

<i>Bollettino della Società Paleontologica Italiana</i>	42 (1-2), 2003	ISSN 0375-7633	157-162	—	Modena, Giugno 2003
---	----------------	----------------	---------	---	---------------------

A new Cervid in the Pleistocene of Sardinia: preliminary report ⁽¹⁾

Maria Rita PALOMBO
Dipartimento di Scienze della Terra
Università di Roma "La Sapienza"

Rita MELIS Serafino MELONI
Dipartimento di Scienze della Terra
Università di Cagliari

Caterinella TUVERI
Soprintendenza per i Beni Archeologici
Nuoro

KEY WORDS – Mammalia, Cervidae, Morphology, Pleistocene, Sardinia.

ABSTRACT – In the Su Fossu de Cannas Cave (Sadali, central-eastern Sardinia), cut into the Mesozoic limestone in the Barbagia of Seulo, various cervid remains have recently been discovered whose dimensions exceed the range of variability calculated for the endemic species "Megaceroides" cazioti (Depéret, 1897), and are comparable to those of the continental red deer. The specimens analysed thus far, however, show close morphological affinities with endemic Sardinian megalocerines, from which in any case the Sadali cervid differs in its proportionally smaller teeth and limb proportions, as well as in some morphological features which, if confirmed by further data, might suggest its attribution to a new taxon, congeneric with the endemic species "Megaceroides" cazioti, of which it might be the ancestor.

RIASSUNTO – [Un nuovo cervide nel Pleistocene della Sardegna: dati preliminari] – Nella grotta Su Fossu de Cannas (Sadali, Sardegna centro-occidentale), che si apre nei calcari mesozoici della Barbagia di Seulo, sono stati recentemente scoperti vari resti di cervidi le cui dimensioni fuoriescono dal campo di variabilità calcolato per la specie endemica "Megaceroides cazioti", e sono comparabili a quelle di cervi elafi continentali. I caratteri morfologici dei resti fino ad ora analizzati mostrano tuttavia strette affinità con la specie endemica, dalla quale il cervide di Sadali si differenzia per le maggiori dimensioni, per proporzioni e per alcuni tratti morfologici che potrebbero suggerire, se confermati da ulteriori dati, la sua attribuzione ad un nuovo taxon, cogenérico rispetto alla specie endemica "Megaceroides" cazioti, della quale potrebbe essere il diretto progenitore.

INTRODUCTION

In the Pleistocene of Sardinia, cervid remains, generally ascribed to "Megaceroides cazioti" (Depéret, 1897) are relatively common, above all in eolianites or in cave deposits, mostly attributed to the Late Pleistocene. The first reports date back to the second half of the 19th century, however, it was only in 1935 that Tobien ascribed cervid remains from the Alghero area to the new species "Cervus" cazioti erected by Depéret in 1897 on the cervid remains found at Nonza (Corsica). In more recent times, knowledge of the morphological and biometric characteristics of "Megaceroides" cazioti has been improved by the detailed studies carried out by Caloi & Malatesta (1974), Hofmeyer (1997) and Pereira & Bonifay (1998), respectively based on the large cervid samples coming from the Late Pleistocene deposits of in Dragonara and Corbeddu Caves (Sardinia), as well as those in Coscia Cave (Corsica). Other reports from Sardinia and Corsica, refer for the most part to sporadic isolated remains or samples not yet analysed (cf. Melis *et al.*, in press and references therein). The oldest occurrence of megalocerines in Sardinia reported thus far should be in the *Rhagamys minor* fauna uncovered in the early Middle Pleistocene karst fissures opening up at Monte Tuttavista (Orosei) ("Megaceroides" sp., Ginesu & Cordy, 1997; Sondaar, 2000). In the *Rhagamys minor* fauna coming from Capo Figari 1 karst fissure, whose age has been hypothesised at approximately 1.8 ± 0.2 Ma (ESR on a *Nesogoral* molar, Made, 1999) cervid remains are absent, whereas they become quite common in the typical Middle/Late Pleistocene faunas characterised by the occurrence of *Rhagamys orthodon*, *Microtus* (*Tyrrhenicola*) spp., *Nesiotites similis*, *Prolagus sardus*, etc. (Palombo in prep.).

Accordingly, the Sardinian and Corsica endemic cervid is quite a well-known species, but in spite of the many studies carried out, specialists still do not agree on the taxonomy and phylogenetic relationships of this taxon. The hypothesis of its derivation from megalocerines belonging to the "M." *verticornis* group has been widely accepted; however, in Sondaar's opinion (personal communication to M.R. Palombo), Sardinian cervids would have been phylogenetically related to the *Dama* genus. While, on the other hand, Made (1999) believes they may have originated from the latest Early Pleistocene species *Eucladoceros giulii* Kahlke, 1997. In any case, despite the different views about the phylogenetic relationships of this cervid, it is now commonly believed that only one phyletic line was present in Sardinia, perhaps represented by more than one chronosubspecies, while in Corsica, in addition to the megalocerines, deer closely related to red deer would also have occurred (*Cervus elaphus rossii* Pereira, 2001). The discovery in the Su Fossu de Cannas Cave at Sadali (Bartolo *et al.*, 1995) (Text-fig. 1) of cervid remains similar in size to those of *Cervus elaphus*, has thus been considered an extremely interesting element. A preliminary on-

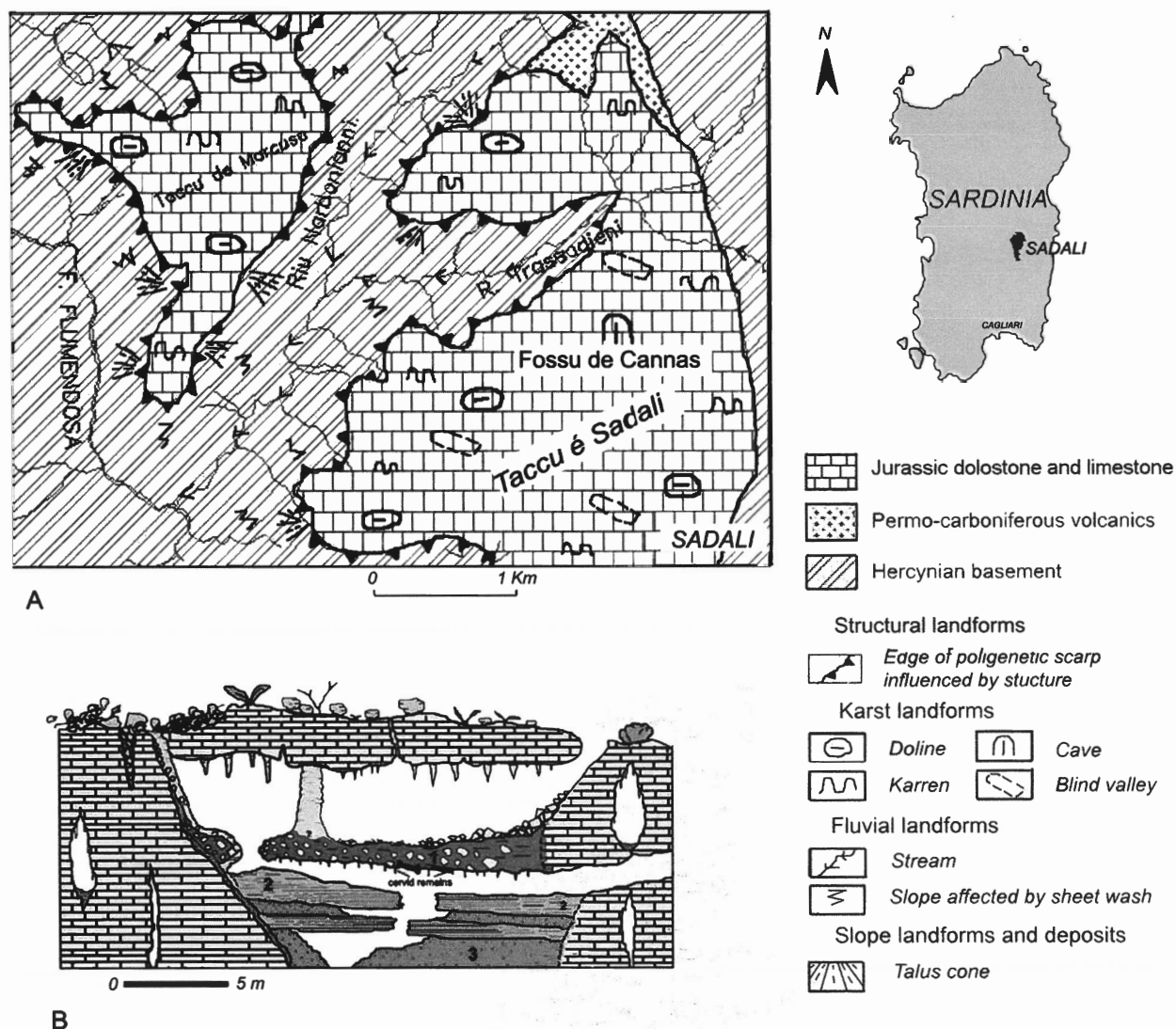
⁽¹⁾ Nota presentata alle "Giornate di Paleontologia 2002", Bolca (VR) giugno 2002.

site inspection in the cave has, however, pointed out how the cervid specimens from Sadali showed no sound morphological affinity with the *Cervus* genus representatives and thus suggested a preliminary explorative analysis, whose results it was felt should be communicated here.

Fossu de Cannas Cave is located in the central sector of the Sadali limestone plateau (central-eastern Sardinia). Initial analysis has pointed out the presence of a vast cavity affected by various sedimentation and erosion stages. The conglomerate containing fossil remains, whose origin can be attributed to high-energy water flow coming from outside, probably represents what remains of the first filling of the cavity. Subsequently, cementing processes protected the conglomerate from an erosion stage during which a partial emptying out of the cave probably occurred. Sedimentological characteristics, degree of cementing and stratigraphical relationships, allow us to hypothesise that the fossiliferous conglomerate is older in respect to the fine sediments outcropping in the lower part of the cave.

THE CERVID REMAINS

The nature of the fossiliferous deposit, very strongly cemented, the presence of massive calcareous concretions as well as the position of the cervid remains on the ceiling of a narrow, very low tunnel, made it extremely difficult to retrieve them. Thus far, it has been possible to partially uncover the lingual side of a left mandibular ramus (unfor-



Text-fig. 1 - A) Geomorphological sketch map of the Sadali land. B) schematic longitudinal section of "Fossu de Cannas" Cave; 1) conglomerate containing fossil remains, 2) carbonate deposits, 3) fine sediments.

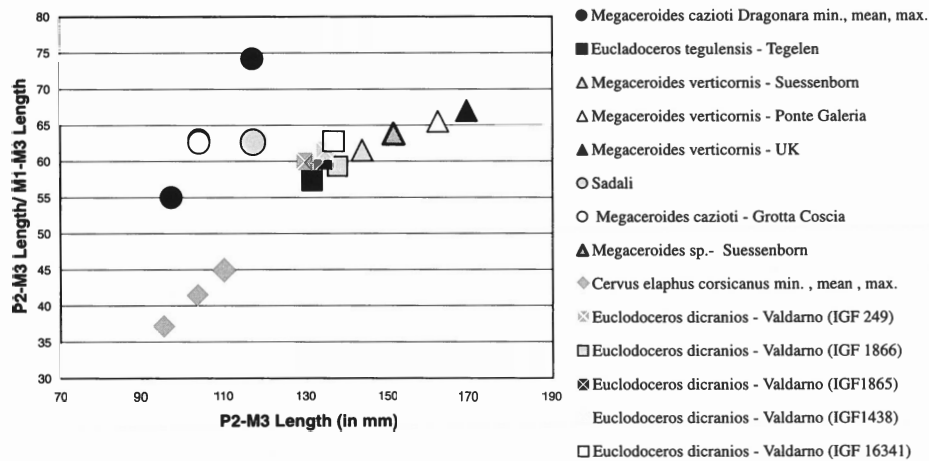
tunately the occlusal surface of the teeth is still retained in the sediment) and retrieve a right metacarpus and the proximal epiphysis of a femur. These bones and other skeletal elements not clearly identifiable perhaps belong to a single individual, probably a female, as inferred from the lateral profile of the atlas. Many other remains are covered and masked by the concretions lining the ceiling of the tunnel; they apparently belong to moderately disarticulated skeletons with no evident anatomical connection.

The morphological features of the mandible (very convex lower profile, short diastema, massive mandibular ramus, curved alveolar limbus, tooth-row occlusal line placed under the incisor teeth one, relatively high vertical branch which extends considerably backwards, condylus in a very high position, fairly weak pachyostosis) (Text-fig. 2) are very similar to those characterising the "*Megaceroides*" *cazioti* specimens from Dragonara Cave. The Sadali cervid however differs from this later species due to its more massive *corpus mandibulae*, the regularly convex lower profile of the horizontal ramus, apparently lacking any fore-concavity at the *angulus mandibulae*, its slightly longer diastema, proportionally smaller toothrow and a lower value of the "length of premolar row/length of molar row" index (Text-fig. 3).

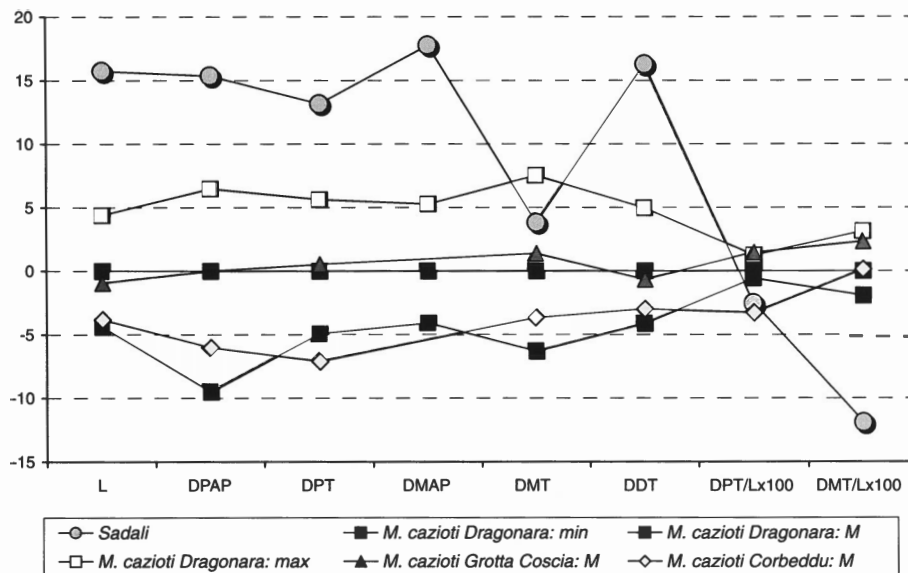
Even in the metacarpus, the morphology of the proximal articular surface is similar to that characterising "*Megaceroides*" *cazioti* specimens from Dragonara (large articular surface for the *capitulum*, having a slightly curved anterior profile, whereas the posterior edge extends to connect laterally with the postero-mesial edge of the articular surface for the *uncinatum*) from which, however, the metacarpus of the Su Fossu de Cannas Cave cervid differs in its notably larger size. Its length, in fact, is more than 26% greater than the maximum length estimated for the metacarpus of the Dragonara sample and 29.8% greater than the standard, clearly placing it outside both the real (170 – 208 mm) and theoretical (162.2 – 213.8 mm) variability ranges calculated for this sample (Caloi & Malatesta, 1974; Palombo unpublished data). Moreover, the Sadali metacarpus is elongated and clearly more slender than the representatives of "*Megaceroides*" *cazioti* from Sardinia and Corsica (Text-fig. 4), the dyaphysis and, perhaps, the proximal epiphysis (unfortunately partially damaged) show reduced transversal diameter. The slenderness of the dyaphysis is also confirmed by the robusticity index ($DMT/L \times 100$), whose value is clearly inferior to the minimum calculated for the Dragonara sample, so that the Sadali metacarpus appears thinner than the thinnest females among the Dragonara specimens. The larger size of the Su Fossu de Cannas Cave cervid in respect to Sardinian and Corsican endemic megalocercines is also confirmed by the dimension of the proximal epiphysis of the femur, also characterised, in addition to its larger size, by the extensive transversal development of the greater trochanter and of the caput, whose morphology would indicate greater running ability as compared to the "*Megaceroides*" *cazioti*.



Text-fig. 2 - "*Megaceroides*" sp. (n. sp.) from Su Fossu de Cannas Cave (Sadali, Nuoro): left hemimandible in lingual view (about $\times 0.5$ of natural size).



Text-fig. 3 - Scatter diagram of the value of the index ratio "Length of premolar row" / "Length of molar row" ($P_2-P_4/M_1-M_3 \times 100$) versus "Length of dental row" (P_2-M_3) in the Su Fossu de Cannas Cave (Sadali, Nuoro) cervid, in "*Megaceroides*" *cazioti* (Depéret, 1897) from Sardinia (Dragonara, post-Tyrrhenian) and Corsica (Coscia Cave, last Glacial, Pereira & Bonifay, 1998), in some endemic cervids, in middle-sized and large cervids from the Pliocene and Pleistocene of Europe.



Text-fig. 4 - Logarithmic distances of the principal dimensional values of the metacarpus from Su Fossu de Cannas Cave (Sadali, Nuoro) cervid and of "*Megaceroides*" *cazioti* from Dragonara, Corbeddu Cave (Hofmeyer, 1997) and Coscia Cave (Pereira & Bonifay, 1998) (standard = average values of Dragonara sample).

REMARKS

After the preliminary morphological and biometrical analyses carried out thus far, the Su Fossu de Cannas Cave cervid displays peculiar features, suggesting its attribution to a new taxon, congeneric with the endemic species "*Megaceroides*" *cazioti*, of which it might be the direct ancestor and from which it is probably differentiated as a specific rank (Palombo, in prep.). The morphology of the mandibular ramus from Sadali would also confirm that Sardinia and Corsica endemic cervids are closely related to continental megalocercines. Moreover, metacarpal proportions enable us to hypothesise a possible phylogenetic relationship to the so-called "slender-limbed megalocercines" recorded in various localities in the late Early and early Middle Pleistocene of the Mediterranean area (i.e. Venta Micena (Spain), Menendez, 1987; Oubeidiyeh (Israel), Geraards, 1986; Sassa (L'Aquila, Italy), Palombo *et al.*, 2001; Redicicoli (Rome, Italy), Palombo, unpublished data). The authors do not agree on the taxonomy of these cervids; moreover some of them have been ascribed to *Eucladoceros giulii* (Kahlke, 1997), a species (from which, in Made's (1999) opinion, Sardinian cervids might originate) characterised by quite simple antlers and slender limbs, but having a weak and almost right mandible ramus with elongated diastema (Kahlke, 1997). However, after the results of a re-examination of Sardinian skulls from Dragonara (Caloi & Malatesta, 1974), Maritza (Cordy

& Ozer, 1973) and Porto Vesme (Comaschi Caria, 1955), the basic cranial structure of the "*Megaceroides*" *cazioti* confirms its greater affinity with the representatives of the "*Megaceroides*" group. With the continental megalocerines, the Sardinia one shares the typical forehead morphology, characterised by flat frontal bones, slightly convex, the position and direction of the peduncles (even if the beam is straighter and more directed laterally and distally than that of typical antlers of cervids belonging to the "*Megaceroides*" *verticornis* group, but as shown by specimens from the Early Pleistocene Apollonia 1 site, Greece, referred to as "*Megaloceros*" sp. by Kostopoulos, 1997), the shape of the brain case, the angle between the basioccipital and the palatine bones, muzzle shape and morphology of the mandible, curved and with short diastema extending upwards. In addition, the Su Fossu de Cannas Cave cervid is characterised, in respect to the maximum observed in "*Megaceroides*" *cazioti*, by slightly larger mandibular size, proportionally smaller teeth and a shorter premolar row, whereas the metacarpus is of clearly larger dimensions. This fact would suggest for the endemic megalocerines of Sardinia and Corsica a process of allometric reduction in body size, with retarded shortening of the metapodials; accordingly, "*Megaceroides*" *cazioti* would have, in any case, proportionally shorter metapodials than its ancestor species, contrary to what has generally been hypothesised.

The Su Fossu de Cannas cervid can be regarded as the most primitive representative of the genus "*Megaceroides*" in Sardinia and as the ancestor of the endemic species "*Megaceroides*" *cazioti*, even if its relationships with the various continental megalocerine representatives are still unclear. The peculiar features of the Sadali specimens seem to suggest its attribution to a new species; nevertheless, taking into account the scanty remains thus far uncovered, especially in respect to the richness of the deposit, we prefer, for the moment, to refer the Sadali cervid to "*Megaceroides*" sp. (?n. sp.), awaiting new data to perfect its determination.

The lack of any micromammal remains both in the fossiliferous conglomerate and in the other deposits of Su Fossu de Cannas Cave makes it difficult to hypothesise which faunal complex the cervid belongs to. Moreover, given the available data, we can only hypothesise that, after the depositing and diagenesis of the fossiliferous conglomerate, the cave underwent a severe erosion process, followed by the filling in fine sediments alternated with carbonate hardpan indicative of drier climatic conditions.

We hope that ongoing research will clarify the cave evolution and the taxonomical rank of the Su Fossu de Cannas Cave cervid, enabling us to define its biochronological setting.

REFERENCES

- BARTOLO, G., LANZA, B., MELONI, S., SECCI, G. & SERRAU, P., 1995, Sadali, Ambiente, Tradizione, Grotte. Associazione Turistica Pro Loco Sadali, MCO, Oristano.
- CALOI, I. & MALATESTA, A., 1974, Il cervo pleistocenico di Sardegna: Mem. Ist. It. Paleont. Umana, n.s., 2: 163-246.
- COMASCHI CARIA, I., 1955, Resti di cervidi nel Quaternario di Porto Vesme: Riv. It. Paleont. Strat., 61 (1): 17-27.
- CORDY, J.M. & OZER, A., 1973, Découverte d'un crâne de cervidé mégacérin (*Nesolepoceros cazioti*) dans le Quaternaire de la Sardaigne septentrionale: Ann. Soc. Géol. Fr., 95 (1972): 425-449.
- GERAADS, D., 1986, Les ruminants du Pléistocène d'Oubeidiyeh (Israël). In Les Mammifères du Pléistocène inférieur de la vallée du Jourdain à Oubeidiyeh: Mém. Et Trav. Centre recherche française Jérusalem, 5: 143-181.
- GINESU, S. & CORDY, J.M., 1997, Il Monte Tuttavista (Orosei-Galtelli): Ed. Poddighe Sassari: 1-47.
- HOFMEYER, G.K., 1997, Late Pleistocene deer fossils from Corbeddu Cave: BAR Intern. Series, 663: 432 pp.
- KAIKE, H.D., 1997, Die Cervidenreste aus den Unterpleistozän von Untermassfeld. In Kahlke, R. D. (ed.), Das Pleistozän von Untermassfeld bei Meiningen (Thüringen). Teil. 1: Rom.-Germ. Zentralmus., Monogr. 40 (1): 181-275.
- KOSTOPOULOS, D.S., 1997, The Plio-Pleistocene artiodactyls (Vertebrata, Mammalia) of Macedonia 1. The fossiliferous site "Apollonia 1", Mygdonia basin of Greece: Géodiversitas, 19 (4): 845-875.
- MADE, J., VAN DER, 1999, Biogeography and stratigraphy of the Mio-Pleistocene mammals of Sardinia and the description of some fossils. In Reumer, J.W.F. & de Vos, J. (eds.), Elephants have a Snorkel!: Deinsea: 337-360.
- MELIS, R.T., PALOMBO, M.R. & MUSSI, M., in press, The Gonnese (Western Sardinia, Italy) Late Pleistocene sequence. In Wrander, J. (ed.), Island biogeography.
- MENENDEZ, E., 1987, Cervidos del Yacimiento del Pleistoceno inferior de Venta Micena-2 Orce (Granada, Espana): Paleont. I Evol., Mem. Esp., 1: 129-181.
- PALOMBO, M.R., ABBAZZI, L., AGOSTINI, S., MAZZA, P. & MUSSI, M., 2001, Middle Pleistocene faunas and lithic implements from Pagliara di Sassa (L'Aquila, central Italy). In Cavaretta, G., Gioia, P., Mussi, M. & Palombo, M.R. (eds.), The World of Elephants: 224-229, CNR, Roma.
- PEREIRA, E., 2001, *Cervus elaphus rossii* (Mammalia, Artiodactyla), a endemic new sub-species from the Middle Pleistocene in Corsica: Paleovertebrata, 30 (2-4): 189-213.
- & BONIFAY, M.F., 1998, Etude préliminaire des restes de Cervidés de la grotte de la Coscia (Rogliano - Haute-Corse): Paleo, 10: 43-60.
- SONDAAR, P.Y., 2000, Early Human and Exploitation of Islands: Tropics, 10 (1): 203-230.
- TOBIEN, H., 1935, Über die pleistozänen und postpleistozänen *Prolagus* formen Korsikas und Sardinien: Ber. Naturf. Gesellsch. Freiburg i. Br., 34: 253-344.

(manuscript accepted November 11, 2002)

Maria Rita PALOMBO

Dipartimento di Scienze della Terra
Università degli Studi di Roma "La Sapienza"
CNR, Istituto di Geologia Ambientale e Geoingegneria
Piazzale A. Moro 5, 00185 Roma, Italy
e-mail: mariarita.palombo@uniroma1.it

Rita MELIS

Dipartimento di Scienze della Terra
Università degli Studi di Cagliari
Via Trentino 51, 09127 Cagliari, Italy
e-mail: rtmelis@unica.it

Serafino MELONI

Via Sardegna 6, 08030 Sadali (Nuoro) Italy
e-mail: serafinomeloni@tiscalinet.it

Caterinella TUVERI

Soprintendenza per i Beni Archeologici per le province di Sassari e Nuoro
Via Ballero 30, 08100 Nuoro, Italy
e-mail: nellatuveri@yahoo.it