present around the site; moreover, the frequency of these finds permits a reconstruction of the floristic landscape existing at that time.

Arboreal plants are infrequent (*Alnus*, *Salix*, cf. *Populus*, *Platanus*, *Quercus*, *Pinus, Cedrus*), but there is an abundance of palustrine species (*Cyperaceae*, *Typha*). Herbaceous plants dominate (80% of the species identified), the most represented being grasses.

The mammals identified belong to the following *taxa*:

The paleontological data collected confirm the previous paleoecological reconstructions[1]: insectivores are poorly represented, while the dominant rodent forms belong to *Microtus* (*Terricola*) gr. *multiplex-subterraneus* and *Microtus* aff. *arvalis*. The micromammal assemblage indicates a less temperate climate than that of the present day.

Although the large mammal finds are the result of a selection carried out by humans, and therefore are not totally representative of the species present on the surrounding territory, they can neverthe-

REPTILIA	Emydidae	*Emys orbicularis*
AVES	Anatidae	*Anas platyrhynchos*
	Podicipedidae	*Podiceps ruficollis*
INSECTIVORA	Talpidae	*Talpa* sp.
	Soricidae	*Sorex* cf. *runtonensis* Hinton 1911
		Crocidura sp.
CARNIVORA	Ursidae	*Ursus deningeri* von Reichenau 1906
	Felidae	*Panthera leo fossilis* von Reichenau 1906
	Hyaenidae	*Hyaena* sp.
PROBOSCIDAEA	Elephantidae	*Elephas (Palaeoloxodon) antiquus* Falconer e Cautley 1845
PERISSODACTYLA	Rhinocerotidae	*Stephanorhinus hundsheimensis* (Toula 1903)
ARTIODACTYLA	Hippopotamidae	*Hippopotamus* cf. *antiquus* Desmarest 1822
	Suidae	*Sus scrofa* Linnaeus 1758
	Cervidae	*Megaceroides solilhacus* (Robert 1829)
	Bovidae	*Cervus elaphus* cf. *acoronatus* Beninde 1937
		Dama dama cf. *clactoniana* (Falconer 1886)
		Capreolus sp.
		Bison schoetensacki Freudenberg 1914
		Hemitragus cf. *bonali* Harlè e Stehlin 1913
LAGOMORPHA	Leporidae	Cf. *Oryctolagus*
RODENTIA	Microtinae	*Pliomys episcopalis* (Mèhely 1914)
		Pliomys coronensis (Mèhely 1914) (= *P. lenki* Heller 1930)
		Clethrionomys sp.
		Microtus aff. *arvalis* (Pallas 1778)
		Microtus brecciensis (Giebel 1847)
		Microtus (*Terricola*) gr. *multiplex-subterraneus*
		Arvicola cantianus (Hinton 1910)

less provide some useful palaeoenvironmental indications. The fauna examined suggests a prairie or steppe environment dominated over a forest one, leading to presume the climate was almost arid. The most represented species, in fact, belong to the great ungulates (bison, rhinoceros and elephants), whereas cervids and other medium sized animals are underrepresented (wild board, thar). This faunal association suggests an environment consisting of wide open spaces (steppes or grasslands), interspersed in places with wooded areas in the valleys and near watercourses. The presence of hippopotami typified this landscape, while the thar occupied the steep mountain slopes nearby.

Middle and Early Upper Pleistocene Paleoenvironments

(D. Arobba, G. Boschian, C. Falgueres, C. Tozzi)

Trieste Karst (Visogliano and Caverna degli Orsi)

The Middle to Upper Pleistocene environmental evolution of the Trieste Karst area (North-eastern Italy, Figure 1, n. 2) is reasonably well known through the study of two main sequences that were excavated at the Dolina di Visogliano and at the Caverna degli Orsi.

The Dolina di Visogliano is a typical breakdown doline at whose edge there

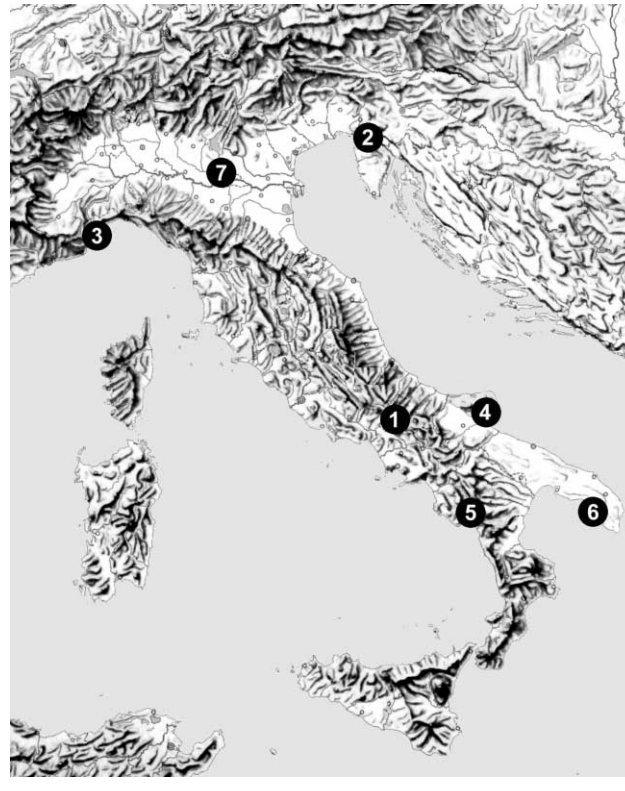

Fig. 1. 1. Isernia La Pineta (Molise); 2. Karst sites (Visogliano, Caverna degli Orsi); 3. Toirano caves (Grotta del Colombo, Grotta di Santa Lucia Superiore); 4. Grotta Paglicci (Gargano); 5. Riparo del Molare (Salerno); 6. Grotta del Cavallo (Lecce); 7. Castellaro Lagusello (Mantova).

are a rock shelter and some breccia outcrops. These features are the remains of a large cave that covered the whole doline in a still undetermined period, probably the late Lower Pleistocene or the early middle Pleistocene[2–5].

Two sondages were dug out; one inside the shelter (locus A) (Figure 2) and one through a breccia outcrop near the western edge of the doline (locus B); the first is at present about 10 m deep, the second one reached the bedrock at about 4 m depth.

The sediments crossed by these excavations can be grouped into three main deposit types.

a) Breakdown deposits; medium angular gravel (*dépôts de microgélivation*) to large blocks and boulders (*dépôts de macrogélivation*) embedded in yellowish to reddish brown silty clay loam.

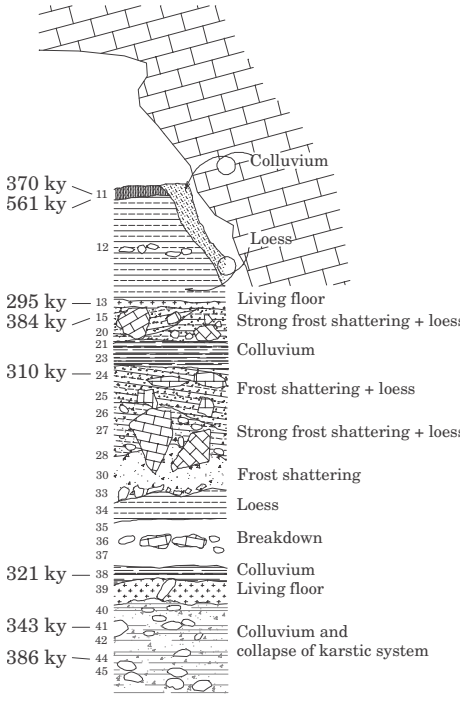

Fig. 2. Profile of the Visogliano Shelter (Trieste) excavation.

b) Yellowish silty loam deposits, with few coarse elements; the grain-size curves show a peak in the 25–50 mm interval. Muscovite is dominant among the heavy minerals, augite and amphiboles are also present.

c) Reddish to brownish clay or clay loam deposits, with very few coarse elements and very common aggregates of clay minerals. Ti-oxides are common within the heavy minerals fraction.

The breakdown deposits were originated by the frost shattering of the shelter walls, and can be ascribed to cold and reasonably wet phases; the grain-size of the elements is directly related to the intensity of the cold and to the length of the freeze-and-thaw cycles.

The silty deposits were sedimented during phases immediately following the cold peaks, and can be considered as typical loess deposits. Nevertheless, it is likely that the loess is subprimary, deriving from aeolian dust deposited outside the shelter and immediately reworked by runoff.

Eventually, the reddish clay deposits are the end products of a complex sequence of alteration and reworking processes; they were originated by the erosion and transport into the shelter of *terra rossa*-like soils which developed outside, on loessic sediments previously deposited. These colluvium deposits were formed in the periods immediately following the warm and moist phases, when a shift to continental conditions started deforestation, so causing the erosion of the soils developed during the preceding warm stages.

The deposition cycle of these sediment *facies* is still not completely explained within the Visogliano sequence, which is complicated by several erosion surfaces and other unconformities. At present, at

least two main cycles of breakdown, loess and colluvium deposits can be identified in the upper part of the sequence (levels 11–39), while the bottom is characterized by a more complicated interfingering of colluvia and underground karstic system collapse deposits (levels 39–45). It may be inferred that the two upper cycles are subphases of a cold stage, while the lower one may testify to a warm and moist period. This hypothesis is corroborated by the indications provided by the study of the composition of the faunal assemblage. Mainly open environment species were found in the upper levels (*Equus* sp., *Ovis ammon antiqua*), even if the occurrence of *Cervus elaphus acoronatus* suggests that some wood patches were anyway present in the landscape. Conversely, species of warm and thick wood environment were found in the bottom levels, including *Dama clactoniana*, *Felis sylvestris* and *Macaca* sp. This pattern is followed also by the micromammalofauna assemblage, which includes *Ochotona* sp., *Marmota* sp., *Citellus* sp., *Microtus* (*Stenocranius*) *gregalis* in the top levels and *Microtus* (*Terricola*) sp. and *Crocidura* sp. in the bottom ones.

It is likely that the sequence of one warm phase and two cold subphases may correspond to the OIS 11 and 10, as also suggested by the evolutionary study of the thickness of the email of the teeth of the Arvicolids[5], carried out on samples collected at Visogliano and in other European key-sites of middle Pleistocene age.

A set of 8 integrated U/Th and ESR datings was carried out on samples of the email and dentine of large ruminant teeth (*Bos/Bison* and *Stephanorhinus*); the results, included in the time range between 295 and 386 ky, are in accordance with these hypotheses. Nevertheless, this sequence may also be ascribed to the OIS 13–12, as suggested by the typological aspects of the lithic assemblage (»*tayacien*« tools in the upper levels, and archaic pebble industries in the bottom ones).

The Caverna degli Orsi (Figure 1, n. 2) is a cave bear den, also situated in the Trieste Karst. This 140 m-long tunnel-shaped cave was closed by the slow accumulation of a scree-slope deposit during a still unknown period of the late Pleistocene. As a consequence, the clastic sedimentation was stopped inside the cave, so that the aspect of the ancient pavement was kept untouched till today. On this pavement, evident traces of the cave bear frequentation were found: bones, hibernation nests and polished rock patches[6,7].

Two sondages were dug out inside the cave, in two loci not far from the old entrance (Figure 3). The sequence found in the inner locus is about 2.5 m thick; it includes a thick flowstone whose depressions were filled up by a clay deposit that embeds a large quantity of dephosphatized bear bones. Above these levels, there is a thick breakdown deposit that can be divided into several sublevels; here, a faunal assemblage dominated by the cave bear and including other carnivores and

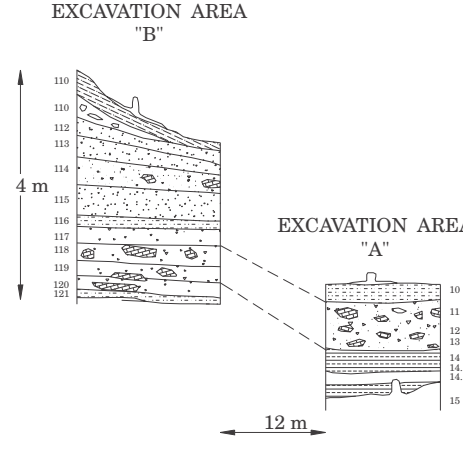

Fig. 3. Caverna degli Orsi (Trieste); excavation profiles of the outer (»A«) and inner (»B«) loci. The dashed lines tentatively correlate the levels with stone artefacts.

small ungulates was found. The sequence is closed by a thin silty clay loam level covered by discontinuous patches of active flowstone.

The sondage of the outer locus was excavated through the deposits accumulated by the scree-slope that closed the ancient entrance. This sequence is mainly made up of fine to medium angular gravel layers, whose matrix is a brownish to yellowish silty loam. Some of these levels are richer in coarse, cobble- to boulder-size elements. While only a few micromammalofauna was found in the upper levels, the bottom ones yielded bear and other carnivore remains, together with gnawed and digested bone fragments, showing that the cave was sometimes used as a den by other large predators.

It is noteworthy that flint and limestone tools of Mousterian discoid technique were found in both sondages, *i.e.* within the breakdown deposit of the inner locus sequence and in the bottom levels of the outer one[8].

The sequence of the inner locus testifies to a shift from moist and warm conditions (flowstone) corresponding to a warm stage or substage, to a glacial maximum (breakdown deposits) followed by the typical cold and aridic conditions of the catastadial phases (*loess*). The faunal assemblage is in agreement with this model, as the warm wood species of the bottom levels are replaced by open environment ones in the overlying levels.

The paleoenvironmental meaning of the outer locus sequence is not yet clear because the faunal assemblage is still under study and because the interactions between the scree-slope and the cave sedimentary processes are complex. Apparently, several loess deposition and ceiling breakdown phases are interfingered with the coarse scree-slope rubble; therefore only a tentative correlation between the cultural levels of the two sequences can be proposed at present.

As to the chronology of the site, it can be inferred that the sequence of a warm and a cold stages found in the inner locus can be ascribed to the end of the OIS 5, possibly 5e, and the OIS 4. This hypothesis is supported also by the occurrence of *Allocricetus bursae*[9] and of Mousterian tools assemblages.

The information collected in these two excavations show that the geological processes forming the Karst cave infillings were the same throughout the period spanning from the Middle to the early Upper Pleistocene. Comparisons with other sites of the area show that these processes continued till the early Holocene in almost all the caves of the area[10,11]; moreover, this stadial-interstadial sedimentary sequences show strict analogies with those excavated in the caves and shelters situated at the edge of the Po plain in Northern Italy[12]. The geological data are in agreement with the paleoecological information obtained from the study of the microfauna; conversely, there is often some bias on the composition of the large mammal assemblages, that may have been introduced into the caves by animals or men operating various sorts of selections.

Toirano caves (Liguria)

The Toirano caves are situated in the western Liguria (North-western Italy, Figure 1, n. 3), at some hundred metres a. s. l. in the Varatella valley. These long, tunnel-like caves are distributed at various levels of a complex cave system that developed in the vadose zone during a still undetermined period; later, the tectonic uplift of the area caused the drying of the passages.

Middle to Upper Pleistocene sediments are still preserved inside the Grotta del Colombo and the Grotta di S. Lucia Superiore. The Grotta del Colombo was ex-

cavated already in the late 1800s, and in this period the Holocene sediments were removed. In the 1950–60s, new excavations were carried out through the Pleistocene deposits of these two caves, and several phases of man frequentation of Lower and Middle Palaeolithic age were found. No cultural remains were found in the levels 20–13; premousterian flake industry was found in the levels 12–5, while a mousterian tool assemblage comes from the levels 3–1[13–16].

New sedimentological and soil micromorphological studies were carried out on these sequences and provided good palaeoenvironmental information; the results of the research work carried out on new samplings of the profiles are reported here.

At Grotta del Colombo, the 5 m thick sequence was strongly altered by phosphatization processes and carbonate recrystallization, so that the original levels cannot be always well identified. Nevertheless, the following six climatic phases were identified above a basal conglomerate of river origin (Figure 4).

Levels 20–13. Long phase of climatic instability, mainly characterized by fresh and aridic climate with deposition of subprimary loess. Wetter and probably warmer phases are testified by the evidence of rolling of eroded soil fragments into the cave, and by the growth of discontinuous and thin flowstone sheets. A colder phase is also testified by the deposition of a stony level due to frost shattering.

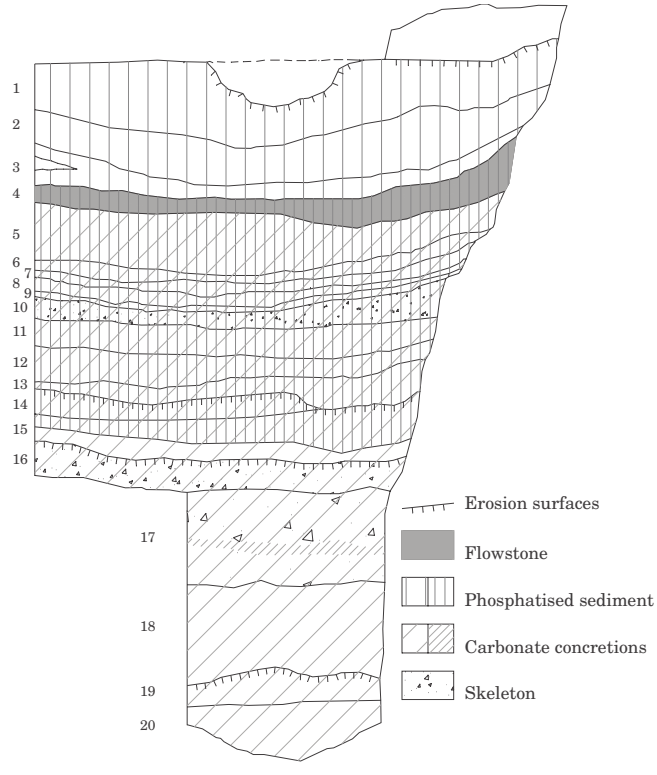

Fig. 4. Excavation profile of Grotta del Colombo (Toirano).

Levels 12–9. These levels testify to an increase of the erosion and transport phenomena observed in the underlying levels; the occurrence of deep seasonal frost pedofeatures suggests a shift to colder conditions.

Levels 8–7. Living floor, made up of several thin sets of sublevels that occur cyclically. The organic matter, mainly layered and trampled vegetal remains, is rather common. The evidence of clay illuviation suggests that the climate was rather moist.

Levels 6–5. The erosion and transport of micaceous deposits is apparently the most remarkable sediment forming process. Apparently, this level resembles the general trend of levels 20–13.

Level 4. Flowstone, testifying to wet and probably warm conditions, with no clastic sedimentation. Pollen analyses are in accordance to this hypothesis, suggesting a wood environment (AP 64.8%, mainly *Quercetum mixtum* with some Mediterranean pine) with open patches populated by *Gramineae* and *Compositae*. The occurrence of *Alnus* sp. and *Salix* sp. may have been linked to river beds (Figure 5). This flowstone marks a major paraconformity that divides the underlying horizons, characterized by *tayacien*-like lithic technocomplexes, from the above ones where Mousterian assemblages were found.

Levels 3–1. These deposits are mainly made up of fine eolian dust (loess) pertaining a cataglacial phase, and probably reworked soon after the deposition.

The Grotta di Santa Lucia Superiore lies a few tenths of meters lower than the Grotta del Colombo; the sequence excavated here is much thinner, about 1.5 m, an can be divided into four main horizons (B, C, D, E) that lie under the reworked surface level A, and that can be grouped into two main sedimentary *facies*.

Levels E. Moderately altered loessic level, with some input from the outside, by inwash of *terra rossa*-like soil relicts; strong *in situ* secondary phosphatization and calcite crystallization. This level testifies to a complex sedimentary environment, affected by a fresh and moderately aridic climate.

Level D. Remarkably altered loessic sediment, probably deriving from the reworking and inwash of somewhat pedogenized loess deposits lying outside the cave. The climate was probably slightly milder and somewhat wetter.

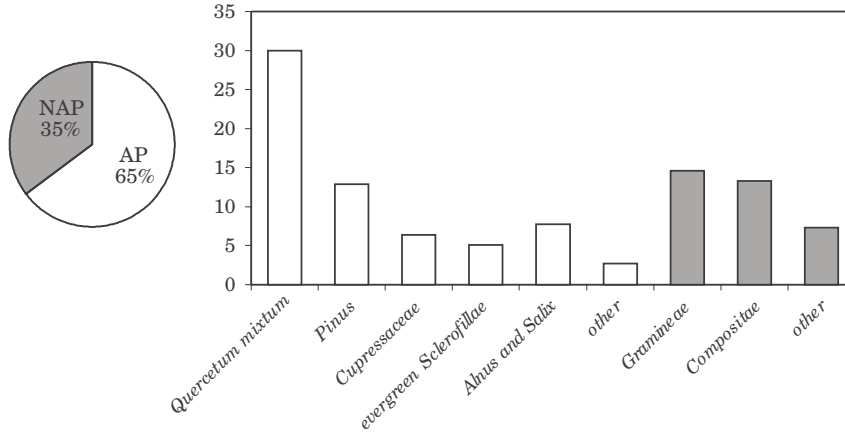

Fig. 5. Pollen diagrams for Grotta del Colombo (Toirano), level 4 (flowstone).

Level C. Strongly reworked loessic sediment, deriving from dramatic erosion processes affecting more or less altered loess sediments lying outside the cave. These processes testify to a poor wood cover of the hill sides and a climate characterized by strong seasonal contrast.

Level B. Stony level, with common frost slabs and other stones deriving from frost shattering processes; some fine matrix is present, as a product of colluvium processes. Carbonates, mainly microsparite, are common within the matrix. Some traces of deep seasonal frost are evident. This horizon testifies to somewhat cold and moist climatic conditions.

The bottom part of the S. Lucia cave infillling shows strict analogies with the Colombo deposits, as to the sedimentological/soil micromorphological and weathering characteristics. Though the chronological setting of these two sequences is still to be fully understood, it may be inferred that the upper part of the Colombo (levels 1–3) and S. Lucia caves (level B) can be ascribed to the early and middle upper Pleistocene; conversely, the middle and bottom levels of Colombo (5–20) are of middle Pleistocene age, divided from the upper ones by the flowstone (4) that may represent the OIS 5. The chronological attribution of the levels C-E of S. Lucia is more questionable; apparently, there are no evident traces of erosion surfaces between them and the overlying ones, so that it may be inferred that they are of upper Pleistocene age. Nevertheless, it may be argued that the sedimentary *facies*, the alteration pattern and the evolution of the deposit are very different from the overlying level B, and resemble much more closely the middle Pleistocene loessic levels of the Colombo cave.

New geochronometric datings and a thorough study of the tool assemblages may give new hints for the chronological assessment of the Colombo – S. Lucia sequence.

Faunistic Remains of Ungulate: Palaeoenvironmental Considerations on Some Middle Paleolithic Sites in Southern Italy (P. Boscato)

The stratigraphic series of the middle Paleolithic explored conserve an important set of ungulate bones hunted by the Paleolithic hunters in the territories near the inhabited sites. The skeletal remains represent most probably the faunistic associations present during the various phases of human frequentation.

During the strong climate changes of the Pleistocene, the particular conformation of the Italian territory has notably influenced the diffusion of faunal population[17–21].

The Italian peninsula, delimited at the north by the Alpine arch, has generally constituted an area of refuge during the stadial phases, favoring migrations of *taxa*, more sensible to the lower temperatures, both towards the south as well as to the western side.

A second important factor which has influenced the distribution of the faunistic presences in the south of Italy, is the orographic-climatic difference existing between the Adriatic and Tyrrenian regions. The first, more arid and influenced by the Balkanic areas, have seen the diffusion of steppes-grasslands from the end of the middle Wurmian to the beginning of the Late Glacial**.** The Tyrrenian regions, subject to more precipitations, are characterized in the same phases by the presence of large wooded areas. Minor differences between the two regions may be observed in the fauna of the lower Wurmian and in the first part of the middle Wurmian. During the more temperate periods or less colder periods, these differences appear less marked: the domination of microthermic animals, that characterizes the Adriatic regions during the stadial phases, is not present.

The strong variability of the landscape of our peninsula, with the exception of the vast plains, represents another character that has determined in limited regions the contemporary presence of *taxa* typical of different habitats. A strong geographic diversification between two areas close together brought in some cases to different faunistic associations.

Grotta Paglicci – external area

In the external deposit of Paglicci cave in the Gargano (Figure 1, n. 4), faunistic associations have been recently found in the level 1 (divided in four cuts). These associations are dominated by Cervids, above all fallow deer and red deer in a chronological setting referable to a temperated phase of the last or the penultimate Glacial[21]. The attribution to the more ancient moment is based on the finding of *Microtus brecciensis* in the microfauna (SALA, personal communication), at the moment never signalled on the inside of the last Glacial, and on the temperate character of the ungulate associations (Table 1).

TABLE 1
EXTERNAL PAGLICCI – PERCENTAGES OF IDENTIFIED UNGULATE REMAINS

	1B	1C	1D	1E
Stephanorhinus sp.	–	–	0.3	–
Equus caballus	–	6.3	2.9	0.2
Equus sp.	3.3	–	–	–
Sus scrofa	3.3	–	0.3	4.0
Bos primigenius	–	1.0	0.6	0.2
Capra ibex	10.0	1.0	0.3	–
Rupicapra sp.	–	3.2	1.1	0.7
Cervus elaphus	40.0	26.3	23.3	14.9
Dama dama	33.3	56.8	62.9	77.5
Capreolus capreolus	6.7	–	1.1	0.5
Cervidae sp.	3.3	5.3	7.2	2.0
Tot. NISP	30	95	358	551

The fauna of the external level 1 furnishes a new setting with respect to the faunistic associations already known of the inside of the cave. In the first place, we observe a strong presence of lagomorphs and carnivores (36% of the total determinated fragments), with evidence of temporary occupations of the site by the latter (wolf and spotted hyena) and of relative contribution of bony material. The second fact that characterizes this fauna regards the composition of the ungulate associations, dominated as already said, by fallow deer and red deer, (the first of which prevails in the 1C, 1D, 1E cuts) accompanied by some remains of ibex, horse, aurochs, wild boar, chamois and roe deer.

The environment predominated by forests, which emerges from this setting, is completely new in respect with the rich stratigraphic series inside the cave, contained between a part of the middle Wurmian and all the upper Glacial (from level 24 up to level 6D)[17,22]. This series is characterized by a strong presence of Equids (horse and *Equus hydruntinus*), aurochs and ibex. It is only during the course of the late Glacial, between Drays I and Bölling, that an increment of forest spaces is verified, above all wild boar, red deer and sporadic roe deer and total absence of fallow deer, already absent in this cave from the middle Wurmian.

The data regarding the isotopic stage 4, probably in part represented in the more recent levels of the nearby Grotta B of Spagnoli[23], where horse is the more frequent ungulate, are missing in the connection between the internal and external series.

Riparo del Molare

On the Tyrrenian coast the Riparo del Molare near Scario (San Giovanni a Piro – SA, Figure 1, n. 5) contains a stratigraphic series of middle Paleolithic of 10 meters thick, with a superimposed ma-

rine level referable to the stage isotopic 5. The deposit is characterized by the presence of numerous *taxa*, due in part to the complex morphology of the landscape. Next to ungulates typical of forest environments, as red deer, roe deer, wild boar, fallow deer, steppe-grassland and wooded grassland species as horse, rhinoceros *hemitoechus*, bison and aurochs meet with other animals of mountain open environments (ibex) or mixed environments (chamois) (Table 2). In the three groups of levels used for a synthetic discussion of the data, these taxa are almost always present with percentage values linked to climatic variations. The dominant species, however, result to be ibex, red deer, roe deer and the aurochs-bison group.

In the most ancient phase, the data regarding the levels in contact with sea deposit (under study) is not available. In the group of levels 67–50 Caprinae forms the most numerous group with the ibex dominating (48.6%). Between the species of open environment, certainly present along the flat coast (now completely submerged), the group aurochs-bison (in total 17.8%) registers in this phase the maximum presence. Elephant, rhinoceros and horse are sporadically present. Of all the forest ungulates red deer is the most frequent (18.7%). This phase corresponds to an arid environment with grassland, steppes and wooded areas, confining probably on the inside of the valleys.

TABLE 2
RIPARO DEL MOLARE – PERCENTAGES OF IDENTIFIED MACROFAUNA REMAINS

	Levels		
	36÷46	47÷49	50÷67
Elephas sp.	–	0.2	0.2
Stephanorhinus cf. *hemitoechus*	2.0	2.5	1.8
Equus caballus	1.2	0.2	0.8
Sus scrofa	2.0	1.1	0.8
Bos primigenius	–	0.2	0.2
Bison priscus	1.2	0.2	2.1
Bos/Bison	5.3	8.1	15.5
Capra ibex	18.0	37.9	48.6
Rupicapra sp.	0.8	0.2	1.2
Caprinae indt.	1.6	0.9	2.4
Cervus elaphus	36.7	39.6	18.7
Dama dama	0.4	–	–
Capreolus capreolus	28.6	6.2	4.9
Cervidae indt.	1.2	0.5	0.4
Ursus arctos	0.8	1.8	2.4
Carnivora indt.	–	0.5	–
Tot. NISP	245	449	492

In the intermediary phase (levels 49–47) red deer (39.6%) is more abundant than ibex (37.9%). This data, with the increase of roe deer and wild boar and the decrease of aurochs-bison, horse and chamois, indicates a general climatic improvement with a probable raising of the temperature, but principally of the humidity, with a progressive extension of the forest area.

The upper phase (levels 46–36) sees a continuous tendency already observed in the preceding layers, with an ulterior increase of the forests. The forest ungulates are dominated above all by red deer (36.7%) and roe deer (28.61%). Worth noting is the finding of a fragment of fallow deer, at the moment the only example of this species found in the series. The ibex is the third ungulate most frequently (18%) found. The top levels of the series (35-III) have not provided at the moment a number of finds sufficient for paleoclimatic analysis.

In this series the constant strong presence of the ibex emerges, even though it decreases from the lower phase. This fact is probably connected to the morphology of the landscape. The Riparo in fact, opens at the foot of a series of steep hills, that, in absence of forest covering, constitutes an environment favorable to this goat.

Interesting for this deposit is the confrontation with the near Grotta Grande (sector A), in which the levels of middle Paleolithic overlap a marine deposit attributed to the isotopic stage 5e[24]. The series documented by faunistic and pollinic remains, is referred to fluctuations moderately cold-temperate inside the isotopic stage 5, with prevailing forest environments (abundance of fallow deer and roe deer). Also in this deposit the presence of ibex is accentuated. In the three cuts (12–14), in which the faunistic sample is statistically reliable, ibex varies from 43.5% to 50% and results to be the dominating ungulate. Fallow deer is the species which characterizes the differences between the two deposits: abundant at Grotta Grande (from 12.9% to 32.1% in the 12–14 cuts) almost absent at Riparo del Molare (a fragment of hemimandible in the layer 46). Inside the Cervids, fallow deer, that indicates a temperate environment, seems to be the most sensible to climatic oscillations; the only one that does not survive in our peninsula the rigors of the glacial maximum[25,26]. In the two sites, therefore, non contemporary faunistic associations are present, even though they derive from two stratigraphic series, which have a common base (marine deposit with *Strombus cf. bubonius*). The two sequences, both referable to the isotopic stage 5, with difficultly may be placed in succession, with the information available at this time.

Grotta del Cavallo

The bone material found in the Grotta del Cavallo near Nardò in Salento (Figure 1, n. 6), during the new research in the mousterian series[27], has been completely analyzed only for the levels I–F, subdivided in a series of cuts (Table 3). The sensible variations of the various taxa evidences strong climatic fluctuations, probably contained inside the middle Wurmian. Due to the momentary absence of datations, there are no sure chronological references.

All the cuts of the layer I contain Mousterian lithic industry with denticulated pieces. The inferior part (cuts I4-I3-I2c) corresponds to a phase characterized by the strong presence of horse and red deer along with a few remains of fallow deer

TABLE 3
GROTTA DEL CAVALLO – PERCENTAGES OF IDENTIFIED UNGULATE REMAINS

	FI-FII-FIIIa	FIIIb-FIIIc-FIIId	FIIIe-FIIIe1-FIIIebase	H	I1-I1a	I1b-I1c	I2a-I2b	I2c-I3-I4
cf *Stephanorhinus*	–	–	–	–	–	–	–	1.8
Equus caballus	19.8	14.9	11.5	19.2	16.1	67.8	74.2	39.8
Equus sp.	–	–	–	1.9	1.1	–	7.2	1.8
Sus scrofa	0.8	1.5	0.3	1.9	–	–	–	2.7
Bos primigenius	39.9	24.6	65.0	1.9	–	1.8	–	–
Capra ibex	–	–	–	–	–	3.6	–	–
Cervus elaphus	27.3	20.1	20.6	34.6	12.6	19.6	18.6	39.8
Dama dama	7.9	31.0	2.0	30.8	59.8	1.8	–	6.2
Capreolus capreolus	1.2	2.2	–	–	2.3	–	–	–
Cervidae sp.	3.2	5.6	0.6	9.6	8.0	5.4	–	8.0
Tot. NISP	253	268	349	52	87	56	97	113

and wild boar, which indicate a temperate-cold continental climate. Successively, in the cuts I2b and I2a the number of taxa reduces: horse clearly dominating, and red deer, are the only ungulates present in a sample of 97 identified remains. This data represents a situation of environmental crisis, rarely seen in the Italian peninsula during the Pleistocene, which has determined the destruction of marginal biotopes. An increase of aridity, together with a drop in temperature, has contributed to the diffusion of large open areas of steppe- grassland.

In the next phase (cuts I1c – I1b) cold and arid climate conditions remain, but with some evidence of climatic improvement. The ungulate association, still dominated by horse, is richer with aurochs, ibex, fallow deer, and red deer with a 20% presence. Clear evidence of an increase in temperature is visible in the associations of cuts I1a – I1 and of the layer H, where forest ungulates dominate with a strong presence of fallow deer.

The set of cuts of the layer F, contains a lithic industry referable to a typical Mousterian rich of scrapers in the lower part and a denticulated Mousterian in the upper part. This set is collocated inside climatic oscillations of the central part of the middle Wurmian. Some *taxa* found in the high cuts of the layer I remain, but in the deeper phase (FIIIebase-FIIIe1-FIIIe) an association clearly dominated by aurochs is present, which represents the forest minimum with a large diffusion of wooded grasslands. A more temperate period with the development of closed forests (FIIId-FIIIc-FIIIb) and a clear dominance of forest ungulates follows.

The more recent mousterian phase (FIIIa-FII-FI) is always characterized by the predominance of forest animal, with a clear decrease of fallow deer and consequent increase of red deer.

After the acquisition of new faunistic data and datations, it will be possible in the future to correlate the series of the middle Paleolithic, discussed above with other series in southern Italy.

In Apulia, the recent finding of an important mousterian deposit, the Riparo of Oscurusciuto near Ginosa (TA) with a stratigraphic series approximately 6 meters thick, will give an ulterior contribution to these studies.

Palaeoenvironmental Preliminary Data from the Bronze Age Site of Castellaro Lagusello (Monzambano, MN) (L. Fasani)

The basin of Castellaro Lagusello (Monzambano, MN, Figure 1, n. 7) is one of the few small lakes remaining of the once numerous intramorainic lakes which flanked the morainic anfitheatre situated in the southern part of Lake Garda. The present water level is much less than the original basin, now reduced due to relatively recent anthropic interventions which gave the Lake a new outlet subsequent to which the level decreased to its present altitude (102 m a.s.l.)[28].

A series of boreholes were sunk along a transect from the morainic flank, to the west of the basin, to the banks of the lake along a line passing through the area occupied by a prehistoric settlement. These have allowed an initial picture of the events to be outlined which characterized the environmental evolution of the basin itself starting from the post-glacial, integrating the data which had already come to light from the palynological research by Bertoldi[29].

The sequences exposed by the drilling, which are presently being studied, have allowed, as far as concerns the Bronze Age settlement area which covers a surface of over a hectare along the west margin of the lake, the identification of a sequence of anthropic levels and bog which

extend to a depth of about 5.5. m from the excavation campaign level. This, to date, has been explored to a depth of 130 cm over a surface of roughly 100 m^2.

The sequence exposed in the drill-cores consists of a normal evolution from plain, slope to shore: one passes from a malacological association adapted to flowing water with *Valvata piscinalis* and *Pisidium* sp. typical of deep water to one richer in Gastropods attached to vegetation such as *Lymnaea peregra*, *Succinta oblunga*, *Armiger crista* and *Gyraulus laevis*. The consequental closure of the basin due to bog formation seems to have an unexpected progressive character on the basis of the data obtained from the drill-cores from the transect, from the margin of the basin towards the center. The traces of an anthropic presence which start to appear at an altitude of about 98 m a.s.l. may indicate that the water level during the Bronze Age was approximately 1–2 m below that of the present.

The data from the excavation show that a certain discontinuity in human presence exists, marked by phases of occupation and of abandonment of the settlement. The stratigraphy obtained to date demonstrates that the last phase of occupation on a »*bonifica*« structure (surface US2) may be attributed to the late or end of the Bronze Age (XIII–XII century B. C.). Prior to this bonifica, US103 represents a surface frequented by man with anthropic sedimentation marked by microlevels of growth and by iso-oriented structures rich in argillaceous material which have been observed in a micromorphological analysis of the thin sections.

In some areas of the excavation this layer covers a cobbled paving, which is discontinuous and has a characteristic undulated form, interpreted as the penultimate »bonifica« of the soil and attributed to the Middle to Late Bronze Age**.** This cobbled paving constitutes the »skeleton« of the bonifica on which the levels of frequentation identified in US103 were constructed. Below this cobbled paving, US104 demonstrates an origin due to colluvium and marks a phase of abandonment subsequent to a phase of occupation evidenced by a wooden scaffold and floor which is found at the base of the area explored to date and dated as Middle Bronze Age. These wooden structures are sealed by this discontinuous level due to the degradation of the flanks subjected to the action of washing water[30–31].

The dendrochronological studies, carried out to date on samples from previous research surveys (1976–77) also confirm this alternation of phases of occupation whose main episodes may be attributed, also on the basis of radiometric studies, to a period of little more than a century between the XVIII and the XVI centuries B.C.[31].

It should be noted that some of the samples used for dendrochronological analysis show rapid increases in the annual thicknesses which may be due to the clearing of the woods following the felling of part of the trees. This phenomenon is called the »clairière« effect which has already been noted for other stations in the Lake Garda area[32].

The preliminary results of the analysis of the carpological remains of a limited area of the excavation displays a picture from which emerges the scarse findings of tree remains in relation to those of herbaceous plants and shrubs which identify an open meadow and shrub foothill environment on the edge of the deciduous woods. The species belonging to the families Pilygonaceae, Chenopodiaceae, Ranunculaceae, Solanaceae and Labiatae are in fact quite diffuse. Obviously, given the closeness to the water level, the varieties of a humid environment prevail within each family. In particular, the association of *Polygonum*/*Chenopodium*, present in all the investigated areas, is typical terrains which are humid, sandy,

gravelly /limnic and rich in organic and nitric substances. Fruits, seeds and other vegetative parts of rushes, carex and water chestnuts which colonize diffusely the banks and the lower and slower waters of the lakes and ponds are also present.

Shrubs of the wood margins such as the elder, cornel**,** thorn-bush and the blackberry bush are very widespread. Concerning the climatic profile, the environment was quite temperate, certainly much milder due to the vicinity of Lake Garda but there also existed there that particular microclimate which is found in the majority of humid areas where thermophilic plants such as the fig (*Ficus carica* L.), which was rather abundant in all the samples examined, and the alkekengi (*Physalis alkekengi* L.) as well as the heliophilous shrubs such as the hazelnut and cornel, grow profusely (Cattani, pers. com.).

Conclusions

The analyses carried out on the selected sites show the strong influence of the climatic changes on the environments of the Italian Peninsula from the Lower-Middle Pleistocene transition (Isernia La Pineta) to the Last glacial and the Postglacial. Environment are very diversified between the North and the South of the Peninsula and between the eastern and the western slope because of the different exposure to the atlantic and continental current and for the different geomorphology.

At Northeast, during the glacial phases, in the Trieste Karst climatic conditions have determined intensive crioclastism phenomena, deposition of loëss and the arrival of cold environment/steppe species as *Ochotona*, *Citellus*, *Microtus gregalis*, *Ovis ammon antiqua*. During the interglacial phases and the interstadial, the mediterranean influences were attested by a temperate and forest fauna (*Sus*, *Dama*, *Macaca*, *Crocidura*, *Terricola*). Humans lived in this environment operating a faunal selection mainly directed to the Cervids. Similar sediments have been deposited in Grotta degli Orsi during the isotopic stadiums 5 and 4. In Liguria, the Grotte di Toirano deposits show that, during the Middle and Upper Pleistocene, the climate was milder in comparison to the Trieste Carso due to the different exposure.

At Isernia La Pineta the faunal remains of large mammals (bison, rhinoceros, elephant) were partly the fruit of a selection carried out by humans, as a result of which they do not reflect in a precise way the real presence of the various species in the territory; however they certainly provide indications of a less temperate climate than the current one, and of an environment characterized by widespread large open spaces of steppe or grassland.

During the Interglacial period, in the external deposit of Grotta Paglicci, open-environment taxa are abundant although cervids are predominant. During the lower Wurm in the South of the peninsula the arid and steppe-grassland environments predominate (Grotta del Cavallo), while on the Tyrrenian coast persist a wider arboreal coverage during the phases of climatic deterioration, as it is pointed out by the abundant presence of the cervids in the faunal assemblages (Grotta del Molare).

The naturalistic data coming from the Bronze Age site of Castellaro Lagusello shows an environment similar to the actual one, but characterized by an increasing deforestation due to human agency.

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PALEO-OKOLIŠNA ANALIZA

S A Ž E T A K

Provedene su nove analize koje rekonstruiraju paleookoliš na nekim talijanskim lokalitetima koji datiraju iz vremena srednjeg pleistocena do brončanog doba. Na svakom lokalitetu istraživani su različiti aspekti ovisno o prikupljenim podacima. Analizirani su sljedeći lokaliteti: *Isernia La Pineta (Molise*); *Visogliano and Caverna degli Orsi (Trieste)*; *Toirano Caves (Liguria); Grotta Paglicci (Gargano)*; *Riparo del Molare (Salerno)*; *Grotta del Cavallo (Lecce)*; *Castellaro Lagusello (Monzambano, Mantova)*.