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REVIEW OF MIDDLE PLEISTOCENE ARCHAEOLOGICAL AND BIOCHRONOLOGICAL DATA IN MALAGROTTA - PONTE GALERIA AREA (ROME, CENTRAL ITALY)

Abstract - P. CERULEO, M.F. ROLFO, C. PETRONIO, L. SALARI, *Review of Middle Pleistocene archaeological and biochronological data in Malagrotta - Ponte Galeria area (Rome, Central Italy).*

In Central Italy, at west of the city of Rome in the area of Malagrotta - Ponte Galeria, there are numerous sites of considerable archaeological and paleobiological interest. This high concentration, perhaps unique in the Italian peninsula, extended chronologically throughout the Middle Pleistocene, and depends on a series of factors. In addition to possibly favorable climatic conditions, this area was subject to strong continuous glacio-eustatic fluctuations, combined with intense volcanic activity. This work, therefore, summarizes the results of recent studies of these phenomena, which have made it possible to modify and better clarify all the paleobiological data and, from the late Middle Pleistocene, also and above all, the archaeological data. In the more than twenty examined sites, it was possible to rearrange the paleobiological data, associated, at least from MIS 11 onwards, to a very high concentration of lithic industries of the Lower Paleolithic, over a wider and more precise time interval, also trying to study their taphonomy for highlighting any eventual events that allowed the conservation of the various sites examined.

Key words - lithic industry, faunal assemblages, Lower Paleolithic, biochronology, Latium, Italy

Riassunto - P. CERULEO, M.F. ROLFO, C. PETRONIO, L. SALARI, *Revisione dei dati archeologici e biocronologici del Pleistocene Medio nell'area Malagrotta - Ponte Galeria (Roma, Italia Centrale).*

Nell'Italia Centrale, ad ovest della città di Roma, nell'area di Malagrotta - Ponte Galeria, sono presenti numerosi siti di notevole interesse archeologico e paleobiologico. Questa alta concentrazione, forse unica nella penisola italiana, si è estesa cronologicamente a tutto il Pleistocene medio, e dipende da una serie di fattori. Oltre a condizioni climatiche favorevoli, quest'area è stata soggetta a forti e continue fluttuazioni glacio-eustatiche, combinate con un'intensa attività vulcanica. Questo lavoro, quindi, riassume i risultati di recenti studi su questi fenomeni che hanno permesso di modificare e chiarire meglio tutti i dati paleobiologici e, dal Tardo Pleistocene Medio, anche e soprattutto i dati archeologici. Negli oltre venti siti presi in esame è stato possibile riordinare i dati paleobiologici, associati, almeno dal MIS 11 in poi, ad un'altissima concentrazione di industrie litiche del Paleolitico Inferiore, in un intervallo di tempo più ampio e preciso, cercando anche di studiarne la tafonomia per evidenziare eventuali eventi che hanno consentito la conservazione dei vari siti presi in esame.

Parole chiave - industria litica, associazioni faunistiche, Paleolitico Inferiore, biocronologia, Lazio

INTRODUCTION

For several years the area of Malagrotta - Ponte Galeria (Rome, Italy) has been the subject of study by numerous palethnologists, geologists and paleontologists (Blanc, 1954; Conato *et al.*, 1980; Barbattini *et al.*, 1982; Kotsakis *et al.*, 1992; Petronio & Sardella, 1998, 1999, 2001; Milli *et al.*, 2004; Sardella & Petrucci, 2012; Marra *et al.*, 2014; 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019, *inter alios*) who proposed, above all for the abundant faunal assemblages found in this territory, numerous biostratigraphic and biochronological reconstructions that mainly concern the first part of Middle Pleistocene and new archaeological data for the last part of this period.

From the late Middle Pleistocene paleobiological and palethnological data (e.g., Torre in Pietra: Blanc, 1954; Piperno & Biddittu, 1978; Ceruleo *et al.*, 2019) dating back to the lower Paleolithic are getting increasing importance.

For a correct interpretation of these data of the Middle Pleistocene, the various glacio-eustatic fluctuations of the sea level connected to the climatic changes of this period, the tectonic rise of the Latium coast and, finally, the related volcanic activity are obviously very important. Because of these geological phenomena, recent studies (Marra *et al.*, 2014, 2018a) have shown that the time span of many sites in this area is different and much wider than previously identified and this has involved a necessary revision of many archaeological and paleontological data (Ceruleo *et al.*, 2019; Petronio *et al.*, 2019). In some cases, in this regard, the geological observations of the deposits have allowed a better understanding of the genesis of the deposits and consequently some updated observations in a more strictly anthropological sense.

In this work, the main archaeological and palaeontological results of the above-mentioned recent studies (Marra *et al.*, 2014, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019) are reviewed and summarized. Furthermore, together with the significance of the concentra-

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tion of the important lithic and bone artifacts of the lower Palaeolithic, a new biochronological scheme with the most relevant mammalian taxa found in the fossil deposits of the area is proposed.

THE SITES OF THE AREA

Malagrotta, along the Via Aurelia (Fig. 1) occupies the area just north of the larger area of Ponte Galeria which in the past was considered as eponym for the Galerian Mammals Age (Gliozzi *et al.*, 1997; Petronio *et al.*, 2011) and the corresponding Faunal Unit (F.U.) of Ponte Galeria for its faunal content (Petronio & Sardella, 1999; Petronio *et al.*, 2011; Marra *et al.*, 2014; Petronio *et al.*, 2019). The Aurelia consular road that crosses the area has also given the name (Gliozzi *et al.*, 1997) to the corresponding Aurelian Mammals Age. Currently most of the quarries where the vertebrate fossil and archaeological remains have been found are not active. The sites, from the oldest to the most recent, are listed in the Tab. 1.

Therefore, according to what is listed, the quarries in the Malagrotta - Ponte Galeria Area represent the only area of the Italian peninsula, and of the Tyrrhenian Sea coast in particular, where it is possible to study in the same territory the biochronological and, in part, archaeological succession starting from first part of the Galerian Mammal Age (Slivia F.U.; MIS 20/19), to the Aurelian Mammal Age (Torre in Pietra F.U., MIS 10/9, and Vitinia F.U., MIS 8,5/7), for a time interval therefore of about 600,000 years.

STRATIGRAPHIC SYNTHESIS

The Malagrotta - Ponte Galeria area was occupied by the Tiber delta from the Middle Pleistocene and this has favored the deposition of fluvio-lacustrine sedimentary (Figs 2-3) successions rich, as mentioned, in remains of mammal fauna and lithic industries. The continuous uplift of this area from 0.9 My, together with the development of the volcanic activity from the Sabatini Mts and Alban Hills Districts, has caused (Marra *et al.*, 2014) widespread erosion and the consequent exposure of these successions, favoring the formation of plateaus crossed by long and narrow valleys currently called Fosso della Magliana and Fosso Galeria, right bank tributaries of the Tiber River today.

After sixty years of researches and various stratigraphic schemes introduced (e.g., Ambrosetti & Bonadonna, 1967; Conato *et al.*, 1980; Marra & Rosa, 1995; Milli, 1997; Funiciello & Giordano, 2008; Milli *et al.*, 2008), thanks to new radiometric data and magnetostratigraphic analyses (e.g., Karner & Marra, 1998; Florindo

et al., 2007; Marra *et al.*, 2008), the new stratigraphic schemes are currently better defined chronologically, so as to be consistent with the new biochronological data (Marra *et al.*, 2014, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019).

BIOCHRONOLOGICAL AND ARCHAEOLOGICAL DATA

Fontignano (lower levels)

A small fauna assemblage (Kotsakis *et al.*, 1992) consisting of only two Arvicolids, *Prolagurus pannonicus* and *Predicrostonyx* sp., was collected in the lower levels of Fontignano (Ponte Galeria area), in the lagoon layers of the clay at *Helicella* (level b by Conato *et al.*, 1980) in the lower part of the Ponte Galeria 1 Formation (Marra *et al.*, 2014). The two Arvicolids (including *Prolagurus* present in the peninsula only in this area of Latium) of Northern origin, associated with a particular fauna of terrestrial molluscs, testify a more rigid climate than today (Esu & Girotti, 1991; Kotsakis *et al.*, 1992, 2003) and this complex can be correlated with a fresh moment (in this case MIS 20/19) of the Slivia F.U. (Marra *et al.*, 2014; Petronio *et al.*, 2019).

Cava Arnolfi

In this gravel quarry (Km 11.2 of the via Portuense, Rome) a hippopotamus canine was found in the cross-stratified sandy levels (Bonadonna, 1965) corresponding to the level "d" by Conato *et al.* (1980), assigned to the Ponte Galeria "b" Unit (Marra & Rosa, 1995) and subsequently to the Ponte Galeria 2B Formation (Marra *et al.*, 2014). This finding has been attributed by Petronio (1986, 1995) to *Hippopotamus antiquus* for the relevant dimensions and for the typical parallel pattern of the external furrows. The taxon has no particular biochronological importance since it occurs in the Italian territory from the late Villafranchian to almost the whole Galerian. Together with the hippo remains (Bonadonna, 1965), abundant tusk remains of *Palaeoloxodon antiquus* and few undefined cervid and bovid remains were reported but lacking of biochronological indications.

The taxa subsequently listed in Ambrosetti (1967) and Azzaroli & Ambrosetti (1970), found "in the central and upper part", immediately above the marine and delta deposits (corresponding to the level d by Conato *et al.*, 1980 of the Ponte Galeria Formation) are: *Megaceros* (*Megaceroides*) *verticornis* (= *Praemegaceros verticornis*), *Hippopotamus amphibius* (= *Hippopotamus antiquus*), *Cervus* sp. (= *Cervus elaphus acoronatus*), *Dama* cf. *dama* (= *Axis eurygonos*), *Elephas* cf. *trogotherii* (= *Mammuthus trogontherii*), *Elaphas* cf. *antiquus* (= *Palaeoloxodon antiquus*) and *Bos primigenius* (= *Bison* sp.) (Marra *et al.*, 2014).

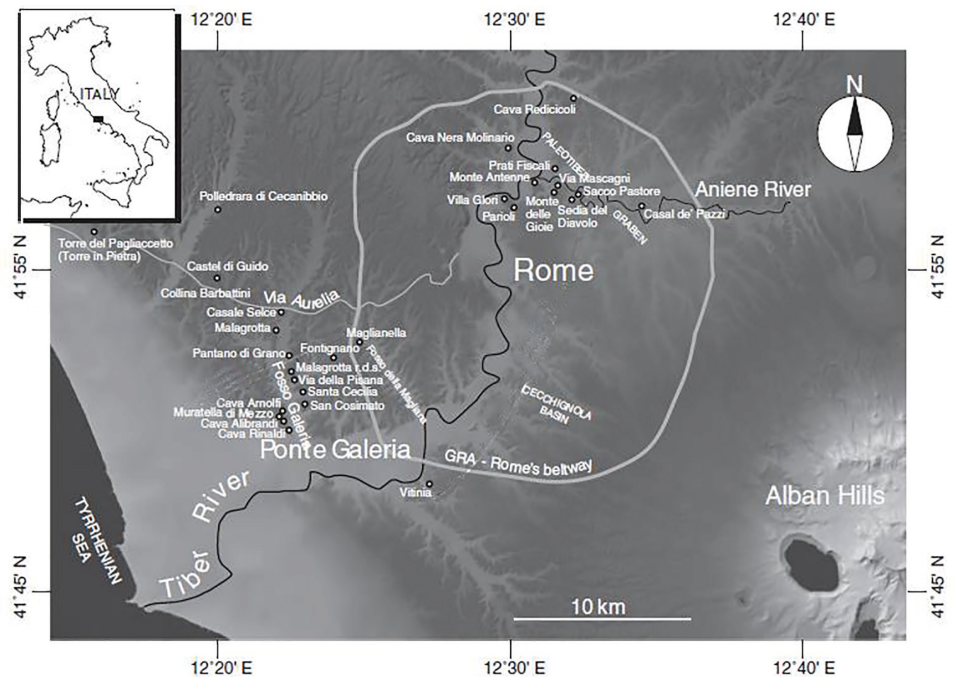


Figure 1. Location of the main sites mentioned in the text (modified from Marra *et al.*, 2014).

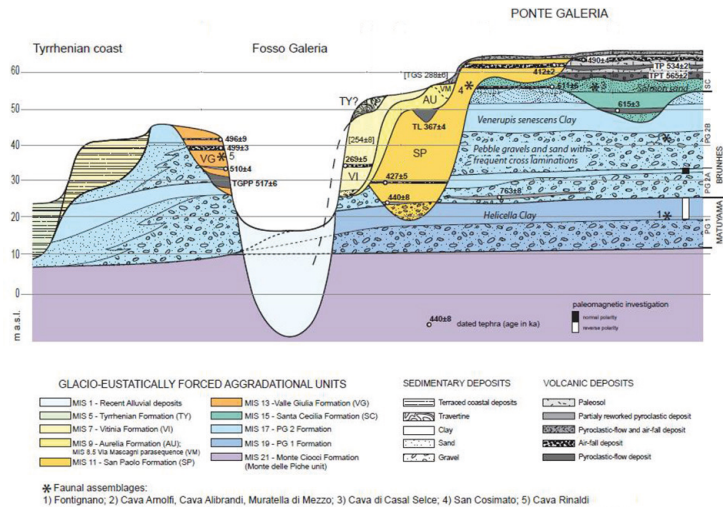


Figure 2. Schematic, composite geologic section (horizontal not to scale) of the Ponte Galeria area (modified from Marra *et al.*, 2014).

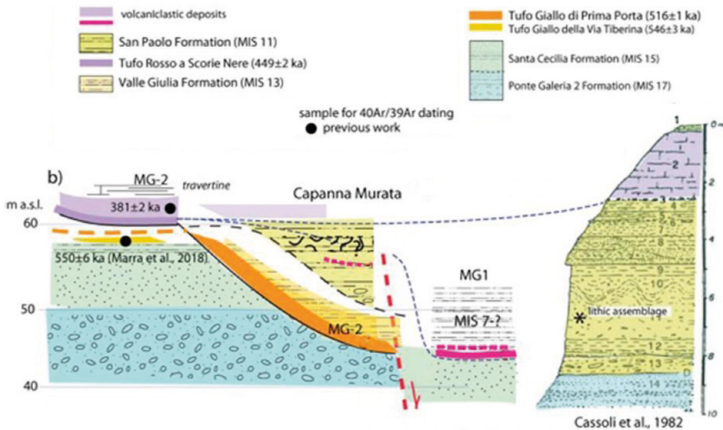


Figure 3. Geological section of Malagrotta site with a stratigraphic sketch by Cassoli *et al.* (1982) on the right (modified from Ceruleo *et al.*, 2019).

Many of the recognized species have a wide bio-chronological distribution and are therefore not indicative of particular time intervals. Among these, *A. eurygonos* (= *Dama* sp. in Ambrosetti, 1967) appeared in the late Villafranchian and it occurs throughout the Galerian (Petronio *et al.*, 2011), up to MIS 13, and *P. antiquus*, present from the beginning of the Galerian up to MIS 4/3 (Palombo & Ferretti, 2005). Both species are easily identifiable: an antler of *A. eurygonos* for the first tine that forms an obtuse angle with the beam (Di Stefano & Petronio, 1998) and the *P. antiquus* molars for the thickness and the wide lamellar frequency that falls within the morphologies of the species.

Among the large cervids, *Praemegaceros verticornis*, represented by numerous remains of antlers and mandibles, is a taxon which instead has a biochronological range between Colle Curti F.U. and Ponte Galeria F.U.; *Mammuthus trogontherii* occurs from Slivia F.U. until almost Isernia F.U. (Gliozzi *et al.*, 1997; Petronio *et al.*, 2011), although the morphological structure and, above all, the low lamellar frequency of the molars found in the quarry could indicate a not very evolved form, similar to the first Galerian forms (Lister *et al.*, 2005; Foronova, 2014). Finally, we must remember (Petronio & Sardella, 1999) the occurrence of *Bison* sp. (Marra *et al.*, 2014) including a typically bison-shaped lower jaw, a lower third molar with robust ectostyle and deep labial valley, a metacarpus with morphometry and typical external and internal profile in the condylar region (Sala, 1986); these features allow to attribute the fossil remains, albeit doubtfully, to *B. schoetensacki*, whose biochronological intervals covering the entire Galerian (Gliozzi *et al.*, 1997; Petronio *et al.*, 2011), do not help to better clarify the age of the sediments.

Therefore, to better clarify the bio-chronological range of this mammal assemblage, one must also look to the lithostratigraphic data (Marra *et al.*, 2014) which, for the Ponte Galeria 2B Formation, indicate MIS 18/17.

Cava Alibrandi

Near Km 13.5 of the Via Aurelia, in the gravel-sandy levels of this quarry, corresponding to level d by Conato *et al.* (1980), several fossil remains were found (Capasso Barbato & Petronio, 1983): a rib of *Palaeoloxodon* sp., a fragmentary molar and a metatarsal of *Equus* morphologically and dimensionally comparable with *E. altidens* (Alberdi & Palombo, 2013), a rib of *Hippopotamus* sp., two basal fragments of antlers of *Axis eurygonos*; are also marked a fragment of an antler with a rose and the characteristic flattened shape of the first tine of *Megaloceros savini* and, finally, some molars previously attributed to *Bos* but, currently, on closer inspection, compatible instead with

Bison morphologies and dimensions. The recognized taxa do not indicate a precise chronological interval with the exception of *M. savini* that occurs in the Ponte Galeria F.U. (Petronio & Sardella, 1999) and it is still present in the subsequent Isernia F.U. The time span is better chronostratigraphically delimited by the attribution of the Cava Alibrandi sediments to the Ponte Galeria 2 B Formation (MIS 18/17) (Marra *et al.*, 2014).

Cava di Casal Selce (lower levels)

In the level d of this quarry (Conato *et al.*, 1980) a cranial fragment of bovid showing horns with typically sub-triangular sections was found. It has been attributed to the new species *Bos galerianus* by Petronio & Sardella (1998) and subsequently to *Hemibos galerianus* by Martinez Navarro & Palombo (2004, 2007). This species, which only occurs in the Ponte Galeria F.U. and it is no longer present in other Galerian F.U.s., characterizes biocronologically the Ponte Galeria 2B Formation (Marra *et al.*, 2014). Together with these remains, some other taxa, such as *Axis eurygonos*, *Equus altidens*, *Crocota crocuta* (Sardella & Petrucci, 2012) and *Mammuthus trogontherii*, are present and referable to MIS 18/17.

Muratella di Mezzo

In this locality, near to the two previous quarries, Caloi & Palombo (1980a) indicate remains of *Palaeoloxodon antiquus*, *Hippopotamus* sp., *Praemegaceros verticornis* and, above all *Megaloceros savini*, present with a basal fragment of the antler with the classic flattened brow tine; this latter taxon, as in the case of Cava Alibrandi, indicates a restricted biochronological interval between the Ponte Galeria and Isernia F.U.s. The fossil remains were found in gravel and sand levels, corresponding to the level d by Conato *et al.* (1980) and, therefore, are correlated with MIS 18/17 (Marra *et al.*, 2014).

Campo di Merlo

From this site on Via della Magliana, in a quarry near the intersection with Via Portuense, in the sandy-gravelly levels still corresponding to the level d of the Cava di Casal Selce (Conato *et al.*, 1980), therefore referable to Ponte Galeria 2B Formation, corresponding to MIS 18/17, a jaw of *Hippopotamus antiquus* has been found (Petronio, 1986). This large remain, lacking of almost all teeth and collected from the lower levels of this quarry, has a clearly concave profile of the lower part of the horizontal branch, a character that allows it to be classified correctly but which does not give particular biochronological indications.

Maglianella

In this locality, near the crossroads between Rome's Grande Raccordo Anulare (GRA) and Km 11 of the Via Aurelia (Petronio, 1986), a fragmentary skull of *Hippopotamus tiberinus*, holotype of Mazza (1991), later attributed to *H. antiquus* by Petronio (1995), was found together with other remains. As already mentioned, this species has a large biochronological range. However, having been found in the lake deposits of the Santa Cecilia Formation present in the area (Marra *et al.*, 2014), these remains can be referred to MIS 15 and Isernia F.U.

Cava di Casal Selce (upper levels)

From the levels above those containing *Venerupis*, consisting of salmon sands (i.e. levels "e" and "f" by Conato *et al.*, 1980, respectively) and correlated with the Santa Cecilia Formation (Marra *et al.*, 2014) it comes a rich fauna of birds, amphibians, reptiles, micro and macromammals collected at different times (Petronio, 1988; Petronio & Sardella, 1999, 2001; Bedetti, 2003; Kotsakis & Barisone, 2008; Mancini *et al.*, 2008; Sardella & Petrucci, 2012; Marra *et al.*, 2014; Strani *et al.*, 2021). Among the micromammals, the occurrence of *Arvicola cantianus* (= *Arvicola mosbachensis*), whose dimensions fall within the average values correlated with those of the lower Toringian (MIS 15) (Maul *et al.*, 1998), is important. Among the macromammals are interesting some dental remains of *Macaca sylvanus*, *Lynx pardina spelaea*, some remains of the limbs and a jaw of *Stephanorhinus hundsheimensis* (Petronio, 1988) which testify the last occurrence of this rhinoceros in the Italian peninsula, some molars and a fragmentary canine with parallel furrows of *Hippopotamus antiquus*, *Sus scrofa* testified by a jaw whose dimensions indicate the presence of the first most archaic wild boars of the Galerian Age; have also been found many equine molars of different sizes and morphologies belonging to *Equus altidens* and, probably to *Equus* cf. *E. sussenbornensis*, some fragments of horns and limb bones of *Bison* cf. *B. schoetensacki*, remains of antlers and bone fragments of the limbs of *Axis eurygonos*, a basal fragment of antler of *Capreolus* sp. and finally *Cervus elaphus acoronatus* which is the most represented taxon with numerous remains of teeth and antlers easily recognizable (Di Stefano & Petronio, 1993, 2002; Di Stefano *et al.*, 2015) together with the size of the radius, metacarpals, shins, and the morphology of the lower and upper molars and premolars. The biochronology of the macromammal assemblage indicates a generic Galerian age, but the occurrence of *Arvicola cantianus* (Petronio & Sardella, 1999, 2001; Sala & Masini, 2007; Marra *et al.*, 2014) and the geological data indicating MIS 16/15 for the Santa Cecilia Formation, allow the reference to the Isernia F.U. (Marra *et al.*, 2014; Petronio *et al.*, 2019).

Cava Rinaldi

In this quarry there were found abundant cranial and limb remains of *Palaeoloxodon antiquus*, a lower canine and a second upper molar of *Ursus spelaeus* with a morphology characterized by the abundance of accessory tubercles (Capasso Barbato & Minieri, 1987), a *Bos primigenius* molar, some remains, including fragments of diaphysis of long bones and molars (Di Stefano & Petronio, 1993) morphologically and dimensionally compatible probably with *Cervus elaphus eostephanoceros* and, finally, a dental arch and some isolated teeth of *Castor fiber*.

The fossil remains were recovered in the basal layer overlying the deposits of the PG 2 Formation. The Yellow Tuff of Prima Porta pyroclastic flow deposit, dated to 516 ± 1 ka, as reported by Marra *et al.* (2018a) (Fig. 2), links the stratigraphy to the first part of the Valle Giulia Formation (Marra *et al.*, 2014, 2018a) and at MIS 13. Therefore, the mammal assemblage was referred to Fontana Ranuccio FU. It represents a series of important biochronological innovations for the Italian territory and more precisely: the cave bear back-dates its first occurrence from MIS 9 (Torre in Pietra F.U.: Gliozzi *et al.*, 1997; Petronio *et al.*, 2011) to MIS 13 (Marra *et al.*, 2018a, Petronio *et al.*, 2019), as well as *Cervus elaphus eostephanoceros* from Cava Nera Molinaro (Rome). These findings, therefore, constitute the oldest presence in Italy included in MIS 13 of the Fontana Ranuccio F.U. Finally, the occurrence of the beaver, one of the few reports in the Roman area (Clerici, 1887, 1891), also constitutes a rarity for the Italian peninsula where the first finds of this rodent dates back to the late Villafranchian (Kotsakis *et al.*, 2003; Salari *et al.*, 2020).

At Malagrotta, Acheulean lithic industry was found together with abundant faunal remains in the Capanza Murata locality, discovered in 1970 by archaeologist Ernesto Longo and subsequently excavated between 1975 and 1978 by the Institute of Anthropology and Human Paleontology of the University of Pisa (Longo & Radmilli, 1972; Caloi & Palombo, 1980b; Cassoli *et al.*, 1982; Pennacchioni & Persiani, 1982; Radmilli, 1984; Palma di Cesnola, 2001). These materials come "from the lower clayey deposit with tuffite (levels 10-11) at the top of which soliflow phenomena are visible" (Radmilli, 1984).

The human presence is characterized by lithic artifacts, bone flakes and portions of long bones with traces of manipulation for the preparation of effemeral instruments, similarly to the nearby sites of Castel di Guido and Polledrara di Cecanibbio; in the site the materials were found concentrated in the upper part of the stratigraphic succession.

The lithic industry shows a total of 601 pieces mainly obtained on flakes or directly on pebbles. The lithic industry on pebbles includes choppers, chopping tools

and little bifaces, while the industry on flakes shows retouched supports consisting of notches, borers, numerous scrapers and rare end scrapers. There are 6 bone artifacts, including an elongated cordiform biface, some scrapers and an end scraper.

The assemblage of lithic and bone artifact is typologically referable to the Acheulean facies of the nearby Torre in Pietra site.

Cassoli *et al.* (1982) attributed the level with the remains of Malagrotta's human presence at the beginning of the Riss (about 300,000 years, MIS 9), a chronological attribution later confirmed by Radmilli (1984). Palma di Cesnola (2001) later cites a new K/Ar dating of the tufaceous level, corresponding to layer 2 of the sequence (see on Fig. 3, the section by Cassoli *et al.*, 1982), which gave an age of 350,000 years. However more recent studies (Marra *et al.*, 2018a) have established a "terminus post quem" of 516 ± 1 ka (i.e., MIS 13, see section Capanna Murata on Fig. 3) for the most of the site succession, data reported also by Petronio *et al.* (2019) and Ceruleo *et al.* (2019). The upper levels from Malagrotta were, instead referred to the San Paolo Formation (MIS 11) (Marra *et al.*, 2018a).

From the Malagrotta area there are two other reports of lithic industries: Quarto della Vipera and Riserva dell'Isolotto, referable respectively to the upper and final Acheulean. The toponym "Riserva dell'Isolotto" is also known in the literature as "Riserva dell'Olmo" (Pennacchioni & Persiani, 1982).

The first site, Quarto della Vipera, is at km 17 of the Via Aurelia, on a plateau to the east of altitude 67 m a.s.l. In this area, about forty lithic artifacts were obtained from small flint pebbles, which according to the Authors (e.g., Pennacchioni & Persiani, 1982), can be compared with the artifacts of the "m" layer of Torre in Pietra.

In addition to the pebble tools mentioned above at the Quarto della Vipera site, 3 bifaces were also found on surface at the end of the last century together with few faunal remains. Two bifaces are on pebbles and one on flake. The two bifaces on pebbles keep a large portion of cortex on the heel. Since the 3 bifaces were found on the surface outside a stratigraphic context, it is not possible to give a certain dating, however typologically they are very similar to those found in the lower level "m" of Torre in Pietra.

The second site, Riserva dell'Isolotto (former Riserva dell'Olmo), is approximately at km 17.600 of the S.S. Aurelia (Pennacchioni & Persiani, 1982). In this locality there were found one biface, some flakes and two cores all in a very restricted area on the top of a small hill. The biface was contained in a tuffitic matrix very similar to the level above the sediments which in the nearby site of Malagrotta (Radmilli, 1984). According to the Authors the other finds did not appear associated with the biface as they were scattered on the surface

by agricultural works. In association with the biface, remains of large mammals were recovered, but for their fragmentary nature they cannot be determined. According to the Authors, the biface is typologically referable to the advanced Acheulean (MIS 9?), a younger period with respect to the Malagrotta artifacts.

In the probably reworked diatomite lake deposits contained in the Yellow Tuff of Prima Porta (Marra *et al.*, 2018a) dated around 500,000 years (MIS 13), according to Caloi & Palombo (1980b) there were found remains of *Elephas antiquus* (= *Palaeoloxodon antiquus*), *Equus caballus* (= *Equus ferus*), *Canis lupus* (= *Canis* sp.), *Dicerorhinus* cf. *hemitoechus* (= *Stephanorhinus hemitoechus*), *Sus scrofa*, *Hippopotamus* sp., *Cervus elaphus*, *Dama* cf. *clactoniana*, *Capreolus capreolus*, *Bos primigenius*, *Castor* sp., *Oryctolagus* sp. (Marra *et al.*, 2018a; Petronio *et al.*, 2019). Apart from the taxonomic updates, some notes concerning this mammal assemblage considered for a long time typical of the first part of the Aurelian (Torre in Pietra F.U.), can be summarized here:

- a carnassials fragment of canid, as discussed by Petronio *et al.* (2019) does not allow a safe attribution to any species, unlike the remains found in Castel di Guido which perfectly fall within the morphological and metric parameters of the oldest *Canis lupus* in western Europe (Salari *et al.*, 2017; Petronio *et al.*, 2019);
- the morphometric features of the hippo remains of Malagrotta present in the paleontological collection of the Museum of Earth Sciences of the Sapienza University of Rome, allow them to be compared to the *H. amphibius* species that occurs in Italy in the Fontana Ranuccio F.U. (Pandolfi & Petronio, 2015; Petronio *et al.*, 2019);
- on the *Cervus elaphus* remains, the morphology of the few antlers remains is characterized by the bez tine that bisects the angle between the brow tine and the beam: this feature makes it possible to attribute them to *Cervus elaphus eostephanoceros*, a subspecies typical of the Fontana Ranuccio F.U. (Di Stefano & Petronio, 1993, 2002; Petronio *et al.*, 2019);
- the morphological features of the antler fragments (Di Stefano & Petronio, 1997, 2002) also indicate the presence of *Dama clactoniana*, occurring in Italy since MIS 15, Isernia F.U., until at least MIS 9, Torre in Pietra F.U. (Petronio *et al.*, 2011, 2019; Di Buduo *et al.*, 2020).
- in the upper travertine layers, at the top of the local stratigraphic succession, within the San Paolo Formation, MIS 11 (Marra *et al.*, 2018a; Petronio *et al.*, 2019), some fox metapodials and an astragalus have been reported (Capasso Barbato & Minieri, 1987) indicating the presence of specimens of *Vulpes vulpes*. This is therefore the first occurrence of the red fox in Italian peninsula.

*Via Aurelia Km 18.700-19.000, direction Rome:
Collina Barbattini*

In the 80s, numerous excavation tests were carried out in some deposits located on the two sides of Via Aurelia, between km 18 and km 20, not far from the Castel di Guido site. Several sites were discovered as a result of the works (Anzidei *et al.*, 1993; Perrone, 2016; Marra *et al.*, 2014, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019).

Among these sites, Collina Barbattini takes the name from archeologist Attilio Barbattini who firstly reported the presence of faunal remains and lithic industry collected on surface; in three excavation tests carried out in 1990 in sandy sediments at the base of the stratigraphic succession between Km 18.930 and Km 18.970 (Anzidei *et al.*, 1993), there were found remains of *Rana* sp., *Bufo viridis*, *Arvicola terrestris* (= *Arvicola amphibius*), *Microtus arvalis agrestis*, *Elephas* (*Palaeoloxodon*) *antiquus* (= *Palaeoloxodon antiquus*), *Stephanorhinus* cfr. *kirchbergensis*, *Hippopotamus* sp., *Cervus* (*Dama*) cfr. *clactonianus* (= *Dama clactoniana*), *Cervus* (*Dama*) cfr. *dama* (= *Dama dama* ssp.), *Cervus* (*Cervus*) *elaphus* (*Cervus elaphus* ssp.), *Bos primigenius*.

During the excavations, five lithic artifacts on flake were also found, including three retouched artifacts with traces of use (Anzidei *et al.*, 1993).

The taxa listed by Anzidei *et al.* (1993) have not been reviewed, and therefore, apart from the purely taxonomic review, the updates that can be proposed only for the biochronological intervals of the taxa all well fitting with the San Paolo Formation (MIS 11) (Ceruleo *et al.*, 2019; Petronio *et al.*, 2019) with the exception of *Arvicola amphibius* which occurs in the peninsula only from the Late Pleistocene (Gliozzi *et al.*, 1997; Maul *et al.*, 1998; Lopez-Garcia *et al.*, 2017; Petronio *et al.*, 2019) and which is better to refer to *Arvicola* sp.

Other unpublished fossil remains were collected on the site by Ernesto Longo (Perrone, 2016), including a fourth premolar and a first molar of *Sus scrofa*, a fragmentary lower third molar of *Ursus* cf. *U. spelaeus*, a fragmentary carnassial referable to *Panthera* cf. *P. spelaea*, a complete ulna of *Stephanorhinus* cf. *S. kirchbergensis*, and a few fragments of *Equus ferus*. In particular, the *Ursus* molar belongs to a senile individual in which it is difficult to count the tubercles of the shredding surface and the systematic position therefore remains doubtful. Even the carnassial fragment of *Panthera* does not give certainties, as well as the rhino ulna whose morphological characteristics are not sufficient for a sure systematic determination.

These remains, however classified, fall biochronologically into the time interval linked to the San Paolo Formation (MIS 11) also known as Torrino Formation (Funicello & Giordano, 2008).

*Variant of junction of the Collina Barbattini
(Via Aurelia 4)*

In the northern part of Collina Barbattini, during road works, a front of about 40 meters was exposed and abundant mammal remains and industry on bone were collected. Fauna and industry were found in the lower levels, in contact with a morphological discordance of the paleovalley filling (Anzidei *et al.*, 1993; Marra *et al.*, 2018a). Particularly interesting is the presence of bones with probable intentional detachments (Anzidei *et al.*, 1993). The study, because the too small number of artifacts, did not reveal any relevant considerations for a chronotypological attribution even if this chronological attribution is given by the stratigraphic position into the San Paolo Formation, as well as the mammal assemblage (Marra *et al.*, 2018a).

Via Aurelia Km 18.900, towards Civitavecchia

Along the escarpment there was an outcrop about m. 30 long which was connected to that of the Collina Barbattini, as it is also confirmed by the same altitude of about m. 65 a.s.l., for the two deposits. In Anzidei *et al.* (1993) are listed: *Rana* sp., *Bufo* sp., *Crocidura* cfr. *suaveolens* (= *Crocidura* sp.), *Elephas* (*Palaeoloxodon*) *antiquus* (= *Palaeoloxodon antiquus*), *Equus caballus* (= *Equus ferus*), *Hippopotamus* sp. (= cf. *Hippopotamus amphibius*), *Cervus* (*Dama*) cfr. *clactonianus* (= *Dama clactoniana*), *Cervus* (*Dama*) cfr. *dama* (= *Dama dama* ssp.), *Cervus* (*Cervus*) *elaphus* (= *Cervus elaphus* ssp.) and *Bos primigenius* (Marra *et al.*, 2018a; Petronio *et al.*, 2019).

Four lithic artifacts of dark flint come from the site, with a rather fresh and slightly patinated appearance, similar to the findings of Collina Barbattini; these are two retouched flakes, a lateral scraper on a pebble and a fragment of a pebble with detachments. The Authors who studied the findings also reported the presence of bones with traces of fracture and probable intentional detachments, among which we note the thinning of the fractured section of an *Elephas antiquus* tusk (Anzidei *et al.*, 1993). The same observations made for the stratigraphy and the faunal remains of Collina Barbattini also apply to this site.

Via Aurelia Km 19.000

Capasso Barbato & Petronio (1981) point out some remains donated by Ernesto Longo to the Museum of Paleontology of the Sapienza University of Rome. These fossil remains were collected in a clayey-sandy horizon reworked from residues of Red Tuff with black scoria (Ceruleo *et al.*, 2019) and correlated with the San Paolo Formation (Marra *et al.*, 2018a), together with other fragments present in the same Museum and placed just higher than the same horizon.

The taxa described are: *Elephas* sp., *Dicerorhinus hemitoechus* (= *Stephanorhinus hemitoechus*), *Sus scrofa*, *Hippopotamus* cf. *antiquus*, *Dama* sp., *Cervus elaphus* ssp., *Bos primigenius*. A revision of these remains currently allows to modify some determinations, such as a fragmentary mandible of *Cervus elaphus* which, due to the archaic morphological characteristics of the lower third molar with a particularly reduced third lobe (Leonardi & Petronio, 1974; Kotsakis *et al.*, 1978), can be ascribed to *Cervus elaphus rianensis* and a metatarsal previously attributed to *Bos primigenius* which, for the internal and external profiles of the distal end (Sala, 1986; Bologna *et al.*, 1994) can be attributed to *Bison priscus*. For this site, the revision of fossil remains does not alter the assumed biochronological intervals of MIS 11 (Marra *et al.*, 2018a). However, it allows to report one of the last probable occurrences of *Hippopotamus antiquus* in the latest Galerian.

Via Aurelia Km 19.300

Along the escarpment of the Via Aurelia, at the km 19.300, a biface was found (Barbattini *et al.*, 1982) and subsequent research led to the discovery of 52 lithic tools, including 5 bifaces and 142 faunal remains with the presence of two bone flakes with traces of use (Anzidei & Sebastiani, 1984). Barbattini *et al.* (1982) and Anzidei *et al.* (1993) report the remains of *Elephas* sp., *Hippopotamus amphibius*, *Equus caballus* (= *Equus ferus*), *Bos primigenius*, *Bison* sp., *Cervus elaphus* (= *Cervus elaphus* ssp.).

During the research, a paleosurface covered by a gray tuffite level was identified (Anzidei *et al.*, 1993). In both levels, some tens of lithic tools, some bone tools and about 200 intentional fragmented bones were found.

The artifacts found on the paleosurface were obtained from silicized limestone pebbles and flint. Among the limestone artifacts there are a biface and some choppers, while flint artifacts are more generic: some cores, a small flake with a so called "Clactonian notch" and a simple flake. Bone tools consist of two points carved from epiphyses of long bones from large mammals.

In the gray tuffite level above, most of the lithic tools obtained from small flint pebbles were found. Among these, there are some double-sided chopper, flakes with Clactonian notch and some scrapers. Among the bone tools, there is a peak bone on the epiphysis of *Bos* and a spatula on piece of deer antler.

The general state of conservation of the lithic and faunal remains is not uniform: some artifacts have a fresh appearance while others have a strong patina of alteration from water floated transport which suggests a partial mixture of materials from multiple sites.

According to Anzidei *et al.* (1993) the material was found in the boundary between the gray tuffite and the underlying yellowish clay layer.

Marra *et al.* (2018a) verified that the yellowish level is a pyroclastic flow deposit correlated with the Prima Porta Yellow Tuff. Later Petronio *et al.* (2019) highlighted that these volcanic deposits can be correlated, at least partially, with the similar deposits dated from 404 ± 8 ka to 381 ± 2 ka from km 16.6 of the Via Aurelia. For these reasons, an internal age to MIS 11 it is also proposed for the lithic materials and for the fossil remains found that are biochronologically comparable.

All the mentioned sites of the Via Aurelia, dated at first generally to a more recent phase of 430 Ky (Anzidei *et al.*, 1993), based on all the recent chronostratigraphic studies (Marra *et al.*, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019) have been now dated to MIS 11 (~ 410 ky). In fact, according to Marra *et al.* (2018a), the lithic sets particularly of Via Aurelia km 19.3, Collina Barbattini, Via Aurelia km 18.9, and Via Aurelia 4 (Svincolo Collina Barbattini) come from the base of a paleosurface excavated in the river-lake deposit of the Valle Giulia Formation of MIS 13, which also contain the Prima Porta Yellow Tuff (516 ka old), where they are often mixed with volcanoclastic deposits remodeled and sealed by the subsequent deposition of the aggradational sequence triggered by the sea level rise during MIS 11.

Castel di Guido

The site of Castel di Guido, 20 km from Rome, along the Via Aurelia, was discovered in 1976 by Renato Mariani who found on surface the remains of fauna and lithic industry of the lower Paleolithic. Surface research was then continued in the following years by E. Longo. The archaeological excavation was carried out with numerous campaigns between 1980 and 1991 (Longo *et al.*, 1981; Barbattini *et al.*, 1982; Fornaciari *et al.*, 1982; Pitti & Radmilli, 1983, 1984, 1985; Radmilli, 1984, 1988, 1992; Mallegni & Radmilli, 1988; Radmilli & Boschian, 1996).

The investigated area, approximately 1200 square meters in size, with a sandy matrix soil containing pyroclastic products contained abundant bone and lithic remains. The study on fauna was carried out on 5763 finds of complete bones and fragments, and over 372 bone objects identified as "tools" were found at the site (bone flakes with traces of use, bone flakes with modification intentional edges, scrapers and bifaces obtained from the fracture of elephant limbs) (Radmilli & Boschian, 1996).

However, more recent taphonomic studies (Boschian & Saccà, 2010, 2015; Saccà, 2012) state that of the 372 bone artifacts identified by Radmilli & Boschian (1996) only 79 were actually worked and of these 23 are bifaces and single-sided artifacts.

The lithic industry consists of over 1200 artifacts, the majority of which in flint, but there are also finds on flint limestone, lava, stiltite, sandstone, tuff and quartz. The lithic industry (Radmilli & Boschian, 1996) made

from pebbles and flakes, consists of choppers and chopping tools, bifaces and flake tools. The site is characterized by the abundance of bifaces and choppers, while among the tools there are scrapers, some of which are made on small pebbles, on flakes, especially scrapers, notches and denticulated. The size of the flake tools are small or very small. A number of unretouched pebbles, probably used to break bones, were also recovered.

In conclusion, the archaeological importance of the Castel di Guido site is due to the presence of the skiving and crushing of the bones to obtain the marrow, as evidenced by the high percentage of both bone and lithic bifaces and by the intensive use of bone as a raw material.

Seven fragments of human bones were also found in the site, collected from a paleosurface, according to Radmilli & Boschian (1996) without any stratigraphic evidence. According to the Authors, some findings show more archaic and other more evolved morphological characters (Radmilli *et al.*, 1979; Mallegni *et al.*, 1981, 1983; Fornaciari *et al.*, 1982; Longo *et al.*, 1982; Radmilli & Mallegni, 1984; Mallegni & Radmilli, 1988; Radmilli & Boschian, 1996; Mariani-Costantini *et al.*, 2001). Considering all the uncertainties, they belong to a minimum of 2 to a maximum of 6 adult individuals. A review of the faunal remains found in the area, obtained from the data by Radmilli *et al.* (1979), Capasso Barbato & Petronio (1981), Capasso Barbato and Minieri (1987), Sala & Barbi (1996) indicates the occurrence of *Emys orbicularis*, undetermined fish and birds, *Lepus* sp., *Canis lupus*, *Panthera spelaea*, *Palaeoloxodon antiquus*, *Stephanorhinus* sp., *Equus ferus*, *Hippopotamus* cf. *H. antiquus*, *Sus scrofa*, *Bison priscus*, *Bos primigenius*, *Cervus elaphus rianensis*, *Dama* sp., *Capreolus capreolus*.

The mammal assemblage from Castel di Guido has been assigned to an early Aurelian (Torre in Pietra F.U., MIS 9) (Gliozzi *et al.*, 1997; Milli & Palombo, 2005). Combined U / Th and ESR dating on *Bos primigenius* teeth gave an age between 327 and 260 ka (Michel *et al.*, 2001).

According to recent chronostratigraphic reinterpretations (Marra *et al.*, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019), the faunal remains and the lithic industry from Castel di Guido, were found in an incision dug during the MIS 12.2 (435 ka) sealed by the deposition of the Vico α/β eruptive cycle (Cioni *et al.*, 1987) dated 412 ± 2 ka: this allowed to correlate the stratigraphic succession with the San Paolo Formation and to assign it to MIS 11 (Marra *et al.*, 2018a).

Fontignano (upper levels)

From pyroclastic levels assigned to the San Cosima Formation by Conato *et al.* (1980) and later relocated by Marra *et al.* (2014, 2018a) to the San Paolo

Formation (440-410ka, MIS 11) come the remains of *Cervus elaphus eostephanoceros* and *Bos primigenius* (see Di Stefano & Petronio, 1993; Iannucci *et al.*, 2021).

Torre in Pietra

Torre in Pietra, the most northwestern site of via Aurelia among those examined, was discovered in 1954 by Alberto Carlo Blanc and Luigi Cardini (Blanc, 1954) who explored it with systematic excavations until 1957. Some further excavations were then carried out by L. Cardini in 1963 and 1964.

In the site there are two faunal assemblages, one from the lower levels (n, m) with rich Acheulean industry and the other (level d) with the Mousterian industry (Piperno & Biddittu, 1978, Caloi & Palombo, 1978, Malatesta, 1978, Palombo, 2004, Petronio *et al.*, 2011, Villa *et al.*, 2016).

From the oldest or lower level (MIS 10/9), in addition to various remains of amphibians and reptiles, come: *Glis glis*, *Oryctolagus cuniculus*, *Lepus* sp., *Palaeoloxodon antiquus*, *Equus ferus*, *Cervus elaphus rianensis*, *Bos primigenius*, *Canis lupus*, *Stephanorhinus hemitoechus*, *Sus scrofa*, *Megaloceros giganteus*, *Vulpes vulpes*, *Ursus spelaeus*, *Panthera spelaea* (see Marra *et al.*, 2018a; Petronio *et al.*, 2019).

The most frequent species, besides *Equus ferus* and *Bos primigenius*, among those listed is the red deer. The simple and archaic structure of the antlers (squat beam, straight, with trez tine close to the terminal crown) is typical of *Cervus elaphus rianensis*. This red deer is well documented at Riano, north of Rome (Leonardi & Petronio, 1974) and, through its similarity to the archaic form *C. elaphus acoronatus*, testifies to a certain degree of isolation of the peninsula's faunas during the late Middle Pleistocene, seemed limited to MIS 11 (Marra *et al.*, 2018a; Petronio *et al.*, 2019) and concomitant with *C. elaphus eostephanoceros* (for the simultaneous presence of two subspecies in the same range see Petronio *et al.*, 2019 and Di Stefano & Petronio, 2021: Therefore, considering the particular paleoecological and paleogeographic conditions of the Italian peninsula, while the presence of the subspecies *C. elaphus eostephanoceros* continues during MIS 13-11 throughout the European continent, the simultaneous appearance in MIS 11 of *C. elaphus rianensis*, an endemic form of central Italy, can be considered justified). The abundant presence in Torre in Pietra extends the diffusion also to MIS 9, when the more archaic form *C. elaphus eostephanoceros* had completely disappeared.

The biochronological intervals of the other taxa present are compatible with Torre in Pietra F.U. (Gliozzi *et al.*, 1997; Petronio *et al.*, 2011, 2019) justified by the first report in Italy of the large cervid *Megaloceros giganteus*.

The lithic industry of the lower level is composed of bifaces, rare choppers and flakes essentially obtained from small siliceous pebbles. The bone industry is scarce: only one worked bone is reported (Piperno & Biddittu, 1978). The taphonomic analysis highlighted a selective transport of the artifacts and faunal remains due to water, highlighting both short and long-distance movements (Villa *et al.*, 2016).

The lower levels of Torre in Pietra are dated 355-335 ky (Villa *et al.*, 2016), corresponding to the end of the glacial phase of MIS 10; this age is about 30 ka older than that of the near site of Polledrara di Cecanibbio.

The upper level of Torre in Pietra dated to MIS 7 (Marra *et al.*, 2018a and references therein), is richer in faunal remains, besides the species mentioned for the lower level there are: *Castor fiber*, *Meles meles*, *Martes foina* (= *Martes martes*), *Clethrionomys glareolus*, *Apodemus* sp., *Microtus arvalis-agrestis*, *Arvicola* sp., *Macaca sylvanus*, *Capreolus capreolus*, *Crocota crocuta*, *Hippopotamus amphibius*, *Cervus elaphus arctinus* and *Dama dama tiberina* (see Caloi & Palombo, 1978; Marra *et al.*, 2018a; Petronio *et al.*, 2019).

The most represented taxa in this level are cervids: in particular the structure and morphology of the figured antlers (Caloi & Palombo, 1978) is very close to that of *Cervus elaphus arctinus* (see Azzaroli, 1947) (thinner, arched beam, with trez tine distant from the terminal crown, still simple); also the abundant remains of fallow deer characterized by peculiar morphologies in the antlers and in the teeth, testify the presence of an archaic form, *Dama dama tiberina* (Di Stefano & Petronio, 1997) compared to the typical taxon of the Late Pleistocene (*Dama dama dama*).

The presence of the last two cervids and the biochronological data of the other taxa, demonstrate the different age between the lower level (MIS 10/9: 354ka, Torre in Pietra F.U.) and the upper one (MIS 7: 250ka, Vitinia F.U.).

The lithic industry of the upper level “d” consists of 734 artifacts on flakes characterized by a high number of scrapers of various types; Most of the blanks are corticated (Taschini, 1967; Piperno & Biddittu, 1978). Bietti (1983a, 1983b), and Piperno & Segre (1984), observed the similarity of the Torre di Pietra level “d” industries with those found at the Saccopastore site and in other sites of the Lower Aniene Valley (Ponte Mammolo, Sedia del Diavolo, Monte delle Gioie and Casal de’ Pazzi).

These latter sites have recently been re-examined and geochronologically dated in a period between 285 ± 2 ka (MIS 8.5) of Sedia del Diavolo and Monte delle Gioie, ~ 270 ka (MIS 7) of Casal de’ Pazzi and finally 245-220 ka (MIS 7) of Saccopastore (Marra *et al.*, 2017, 2018a; Salari *et al.*, 2019) and well agree with the chronological attribution of this level.

Castelmalnome

The Castelmalnome site is located about 5 km SO of the SS. Aurelia about 15 km from Rome.

In 1959 abundant lithic industry was found on the surface consisting of several thousand artifacts scattered in the agricultural ground on top of some small reliefs at an altitude between 55 and 60 a.s.l. (Taschini, 1961). According to the preliminary geological study, the artifacts were included in a superficial soil that largely lays on sediments attributable to a brackish facies of Sicilian age. Translated into current terms, it could be a fluvio-lacustrine sediment above the level “d” of the stratigraphy by Conato *et al.* (1980).

The lithic industry found in Castelmalnome is typologically mostly attributable to the middle Paleolithic Mousterian lithic industry, locally defined “facies Pontiniana” (Blanc, 1937). However, among the various thousands of objects recovered in Castelmalnome, at least a hundred pieces do not fall within the Mousterian typology and among these there is a biface on flint pebble, which shows traces of prolonged weathering. This suggests a partial mixing between two different openair sites, one of them relatively more ancient.

La Polledrara di Cecanibbio

The site of La Polledrara di Cecanibbio was discovered in 1984 and has since been excavated for more than 30 years (Anzidei *et al.*, 2004, 2015, and references therein) with excavations still continuing nowadays. The researches revealed two horizons: the first is represented by a fluvial channel sealed by a syn-eruptive deposit of volcanoclastic mud (Marra *et al.*, 2018a) which has incorporated a large number of vertebrate remains and stone and bone artifacts. The second horizon, excavated since 2006, consists of the surface of this volcanic deposit with the remains of three elephants including an almost complete skeleton in anatomical connection of *Palaeoloxodon antiquus* trapped in the mud together with abundant lithic industry.

In the first horizon lithic and bone artifacts were found. As reported in literature (Anzidei *et al.*, 1999, 2001, 2004), the lithic artifacts are mostly small in size and obtained on not-local raw materials. The artifacts obtained on pebble and flake are cores, tools, flakes and debris. A distinctive feature of the site is the absence of bifaces, which are instead present in the nearby sites of Malagrotta, Castel di Guido and Torre in Pietra level m. In the second horizon, the excavations have led to the discovery of about 600 stone objects in proximity and relationship with elephant remains.

So far, 304 artifacts from the highest part of the deposit have been analyzed (Santucci *et al.*, 2016). Of these artifacts 176 have dimensions between 3 and 85 mm and the remaining 128, of smaller dimensions, are essentially debris.

Most of the artifacts found during the excavation are located along the right side of the trapped elephant, an adult of *Palaeoloxodon antiquus*, on the same level as the bone remains. In addition, around 30 artifacts have been found in a very limited area near the distal part of the elephant premaxilla.

The whole picture suggests the slaughtering and fracturing of the bones for the extraction of the marrow in a context of scavenging on the elephant carcass occurred during one or more episodes of human presence at the site.

The human presence on the site is further confirmed by the discovery of a deciduous molar of a hominid juvenile individual between 5 and 10 years old and classified, for its morphology and for the period of occupation of the site, as *Homo heidelbergensis* (Manzi *et al.*, 2011).

New studies by Pereira *et al.* (2017), led to the conclusion that the volcanic deposit inside which part of the lithic industry were found and the elephant carcass in anatomical connection was deposited in the form of a syn-eruptive or shortly post-eruptive pyroclastic – flow emplaced in form of a mudflow which flowed above – and sampled portion of the older volcanic substrate (Marra *et al.*, 2018a; Ceruleo *et al.*, 2019). Nevertheless, other Authors (e.g., Anzidei *et al.*, 2012) have different opinions on the Polledrara succession, but this has no impact on this review.

The radiometric age of the volcanic deposit testifies that this event occurred about 325 ± 2 ka BP, during the incipient stage of the regressive phase following the MIS 9 high stand. Consequently, this muddy deposit, partially modified by the water of the river that flowed on its top, constituted a natural trap in which an elephant, whose skeleton was found in anatomical connection together with the lithic artifacts, remained trapped thus becoming a easy prey for the human group that slaughtered it.

The entire archaeological context therefore constitutes one of the most significant examples of opportunistic activity and subsistence strategies of *Homo heidelbergensis* ever observed in other sites of the lower and middle Paleolithic (Santucci *et al.*, 2016).

According to Anzidei *et al.* (2012), the faunal assemblage of this site mainly consists of remains of *Bos primigenius* and *Palaeoloxodon antiquus*. The other taxa are *Stephanorhinus* cf. *S. hemitoechus*, *Equus ferus*, *Macaca sylvanus*, *Lepus* sp., *Canis lupus*, *Vulpes vulpes*, *Meles meles*, *Sus scrofa*, *Cervus elaphus* ssp (= *C. elaphus rianensis*), *Felis silvestris* (= *Felis* cf. *F. silvestris*) and *Bubalus murrensis*. Concerning the microfauna (Anzidei *et al.*, 2004), the main species are *Apodemus sylvaticus*, *Pliomys* cf. *P. episcopalis*, *Arvicola* sp., *Microtus (Iberomys)* cf. *M. breccensis*.

The fauna of the site, like that of the lower level of Torre in Pietra, fits well in the Fauna Unit of Torre in Pietra (MIS 10/9) (Marra *et al.*, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019).

DISCUSSION AND CONCLUSIVE REMARKS

Archaeological and anthropological considerations

The recent geochronological data (Marra *et al.*, 2014, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019) on the sites along the Via Aurelia and in the Ponte Galeria area allow some considerations.

- The sites are no longer compressed in 30/50 ky but have developed for over 200 ky.
- The only “*in situ*” site is the upper level with trapped and partly connected elephants from Polledrara di Cecanibbio. All the other sites are the result of accumulation of materials carried from their place of origin by pyroclastic hydraulic flows and therefore it is not sure that each of them is the expression of the same group of hominins or even of the same species.
- The open-air sites over the millennia have been subjected to countless geological, climatic, hydrological processes, so that it is necessary to detect if each site has been preserved undisturbed or if it is the result of various subsequent taphonomic events, also not connected to each other in some cases. Therefore, it is very important to analyze the genesis of each site and the taphonomy of both artifacts and fossil remains and the various sites along the Via Aurelia have to be reconsidered taking into account the processes of stratigraphic condensation.
- Latium, as mentioned, is a region particularly affected by volcanic phenomena and this has allowed the conservation of many sites that have been “frozen” by various volcanic events.
- A surface site can bring to light archaeological materials from different periods: from prehistory to modern times. It hardly returns only materials from a single human phase occupation. Infact the more it has been exposed to geological, atmospheric and anthropic agents, the more the remains of different periods have been accumulated in the surface site. The same happens for stratified sites. Before being covered they may have been subjected to various external events and therefore the record they hold may be referred to different periods of human presence. Natural events that occurred to the site or immediately after the deposition and that sealed it forever can preserve a single homogeneous level of human presence. This is the case of the upper level with the elephant of the Polledrara di Cecanibbio.
- In fact, almost all the other most important Latium sites, in addition to those along the Via Aurelia, are not “*in situ*”: all the sites of the lower Aniene valley (Marra *et al.*, 2017 and references therein), the sites of the Sacco valley (Pereira *et al.*, 2018 and references therein), those of the Pontine plain

(Marra *et al.*, 2018b and references therein). In Italy the only other undisturbed open air site is that of Venosa-Notarchirico in Basilicata (Cassoli *et al.*, 1993) which is also the oldest Italian undisturbed open air site and perhaps that of Ficoncella in northern Latium (Aureli *et al.*, 2015).

- In fact, Mishra *et al.* (2007) and Chauhan *et al.* (2017) demonstrated that the majority of openair sites in the lower Paleolithic of Northern Europe are in secondary depositional contexts. A similar study was not carried out intensively for the central Italian sites but, it as has been shown, all the sites examined in this study were subject to surface water transport and subsequent accumulation at the base of river incisions mainly during the regressive phases likely associated with sea level drop.
- In the case of several sites located in a restricted area is discriminant understand the “use of the territory”, distinguishing if the various findings cover a period of time of thousands of years. In this respect, the sites along the Via Aurelia west of Rome before the study of Marra *et al.* (2018a) have been considered restricted in a time span of a few tens of thousands of years.
- The sites of Malagrotta (MIS 13-11), Castel di Guido (MIS 11), Polledrara di Cecanibbio (MIS 9) and Torre in Pietra (MIS 9), despite being geographically very close, really show in reality present typological characteristics very different from each other:

Malagrotta presents lithic industry with bifaces and also industry on bone with a biface. In particular, as regards the bone industry, the site is among the oldest in Lazio together with the sites of the Cretone basin (MIS 15-11) (Ceruleo *et al.*, 2015), Rignano Flaminio (MIS 11) (Petronio *et al.*, 2017) and Fontana Ranuccio (MIS 11) (Pereira *et al.*, 2018).

Castel di Guido (MIS 11) is rich in bifaces, many of them in bone, and this constitutes an *unicum* not only in Italy but also in the rest of Europe. In addition, in Castel di Guido, as well as in Polledrara di Cecanibbio (MIS 9), remains of *Homo* have been found which are missing in the other examined sites.

Polledrara di Cecanibbio is without bifaces while there are bone artifacts and therefore its lithic complex differs from those of Malagrotta, Castel di Guido and Torre in Pietra while the lack of bifaces in the sites along the Via Aurelia could be due to the poor sampling. In addition, the site has a very important feature: the documented presence of an elephant carcass slaughter site.

Torre in Pietra has bifaces, such as Castel di Guido and Malagrotta, but absent from the Polledrara di Cecanibbio, but very few bone artifacts very common in other sites.

Bone industry

An important element to take into consideration is the bone industry particularly present not only in the area but also in many other sites of Latium.

In the area, the oldest bone industry appears to be that of Malagrotta (MIS 11) which, among other things, following the new dating, is also among the oldest in Latium, but the use of bone as a material for the production of artifacts, including bifaces persisted in the area for about 100 ky.

The use of bone seems to decrease if not completely disappear with the passage from the late Acheulean to the early Mousterian.

The presence and in some cases the abundance of the bone industry in the lower Paleolithic is a characteristic of the Latium sites which is rarely found both in other Italian Peninsula and European sites. The sites with a good amount of bone bifaces are Revadim and Castel di Guido, significantly all the other European sites have returned a modest number of bone bifaces (Zutovski & Barkai, 2016).

In addition to the sites along Via Aurelia, the bone industry is present in numerous other Latium sites: Cretone (Ceruleo *et al.*, 2015), Rignano Flaminio (Petronio *et al.*, 2017), Fontana Ranuccio (Pereira *et al.*, 2018), Bucobello (Di Buduo *et al.*, 2020) and in many sites of central and southern Lazio near Frosinone (Pereira *et al.*, 2018 and references therein). Some authors have explained the use of the bone with the lack of lithic raw material; others consider instead a simply opportunistic use for the bone (Zutovski & Barkai, 2016).

Faunal assemblages

Because of the large number of findings, the numerous faunal and archaeological sites investigated in the area from Via Aurelia to the zone of Malagrotta and Ponte Galeria, are among the most important for the Italian prehistory. Some of them have been displayed in the same recovery area (Polledrara di Cecanibbio and Torre in Pietra) and many of the fossil remains from these deposits are preserved in the Paleontology Museum of the Department of Earth Sciences of the “Sapienza” University of Rome.

As it has been listed in the work, many sites from Fontignano to the numerous quarries in the Malagrotta area, around the current waste dump, and Ponte Galeria, around the Fosso Galeria, yield faunal assemblages referred to MIS 20/19 (Fontignano lower levels, Slivia F.U.; Gliozzi *et al.*, 1997), MIS 18/17 (Cava Arnolfi and other quarries, Ponte Galeria F.U.; Petronio & Sardella 1998, 1999, Petronio *et al.*, 2011) and MIS 16/15 (Maglianella quarry and Cava di Casal Selce upper levels, Isernia F.U.; Marra *et al.*, 2014). Among the most significant biochronological data (Fig. 4), the last occurrence of *Stephanorhinus hundsheimensis* in the

	Slivia	Ponte Galeria	Isernia	Fontana Ranuccio	Torre in Pietra	Vitinia
<i>Allocrietus bursae</i>	-----					
<i>Apodemus sylvaticus</i>	-----					
<i>Meles meles</i>	-----					
<i>Canis mosbachensis</i>	-----					
<i>Palaeoloxodon antiquus</i>	-----					
<i>Stephanorhinus hundsheimensis</i>	-----					
<i>Equus altidens</i>	-----					
<i>Hippopotamus antiquus</i>	-----					
<i>Praemegaceros verticornis</i>	-----					
<i>Axis eurygonos</i>	-----					
<i>Bison shoetensacki</i>	-----					
<i>Prolagurus pannonicus</i>	>-----					
<i>Mammuthus trogontherii</i>	>-----					
<i>Cervus elaphus acoronatus</i>	>-----					
<i>Sus scrofa</i>		>-----				
<i>Megaloceros savini</i>		>-----				
<i>Hemibos galerianus</i>		>-----				
<i>Arvicola mosbachensis</i>			>-----			
<i>Panthera spelaea fossilis</i>			>-----			
<i>Equus ferus</i>			>-----			
<i>Dama clactoniana</i>			>-----			
<i>Bos primigenius</i>			>-----			
<i>Ursus spelaeus</i>				>-----		
<i>Stephanorhinus kirchbergensis</i>				>-----		
<i>Stephanorhinus hemitoechus</i>				>-----		
<i>Hippopotamus amphibius</i>				>-----		
<i>Cervus elaphus eostephanoceros</i>				>-----		
<i>Bison priscus</i>				>-----		
<i>Oryctolagus cuniculus</i>					>-----	
<i>Felis silvestris</i>					? -----	
<i>Canis lupus</i>					>-----	
<i>Vulpes vulpes</i>					>-----	
<i>Cervus elaphus rianensis</i>					>-----	
<i>Panthera spelaea spelaea</i>					? -----	
<i>Martes martes</i>					>-----	
<i>Megaloceros giganteus</i>					>-----	
<i>Cervus elaphus aretinus</i>					>-----	
<i>Ursus arctos</i>						? -----
<i>Equus hydruntinus</i>						>-----
<i>Dama dama tiberina</i>						>-----

Figure 4. Biochronological scheme showing the range of the main mammalian taxa of the Middle Pleistocene discussed in the text.

upper levels of the Cava di Casal Selce (Isernia FU) is recalled. This species will be replaced by *S. kirchbergensis* and *S. hemitoechus* in the following F.U.s. It is also interesting one of the few findings in the peninsula of *Allocrietus bursae* in the lower Toringian (Marchetti *et al.*, 2000) and the occurrence in two sites of *Mammuthus trogontherii*.

In the upper levels of Cava di Casal Selce the occurrence of *Arvicola cantianus* with size and morphological features close to those of the most archaic forms

of this micromammal species (Maul *et al.*, 1998) is significant, although it should be added that according to Maul *et al.* (2000) and Kotsakis *et al.* (2020) it would be preferable to use, outside the type locality, the name *Arvicola mosbachensis*. Without considering the nomenclature problem, this represents the first occurrence of this species in the Italian territories.

Many of the sites around the Via Aurelia were previously dated chronologically around 350/300 ka, in the early Aurelian (Torre in Pietra F.U.).

Table 1. List of sites.

Fossiliferous locality	Mammal Age	Faunal Unit	Formation	MIS	Age (ky)
Fontignano (lower levels)	Galerian	Slivia	Ponte Galeria 1	20/19	
Cava Arnolfi	Galerian	Ponte Galeria	Ponte Galeria 2B	18/17	
Cava Alibrandi	Galerian	Ponte Galeria	Ponte Galeria 2B	18/17	
Cava di Casal Selce (lower levels)	Galerian	Ponte Galeria	Ponte Galeria 2B	18/17	
Muratella di Mezzo	Galerian	Ponte Galeria	Ponte Galeria 2B	18/17	
Campo di Merlo	Galerian	Ponte Galeria	Ponte Galeria 2B	18/17	
Maglianella	Galerian	Isernia	Santa Cecilia	16/15	
Cava di Casal Selce (upper levels)	Galerian	Isernia	Santa Cecilia	16/15	615
Cava Rinaldi	Galerian	Fontana Ranuccio	Valle Giulia	13	517
Malagrotta (lower levels)	Galerian	Fontana Ranuccio	Valle Giulia	13	516
Malagrotta (upper levels)	Galerian	Fontana Ranuccio	San Paolo	11	
Via Aurelia Km 18.700	Galerian	Fontana Ranuccio	San Paolo	11	
Via Aurelia 4 Variant junction	Galerian	Fontana Ranuccio	San Paolo	11	
Via Aurelia Km 19.000	Galerian	Fontana Ranuccio	San Paolo	11	
Via Aurelia Km 18.900	Galerian	Fontana Ranuccio	San Paolo	11	
Via Aurelia Km 19.300	Galerian	Fontana Ranuccio	San Paolo	11	
Castel di Guido	Galerian	Fontana Ranuccio	San Paolo	11	412
Fontignano (upper levels)	Galerian	Fontana Ranuccio	San Paolo	11	
Torre in Pietra (lower levels)	Aurelian	Torre in Pietra	Aurelia	9	354
Polledrara di Cecanibbio	Aurelian	Torre in Pietra	Aurelia	9	325
Torre in Pietra (upper levels)	Aurelian	Vitinia	Vitinia	7	253
Castelmalnome	Aurelian	Vitinia	Vitinia	7	

In fact, several studies (Marra *et al.*, 2017, 2018a; Ceruleo *et al.*, 2019; Petronio *et al.*, 2019), as mentioned in the stratigraphic summary, backdated up to MIS 13 the oldest levels of the Malagrotta site, where there are also levels referable to MIS 11, and have correlated all these sites of the Via Aurelia, including the Castel di Guido site, with the San Paolo Formation and an age of about 400 ka. Ultimately, the only sites that can still be related to the oldest part of the Aurelian (Torre in Pietra F.U.) are Polledrara di Cecanibbio and the lower levels of Torre in Pietra with an age between 354 and 325 ka., constraining their chronology between the end of MIS 10, the beginning of sea level rise during MIS 9 and the last part of MIS 9, during the early regressive phase leading to MIS 8.6. In the latter important site, as mentioned, there are also levels with faunal remains and lithic industry referred to MIS 7 (Vitinia Formation and F.U.).

A first consequence of these backdates for biochronology allows (Fig. 4) to date back the first occurrence of *Ursus spelaeus* in Italy by more than 150ky. As it is known, this species is derived filetically from a speciation that occurred in the European continent and at different times starting from *Ursus etruscus*, migrated

in Italy in the Villafranchian Age (Valdarno, Tasso F.U.) and, subsequently, from *Ursus deningeri* which makes its first occurrence in Italy in Selva Vecchia, Monte Tenda (Bartolomei, 1980; Gliozzi *et al.*, 1997) in MIS 19/18, in the Slivia F.U. and disappears at the end of the Galerian. The discovery at Cava Rinaldi in the Fontana Ranuccio F.U. (MIS 13) of *Ursus spelaeus* proves the subsequent speciation, migration from Europe and the contemporary presence of this species with the European progenitor, *U. deningeri*. The co-occurrence of these two species of bears was also possible in consideration of the feeding difference: *U. deningeri* still tending to be preferably carnivorous (thin, sharp molars, with few tubercles), such as the progenitor *U. etruscus*, and *U. spelaeus* which, due to its tendency to herbivorism (large teeth with numerous tubercles), tends to occupy a completely different ecological niche.

Also the backdating of the first certain occurrence of *Canis lupus* from Castel di Guido (MIS 11) implies the contemporaneity of the diffusion of this carnivore in western Europe (Bertè & Pandolfi, 2014; Salari *et al.*, 2017), considering its report at Atapuerca TD 10 (Burgos, Spain; MIS 11); (Cuenca-Bescós & García, 2007)

and Lunel Viel (Hérault, France; MIS 11/10; Brugal & Boudadi-Maligne, 2011; but MIS 9/8 according to Brugal *et al.*, 2019) approximately in the same time.

As for the felids, the wild cat and the cave lion appear in the examined sites. According to several Authors (e.g., Yamaguchi *et al.*, 2004; Iurino *et al.*, 2014), the modern *Felis silvestris* occurs only in the Late Pleistocene, therefore the remains of wild cats found in the Polledrara di Cekanibbio are prudently attributed to *Felis* cf. *F. silvestris*. Fossil remains attributed to *Panthera spelaea* or *Panthera* cf. *P. spelaea* have been found in various examined sites, between MIS 11 and MIS 7, but it needs to be clarified whether these specimens were similar to the form *P. spelaea fossilis*, as in Isernia, referred to the homonymous F.U. (MIS 16/15; Gliozzi *et al.*, 1997; Petronio *et al.*, 2011, 2019) or similar to *P. spelaea spelaea* typical of the Late Pleistocene (Marciszak *et al.*, 2019).

The copresence of the archaic subspecies *Cervus elaphus eostephanoceros* in MIS 13 with the local chronosubspecies *C. elaphus rianensis* in MIS 11 could prove the remarkable speed of genetic plasticity in cervids in a highly articulated territory such as that of the Italian peninsula, in response to particular environmental variations in the Middle Pleistocene.

Finally, two last interesting biochronological shifts concern the occurrence of *Hippopotamus amphibius* in the levels of Malagrotta, which confirms the presence of this species since MIS 13 (Pandolfi & Petronio, 2015) and the co-occurrence of the archaic *Hippopotamus antiquus*, which survived in the Rome basin until MIS 11.

Finally, it has been underlined the first occurrence of *Bos primigenius* in MIS 13 faunal assemblages of this area already pointed out at Venosa Notarchirico (MIS 15, Isernia F.U.) (Pandolfi *et al.*, 2011; Petronio *et al.*, 2017).

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