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La Polledrara di Cecanibbio: one of the richest *Elephas (Palaeoloxodon) antiquus* sites of the late Middle Pleistocene in Italy

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La Polledrara di Cecanibbio site, together with the Castel di Guido site, is one of the richest deposits with *Elephas (Palaeoloxodon) antiquus* of the Italian late Middle Pleistocene (= Early Aurelian Land Mammal Age). The deposit, located NW of Rome at an elevation of about 83 m asl was discovered in 1984. About 750 m² of a paleosurface belonging to an ancient stream bed were uncovered, with a high concentration of large mammal bone remains associated with lithic and bone industry. The site is included in the terminal series of the pyroclastic deposits of the 'Sabatino' volcanic complex, up to now correlated with the Aurelia Formation and correlated with OIS 9. Recent stratigraphical research seems to indicate an erosive contact between the layers including La Polledrara di Cecanibbio site and the deposits of the Aurelia Formation. Therefore, La Polledrara might be older and can be correlated with a terminal phase of OIS 10. Among the most common species (*Bos primigenius*, *Elephas antiquus*, *Cervus elaphus*, *Equus caballus*, *Canis aff. Canis lupus*, *Stephanorhinus sp.*) *Elephas* bones are the most interesting, especially for the presence of two well preserved skulls. They offer a broader knowledge on the morphology of the Italian specimens of *Elephas antiquus*, up to now often studied on incomplete or deformed skulls. All skeletal elements are represented: numerous tusks, mandibles, isolated molar teeth and post-cranial bones (some of them in anatomical connection), belonging at least to twenty-five individuals. The studies, presently in progress, may contribute to the knowledge of the morphological and biometrical variability of the *Elephas antiquus* populations of the late Middle Pleistocene and test the variability of some characters considered useful for gender determination.

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INTRODUCTION

Mammal faunas referred to the late Middle Pleistocene are known since a long time from Latium, especially from the 'Bassa Campagna Romana', where eruptive products of the Sabatinian and Alban volcanic districts are interbedded with sedimentary cycles that represent alluvial fills. La Polledrara di Cecanibbio site, together with the Castel di Guido site (Sala & Barbi 1996), is one of the richest deposits with *Elephas (Palaeoxodon) antiquus* FALCONER & CAUTLEY, 1847 in the late Middle Pleistocene (= Early Aurelian Land Mammal Age, *sensu* Gliozzi *et al.* 1997) of Italy. The deposit, located on the highest terrace of the northwestern surroundings of Rome (Fig. 1), at an elevation of about 83 m asl (above sea level), was discovered in 1984 during a survey organised by the Soprintendenza Archeologica di Roma (Anzidei *et al.* 1989; Anzidei & Arnoldus-Huyzendveld 1992; Anzidei *et al.* in press).

The preliminary excavation pointed out the particular interest of the deposit because of the wealth of archaeological and paleontological material. During numerous excavation campaigns, about 750 m² of a paleosurface belonging to an ancient stream bed were uncovered, with a high concentration of large mammal bone remains (over 8.000) associated with lithic and bone industry (Fig. 2). Excavation, recovery and restoration is still in progress. Part of the bones has been removed and is presently preserved in the deposits of the Soprintendenza Archeologica of Rome, another part is still preserved at the site, which is destined to become a museum.

Mammal fauna

The mammal fauna consists of: *Bos primigenius* BOJANUS, 1827, very abundant; *Elephas (Palaeoxodon) antiquus* FALCONER & CAUTLEY, 1847, very abundant; *Cervus elaphus* LINNAEUS, 1758 advanced form, less

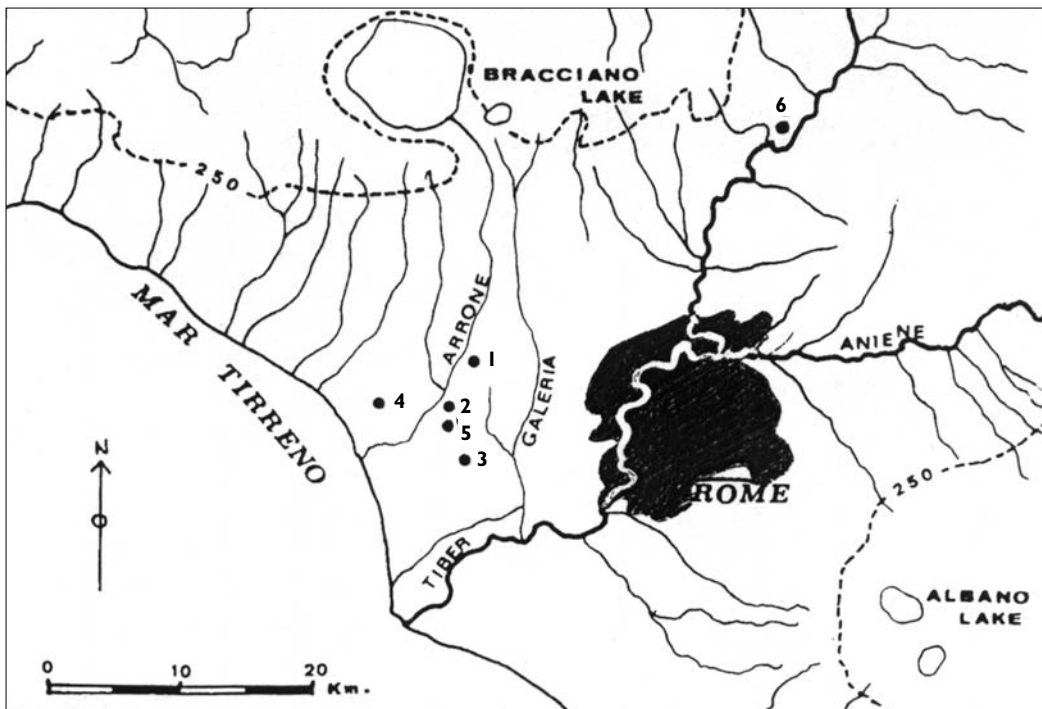


Figure 1 Location map of late Middle Pleistocene (Early Aurelian Mammal Age, Torre in Pietra Faunal Unit) sites in the North and north-western area of Rome. 1: La Polledrara di Cecanibbio, 2: Castel di Guido, 3: Malagrotta, 4: Torre in Pietra, 5: Collina Barbattini, 6: Riano Flaminio.

frequent; *Equus caballus* ssp., very rare; *Stephanorhinus* sp., very rare; *Canis* aff. *C. lupus* LINNAEUS, 1758, only one largely incomplete skeleton; *Bison priscus*

(BOJANUS, 1827); *Hippopotamus* ex group of *Hippopotamus amphibius* LINNAEUS, 1758. With respect to taxonomical composition and evolutive degree, this fauna may be included

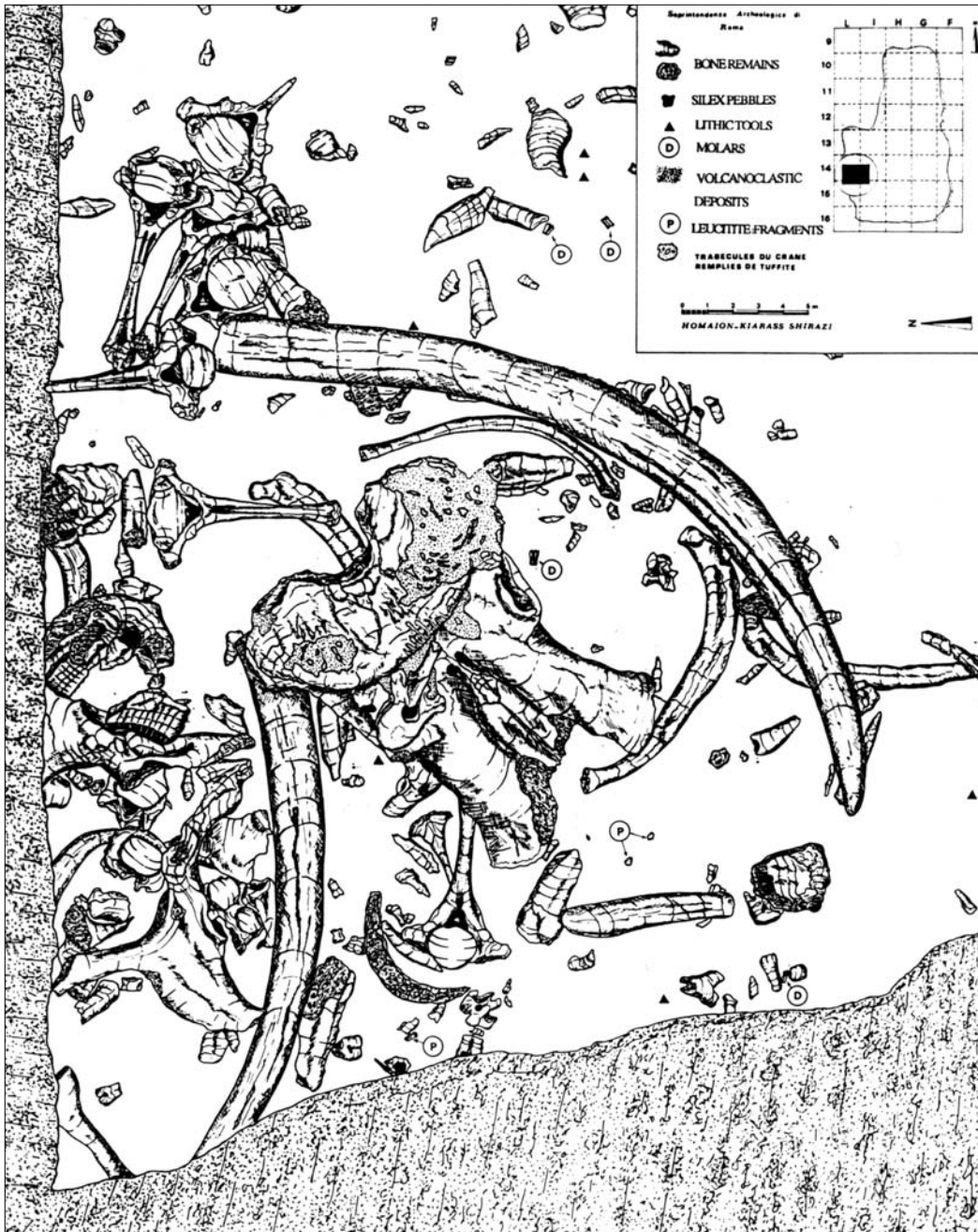


Figure 2 Excavation plane of the squares L14 (partim) and I14.

in the Torre in Pietra Faunal Unit (Caloi & Palombo 1990; Gliozzi *et al.* 1997), it can be correlated with the oxygen isotopic stages (OIS) 10-8. Various associations in the Campagna Romana originating from the layers of the Aurelia Formation (Conato *et al.* 1980), (or correlated with it) can be referred to this Unit. The more representative sites are those of Torre in Pietra, Collina Barbattini, Riano Flaminio, as well as Polledrara di Cecanibbio (Fig. 1; Anzidei *et al.* 1989; Caloi & Palombo 1995; Caloi *et al.* 1998). The mammalian assemblages are generally characterised by the association of *Elephas (Palaeoloxodon) antiquus* with large *Bos primigenius* accompanied by cervids. The cervids are represented by the yet persistent Galerian form *Dama clactoniana* (FALCONER, 1868), by the archaic form of red deer *Cervus elaphus 'rianensis'* LEONARDI & PETRONIO, 1974, as well as by *Megaloceros giganteus* BLUMENBACH, 1803 (here occurring for the first time in Italy) and roe deer, which are less frequent. Horse may be present, at times abundantly, as may rhinoceros [*Stephanorhinus* cf. *S. hundsheimensis* (TOULA, 1902), *S. hemitoechus* (FALCONER, 1868) and *S. kirchbergensis* (JAGER, 1839)], *Hippopotamus*, wild boar, small carnivores, whilst the big carnivores (bears, lions and leopards) are rarer. The overall composition of the fauna varies at the different sites.

The horse is particularly abundant at Torre in Pietra, whereas the urus and the elephant are the dominant forms at La Polledrara. The Clacton fallow deer, absent in La Polledrara, Torre in Pietra and Castel di Guido, is, however, abundant in Collina Barbattini. The red deer *Cervus elaphus* is always present, but its percentage varies from site to site (it is for example abundant in Torre in Pietra and in Riano, scarce in La Polledrara and in Collina Barbattini; the giant deer is present in Torre in Pietra and in Castel di Guido). The occurrence of *Hippopotamus* is noteworthy with sparse remains in Via Aurelia, in Castel di Guido and in Malagrotta; the urus *Bos primigenius* is generally abundant in all the associations (Caloi and Palombo 1995, Caloi *et*

al. 1998). The composition of Campagna Romana large mammal assemblages belonging to the Torre in Pietra F.U., suggest cool-temperate climate conditions, corresponding to the positive oscillations of OIS 9, or of a terminal phase of OIS 10, as well as the presence of an open environment along the coast, whereas, inland, deciduous forests, widespread in moister temperate conditions.

GEOLOGICAL AND PALEO-ENVIRONMENTAL SETTING

La Polledrara di Cecanibbio is located near Rome, upon a relict of the lower footslopes of the Sabatini volcanic structure, dated to the Middle Pleistocene (Di Filippo 1993). The absolute level of the site is 83 m asl, whereas the local morphology is gently undulating. Stratigraphy at the site has become exposed through Holocene slope erosion, and was partly disturbed by modern ploughing. The regional geology is made up of the following formations (Dragone *et al.* 1967; Servizio Geologico d'Italia 1963; Servizio Geologico d'Italia 1986; Compagnoni *et al.* 1986): (1) at the base, the 'Ponte Galeria' formation, age about 0.9-0.7 My, composed of sands, pebbly sands and clays of deltaic and lagoonal facies, preceeding the volcanic activity; (2) pyroclastic fall products from the Sacrofano and local scoria cones, locally reworked, composed of graded alternating scoria-lapilli layers, rich in pumiceous elements towards the top. The uppermost part of the pyroclastic fall deposits is dated generally at 0.26 My. Local top level: 88 m asl. (3) intercalated within the former sequence: the 'Red tuff with black scorias' pyroclastic flow unit, dated 0.49-0.43 My. This ignimbrite has an alkaline-trachytic composition and is made up of a micro-pumiceous matrix, locally lithified, containing large black pumices. Local top-level 80 m asl. (4) at the top: travertine and clay deposits of lacustrine facies; local top level 91 m asl.

The La Polledrara archaeological remains are embedded within the thin lacustrine layers belonging to the 'Cornazzano-Valle

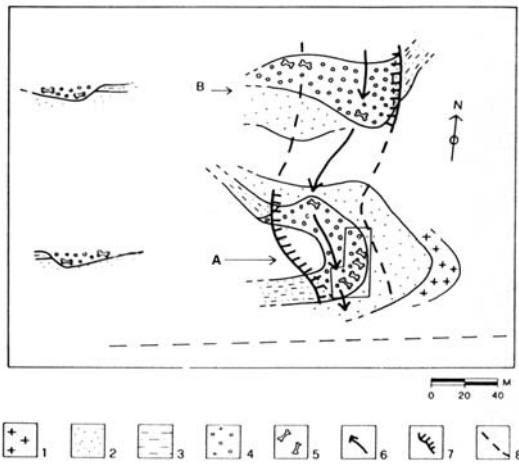


Figure 3 La Polledrara di Cecanibbio, reconstruction of the stream course, on the basis of soil survey in the surrounding areas: **1**: red tuff with black scorias; **2**: granular tuffite; **3**: fluorite; **4**: grey ashy tuffite; **5**: presence of fossil bones; **6**: reconstruction of the course; **7**: outer curve, rather steep; **8**: inner curve, gradual and terraced.

Santa' basin, intercalated in the terminal pyroclastic fall series (Bottino 1976; Corda *et al.* 1978; Locardi & Orsini 1990). The lacustrine environment has been linked to subsidence along faults, known to have occurred during the late Middle Pleistocene (De Rita *et al.* 1996). The sediments are made up mainly of light grey ashy tuffites, locally sandy at the base. Often they overly directly a medium-grained granular tuffite, rich in analcimesed leucite. Within the lacustrine sediments there may occur whitish layers, composed mainly of fluorite. Geological survey has revealed the spatial distribution of the latter ones, as limited to a narrow N-S belt crossing exactly the archaeological site (Arnoldus-Huyzendveld & Anzidei 1993) (Fig. 3). On the base of the excavation data, the La Polledrara site has been associated with a small ephemeral river, having cut various

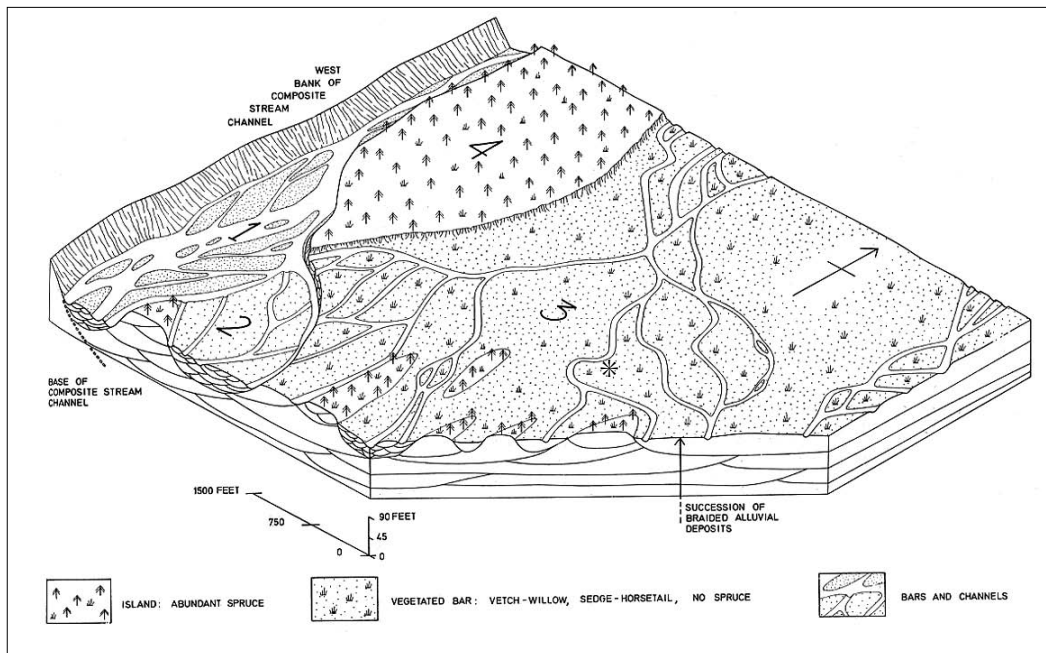


Figure 4 Scheme of a braiding river landscape type, with indicated the presumed position of the site (*) (after Williams & Rust 1969, in: Reineck & Singh 1980: 283, modified).

bends into the granular tuffite (Anzidei & Arnoldus-Huyzendveld 1992) (Fig. 4). The infill as found, was composed of light grey ashy tuffite. Bone remains were found, both embedded in the valley fill as well as scattered along the stream borders. They are frequently associated with small fluoritic aggregates, covering the paleosurface and, more rarely, with large imprints of radial gypsum crystals (Anzidei *et al.* 1989). The depth of the encountered fluvial incision did not exceed 1.5 m, and total valley width ranged up to 40 m. Bend radius was supposedly 120 - 200 m. Lateral bed-displacement signs were encountered. The longitudinal profile of the water stream must have been smoothly graded, with a general current direction to the south.

The pyroclastic fall deposition still active during the lifetime of the site, with a consequential high sediment charge of the river system, points to the existence of a typical

'young' paleo-landscape, characterised by fluvial-marshy environmental features, such as stagnant waters and braiding stream channels (Arnoldus-Huyzendveld & Anzidei 1993). Final fossilisation of the animal bones took place by their transformation into fluoro-apatite. The formation of this highly resistant material is linked to the occurrence of post-volcanic, highly mineralised, fluids, rising upward along fractures and then forming 'fumaroles' (Mastrangelo 1976). This phenomenon can be linked directly to the known N-S direction of the neotectonic structural alignments. The state of conservation of the bones points to a moment of fossilisation rather soon after (or even before) their complete burial.

The age of the La Polledrara site has been associated with the 'Aurelia' formation (ois 9; age 0.37-0.27 My), together with 'Castel di Guido' and related sites (Anzidei *et al.* 1989). The latter formation fills up the fluvial



Figure 5 La Polledrara di Cecanibbio: detail of the paleosurface excavated in 1985/86. *Elephas (Palaeoloxodon) antiquus* bones are visible: at the lower right a jaw, at the centre a tusk, a femur and a humerus.

incisions created during the marine low-stand, associated to OIS 10 (Conato *et al.* 1980; Malatesta & Zarlenga 1988). Recent field work on stratigraphical sections led to the conclusion that the contact between the lacustrine deposits and the Aurelian formation may not be heteropical, but instead erosive. Thus, the La Polledrara site might be slightly older than the Aurelian Formation sites, and eventually belong to a final moment of OIS 10 (Anzidei *et al.* in press).

THE ELEPHANT

Elephas bones are very abundant in the fauna of La Polledrara, especially in the levels that originated in a phase of river flooding, leading to the bone deposition along the margins of the channel and in a last phase of overall deposition of lake and marshy sediments outside the former streambed. Until now 1,411 remains have been examined, making up a significant sample, but not including all elephant remains encountered. In fact, some bones removed from the site still await restoration, whereas others have been identified in only partially excavated portions of the site. The taxonomic and taphonomic study of the deposit, the fauna and the industry is still in progress. The study of the *Elephas antiquus* remains may contribute to a better knowledge of the morphological and biometrical variability of the late Middle Pleistocene *Elephas antiquus* populations of Italy. Bone preservation varies greatly because of the large number of intervening factors. It ranges from bones in partial anatomical connection to isolated whole bones with a very fresh surface, or fragmented bones with sharply fractured edges, to bones and bone fragments with a variable degree of rolling, differential erosion and epiphiseal or cancellous bone abrasion (Fig. 5). All skeletal elements are represented: six quite complete skulls, numerous tusks (many almost complete), mandibles, isolated molar teeth and postcranial bones (some of them in anatomical connection), belonging at last to twenty-five individuals.

The partial articulated remains of two ele-

phant skeletons have been recovered and, in addition, one complete foreleg, one hand, two partial hind legs, some dorsal vertebrae and ribs of two disarticulated vertebral column (Figs. 6 and 7). Very recently, another skeleton has been found at the top of the fossiliferous levels, near the margin of the fluvial-marshy landscape. The remains, very well preserved, consist of the almost complete vertebral column (only sacral and caudal vertebrae lack, the cervical vertebrae are in anatomical connection, the dorsal and the lumbar are slightly disarticulated), several ribs, one fragment of scapula and one humerus, exhibiting fracture traces typical of fresh bones. Close to the skeleton, three implements were encountered: one of bone and two of flint not showing any fluvial reworking marks. The excavation of this area is still in progress.

In the partial sample examined, the remains



Figure 6 La Polledrara di Cecanibbio: detail of the paleosurface excavated in 1985/86. *Elephas (Palaeoloxodon) antiquus* cervical and dorsal vertebrae and some ribs of a disarticulated axial skeleton.



Figure 7 La Polledrara di Cecanibbio: detail of the paleosurface excavated in 1985/86. *Elephas (Palaeoloxodon) antiquus* connected bones of complete left manus, in posterior view.

of large adult individuals are clearly prevailing, whereas the remains of young or very young individuals are but scarce. The best-represented parts are the axial skeleton, in particular vertebrae and long bones, present in a high percentage not only with diaphysal fragments, but also with more or less complete

te bones (Fig. 7). When comparing the La Polledrara sample with the data of the elephant remains from Castel di Guido (Fig. 8), one may observe how the only notable differences concern the axial skeleton, and particularly the vertebrae. Though it is premature to forward hypotheses in this study phase, it is not to be excluded that the higher percentage of axial skeleton remains at the La Polledrara site may be partly linked to a higher presence of only partially disarticulated skeletons.

The elephant skulls of la Polledrara are very interesting and offer a broader knowledge on the morphology of the Italian specimens of *Elephas antiquus*, up till now often studied on incomplete or deformed skulls. The better preserved skulls are those of two fully grown elephants (Figs. 2 and 9) which exhibit a short and broad brow with a transverse occipito-frontal torus, very prominent and reaching the posterior border of the nasal choanae, as in females and males of *E. namadicus* FALCONER & CAUTLEY, 1846. The anterior margin of the torus is high, robust, with strong crests for the insertion of the trunk muscles. A less developed occipito-frontal torus is also present in the Italian specimens of Viterbo (Trevisan 1949) and Pian dell'Olmo

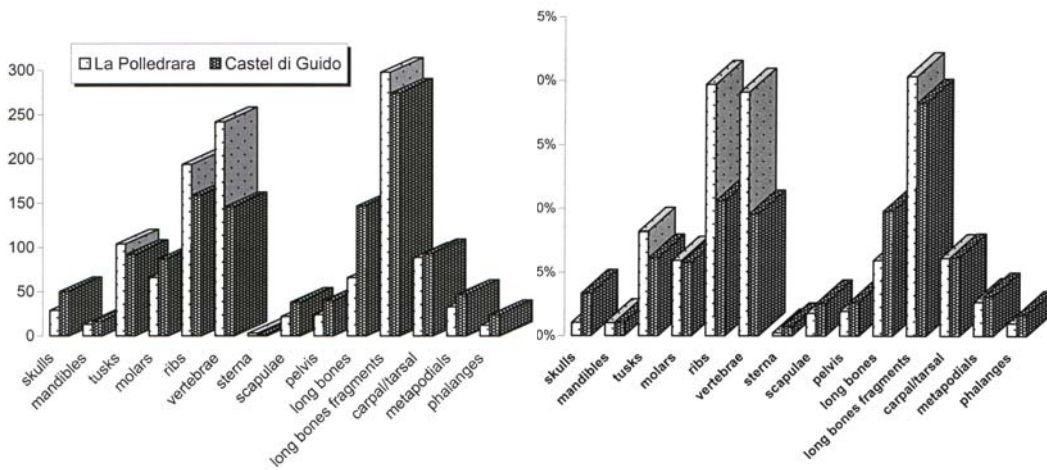


Figure 8 Diagrams showing the distribution of total number (left) and percentages (right) of *Elephas (Palaeoloxodon) antiquus* different skeletal bones in the samples of la Polledrara di Cecanibbio and Castel di Guido.



Figure 9 *Elephas (Palaeoloxodon) antiquus* Falconer & Cautley, 1847, skull (specimen no. 3412) in frontal view.

(Maccagno 1962), whereas in the German skull kept in the Stoccarda Museum (Osborn 1942) the torus is very little developed. The praemaxillary bones are very enlarged also proximally; the incisive alveoli are swollen, and a broad, almost triangular shallow depression occupies their centre. However, the parietal-occipital region is more transversally enlarged than the distal edge of the fan. In posterior view, the occipital exhibits an approximately oval contour; a great distance separates the deep occipital fossa from the foramen magnum; in lateral view, the occipital passes into the parietal and frontal surfaces by an almost rectangular bend.

In the examined sample (Figs. 10, 11 and 12), the penultimate and ultimate molars prevail, whereas the first three teeth are less represented. Taking into account the morphological variability related to ontogenetic growth, two morphotypes have been recognised: the first has thick and less folded enamel loops; in the second one, the enamel is relatively thin, densely and regularly folded, the



Figure 10 La Polledrara di Cecanibbio: *Elephas (Palaeoloxodon) antiquus* left incomplete hemi-mandible (specimen no. 2712) with d4 and the alveolus of d3.



Figure 11 *Elephas (Palaeoloxodon) antiquus* right M3 of a male individual (specimen no. 606). Upper photo: occlusal surface; lower photo: buccal view.

laminae are more closely packed. However, the differences are not very important. The worn lamina exhibit more or less strongly folded enamel surfaces, from initial to medium wear, in the M3. The plication ranges from relatively regular to more sharpened, in both cases it extends until the lingual and buccal side. An accentuated plication (medial



Figure 12. *Elephas (Palaeoloxodon) antiquus* right M3 of a female individual (specimen no. 3528). Upper photo: occlusal surface; lower photo: buccal view.

pillar) is frequently present on the posterior side of the lamina. This fold is generally 'C'-shaped, as has frequently been recorded in not very advanced *E. antiquus* samples from the Middle Pleistocene of Italy (Palombo 1986). The pillar is in some cases flanked by two or (rarely) four large and sharper folds. Plications became more regular in the very worn laminae. The average enamel thickness range from 1.5 mm in the first tooth, to 2.8 mm in the last molar. The lamellar frequency range from 8 to 5. The enamel thicknesses, lamellar frequency, hypsodontia index of the elephant teeth of La Polledrara, fall in the range of variability of *E. antiquus* of late Middle Pleistocene of Italy (Palombo 1986, 1995).

According to Maglio (1973), several authors consider *Elephas antiquus* as a younger synonym of *Elephas namadicus*, as a result of which only one species would be present in the Pleistocene of Eurasia. In effect, Falconer and Cautley named *Elephas antiquus*, the European straight-tusked elephant, in 1847, while the species *Elephas namadicus* was erected in 1846 for Pleistocene Indian specimens. Consequently, if the two species are identical, as alleged by several authors, the

name *E. namadicus* has priority. Nevertheless, there are some reasons for treating the straight-tusked elephant of Europe as a species distinct from, although closely allied to, its Asian relative *E. namadicus*. Firstly, the different routes (towards north-western and towards north-eastern) of diffusion followed by the ancestral population, which (originating itself in Africa) have colonised the Eurasia territories via Anatolia. As a result, the two groups of populations maintain a different areal distribution during the Middle and the early Late Pleistocene. This fact could hamper genetic flow between the two groups, allowing a speciation process.

Secondly, in spite of their great variability, some biometrics and morphological characters of the molars seem to differentiate the specimens of *E. antiquus* from those of *E. namadicus*. Additional evidence supplied by the study of La Polledrara specimens allows us to hypothesise that both species are probably valid. As a matter of fact, if the two species resemble each other in basic morphology of skull, some distinctive biometrics characters are present as is showed by La Polledrara skulls. The skulls exhibit, compared to the average morphological and biometrics characters of *Elephas namadicus*, a parieto-occipital region which is less strongly convex in the horizontal direction; consequently the zygomatic process of the temporal are pushed to the front in a minor degree; the distal edge of the fan (tusk sockets and triangular, flattened area between them) is proportionally less enlarged. Thus, taking into account the few available data and until additional evidence becomes available, we prefer to retain both specie as valid.

INDUSTRY

Lithic industry and a some bone industry of the Lower Paleolithic type has been recovered in association with the faunal remains. Lithic industry, consisting of about 400 implements, is made from small flint pebbles. The choppers and chopper-scrapers are the largest tools (max. dimensions = 80 x 60 x 35

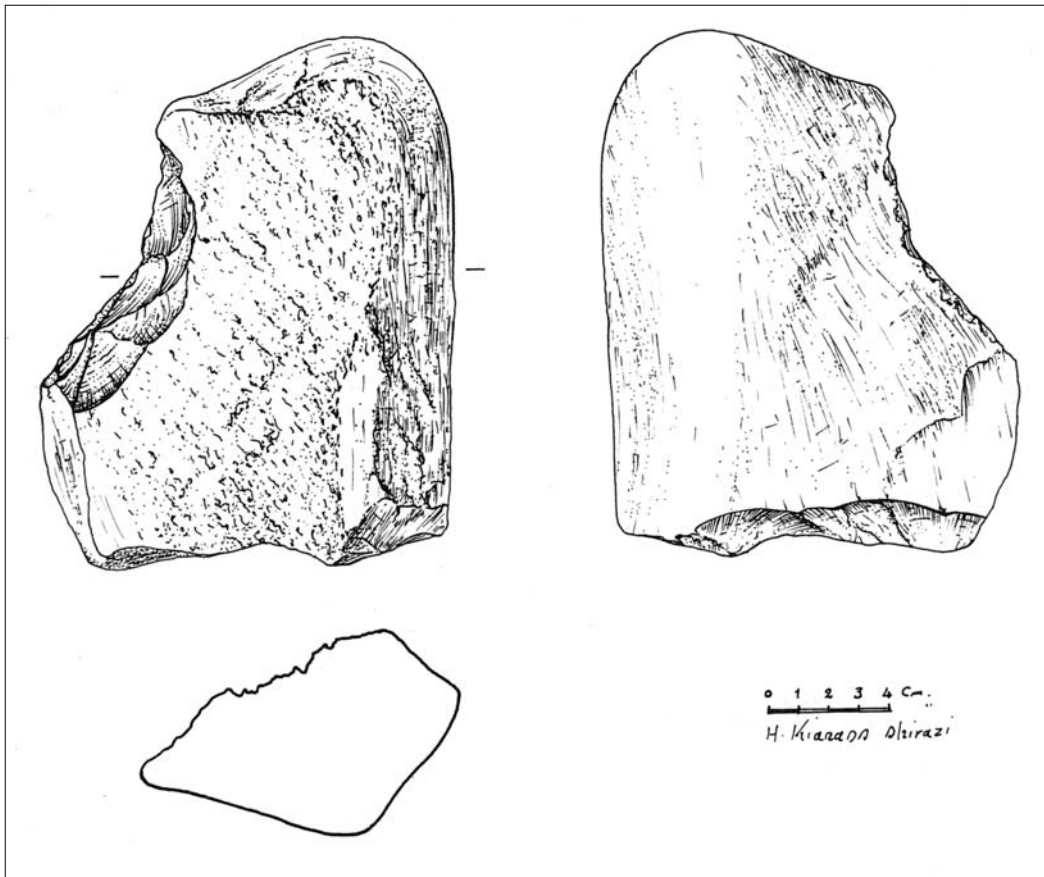


Figure 13 Concave side-scraper on diaphysis fragment, with a direct continuous unidirectional retouch (170 × 139 × 52 mm).

mm); the other tools, pebbles and flakes, are smaller. There are various types of scrapers, many of them with a rather thick retouched edge; gradually becoming end-scrapers in some pieces. There are a large number of notches, denticulates and multiple tools, both on pebbles, cores and flakes. Many tools are not typologically well defined, with a kind of halfway form between two types (side scraper/end scraper; retouched chopper/side scraper on chopper). The tools with only one retouched edge are not common; generally they show two, three or four retouched edges. This intensive exploitation of pebbles was certainly caused by the difficulty in obtaining raw material: siliceous pebbles do not belong to the volcanic nature of the area and certainly were brought to the site by humans. The

lithic industry shows various degrees of rolling and soil sheen. The artefacts, almost all located in the marginal area of the stream, have been displaced by water and their position in relation to the bones is fortuitous. Only in the western sector of the excavation, in a small area with stagnant water deposits, where the partially articulated remains of two elephants have been found, there was a perfectly preserved lithic industry with use-wear traces (polish and striations) indicating butchering activity.

Only six clearly worked bones have been found, all made from the diaphysis of elephant long bones. Some artefacts are presented here: (1) Concave side-scraper on diaphysis fragment, with a direct, continuous, unidirectional retouch. Cortical bone is preserved on

the dorsal face, while spongy tissue is exposed on the ventral face (170 x 139 x 52 mm; Fig. 13). (2) Diaphysis fragment with two longitudinal unidirectional flake scars, which partially removed the cortical surface. On the opposite side, spongy tissue is exposed. Both extremities have been sharpened by a series of contiguous bifacial negative flake scars (240 x 136 x 62 mm; Fig. 14). (3) denticulate side-scraper on diaphysis fragment. The mar-

gin has been sharpened by a few large negative flake scars on the internal part of the bone, where the spongy tissue is preserved. The distal extremity has been reduced and pointed by short bifacial negative flake scars (263 x 99 x 49 mm). Other fragments of elephant diaphysis and bovid epiphyses have been modified by multiple scars and probably used by man; some elephant bone flakes with butt, bulb of percussion and ventral ripples, are probably due to human activity.

CONCLUSIONS

The preliminary analysis of the sample of elephant specimens from La Polledrara di Cecanibbio on the one hand confirms the morphological and biometrical characters of the late Middle Pleistocene Italian population of *E. antiquus*, on the other hand emphasises the problems related to the taxonomical identity of *E. antiquus* versus *E. namadicus*. The features of the La Polledrara elephant skull seem to support a separation between these two species, as have been already hypothesised on the basis of their areal distribution. However, the range of morphological and biometrical variation of European paleo-loxodontine elephants still remains poorly known. We need more additional evidence and analytical data to resolve this question. Concerning the paleo-environmental conditions of La Polledrara di Cecanibbio, all available data point to the occurrence, of a flat fluvial-marshy landscape, with open spaces and moderately covered woodlands, even if the faunal assemblages recorded from various sites of the same area are characterised by a different frequency - of species inhabiting open or forest environments (Caloi *et al.* 1998). The indications of a relatively temperate climate inferred by the faunal assemblages agree with the oxygen isotope data in the Tyrrhenian record, indicating two warm peaks for the stage 9 (Vergnaud Grazzini *et al.* 1990). However, in the faunal assemblages of La Polledrara very few taxa occur, moreover with wide ecological tolerances, consequently it is difficult to offer a precise

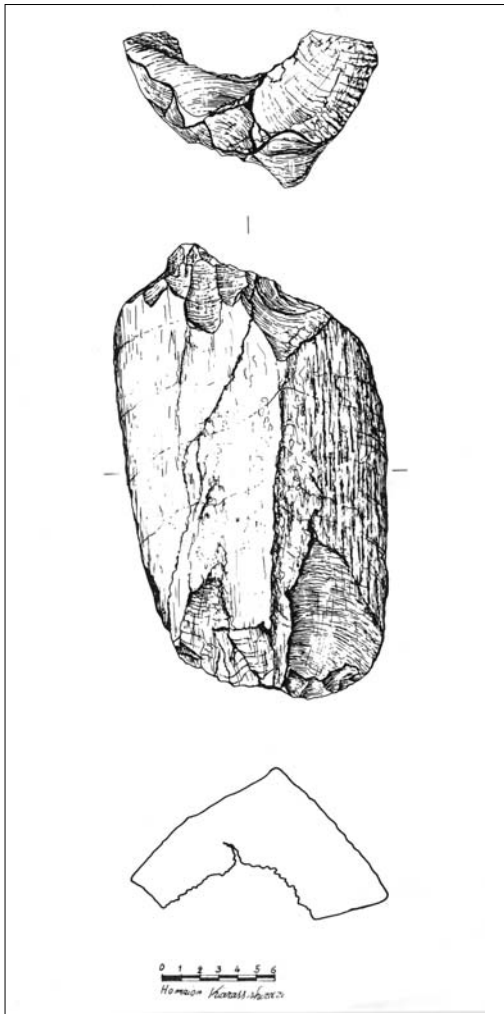


Figure 14 Diaphysis fragment with two longitudinal unidirectional flake scars which partially removed the cortical surface. Spongy tissue is exposed (240 x 136 x 62 mm).

paleo-environmental reconstruction for this site; both dominant taxa indicate open grasslands at the margin of woody areas. It is surprising to note the scarcity (or absence?) of *Hippopotamus* remains, frequent in other mammal assemblages of the same area (Sala & Barbi 1996).

The local stratigraphical sequence marks a complete fluvial cycle of a single river channel; the cycle could be divided into the following paleo-environmental phases: (1) at first, the occurrence of a small braiding-river channel. In spite of its limited size and the low slope-angle, the stream was evidently strong enough to rework animal bones, of which the remains were found scattered in a fragmented and eroded state throughout the central part of the fluvial infill; (2) a probably slightly successive phase of river flooding, leading to the rearrangement of large animal bones along the margins of the channel; and (3) the occurrence, after the silting up of the channel and marginal areas, of a last phase, characterised by the overall deposition of lake and marshy sediments outside and over the former streambed, thus allowing the preservation of animal bones with no evidence of fluvial transport, but incidentally carrying the traces of some human activity.

The inferred fluvial cycle has probably only a local meaning, i.e. marking in time and space a relatively short episode of a single shifting channel of a braiding system, the latter draining a landscape with a still immature geomorphology. The lifetime of the archaeological site coincides with a phase of the final local volcanic activity, the latter probably limited to pyroclastic ash falls and the outbreak of volcanic gases through fractures. But both these processes were essential in bone preservation, through burying and chemical transformation.

The studies of the *Elephas antiquus* remains may improve the knowledge of the morphological and biometrical variability of the late Middle Pleistocene *Elephas antiquus* of Italy and contribute to a better comparison with Western and Eastern European speci-

mens, as well as with *Elephas namadicus*. Moreover, the presence of various pelvic and carpal bones may help to test the variability of some characters considered useful for the gender determination.

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