

Late Quaternary extinction of the narrow-nosed rhinoceros *Stephanorhinus hemitoechus* (Mammalia, Perissodactyla) in Italy

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The chronological extinction of the narrow-nosed rhinoceros *Stephanorhinus hemitoechus* is still uncertain (Stuart & Lister, 2007, 2012). The species appeared in southern Europe around 500 ka (Pandolfi et al., 2013) and was widely distributed throughout Europe during the late Middle and early Late Pleistocene (Guérin, 1980). According to Stuart & Lister (2012) the extinction of *S. hemitoechus* is estimated around cal. 45 ka. In the United Kingdom, *S. hemitoechus* is reported from the Wood Quarry (Nottinghamshire) dated around 66.8 ka (Pike et al., 2005). Nevertheless, this species was listed in the faunal assemblage on the basis of a reminiscence rather than actual specimens (Pike et al., 2005). According to Stuart (1991) *S. hemitoechus* retreated to southern Europe during the Last Cold Stages and it was absent in northern Europe.

Site	Taxonomy	Age
Muracci Quarry	<i>Stephanorhinus hemitoechus</i>	cal. 41 ka
Grotta del Fossellone, levels 32-33	<i>Stephanorhinus</i> sp.	end MIS 5a-beginning MIS 4
Torre Talao	<i>Stephanorhinus hemitoechus</i>	? MIS 4
Grotta di Gosto	Rhinocerotini indet.	ca. 48 ka
Grotta del Capriolo	<i>Stephanorhinus</i> sp.	early MIS 3
Buca della Iena, level D	<i>Stephanorhinus cf. hemitoechus</i>	> cal. 41 ka
Grotta di S. Agostino, level A2	<i>Stephanorhinus</i> sp.	ca. 55-43 ka
Grotta dei Moscerini	Rhinocerotini indet.	early MIS 3
Buca del Tasso	Rhinocerotini indet.	early MIS 3
Riparo l'Oscursciuto, level 5-7	cf. <i>Stephanorhinus</i>	> cal. 42,975 ka
Grotta Romanelli, level G	<i>Stephanorhinus cf. hemitoechus</i>	>69-40 ka
Grotta del Cavallo, level M	<i>Stephanorhinus</i> sp.	> cal. 40 ka
Ingarano, sandy-clays level	<i>Stephanorhinus hemitoechus</i>	? MIS 4
Grotta Parignana	<i>Stephanorhinus hemitoechus</i>	? MIS 4-early MIS 3
Avetrana, bed 8	<i>Stephanorhinus hemitoechus</i>	MIS 4-early MIS 3
Sora-Valle Radice	<i>Stephanorhinus hemitoechus</i>	MIS 4
Castelvita	?Rhinocerotini indet.	>40 ka
Grotta della Cala	cf. <i>Coelodonta</i>	? (> 29 ka)

Tab. 1: Revised taxonomy of latest Pleistocene rhinoceros remains from selected Italian localities.

Fossil rhinoceros records during MIS 4 and MIS 3 are relatively scarce in Italy (Tab. 1) and mainly represented by juvenile individuals.

A few juvenile *Stephanorhinus* remains have been collected from the levels 32-33 of Grotta del Fossellone (Latina), chronologically related with the end of MIS 5a and the beginning of MIS 4. A juvenile fragmentary maxilla of *S. hemitoechus* has been recovered from the late Pleistocene (MIS 4?) deposits at Torre Talao (Cosenza). At Grotta di Gosto (Siena), U/Th dated around 48 ka (± 4 ka), scanty and indeterminate fragments classified as *Rhinoceros* sp. have been reported. At Grotta del Capriolo (Lucca; early MIS 3) a fragment of a deciduous tooth was referred to *Rhinoceros* sp. Rhinoceros is recorded from the level D of Buca della Iena (Lucca). This level is older than the level C dated around cal. 41 ka and the specimens can be confidentially ascribed to *S. cf. hemitoechus*. A few remains surely attributable to *S. hemitoechus* has been collected from Cisterna di Latina (Latina) and dated around cal. 41 BP (Fig. 1). *Stephanorhinus* sp. has been recorded from the level 5-7 of Riparo l'Oscursciuto (Taranto) which underlie the level 1, 14C dated around cal. 42.975 BP. Several *Stephanorhinus* remains have been discovered from the terre rosse deposits of Grotta Romanelli (Lecce), chronologically U/Th dated between >69 and 40 ka. Rhinoceros bones collected from terre rosse have been recently investigated for 14C dating but they did not contain collagen (M. Mannino pers. comm. 2015). Scanty *Stephanorhinus* remains from Grotta del Cavallo (Lecce) were collected from the level M which is stratigraphically lower than the chronologically dated level E III (dated 47.530 – 43.000 cal BP. A few juvenile remains of *S. hemitoechus* were collected from the bed 8 of Avetrana karst filling (Taranto) which was recently referred to MIS 4 or MIS 3. The fossiliferous deposit of Sora-Valle Radice (Frosinone) which yielded a lot of *S. hemitoechus* remains has been referred to a cold phase of the Late Pleistocene, probably MIS 4. Unfortunately, rhinoceros remains sampled for 14C dating contained insufficient collagen.

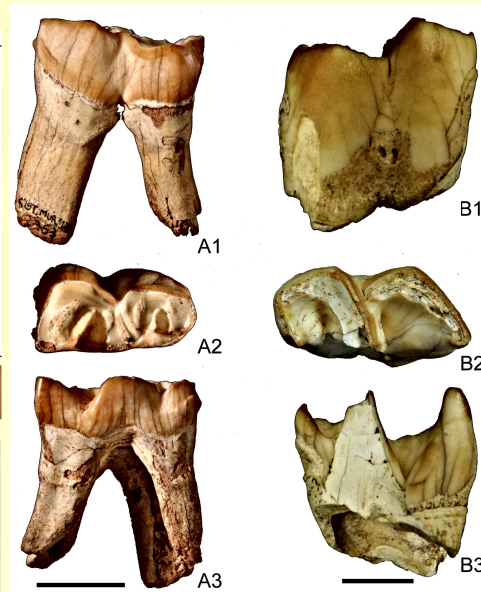


Fig. 1: Remains of *Stephanorhinus hemitoechus* from Muracci quarry, Cisterna di Latina. A, third lower deciduous (es. 363); B, first lower molar (es. 365). 1, buccal view; 2, occlusal view; 3, lingual view. Scale bars=2 cm.

The presence of rhinoceros from the lower levels (gar2; Musterian level, not calibrated age around 40 ka) of Castelvita is only based on a second central phalanx. Although it is not possible to ascribe the remain to a species it was referred to *S. cf. hemitoechus*. This record appears very doubtful and an attribution to *Coelodonta* cannot be discarded. *S. cf. hemitoechus* was reported from the level 14 of Grotta della Cala (Salerno) on the basis of a pyramidal. The age of the level 14, ca. 29 ka, was considered problematic and not reliable. In addition, the pyramidal doesn't display certain morphological characters which suggest an attribution to *Stephanorhinus*. The dimensions and proportion of the bone, the morphology of the dorsal and distal profile of the bone surface are close to *Coelodonta* rather than to *S. hemitoechus*.

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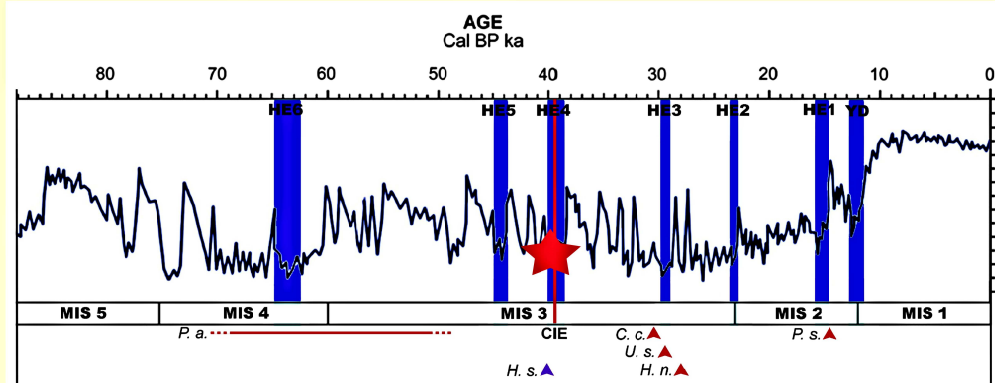


Fig. 2: Extinction of *Stephanorhinus hemitoechus* in Italy (red star). The main cold episodes (HE) during MIS 3 and the Campanian Ignimbrite eruption (CIE) are evidenced. The chronological extinction of selected Megafaunal taxa in Europe and the appearance of *H. sapiens* are also reported. P.a. = *Palaeoloxodon antiquus*; C.c. = *Crocota crocuta*; P.s. = *Panthera spelaea*; U.s. = *Ursus spelaeus*; H.n. = *Homo neanderthalensis*; H.s. = *Homo sapiens*.

CONCLUSIONS

The available data suggests that, in Italy, the steppe rhinoceros became extinct around cal. 41 BP. The disappearance of *S. hemitoechus* seems not to be directly related with intensive hunting (by humans or large carnivores). Inter-specific competition with *C. antiquitatis* and *M. primigenius*, despite they are not well-documented as in central Europe, cannot be excluded but need to be supported by further evidences, in particular by radiometric dating. However, the presence of these two taxa are indicative of a cold climatic deterioration. Studies on extant populations of African and Indian rhinoceroses revealed that decrease in numbers of individuals is related with environmental variations and fragmentation of their habitats. Environmental variations influenced several aspect of rhinoceros ecology and reproduction whereas habitat fragmentation created an increase of small populations which have a tendency to become extinct. The climatic fluctuations occurred during the late Pleistocene, in particular during MIS 4 and early MIS 3, and the contraction of the distribution area of the species probably returned with an increase and isolation of several small populations. These factors, also associated with the presence of possible ecological competitors (i.e., *M. primigenius* and *C. antiquitatis*), probably driven the species towards extinction.