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ON A BONE BRECCIA NEAR ULIVETO TERME (MONTE PISANO, ITALY)

Abstract - *On A Bone Breccia Near Uliveto Terme (Monte Pisano, Italy).* The study of the macromammal remains of a bone breccia from the Uliveto quarry (Monte Pisano, Pisa) is here presented. The fossil material is scanty and very fragmented and consists mainly of *Dama dama* remains. The presence of *Dama dama* has been recognized also in another fossil site of the Monte Pisano (Grotta Cucigliana) referred to the late Aurelian.

Key words - Mammals, late Aurelian, Bone Breccia, Monte Pisano.

Riassunto - *On A Bone Breccia Near Uliveto Terme (Monte Pisano, Italy).* Su una breccia ossifera nelle vicinanze di Uliveto Terme (Monte Pisano, Italia). Viene presentato lo studio dei fossili di macromammiferi raccolti in un breccia ossifera situata nella cava di Uliveto (Monte Pisano, Pisa). Il materiale è scarso e frammentato e consiste prevalentemente di resti di Dama dama. La presenza del daino è stata riscontrata anche in un altro sito del Monte Pisano (Grotta Cucigliana) riferito all'Aureliano superiore.

Parole chiave - Mammiferi, Aureliano superiore, Breccia ossifera, Monte Pisano.

Introduction

The South-Western side of Monte Pisano is rich in fossil sites discovered from the second half of the XIX century. In addition to the famous Triassic footprints (Collareta & Farina, 2014; Leonardi & Lockley, 1995; von Heune 1940a; 1940b; 1941; Rau & Tongiorgi, 1974; Sirigu & Tongiorgi, 1997), a lot of Late Pleistocene and Holocene mammals were found. The most important mammal associations are those from "Grotta Parignana" (Caterini, 1921; Del Campana, 1925; Farina, 2012; Farina, 2014), "Grotta Cucigliana" (Acconci, 1880; Del Campana, 1914; Farina, 2011; Farina, 2013) and "Grotta del Leone" (Cardini, 1947; D'Eugenio, 1990; Farina, 2010). Other fossil remains were collected from "Buca dei Ladri" (Bianucci, 1980), "Cava la Croce", and "Cava le Conche"(Tavani, 1951).
In the area of Uliveto Terme, Ugolini (1902) reported the discovery in a bone breccia of an incomplete cranium of a young specimen of *Ursus spelaeus*. Other mammal remains were discovered at "Grotta del Pippi", in association with fragments of iron objects (Lopane, 1949). The fauna consists of *Myotis myotis*, *Meles meles*, *Ursus arctos*, *Canis lupus*, *Vulpes vulpes*, *Apodemus sylvaticus*, *Sus scrofa*, *Capreolus capreolus*, *Cervus elaphus*, *Ovis aries*, *Bos taurus*, *Lepus europaeus*, and *Arvicola amphibius*; it was referred to a very recent period (Holocene).
The aim of the present paper is to update the knowledge and the biochronological framework of the late Aurelian mammal assemblage of the South-Western side of Monte Pisano by reporting on the fossil content of a bone breccia discovered in the Uliveto quarry.

Geological Setting

The Monte Pisano complex is part of a geological alignment (called Middle Tuscan Ridge) that includes the Alpi Apuane complex, the Montagnola Senese and the Monticiano-Roccastrada Unit.
This relief separates the Pisa plain from Lucca plain between Serchio (N) and Arno (S) valleys (Rau & Tongiorgi, 1974) (Figure 1).
Within the Monte Pisano complex, three tectonic units can be recognized:

1) the non-metamorphic Tuscan Nappe;
2) the Santa Maria del Giudice Unit;
3) the Monte Serra Unit.

The Santa Maria del Giudice and Monte Serra Units consist of Palaeozoic rocks marked by the Hercynian orogeny and Mesozoic to Oligocene carbonatic-siliciclastic metamorphic rocks (greenschist facies); these two units are separated by the Asciano-Vorno lineament. This lineament represents the thrust that brought the Santa Maria del Giudice Unit to overlay the Monte Serra Unit (Rau & Tongiorgi, 1969; Giannini & Nardi, 1965). The two tectonic units were overlaid by the Tuscan Nappe during the first alpine tectonic phase (Carosi & Montomoli, 1999).

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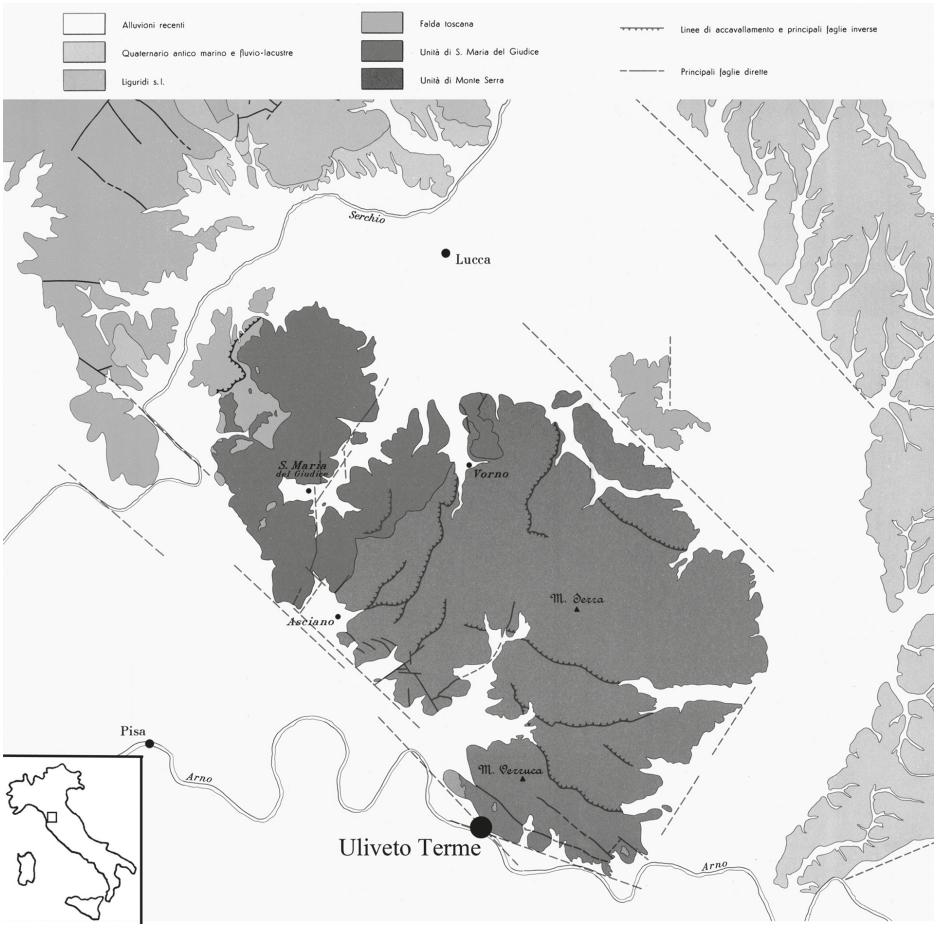

Figure 1 - *Geological map of the Monte Pisano area.* (Modified after Rau & Tongiorgi, 1974).

The Monte Pisano complex looks like an horst surrounded by sinking zones, and its structure is the result of the extensional tectonic alpine phase that started during the Miocene (Rau & Tongiorgi, 1974; Carmignani & Kligfield, 1990).

Since the XI century, intensive quarrying of ornamental stones and inert materials for religious and civil building (Franzini, 1993) deeply changed the topography of the South-Western margin of Monte Pisano complex. The quarrying activity, on the other side, has uncovered brecciated rocks whose composition consists of continental vertebrate bone fragments and Grezzoni clasts.

The bone breccia here studied is a filling fissure, found in the lower "gradoni" of Uliveto quarry on Monte Bianchi (between Caprona and Noce villages) at the southern edge of the Monte Pisano complex, in the Monte Serra Unit (Grava, 2002).

The crack which hosts this bone breccia is developed in the Grezzoni Formation (consisting of calcareous-dolomitic rocks where dissolution processes are usual), and it has probably karst origin (Figure 2). The N-S trend of the crack, like most of the faults and fractures found in the quarry, could probably be related to neotectonic extensional faults found in the western margin of the Monte Pisano complex (D' Amato Avanzi & Nardi, 1993).

FAUNA

The macromammal remains are very fragmentary and poorly preserved. The fauna consists of 27 fragments, 7 of them being completely indeterminate. The NISP (Number of Identified Specimens) (Grayson, 1984) is 18.

Dama dama (Linnaeus, 1758)

I17117 - right M^1 (length: 1,9 cm; breadth: 2,1 cm); I17118 - first phalanx (2 specimens); I17119 - distal epiphysis of left femur (the breadth of the distal end is 6,5 cm) (Figure 3); I17120 - distal epiphysis of left humerus (the greatest breadth of the troclea is 4,2 cm); I17121 - fragment of metacarpal (the distal epiphysis and 1/4 of the diaphysis is preserved); I17122 - fragment of the distal epiphysis of left humerus; I17123 -

Figure 2 - The bone breccia at the Uliveto's quarry.

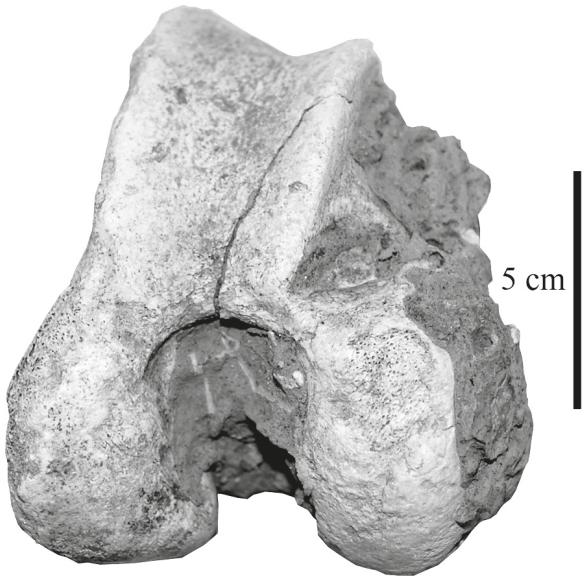

Figure 3 - *Dama dama* (Linnaeus). I17119 - Distal epiphysis of left femur.

fragment of right femur; I17124 - incomplete left P^3; I17125 - fragment of left mandible; I17126 - fragment of the condyle of metapodial bone (2 specimens); I17127 - fragment of left metatarsal (a part of the proximal epiphysis and 1/4 of the diaphysis is preserved); I17131 - left M2 (length: 1,4 cm; breadth: 1,2 cm).

Cervus vel *Dama*

I17128 - incomplete left incisor tooth (I_2?); I17129 - incomplete left P2; I17130 - incomplete left incisor tooth; I17133 - fragment of lower right molar.

Anatomically determined specimens

I17132 - Fragment of glenoid cavity; I17115 - fragment of a proximal epiphysis of left humerus.

Palaeoecological And Biochronological Inferences

The fossil material is scanty and too fragmented to allow any reliable analysis. The occurrence of *Dama dama* suggests the presence of temperate climate and forested environment.

The first occurrence of the modern fallow deer is referable to the oldest faunas (Marine Isotopic Stage 5) of the late Aurelian assemblage, which begins with the Eemian and terminates with the end of the last glaciation (MIS 2) (Gliozzi et al., 1997).
The presence of *Dama dama* in the Monte Pisano area was attested at the Cucigliana cave in the faunal assemblage Cucigliana A (MNI, Minimum Number of Individuals, = 16) together with *Capreolus capreolus*, *Cervus elaphus*, *Sus scrofa*, *Ursus arctos*, *Canis lupus*, *Canis aureus*, *Vulpes vulpes*, *Stephanorhinus hemitoechus,* and *Elephas antiquus* (Farina, 2011). The Cucigliana A assemblage indicates temperate climatic conditions and a forested and humid environment with open areas (grassland) included, and could be tentatively correlated biochronologically with the late MIS 5a or early MIS 4 (Farina, 2011).

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