

A brief review of the occurrences of Pleistocene *Hippopotamus* (Mammalia, Hippopotamidae) in Italy



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ABSTRACT

Several Pleistocene hippopotamid remains have been collected from the Italian Peninsula, but some of them lack any stratigraphic data or details about the fossil localities. The *Hippopotamus* was present in Italy and Western Europe from the latest Villafranchian (late Early Pleistocene), whereas the oldest records of the genus (Coste San Giacomo and Chiusi basin) need to be confirmed by further evidence. *Hippopotamus antiquus* is recorded from Italy until MIS 15, whereas *H. amphibius* is first known from the late Middle Pleistocene (MIS 13 or 11) and survived in Southern Italy until MIS 4/3.

Keywords: *Hippopotamus*, chronology, Pleistocene, Italian Peninsula

1. INTRODUCTION

The *Hippopotamus* represents one of the African taxa that spread throughout Europe during the Early Pleistocene (GLIOZZI et al., 1997; PETRONIO et al., 2011; PALOMBO, 2014). Nevertheless the first occurrence of this genus in Europe, in particular in the Mediterranean area, is debated (PETRONIO et al., 2011; PALOMBO, 2014). The Italian Peninsula is quite rich in remains of Pleistocene fossil hippopotami (CALOI et al., 1980; PETRONIO, 1986, 1995; MAZZA, 1995; GLIOZZI et al., 1997; PETRONIO et al., 2011) and it surely plays an interesting role in documenting the dispersal pattern of this taxon. Two species have been documented from the Pleistocene in the Italian Peninsula: *H. antiquus* and *H. amphibius*. The first and last occurrences of these species, however, are still a matter of discussion among researchers (PETRONIO, 1995; PETRONIO et al., 2011; MANCINI et al., 2012; PALOMBO, 2014).

The aim of this communication is to update and to clarify the chronological or biochronological limits of the hippopotamus in the Italian Peninsula.

2. MATERIALS AND METHODS

The hippopotamus remains considered in this work are housed at several Italian museums and institutions. The Italian specimens have been published or mentioned in several contributions, in particular LEONARDI (1948), MAINI (1952), MACCAGNO (1962), BLANDAMURA & AZZAROLI (1977), CALOI et al. (1980), PETRONIO (1986, 1995), MAZZA (1995), MANCINI et al. (2012). The biochronological scheme mentioned in this note follows the work of GLIOZZI et al. (1997), PETRONIO et al. (2011) and MARRA et al. (2014) (Fig. 1).

Institutional Abbreviations: Museo di Storia Naturale, sezione di Geologia e Paleontologia, Florence (IGF); Museo di Anatomia Comparata, Sapienza, Università di Roma, Rome (MACUR); Museo Civico di Storia Naturale A. Doria, Genova (MCZG); Museo di Paleontologia, Sapienza, Università di Roma, Rome (MPUR); Museo di San Giuliano, L'Aquila, (MSG); Museo di Storia Naturale, Accademia dei Fisiocritici, Siena (MSNAF); Museo di Storia Naturale della Certosa di Calci, Pisa (MSNCC):

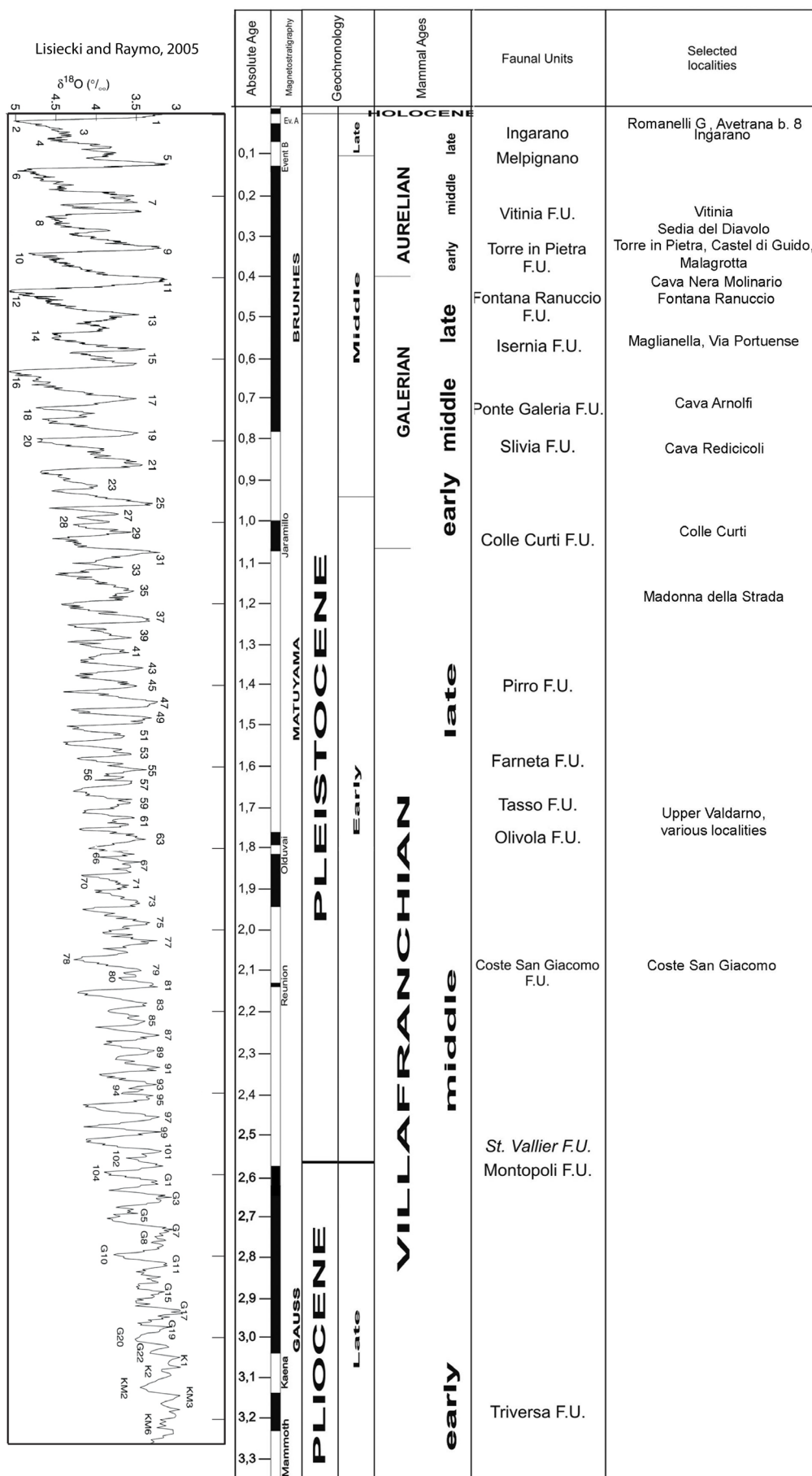


Figure 1: Correlation between Geochronology, Marine Isotopic Stages and the Italian Mammal Units (after PETRONIO et al., 2011 and MARRA et al., 2014).

3. SYSTEMATIC PALAEOLOGY

Class Mammalia LINNAEUS, 1758

Order Artiodactyla OWEN, 1848

Family Hippopotamidae GRAY, 1821

Genus *Hippopotamus* LINNAEUS, 1758

Hippopotamus antiquus DESMAREST, 1822

(Fig. 2, Fig. 3A)

Chronological distribution: From the Early Pleistocene to the first half of the Middle Pleistocene.

Geographic distribution: Europe and the Levant. According to PETRONIO (1995) the species also occurred in Northern Africa during the Pleistocene (Ain Hanech and Ternifine, Algeria):

Short remarks on distinctive cranial and mandibular features: The skull of *H. antiquus* is relatively long and slender.

The zygomatic arches are transversally shorter than the transverse diameter between the external borders of the canine (DESMAREST, 1822; CALOI et al., 1980). The sagittal crest is short (LEONARDI, 1947). The ventral border of the mandible is slightly concave in *H. antiquus*. The horizontal ramus of the mandible is relatively long and slender (CALOI et al., 1980).

Hippopotamus amphibius LINNAEUS, 1758

(Fig. 3B–C)

Chronological distribution: From the Early Pleistocene (ca. 2 Ma) to the present.

Geographic distribution: Africa, Europe (late Middle and Late Pleistocene):

Short remarks on distinctive cranial and mandibular features: The skull of *H. amphibius* is relatively short and massive; the mastoid area is transversally well developed as well as the zygomatic arch (CALOI et al., 1980). The sagittal

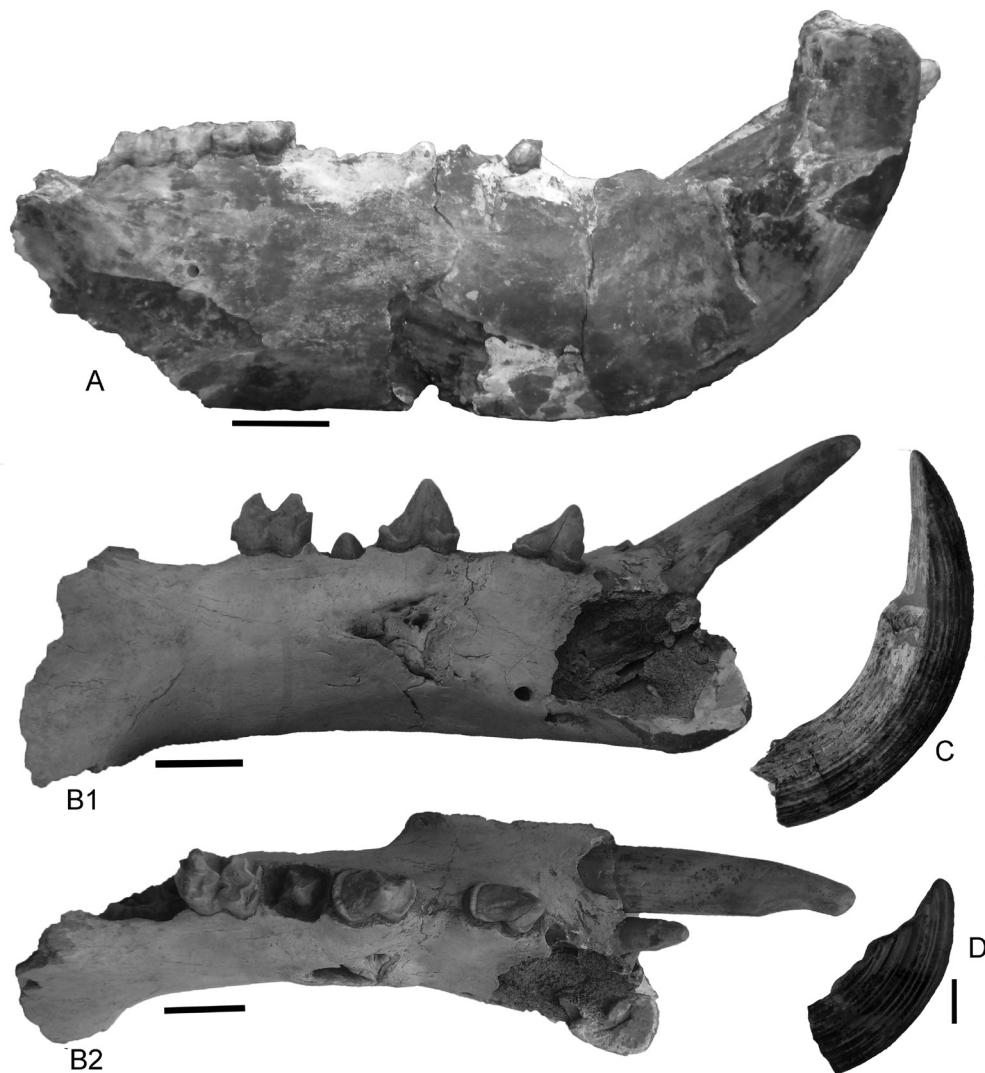


Figure 2: Remains of *Hippopotamus antiquus* from the Chiusi Basin. A) fragmentary mandible (MSNAF nc) in lateral view; B) fragmentary mandible of a young individual (MSNAF 4726): 1) in lateral view, 2) in occlusal view; C) lower canine (MSNAF 4719) in lateral view; D) fragment of lower canine (MSNAF 4718) in lateral view. Scale bar equals 5 cm.

tal crest is longer than in *H. antiquus* (LEONARDI, 1947). The ventral border of the mandible in *H. amphibius* is convex but it appears straight in young individuals (CALOI et al., 1980). The horizontal ramus of the mandible is high and short; the mandible appears massive with respect to that of *H. antiquus*. In addition, the two horizontal rami are slightly divergent in dorsal view.

4. OCCURRENCES OF HIPPOPOTAMUS IN THE ITALIAN PENINSULA

The first occurrence of the Pleistocene *Hippopotamus* in Italy is controversial. Until the end of the last century it was thought to have been in the Early Pleistocene sites of the Upper Valdarno, referred to approximately the end of the Olduvai subchrone (Tasso Faunal Unit according to GLIOZZI et al., 1997). However, according to NAPOLEONE et al. (2003), the Upper Valdarno specimens are probably younger and they ascribed them to the latest Early Pleistocene. During the latter time span, the *Hippopotamus* was present at Montecastrilli (Terni), as well as at Redicicoli and Cava Arnolfi (Rome), Madonna della Strada (L'Aquila), Colle Curti (Macerata), Il Crostolo (Reggio Emilia) and in the Mugello Basin (Tuscany) (AMBROSETTI & CREMASCHI, 1976; FICCARELLI & MAZZA, 1990; ABBAZZI et al., 1995; COLTORTI et al., 1998; PALOMBO et al., 2002; GIROTTI et al., 2003; PETRONIO et al., 2003; MAGRI et al., 2010; PETRONIO & PANDOLFI, 2011; PETRONIO et al., 2011; KOTSAKIS & PANDOLFI, 2012; MANCINI et al., 2012; MARRA et al., 2014; PANDOLFI et al., 2015):

Recently, BELLUCCI et al. (2012) reported the presence of an incisor fragment of hippopotamus in the Middle Villafranchian assemblage of Coste San Giacomo (Anagni Basin). According to these authors, the specimen was found „in the field where most of the CSG FU bones were previously collected“ (BELLUCCI et al., 2012, p. 37). A large number of remains of hippopotamus housed at the MSNAF have been collected from Early Pleistocene lacustrine deposits in the Chiusi Basin (Tuscany) (CUSCANI POLITI, 1966, 1971; MAZZA, 1995) (Fig. 2). Among the other specimens, an almost complete mandible displays morphological features typical of *H. antiquus*: the horizontal rami are quite parallel and the lower border is slightly convex (cfr. CALOI et al., 1980; Fig. 2).

The mammal assemblage from the Chiusi Basin, which is still being studied (PANDOLFI & PETRONIO unpublished data), includes *H. antiquus*, *Gazella* sp., *Axis* cf. *A. nestii* and *Eucladoceros* sp. On the whole, the assemblage from the Chiusi Basin suggests an age older than Farneta FU (probably Coste San Giacomo or Olivola FUs) and supports the hypothesis of an early diffusion of hippopotamus in Western Europe. Nevertheless, the specimens from the Chiusi Basin are surface finds (not-stratified) and the presence of two different faunal assemblages with different ages cannot be ruled out. In Europe, chronologically early remains of *Hippopotamus*, including a partial skull, have been collected from the Early Pleistocene deposit at Elis (Greece), approximately 2.0-1.8 Ma (THENIUS, 1955; REIMANN &

STRAUCH, 2008; ATHANASSIOU & BOUZAS, 2010), while the genus was documented during the late Early Pleistocene in Spain (Venta Micena, Fuente Nueva-3 and Barranco León-5) (MARTÍNEZ-NAVARRO et al., 2003; ROOK & MARTÍNEZ-NAVARRO, 2010) and from the Early-Middle Pleistocene transition in France (Sainzelles, Soleilhac and Saint Priest; PALOMBO & VALLI, 2003; GUÉRIN et al., 2003). *H. antiquus* (or closely related forms also classified as *H. tiberinus* or *H. ex gr. H. antiquus*; see discussion in CALOI et al., 1980; PETRONIO, 1986, 1995; MAZZA, 1995; ATHANASSIOU & BOUZAS, 2010) was surely present in Italy until MIS 15. During this time, the species occurred at Maglianella (Rome) where a fragmentary skull and mandible belonging to the same individual have been collected (CALOI et al., 1980; PETRONIO, 1986, 1995; MARRA et al., 2014) and at Via Portuense (Rome: MARRA et al., 2014). The fragmentary skull from Maglianella (MSNCC) has elevated ocular orbits, the occipital face is inclined as in *H. antiquus* from S. Oreste (Rome) and the nuchal crest is marked. The mandible displays a slightly convex lower border of the horizontal ramus, which is relatively long and low (CALOI et al., 1980; PETRONIO, 1986, 1995). In the local fauna of Fontana Ranuccio (Anagni Basin, ca 0.41 Ma, MARRA et al., 2014) the presence of *H. cf. amphibius* is reported by CASSOLI & SEGRE NALDINI (1993). However the hippopotamus is represented only by a small fragment of lower incisor (CASSOLI & SEGRE NALDINI, 1993, p. 36), as in the case of Coste San Giacomo, but it cannot be identified at specific level. An almost complete skull and mandible belonging to the same individual (MPUR/V 149 and 149a) were reported by FABIANI & MAXIA (1953) (Fig. 3B) from the Cava Montanari, in the Via Flaminia (Rome). The skull displays morphological characteristics close to the recent *H. amphibius* (e.g. the occipital condyles are not as far back as the occipital crest, the sagittal crest is relatively long and low: Fig. 3B, C) as was extensively described by CALOI et al. (1980). According to these authors, the original label of the above-mentioned specimens was reported as „Cava Nera Molinaro“ (Via Flaminia, Rome) as the site of collection. Therefore, they are likely to be a part of the mammal assemblage of the Cava Nera Molinaro, which includes *Cervus elaphus eastephanoceros* and *Palaeoloxodon antiquus* (MARRA et al., 2014), recovered within a sedimentary layer underlying the „Tufo Rosso a Scorie Nere“ pyroclastic-flow deposit (452±2 ka, KARNER et al., 2001; DI STEFANO & PETRONIO, 1993; MARRA et al., 2014). This sedimentary layer is a fluvial-lacustrine deposit overlying the Tufo del Palatino pyroclastic-flow deposit (530±2 ka, KARNER et al., 2001; MARRA et al., 2009), and represents the aggradational succession of the Valle Giulia Formation (MARRA & ROSA, 1995), deposited during the sea-level rise of MIS 13, between 530 and 500 ka (KARNER & MARRA, 1998). If the provenance from Cava Nera Molinaro is correct for the specimens MPUR/V 149 and 149a, the earliest occurrence of *H. amphibius* in Italy could be chronologically placed within MIS 13. Nevertheless, PETRONIO (1995), PALOMBO (2004) and KOTSAKIS & BARISONE (2008) did not include the

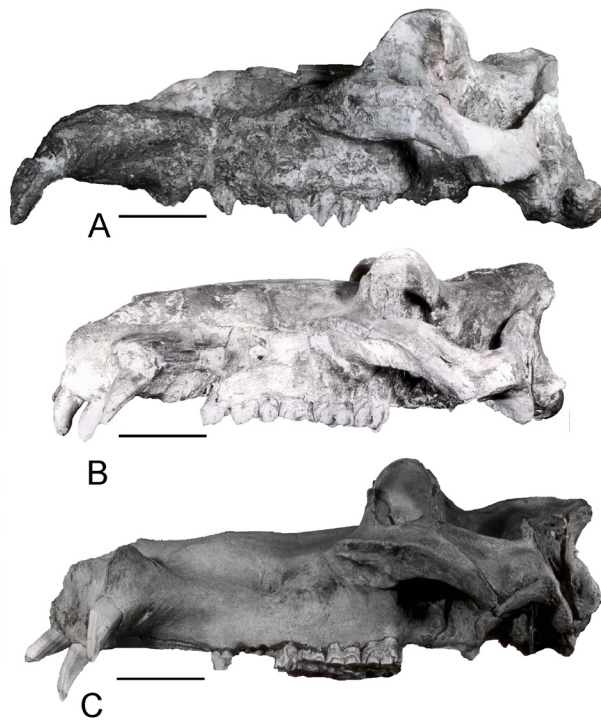


Figure 3: Skulls of *Hippopotamus* in lateral view. **A)** *Hippopotamus antiquus* from Sant'Oreste (MPUR/V 1950); **B)** *Hippopotamus amphibius* from Tor di Quinto (MPUR/V 149); **C)** *Hippopotamus amphibius* recent Africa (MACR nc). Scale bar equals 10 cm.

specimens MPUR/V 149 and 149a in the list of remains collected at Cava Nera Molinario and gave the general indication „Tor di Quinto“ as the locality of the skull and mandible. However, even if the provenance of the specimens could be Tor di Quinto or any other locality in Rome along the Via Flaminia, the stratigraphic sections published by MARRA & ROSA (1995) and PANDOLFI & MARRA (2015) reveal that the conglomerate levels outcropping in these areas can be chronologically placed within MIS 13 or MIS 11, ranging between 530 and 450 ka.

The presence of *H. amphibius* in Italy is also reported in several latest Middle Pleistocene localities (PETRONIO et al., 2011), but the specimens collected at Castel di Guido (Rome, MIS 9) were referred to *Hippopotamus* sp. and *H. cf. antiquus* by CAPASSO BARBATO & PETRONIO (1983) while MAZZA (1995) did not exclude an attribution to *H. tiberinus* (= *H. antiquus* according to PETRONIO, 1995). Moreover, the few specimens from Malagrotta (Rome, MIS 9) appear indeterminable to specific level (CALOI & PALOMBO, 1980, 1988, 1994; MAZZA, 1995). *Hippopotamus* cf. *amphibius* was recorded at Sedia del Diavolo (Rome, ca 0.360 Ma) by CALOI et al. (1980) but MAZZA (1995) questioned this attribution as well as that of the fragmentary specimens from Torre in Pietra (Rome, MIS 9) ascribed to *H. amphibius* by CALOI & PALOMBO (1978). *H. amphibius* is reported during the latest Middle Pleistocene in France (PALOMBO & VALLI, 2003 and references therein), whereas according to MAZZA (1995) one of the first records of *H. amphibius* is in the early Late Pleistocene site of Barrington (England). In

Great Britain, the species appears to have been present only during the Last Interglacial MIS 5e (SCHREVE, 2009) whereas it was recorded in southern Italy as late as MIS 4 (GLIOZZI et al., 1997; PALOMBO, 2004; PETRONIO et al., 2007, 2011). Indeed, at Grotta Romanelli (Lecce), *Hippopotamus* has been documented from level G, which chronologically spans from ca. 69 to ca. 40 ka (BLANC, 1920, 1928; FORNACARINALDI & RADMILLI, 1968; MAZZA, 1995; PANDOLFI & TAGLIACOZZO, 2013) and overlies the level I with *Coelodonta antiquitatis* (PANDOLFI & TAGLIACOZZO, 2013, 2015). *H. amphibius* has been recorded in the layer C2 of Canale delle Acque Alte (Latina) referred to the beginning of MIS 4 (FARINA, 2011). The species has also been reported from sandy-clay sediments at Ingarano (Foggia: PETRONIO & SARDELLA, 1998). These sediments, which also contain *C. antiquitatis* (PETRONIO & SARDELLA, 1998), have been referred to MIS 4 but their stratigraphic relationship with the cave sequence is unclear (PETRONIO & SARDELLA, 1998). *Hippopotamus* has never been collected from Avetrana bed 8 (Taranto), recently referred to MIS 4-3 (PANDOLFI et al., 2013; BERTÉ & PANDOLFI, 2014), probably due to the absence of a nearby relatively large water body.

5. CONCLUSIONS

Several remains of Pleistocene hippopotamuses have been collected from the Italian Peninsula but, unfortunately, some of them lack any stratigraphic data. *Hippopotamus* was certainly present in the Peninsula at the end of the Villafranchian and afterwards. This is in agreement with the data on the occurrences of this taxon in Europe and suggests a dispersal pattern of the genus from Southeastern Europe (Greece: Middle Villafranchian) to Western Europe (Spain: latest Villafranchian) and throughout Italy. The species *H. antiquus* occurred in the Peninsula until MIS 15. With the exception of the specimens MPUR/V 149, which testify to the occurrence of *H. amphibius* in Italy during the Middle Pleistocene, several other hippopotamus remains reported from localities chronologically related to MIS 13-9 cannot be presently assigned to a well-defined species. However, these records suggest the continued presence of the genus in Italy. The latest records of hippopotamus in the Peninsula are from southern Italy (Apulia) where the taxon survived during MIS 4 and the beginning of MIS 3 (e.g., level G of Grotta Romanelli), confirming the role of this area as one of the last refugia of the genus in Europe.

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