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SUS SONDAARI VAN DER MADE, 1999 (MAMMALIA, SUIDAE) FROM MONTE TUTTAVISTA (OROSEI, WESTERN SARDINIA, ITALY)

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Abstract. This paper formally describes some cranial and post-cranial remains of young and adult fossil suids retrieved from Monte Tuttavista karst fissures (Orosei, western Sardinia). The material is herein attributed to the Sardinian species *Sus sondaari* Van der Made, 1999. Features of skulls, mandibles, some milk teeth, definitive canines, and thus far unknown post-cranial elements of Monte Tuttavista suids significantly integrate our knowledge of the endemic species *Sus sondaari.* An emended diagnosis is here proposed, including some new diagnostic features such as lower canine with scrofic section, and oval shape of scapular glenoid fossa. Finally, the challenging evolutionary relationships of *Sus sondaari* are briefly discussed.

Riassunto. Si descrivono i resti di suide provenienti dalle fessure carsiche del Monte Tuttavista (Orosei, Sardegna). Tutto il materiale è attribuito alla specie *Sus sondaari* Van der Made, 1999. La descrizione della mandibola, dei denti di latte, dei canini definitivi e di diversi elementi del post-cranio di *Sus sondaari* provenienti dal Monte Tuttavista (Orosei) ampliano la conoscenza di questa specie endemica. I nuovi fossili permettono di introdurre nuovi caratteri diagnostici per la specie quali canino inferiore maschile scrofico e contorno ovale della fossa glenoidea della scapola. Grazie a questi nuovi caratteri viene proposto un emendamento della diagnosi specifica. Vengono inoltre brevemente discusse ipotesi sui rapporti filogenetici di questo taxon.

Introduction

Monte Tuttavista (Orosei, Eastern Sardinia, Italy) is one of the most important localities for Cenozoic fossil vertebrates in Sardinia. Ginesu & Cordy (1997) and Sondaar (2000) first reported the occurrence of fossiliferous karst fillings at Monte Tuttavista. In the area significant quarrying activity led to the discovery and sampling of a number of karstic fossiliferous cavities and fissures. More than 80.000 fossil remains have been thus far retrieved and more than 80 taxa, fishes, amphibians, reptiles, birds and mammals, ranging in age from Early to Late Pleistocene, have been identified (Rook et al. 2003; Abbazzi et al. 2004, 2005; Rook et al. 2004; Marcolini et al. 2006; Palombo et al. 2006a,b; Angelone et al. 2008; Delfino et al. 2008; Novelli et al. 2009).

At Monte Tuttavista suid remains, preliminarily ascribed to *Sus* cf. *S. sondaari* (Rook et al. 2003; Abbazzi et al. 2004), have been retrieved from fissure "Cava VI-3 antica". From the same fissure a larger sized hemimandible, similar to *Sus sondaari* in showing simple and smooth enamel as well as a very short diastema, but bearing the $P_{1,}$ had been preliminarily attributed to *Sus* sp. by Abbazzi et al. (2004). The faunal assemblage associated is made up of the following taxa: *Talpa tyrrhenica, Nesiotites* sp. II, *Macaca* aff. *M. majori, Tyrrhenoglis* cf. *T. figariensis, Rhagamis minor, Prolagus* aff. *P. sardus, Oryctolagus* aff. *O. lacosti, Mustela* sp., *Pannonictis* sp., *Asoletragus gentryi, Nesogoral* sp. 1 cf. *N. melonii* and *Nesogoral* sp. 2 (Rook et al. 2003; Abbazzi et al. 2004; Palombo et al. 2006 a,b). The "Cava VI-3 antica" faunal assemblage is referred to "Capo Figari/ Orosei 1 faunal sub-complex" (*sensu* Palombo 2006, 2009).

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The occurrence of an endemic suid in the Plio-Pleistocene fossil fauna of Sardinia was first reported by Passemard (1925) and Vaufrey (1929). These authors reported as *Potamochoerus* sp. a fragment of mandible from the bone-breccia cropping out at Capo Figari (Olbia, north-eastern Sardinia). Afterwards Azzaroli (1961) suggested this specimen should be ascribed to a new, dwarfed species of *Sus.* Van der Made in 1988 established the new species "*Sus nanus*" on the basis of suid specimens from Capo Figari, kept in the Basel Naturhistorishes Museum (Forsyth Major collection; cfr. Rook 2012). Since the specific name was already assigned to a domestic species (*Sus scrofa nanus* Nehring, 1884), a few years later van der Made (1999) thereby changed it into *Sus sondaari.* The Capo Figari sample encompasses the holotype of the species, a fragmentary palate (TY5340), some fragmentary cranial bones [a maxillary with M^3-M1 (TY3341), an incomplete mandible with P_3-M_1 (TY5353), and a mandibular fragment with M_3 (TY5351)], isolated teeth [a P^4 (TY5356), an isolate M^2 (TY5348)] and a third right metacarpal (without identification number) described by Van der Made (1988) as paratypes of the species. The small endemic Sardinian suid has also been reported on the western coast of Sardinia, in the Oristano gulf, both from the weathered deposit cropping out at the top of the Mandriola Formation (*sensu* Carboni & Lecca 1995) and in the palaosoils of Capo Mannu Formation (Carboni & Lecca 1995; Capo Mannu D4, sensu Abbazzi et al. 2008) (= *Sus scrofa* ssp. dwarfed, in Ambrosetti et al. 1980). The remains from Mandriola – three isolated teeth – have been considered more primitive than the Capo Figari's holotype because of the non-reduced premolar row, and ascribed to *Sus* aff. *sondaari* (Van der Made 1999) (= *Sus* aff. *nanus* in Van der Made 1988). More recently, the specimens from Capo Mannu D4, have been ascribed to *Sus sondaari* because of their simple morphology, crown height and enamel thickness (Abbazzi et al. 2008).

The generous sample from Monte Tuttavista fissure fillings is crucial to clarify some aspects of cranial and teeth morphology of *Sus sondaari*. Furthermore, it provides additional information about the milk dentition and on morphology of the postcranial skeleton, characteristics that until present were inadequately known.

Methods and Abbreviations

The acronym "MAN" in inventory numbers refers to the collections of the "Museo Archeologico Nazionale di Nuoro". The specimens were found in strongly carbonate-cemented breccias. Red mud-matrix frequently fills up bone cavities giving rise, for instance, to the natural braincase cast as just partially observable in the skull MAN2137. Bones are mainly incomplete, although diagenetic fossilization was leading to complete mineralization.

The fossil suids from Orosei are described and compared to the following suid taxa: *Sus sondaari* from Capo Figari and Mandriola/Capo Mannu (Late Pliocene – Early Pleistocene); *Sus arvernensis*: (Early to Late Pliocene; Late Ruscinian to Early Villafranchian Land Mammal Age, LMA); *Sus strozzii* (Early Pleistocene; Middle Villafranchian to earliest Galerian LMA); *Sus scrofa* (latest Early Pleistocene to recent; Early Galerian LMA to recent) (Palombo 2006; Rook & Martínez-Navarro 2010).

All the measurements were acquired with digital caliper and are given in millimetres (accuracy at nearest 0.05). The abbreviations used in the text follow Van der Made (1996): Dentition – DAP (maximum length); DTa (transverse diameter of the first pillar pair); DTp (transverse diameter of the second pillar pair); DMD (mesio-distal diameter); DLL (linguo-labial diameter); La (Width of the labial side of the C_m); Li (width of the lingual side of the C_m); Po (width of the posterior side of C_m). Postcranial elements – DAP (maximum length); DAPn (antero-posterior diameter at the "neck" of a bone); DAPpf (antero-posterior diameter of a facet at the proximal side); DAPps (maximum diameter at the proximal side); DT (transverse diameter); DTd (width of the distal part in a bone); H (height); L (length); Ld (length of a lower part of a bone); Lint (length at the internal side); Lext (length at the external side); Lm (length in the middle of the bone); R (diameter in astragalus); Ta (thickness of enamel measured at the metaconid); Tp (thickness of enamel measured at the entoconid). Van der Made (1996) is followed for the terminology and description of dental traits, while Kratochvil (1973), Barone (1974) and Leinders (1976) are followed for limb bone descriptions.

Systematic Palaeontology

Order **Artiodactyla** Owen, 1841
Family Suidae Gray, 1821
Subfamily Suinae Gray, 1821
Tribe Suini Gray, 1821
Genus *Sus* Linnaeus, 1758

Sus sondaari Van der Made, 1999

1925 *Potamohœrus* (*Sus*) (sic). Passemard: 348
1929 *Potamochoerus* sp. I. Vaufrey: 92
1961 *Sus* n. sp. (dwarfed). Azzaroli: 22
1968 *Sus* sp. Comaschi Caria: 189
1980 "una forma nana di suide evoluto, forse *Sus scrofa*". Ambrosetti et al.: 247
1980 *Sus* sp. Gliozzi & Malatesta: 298
1988 *Sus nanus* Van der Made: 373, Plate 3, Figs 3,6
1988 *Sus* aff. *nanus* Van der Made: 375, Plate 3, Figs 7-9
1999 *Sus sondaari* Van der Made: 347
2003 *Sus* cf. *Sus sondaari* - Rook et al.: 21, Fig. 8
2004 *Sus* cf. *Sus sondaari* – Abbazzi et al.: 697, Fig. 6 G,H
2004 *Sus* sp. Abbazzi et al.: 697, Fig.13

Studied material: The suid sample from Monte Tuttavista represents at least four individuals, including adult and young individuals of both sexes.

MAN (no id.), right I^1; MAN1002, left I_2; MAN1016, right upper canine (male); MAN1017, mandibular fragment with P_3-P_4; MAN1018, left I^2; MAN1026, right scapula; MAN1027, rigth humerus; MAN1033, right astragalus; MAN1034, left astragalus; MAN1038, right astragalus; MAN1053, rigth proximal phalanx digiti IV pedis; MAN1060, right medial phalanx digiti III pedis; MAN1062, right medial phalanx digiti III pedis; MAN1074, left talus; MAN1077, right talus;

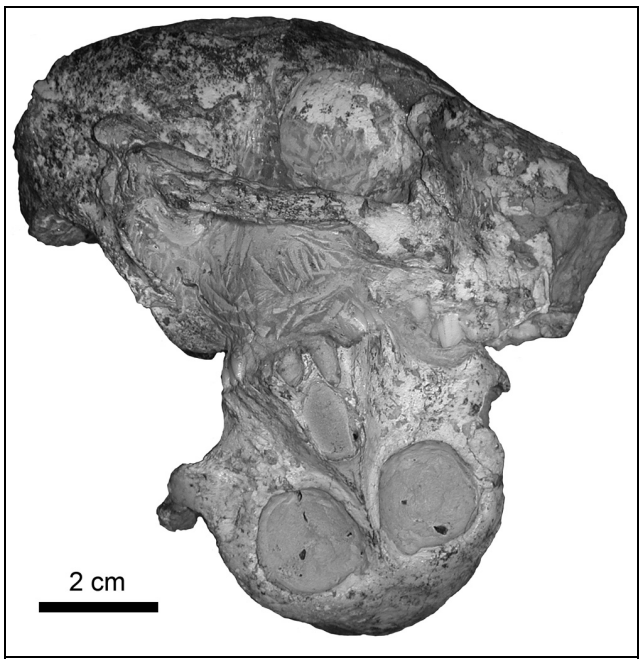

Fig. 1 - *Sus sondaari* cranium from "Cava VI-3 antica" (Monte Tuttavista, Orosei) (MAN2137) in right lateral view. Note the *Macaca majori* cranium in upside-down frontal view still united to the suid specimen.

MAN1086, right proximal phalanx digiti IV pedis; MAN1102, Left M_3; MAN1103, Left I^2; MAN1174, right hemimandible (juvenile); MAN1182, left hemimandible (male); MAN2127, right femur; MAN2129-1, Left V metacarpus; MAN2131, left?D^1; MAN2133, Right M^1; MAN2135, right D^3; MAN2137, skull (juvenile); MAN2214, left ulna.

Repository: All specimens are kept at the "Museo Archeologico Nazionale di Nuoro" (MAN), Soprintendenza per i Beni Archeologici delle province di Sassari e Nuoro (Nuoro).

Emended diagnosis: Small-sized suid with hypsodont premolars and molars, dentition characterised by simple morphology, and thick, smooth enamel. P_4 is *Sus*-type (cutting blade with protoconid and metaconid on the same longitudinal line). The lingual cingulum of I^1 is slightly pronounced or absent. The lower canine of male has a "scrofic" section. P_1 is small, sometimes absent. Deciduous teeth are narrow in the anterior part. The glenoid fossa of the scapula has an ovoidal shape and the the supraglenoid fossa of the femur is deep.

Description and comparisons

Skull, mandible and dentition: **MAN2137**- Juvenile skull (Fig. 1). This single incomplete specimen belongs to an immature individual. D^2-D^3 are preserved M^1 is in erupting. The skull is broken at nasal level, the left orbital cavity is partially covered by sediment; parietal and frontal bones are not preserved, thus the natural endocranial cast is partially visible. Considering the age of eruption of the teeth in *Sus scrofa* (according to Barone 1974) the Monte Tuttavista specimen could be at most an individual of one month of age, although Van der Made (1988) points out how this species there could be characterised by an earlier eruption when compared with the recent species of the genus *Sus*. No other skulls at this ontogenetic level are known in the *Sus arvernensis* or *Sus strozzii* fossil record, making impossible any comparison with Pliocene-Early Pleistocene European continental species of the genus. The skull has inflated parietal bones and neurocranium a little more developed than in recent continental *Sus scrofa* of about the same age, but morphology of the skull does not show remarkable differences when compared with individuals of recent young *Sus scrofa.* Conversely, milk teeth are narrower than in *Sus scrofa*, the first molar is simple with smooth and thick enamel. The diastema is short.

Measurements: D^3= DAP= 9.70, DTa= 4.70, DTp= 7.50.

MAN (no id.) - Right I^1 (Fig. 2 C, D). The tooth is curved and narrow, with a low unworn crown. The single root is broken. It differs from *Sus scrofa*, *Sus arvernensis* and *Sus strozzii* in having a slightly pronounced or absent lingual cingulum.

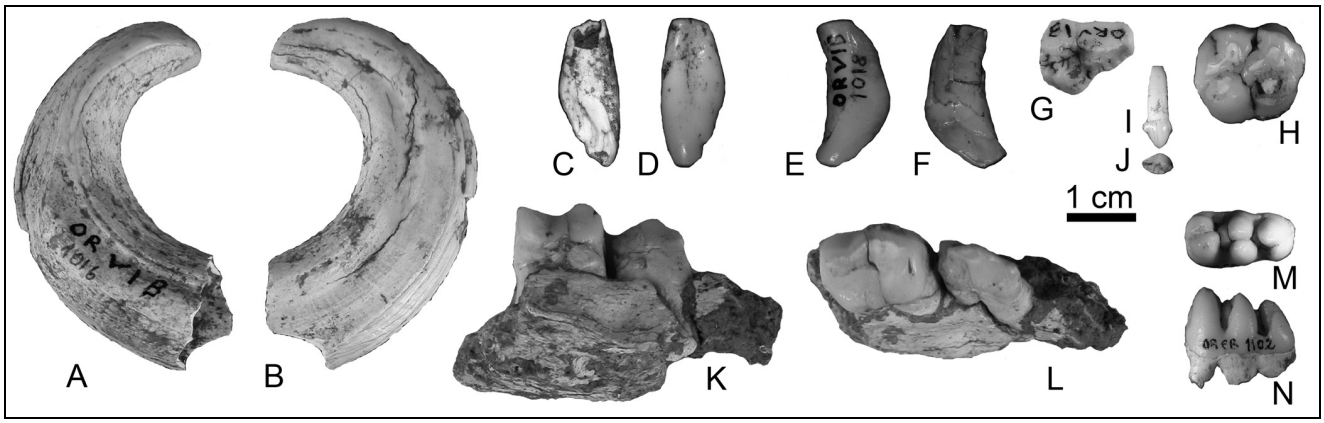

Fig. 2 - Dental specimens of *Sus sondaari* from "Cava VI-3 antica" (Monte Tuttavista, Orosei) A, B - MAN1016 C^m in lingual (A) and labial (B) views; C, D - MAN (no id.), I^1 in lingual (C) and labial (D) view; E, F - MAN1018 I^2 in lingual (E) and labial (F) views; G - MAN2135 D^3 in occlusal view; H - MAN2133 M^1 in occlusal view; I, J - MAN2131 D^1 (tentative attribution) in lingual (I) and occlusal (J) views; K, L - MAN1017 mandibular fragment with P4 and P3 in lingual (K) and occlusal (L) views; M, N - MAN1102 M_3 in occlusal (M) and labial (N) views.

Measurements: DLL= 5.40; DMD= 8.60.

MAN1018 (Fig. 2E, F); **MAN1103** - Left I^2. The tooth is curved. Compared with recent *Sus scrofa* the tooth is shorter and the root is larger. In addition, this tooth in the wild pig ends in the anterior part with a much "pointed" shape. An enamel band runs posteriorly, a lingual cingulum is slightly visible.

Measurements: MAN1018: DMD= 11.20, DLL= 5.90; MAN1103: DMD= 10.45, DLL= 4.75.

MAN1016 - Right upper male canine (Fig. 2A, B). This open rooted tooth, broken at the base, shows an oval wear surface. An enamel band runs from the base of the tooth to the tip ventrally and on labial side. Dorsally, because of wear, the dentine is exposed.

Measurements: DAP= 16.90.

MAN2133 - Right M^1 (Fig. 2H). Tooth with broken metacone. There is no evidence of a posterior cingulum.

Measurements: DAP= 16.20, DTa= 14.45, DTp= 13.60, Ta= 1.60, Tp= 1.70.

MAN2131 - Left D^1 (tentative attribution) (Fig. 2I, J). A deciduous simple single rooted tooth is tentatively attributed to left D^1. Morphology of this tooth is very simple, with a single main cusp. Deciduous upper premolars of recent *Sus scrofa* have two main cusps.

Measurements: DAP= 4.50, DTa= 2.75.

MAN2135 - Right D^3 (Fig. 2G). Triangular shaped tooth. The enamel is highly wrinkled. A anterior cingulum is clearly visible laterally to the paracone. The anterior part is narrower than in recent *Sus scrofa* specimens.

Measurements: DAP= 10.75, DTa= 5.80, DTp= 8.70.

MAN1174 - Right juvenile hemimandible. The specimen is still partially covered by sediment on labial side. DI_1 and DI_2 are not well preserved, and we can observe D_2-D_4 and a first molar (the latter broken at the root). In addition, the specimen preserves a small part of left emi-mandible with an incomplete DI_1 and D_4-D_3. The D_2 is smaller compared with D_3. The occlusal surface is oval in shape and made up by a main cusp on the medial line at the centre of the tooth. No cingula are present and enamel does not present the wrinkled surface, typical of the deciduous teeth. The shape of D_3 is very similar at the definitive tooth but simpler. Both D_4 are partially covered by sediment and in an earlier stage of eruption. They are narrow and elongated in shape, which is in a condition similar to the *Sus scrofa*. There are three pairs of cusps that decrease in width postero-anteriorly and are divided by small accessory cusps. The posterior part of the tooth ends with an accessory cusp (pentaconid) that forms a small cingulum.

Measurements: D_4: DAP= 13.80, DTp= 7.95; D_3: DAP= 7.00; D_2: DAP= 3.55, DTa= 2.80; I^1: DMD= 8.20, DLL= 6.35; I^2: DMD= 4.00, DLL= 2.30.

MAN1017 - Left mandibular fragment with P_3-P_4 (Fig. 2 K, L). The specimen is similar to MAN1182 and presents no peculiar feature in its morphology.

Measurements: P_4: DAP= 13.05, DTa= 10.25; P_3: DAP= 10.65, DTa= 5.20.

MAN1182 - Left male hemimandible (Fig. 3). It preserves C-M_3 (P_2 is missing). The hemimandible do not preserves the symphysis nor the incisors. The ramus is broken at masseteric fossa. The horizontal ramus is thick and there are five mental foramina (that increase in size from caudal to cranial position). The symphysis

Fig. 3 - *Sus sondaari* from "Cava VI-3 antica" (Monte Tuttavista, Orosei): MAN1182 left hemimandible with M_3 - P_1 in occlusal (A) and lingual (B) views.

has, inferiorly, two medial mental foramina. The C_m is a tipical "scrofic tooth" with labial side short, elongated lingual side and the posterior side in intermediate condition (cf. Stehlin 1900). There is a wear facet on the inferior side. The superior part of the tooth is broken and the tip is missing. The enamel covers only the labial and lingual sides. A concavity is present from the base to the tip of the posterior part of the labial side and in the lingual side. *Sus sondaari* and *Sus scrofa* differ from *Sus arvernensis* in having a "scrofic type" lower canine instead of a "verrucosic type" one. The P_1 is a small double rooted tooth with oval occlusal surface. The morphology is simple with a single main cusp anteriorly. The tooth has very simple morphology, which is similar to the other species of the genus *Sus*. It is remarkable that in *Sus scrofa* and *Sus strozzii* P_1 is usually present but that it may be lost during the lifetime. The P_3 is a tooth similar in morphology to P_4, but it has the protoconid aligned with the other cusps. The P_4 is a "Suini type" tooth (*sensu* Van der Made 1989) with a cutting-surface. It has a high crown with four main aligned cusps. Protoconid extends on the lingual side. The M_1 is a tooth with a rectangular occlusal surface. Between the anterior and posterior main pair of cusps there is an hypopreconulid. Talonid is simple with a single main cusp (pentaconid). A little accessory cusp is present on the labial side of hypopreconulid. The M_2 morphology is comparable to M_1 but the lower second molar is about twice bigger in size. The M_3 is a tooth with a rectangular occlusal plane and a high crown. There are four main cusps plus hypopreconulid and hypoectaconulid. The enamel is thick and there is no evidence of any grooves on the surface of the main cusps.

Measurements: M_2: DAP= 17.00, DTa= 12.85, DTp= 12.85, Ta= 1.70, Tp= 1.65; M_1: DAP= 13.35, DTa= 9.90, DTp= 9.90, Ta= 1.40, Tp= 1.50; P_4: DAP= 13.15, DTa= 9.85; P_3: DAP= 10.75, DTa= 5.95; P_2: DAP= 4.55, DTa= 2.95; C_m: DAP= 8.30, Li= 12.10, Po= 9.10, La= 8.30.

MAN1002 - Left I_2. This is an asymmetric tooth with lingual side higher than labial side. The enamel covers only the mesial and distal parts of the tooth. Dorsally, because of the wear, the dentine is exposed. The root is broken off. In recent *Sus scrofa* an endocrista runs from tip to the root of the tooth. This feature is not present in MAN1002 specimen.

MAN1102 - Left M_3 (Fig. 2 M, N). Similar to the lower third molar described for MAN1182 specimen.

Postcranial remains: **MAN1027** - Right humerus (Fig. 4I). The humerus is not well preserved. Only part of the diaphysis and a fragmentary portion of the distal epiphysis are preserved. The latter lacks both trochlea and condylus.

MAN2214 - Left ulna (Fig. 4K). Only part of the olecranon is preserved, fully comparable in morphology to the recent wild pig *Sus scrofa* but definitely smaller.

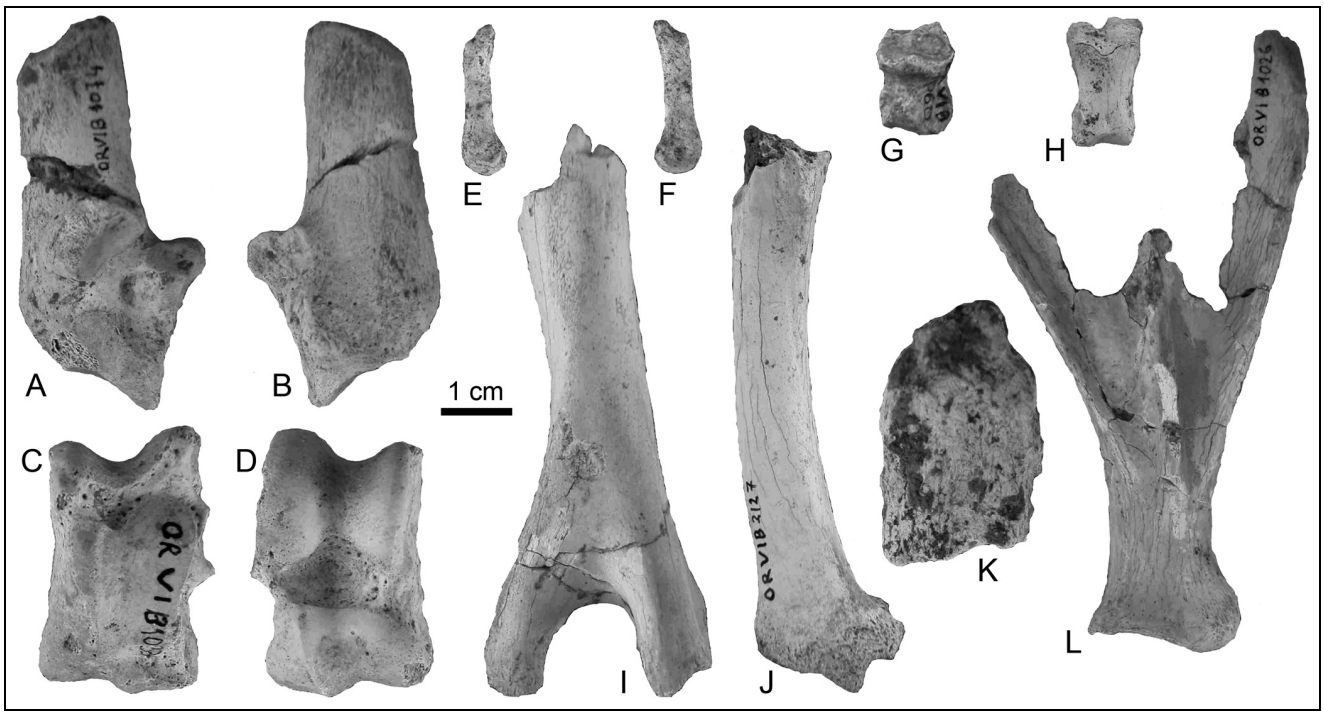

Fig. 4 - Post-cranium of *Sus sondaari* from "Cava VI-3 antica" (Monte Tuttavista, Orosei): A, B - MAN1074 left talus in medial (A) and lateral (B) views; C, D - MAN1033 right astragalus in plantar (C) and dorsal (D) views; E, F - MAN2129-1 Left V metacarpus in lateral (E) and medial (F) views; G - MAN1060 right medial phalanx digiti III pedis in dorsal view; H - MAN1053 right proximal phalanx digiti IV pedis in plantar view; I - MAN1027 right humerus in caudal view; J - MAN2127 right femur in lateral view; K - MAN2214 left ulna (olecranon); L - MAN1026 right scapula in lateral view.

Measurements: DAP= 23.45.

MAN1026 - Rigth scapula (Fig. 4L). The distal part of the scapula is well preserved in, while the proximal part is broken. The coracoid is partially preserved. In lateral view we can see that the thickness of the scapular spine increases progressively antero-posteriorly, except at the infraspinous fossa level. The Monte Tuttavista scapula differs from *Sus scrofa* in having a glenoid fossa with an oval oultline of joint surface, instead of more squared. A "neck" straight, instead of projecting more posteriorly, a scapula notch less deep.

Measurements: DAP= 27.65, DAPn= 20.50, DAPpf = 22.65, DTpf= 18.55.

MAN 2129-1 - Left V Metacarpus (Fig. 4E, F). Morphology of the distal and proximal articulation is fully comparable, both in size and proportions, with recent forms of the genus *Sus*.

Measurements: L= 33.80, DAPp= 7.30, DAPd= 9.80.

MAN2127 - Right femur (Fig. 4J). The specimen is incomplete, lacking the proximal part. In the distal part the trochlea is not fused. The bone shows a deeper supraglenoid fossa when compared with recent *Sus scrofa*.

MAN1074 (Fig. 4A, B); **MAN1077** - Calcaneum. Both specimens are quite well preserved. In MAN1074 the tuber calcis is not present and its surface of ossification is exposed (which in the *Sus Scrofa* ossifies between 24 and 30 months of age). MAN1077 is broken in the distal part. Calcaneum is fully comparable in morphology to the extant and fossil *Sus* species. Dimensionally, the Orosei specimens appear smaller than the Plio-Pleistocene European suids (*Sus arvernensis* and *Sus strozzii*) and the recent *Sus scrofa* (Fig. 5).

Measurements: MAN1074: L= 25.65, LD= 22.40, DT= 13.95; MAN1077: L= 19.65, LD= 20.11, DT= 12.85.

MAN1033 (Fig. 4C, D); **MAN1034**; **MAN1038** - Astragalus. The two well-preserved specimens (MAN1033 and MAN1034) probably belong to the same individual. Proximal, distal and plantar trochleae are preserved. Specimens are smaller (Fig. 6) but morphology is comparable with that of *Sus scrofa* and *Sus arvernensis* though the proximal and distal part of the astragalus form an angle narrower than in the extant species (about 150 degrees).

Measurements: MAN1033: DTd= 19.10, DTpf= 16.05, Lext= 31.75, Lint= 29.35, Lm= 26.60, R= 19.10; MAN1034: DTd= 19.00, DTpf= 16.05, Lext= 32.10, Lint= 29.30, Lm= 26.15, R= 19.00; MAN1038: DTd= 18.00, DTpf= 15.85, Lext= 31.05, Lint= 28.85, Lm= 25.55, R= 18.05.

MAN1053 (Fig. 4H); **MAN1086** - Right proximal phalanx digiti IV pedis. These specimens are smaller and shorter, although similar in morphology, when compared with Plio-Pleistocene European suids (*Sus arvernensis* and *Sus strozzii*) and recent *Sus scrofa*. Finally there are no remarkable differences in the inclination of the articular surface when compared with other species of *Sus*.

Measurements: MAN1053: DAPp= 11.70, DAPpf= 10.15, DTd= 12.40, DTp= 14.00, L= 26.00; MAN1086: DAPp= 12.05, DAPpf= 10.00, DAPps= 11.40, DTd= 10.75, DTp= 13.45, L= 22.65.

MAN1062; MAN1060 (Fig. 4G) - Right medial phalanx digiti III pedis.

Measurements: MAN1062: DAPp= 11.00, DAPpf= 7.35, DAPps= 11.35, DTd= 11.45, DTp= 11.50, L= 16.90; MAN1060: DAPp= 10.10, DAPpf= 6.50, DAPps= 9.75, DTd= 9.80, DTp= 10.80, L= 15.60.

Concluding Remarks

Morphology and biometry of suid remains from the fissure "Cava VI-3 antica" of Monte Tuttavista, indicate that the whole sample is attributable to endemic species *Sus sondaari* (Van der Made 1988, 1999), the smallest suid thus far known in the Mediterranean region. The new evidences about cranial and post-cranial

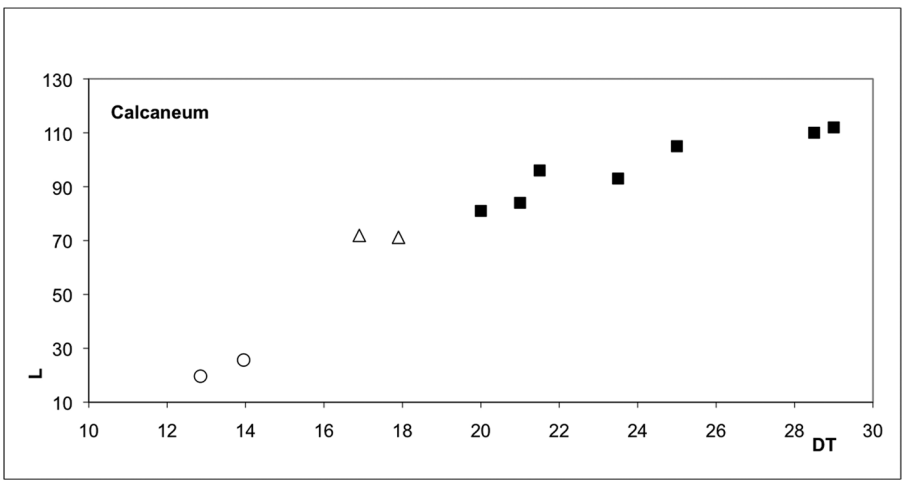

Fig. 5 - Scatter diagram plotting Calcaneum L vs. DT. Open circle: *Sus sondaari* from Orosei; open triangle: *Sus arvernensis* from Villafranca d'Asti; solid square: *Sus scrofa* from various localities (Pleistocene to recent). Data from Faure & Guerin (1983) and G.G. unpublished data.

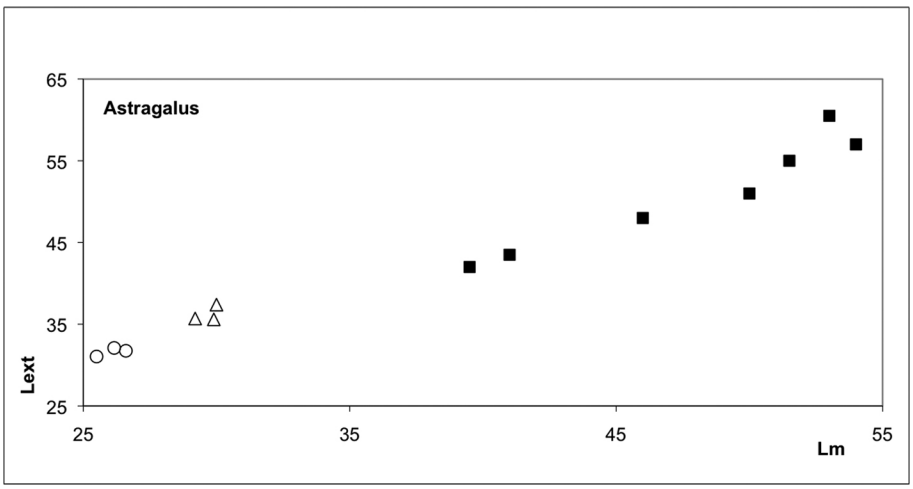

Fig. 6 - Scatter diagram plotting Astragalus Lext vs Lm. Open circle: *Sus sondaari* from Orosei; Open triangle: *Sus arvernensis* from Villafranca d'Asti; Solid square: *Sus scrofa* from various localities (Pleistocene to recent). Data from Faure & Guerin (1983) and G.G. unpublished data.

remains of this taxon described thanks to the sample from Monte Tuttavista, can be summarised as follows:

i) the lower canine has a "scrofic"-type section;

ii) the mandible is slender, like in *Sus scrofa*;

iii) there is no lingual cingulum in I^1;

iv) there is no endocrista in I_2;

v) all post-cranial remains are generally small in comparison with other taxa of the genus *Sus*;

vi) the glenoid fossa of the scapula has an oval joint surface;

vii) the supraglenoid fossa of the femur appear to be more deeper than in recent suids.

It is important to note that in Suidae the presence/absence of P_1 is an extremely variable feature. Therefore such a trait cannot be regarded neither as distinctive nor as diagnostic to identify the species of genus *Sus*. This study confirms that teeth of this species have thick enamel without grooves on the main cusps enamel surface, and are more hypsodont and with a simpler morphology than those of *S. arvernensis* and *S. scrofa* (Van der Made 1988). Such a condition, as well as the reduction of premolar root, is assumed to be a result of an adaptation to an herbivorous diet in insular environment (Van der Made 1988; 1999). Endemic herbivores usually have shorter and more robust metapodials and sometime phalanges with respect to their mainland ancestor. These traits have also been regarded as a common adaptation to insular environments, and have generally been interpreted as low gear (and energy efficient) locomotion in predator-free environments (e.g. Sondaar 1977; Houtekamer & Sondaar 1979; De Vos 1978; Köhler & Moyà Solà 2001; Van der Made 2005; Palombo & Melis 2005; Palombo et al. 2006a). Conversely, the postcranial bones of *Sus sondaari* differs in many features from the recent form of the genus *Sus,* although the suids are highly conservative in postcranial anatomy (McCrossin 1987; Van der Made 1996). Albeit it is critical to note that the shape and the size of the post cranial remains in continental Suidae could be related to the body mass variation (Alexander et al. 1977; McCrossin 1987), a possible moderate slenderness of metapodials could suggest some cursorial aptitude, as however shown by modern wild boar. As a matter of fact, the presence of cursorial features in the Sardinian suid (Van der Made 1999) is not unique. Other taxa in the faunal assemblage show a similar morpho-functional trend (apparently contrasting one of the "island rules" characteristics), such as bovids belonging to the *Nesogoral* group (Palombo et al. 2006a, b; Palombo 2009). Such "peculiar" common trait in the Sardinian artiodactyls of "*Nesogoral*" faunal complex, is likely related to selective pressure by the large running predator, the hyaenid *Chasmaporthetes melei*, present at that time on the island (Rook et al. 2004; Lyras et al. 2010).

The sample of Sardinia suid from the fissure "Cava VI-3 antica" of Monte Tuttavista (Abbazzi et al. 2004) indicates that *Sus sondaari* is the first known member of the genus *Sus* that acquired a "scrofic canine", due the fact that the canines of older species (eg. *Sus liuchengensis, Sus xiaozhu*) are unknow. This fact makes arguable the evolutionary relationships of *Sus sondaari* thus far proposed. Van der Made (1988) suggested that *Sus sondaari* was a descendant of *Sus arvernensis* and that the specific separation probably occurred at shortly after the entrance of the ancestor of *Sus sondaari* in Sardinia at the very end of the Miocene (Messinian). Indeed, although *Sus sondaari* together with endemic bovids, and archaic micromammals typified the earliest Sardinian local faunal assemblages ascribed to the latest Pliocene-Early Pleistocene "*Nesogoral*" faunal complex, it seems that after the Messinian no migratory routes from the Provencal and/or the Iberian region to Sardinia existed that might allowed forerunners of some taxa with no swimming ability (e.g. bovids and suids) to reach Sardinia (Palombo 2006, 2009). If *Sus sondaari* actually evolved from an ancestor population of *Sus arvernensis,* as most of its

morphological traits seem suggest (cf. Van der Made 1988, 1999), we have to conclude that in the insular environment the C_m of Sardinian suid evolved from "verrucosic type" to "scrofic type" and that this type of tooth occurs in both *Sus sondaari* and *Sus scrofa* as a result of omoplasy.

As an alternative we may hypothesize that *Sus sondaari* was the descendent of a still unknown suid characterised by "scrofic canine" and both *Sus sondaari* and *Sus scrofa* shared a common ancestor with scrofic lower canine. Such an hypothesis would be more parsimonious (no reversal in the character of lower C) but unsubstantiated because in the European latest Miocene/earliest Pliocene suid fossil record no "scrofic canine" have thus far been recorded. Based on thus far available data, whether the "scrofic canine" of the Sardinian insular suid represents an apomorphic or plesiomorphic features still remains an unanswered question.

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