

## Short Note



### New remains of *Macaca majori* Azzaroli, 1946 (Primates, Cercopithecidae) from Is Oreris (Fluminimaggiore, southwestern Sardinia)

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*Macaca majori* Azzaroli, 1946 is an endemic primate from the Plio-Pleistocene of Sardinia (Italy). This species is comparable in body size to the smallest extant macaque species of insular and peninsular areas of southeastern Asia. It is characterized by small cranial dimensions, relative to body size, and, with regard to facial morphology, by a shorter anteroposterior palatal length, compared to extant species (Szalay & Delson, 1979).

*Macaca majori* is considered as related to the Plio-Pleistocene European macaque, *Macaca florentina* (Cocchi, 1872), occurring in fossil sites in Italy and around Europe. Some authors (Szalay & Delson, 1979; Jablonski, 2002) doubted on the supposed insular dwarfism of this Sardinian macaque, considering this form a subspecies of the extant macaque *M. sylvanus* Linnaeus, 1758 (*Macaca sylvanus majori*). A study focusing on facial morphology in *Macaca majori* in a comparative ontogenetic context (Rook & O'Higgins, 2005) indicates that *Macaca majori* shows a facial morphology markedly different from extant *M. sylvanus*. On the basis of this evidence it is difficult to support the view that the fossils represent a subspecies of *M. sylvanus* (*M. sylvanus majori*), rather pointing to a distinct specific status for the Sardinian fossil macaque.

*M. majori* has been reported in three localities (Rook, 2009): Capo Figari (Golfo Aranci, northeastern Sardinia), Is Oreris (Fluminimaggiore, southwestern Sardinia, Fig. 1) and Monte Tuttavista (Orosei, eastern Sardinia). The first remains of this species were found in the fossiliferous breccias of Capo Figari promontory (Dehaut, 1911, 1914: materials housed in the Museo di Geologia e Paleontologia of the University of Turin; Major, 1913: materials stored in the Naturhistorisches Museum of Basel, Natural History Museum of London and Museo di Storia Naturale of Florence). The specimens from Capo Figari, discovered during several subsequent excavations, are housed in the following museums: Naturhistorisches Museum of Basel (Forsyth Major Collection; Szalay & Delson, 1979; Zanaga, 1998), Museo di Storia Naturale of the University of Florence (Azzaroli, 1946), Museo di Geologia e Paleontologia of the University of Turin (Dehaut, 1911; Pavia, 1999) and Natural History Museum of London (Rook & O'Higgins, 2005). In the late 1960's, an incomplete cranium (Fig. 2a-b) was found in the Is Oreris area (Fluminimaggiore, southwestern Sardinia; Comaschi Caria, 1970). This cranium is housed in the Museo Sardo di Geologia e Paleontologia Domenico Lovisato of the University of Cagliari under accession number MDLCA 14012. In recent times, other *M. majori* remains were discovered in several fissure fillings at the Monte Tuttavista quarries in the area of Orosei (North Sardinia; Abbazzi et al., 2004; materials housed in the Museo Nazionale Archeologico of Nuoro).

The cranium MDLCA 14012 is the only *Macaca* fossil reported to date in southwestern Sardinia, as further fieldwork in the same area had not provided additional remains of this taxon (Gliozzi et al., 1984). Now, more than forty years after the first report, a new isolated specimen of macaque was recovered from the locality of Is Oreris.

The new specimen (Fig. 2c-h) is housed in the Museo dei Palaeoambienti Sulcitani - E.A. Martel of Carbonia (Sardinia), under accession number MPC 8116. It consists of a partial mandible and associated maxillary fragment with both upper and lower teeth. The fossil was found inside debris at the foot of the disused limestone quarry of Cava Alabastro, so that its exact provenance from the various fissure fillings of the quarry is unknown. No

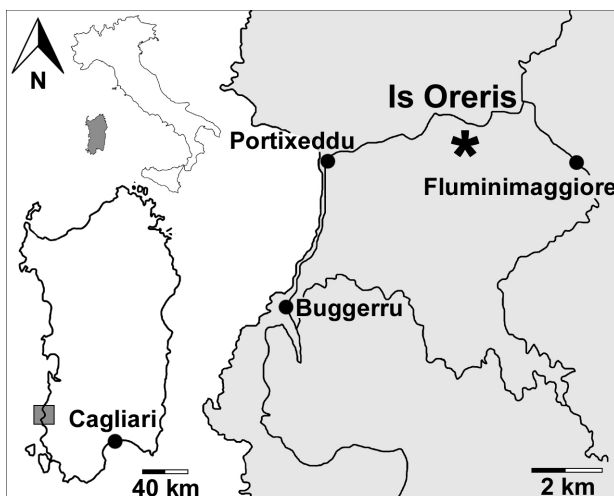


Fig. 1 - Location map of the Is Oreris area (Fluminimaggiore, southwestern Sardinia).



Fig. 2 - *Macaca majori* Azzaroli, 1946 remains from Is Orieris: (a-b) incomplete cranium MDLCA 14012 in (a) frontal and (b) left lateral views; (c-h) the new remain MPC 8116 in (c) left lateral, (d) anterior, (e) right lateral, (f) superior, (g) inferior and (h) posterior views. Scale bar corresponds to 1 cm.

additional vertebrate remains were found together with the specimens, and further field surveys aimed to discover further macaque remains were not successful.

#### *Fossil preservation*

The specimen belongs to a single individual represented by an incomplete mandible in occlusion with its fragmentary maxilla. The maxillary fragment preserves the palatine process (including the median palatine suture)

and partially the alveolar processes with right M1 and left P3-M1. The mandible, which is attached to the maxilla in occlusion, preserves the lower portion of the symphysis as well as both corpora up to the level of the second molars, including the left c-m2 and the right c-m1 series.

#### *Teeth description*

**UPPER DENTITION** - The occlusal and the lingual surfaces of the left P3 crown are covered and the middle-cervical

		Is Oleris MPC8116		Capo Figari (type locality) <i>Macaca majori</i>						Monte Tuttavista <i>Macaca majori</i>					
		L	R	n	Mean	Min	Max	StD	95% CI	n	Mean	Min	Max	StD	95% CI
M1	BL(d)	6.42		20	7.56	7.15	8.30	0.33	±0.15	2	5.89	5.75	6.03	0.20	±0.27
P/3	MD		5.53	12	5.66	4.85	7.40	0.85	±0.48	4	5.98	5.18	6.88	0.84	±0.82
P/4	MD	5.24	5.26	15	5.57	5.00	5.95	0.28	±0.14	3	5.38	4.95	5.73	0.40	±0.45
	BL	4.40	4.42	15	4.59	4.30	5.00	0.23	±0.11	3	4.06	3.97	4.17	0.10	±0.11
M/1	MD	6.96		21	7.45	6.80	8.10	0.36	±0.15	4	6.91	6.20	7.23	0.48	±0.47
M/2	MD	8.47		22	8.68	7.65	10.15	0.53	±0.22	5	8.02	7.93	8.24	0.13	±0.11
	BL(m)	6.93		21	7.02	5.95	7.95	0.44	±0.19	5	6.23	6.12	6.39	0.13	±0.12
	BL(d)	5.96		21	6.59	5.80	7.25	0.40	±0.17	5	5.72	5.41	5.90	0.21	±0.19

Tab. 1 - Dental measurements (in mm) of *Macaca majori* Azzaroli, 1946 (MPC 8116) from Is Oleris and descriptive statistics of comparative samples of the same species from Capo Figari (type locality; taken from Zanaga, 1998) and Monte Tuttavista (L.R., unpublished data). Abbreviations: MD: mesiodistal, BL: buccolingual, m: mesial lobe, d: distal lobe, L: left, R: right, CI: confidence intervals.

third of the mesio-buccal surface is broken. The right P3 is missing (albeit the apical-third imprint of the root is preserved). The left P4 crown is probably complete, but only its buccal surface is exposed and, furthermore, the root is broken at the cervix. The right P4 is lacking, but the lingual imprint of the root is present. The left M1 lacks some enamel on its basal mesiobuccal and distal crown portions, and most of the buccal roots and the apex of the lingual root are broken away. The protocone and part of the lingual surface are covered by matrix. The right M1 is merely preserved by a buccal root fragment.

**LOWER DENTITION** - The crown of the left canine is entirely missing, so that only part of the root is visible. The apex of the right canine is broken away, but the mesio-lingual groove of the tooth is still visible at the cervical third. The mesio-lingual surface of its root is exposed. The main axis of the tooth is rotated outwards, thus being obliquely aligned relative to the mesiodistal axis of the remaining postcanine teeth. The crown of the left p3 is broken over the neck, and only its cervical third is preserved. The right p3 is complete but the cervical third of its lingual surface is unexposed. The mesio-buccal face is markedly worn due to honing against the upper canine. Both p4 are complete and more columnar than the p3. Their mesio-buccal faces are inflated just above the cervix. The crown of the left m1 is probably complete but its lingual surface is unexposed. The buccal face shows the deep median groove. The cervical third of the buccal surface of the anterior root and the buccal surface of the posterior root are exposed. The m1 wear is greater than that of m2. The crown of the right m1 is incomplete, and its distobuccal root is missing whereas the mesiobuccal one is largely exposed. The crown of the left m2 is complete but a small part of the lingual surface of its mesial lobe is not visible. The apex of the mesiobuccal root and the whole distobuccal root are lacking. The right m2 is absent but there are imprints of the metaconid, entoconid and most of the lingual surface.

**REMARKS** - The analysis of the new Is Oleris macaque specimen suggests that it is the same taxon that occurs in other Sardinian sites (Capo Figari, Monte Tuttavista and Is Oleris): *Macaca majori*. Dental morphology in specimen MPC 8116 shows the macaque generalized papionin

morphology (bilophodont occlusal pattern) coupled with a peculiar crown morphology described by Szalay & Delson (1979) for *M. majori*: the crown slightly inflated just above the neck giving the tooth a “puffy” aspect. Furthermore, like previously described material, the new sample is smaller in size than extant *Macaca sylvana* and the related Plio-Pleistocene fossil forms *Macaca florentina* (see Rook, 2009).

The incomplete preservation of the canines and the low degree of sexual dimorphism displayed by this taxon (Zanaga, 1998) do not allow a reliable sex determination.

In spite of the incomplete preservation and partial exposure of the teeth, some linear measurements could be taken (following Swindler, 1976; Tab. 1). They have

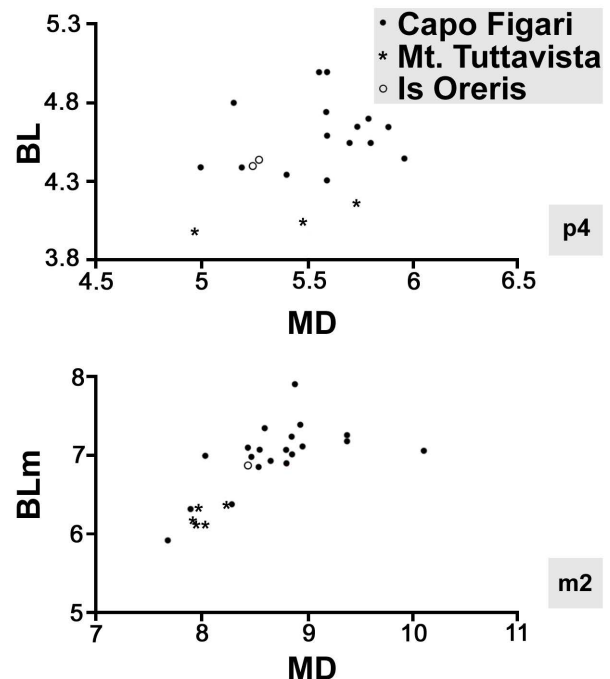


Fig. 3 - Bivariate plots of buccolingual breadth (BL for p4 and BLM for m2 [see Tab. 1]) vs. mesiodistal length (MD) (in mm) for the p4 (top) and m2 (bottom) of *Macaca majori* Azzaroli, 1946 from Is Oleris, Capo Figari (taken from Zanaga, 1998), and Monte Tuttavista quarries (L.R., unpublished data).

been compared with those of *Macaca majori* from Capo Figari (type locality) and Monte Tuttavista quarries. Descriptive statistics are summarized in Tab. 1, whereas bivariate plots of buccolingual width versus mesiodistal length are depicted for p4 and m2 in Fig. 3.

MPC 8116 falls within the range of variability of *Macaca majori* from Capo Figari that it is larger than *Macaca majori* from Monte Tuttavista.

Dental metrics support considering the specimen MPC 8116 as representing a medium size adult individual, a conclusion also confirmed by canine eruption, the degree of dental wear stage and the general dimensions.

In spite of provenance and age uncertainties, the new fossil described in this paper certainly widens our knowledge of the relatively rare Sardinian fossil macaque and may represent the starting point for new investigations in the Is Oleris area.

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