Late Eocene Lorisiform Primate from Eocliff, Sperrgebiet, Namibia

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Abstract: The Late Eocene Eocliff Limestone has yielded an impressive quantity of small mammal remains, among which is a small primate. The morphometry of the upper molar indicates that the Eocliff specimen has affinities with lorisiform primates, for which a new genus and a new species are erected. This brings to three the diversity of Primates known from the Eocene of Namibia, a possible basal anthropoid (*Notnamaia bogenfelsi*) from the Lutetian of Black Crow, an un-named anthropoid from the Bartonian of Silica North and now a lorisiform from the Bartonian of Eocliff described in this paper.

Key Words: Primates, Lorisidae, Eocene, Namibia, Sperrgebiet

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Introduction

The Eocliff Limestone is a roughly circular hill capped by a 15 metre thick deposit of partly silicified limestone. The limestone accumulated as lobes round a hardwater spring, which gradually built up a dome of travertine and tufa, all of which remains today are two outcrops, the main one at Eocliff and a subsidiary deposit at Eoridge, 1.5 km to the east. Both outcrops are richly fossiliferous but they differ in their faunal content, Eocliff yielding exclusively non-aquatic fauna, principally micromammals, whereas Eoridge yields abundant freshwater gastropods, turtles and few mammals.

The micromammalian fauna from Eocliff is dominated by rodents, chrysochlorids, potamogalids and tenrecids. The rodents reveal that the deposits are somewhat older than any of the Fayum mammal-bearing deposits, indicating correlation to the Bartonian.

Among the faunal remains from Eocliff is a single upper molar of a primate, the morphology of which suggests appurtenance to the Lorisiformes.

Geological context

The Eocliff fauna is preserved in the partially silicified Eocliff Limestone, a localised hardwater spring deposit with two main outcrops, Eocliff and Eoridge, 1.5 km apart. The deposits occur on the western margin of the Klinghardt Phonolite Cluster of Middle to Late Eocene age (Pickford *et al.* 2013). The Eocliff Limestone overlies Plaquette Limestone and Scoria Limestone members of the Ystervark Formation, a suite of carbonate-rich tephra and breccia and associated deposits derived from them soon after the eruptions.

The Eocliff Limestone accumulated as carbonate lobes around a hardwater spring, which gradually built up a dome at least 15 metres thick. Trees growing around the spring were apparently used by owls and other raptors for perching and nesting, and as a result many regurgitation pellets were deposited beneath the trees, and these were incorportated into the limestone deposits as they formed. Plant root traces are abundant, indicating the presence of an abundance of vegetation in the vicinity of the spring. The limestone was partly silicified even as it formed, but the unsilicified parts readily dissolve in acetic acid and formic acid. There are also many mat-like silicified layers representing algal mats which grew in pools in the surface of the carbonate mound. There are a few sand grains in the limestone, most of the clastic material being dust that was blown up

onto the mound as it formed and trapped by the vegetation and the water. Thus, when dissolved in acid, the resulting residue comprises about 99.9% skeletal remains, with a few sand grains and sub-millimetric pieces of quartzite, mica schist and granite.

Associated fauna and palaeoenvironment

The fauna associated with the Eocliff primate comprises at least eight taxa of rodents, three or four macroscelidids, one chrysochlorid, one potamogalid and three tenrecids. There are also bird remains (galliform, psittacid (Mourer-Chauviré *et al.* 2014)) and rare herpetofauna, but so far no amphibians, suggesting that the spring may have been somewhat salty or alkaline. Several of the rodents are semi-hypsodont, and two of the macroscelidids are hypsodont, indicating the presence of open country surrounding the spring (Pickford *et al.* 2014).

Material and Methods

The fossil primate tooth was extracted from partly silicified limestone of the Eocliff Formation using 7% formic acid buffered with calcium triphosphate. After extraction, the fossil was consolidated using a weak solution of glyptol in acetone.

Images were captured using a Sony 18.2 megapixel camera positioned over the eye pieces of a binocular microscope. By this means stereo images were obtained, which were enhanced using Photoshop Elements3.

A scale was added manually in order to avoid parallax and frustrum effects which can distort the relationship between the object and the scale if done photographically.

Nomenclature

Dental nomenclature follows a classic tribosphenic system (Klietmann *et al.* 2014) (Fig. 1).

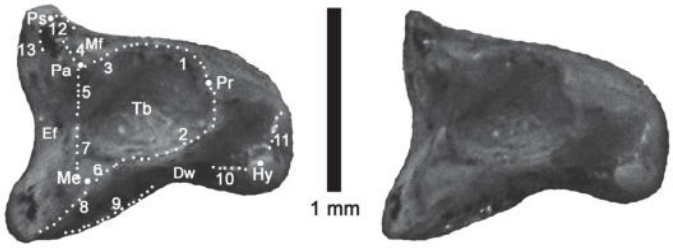

Figure 1. Nomenclature of right upper molar of *Namaloris rupestris* (stereo view) Dw – Distal waist, Ef – Ectoflexus, Hy – hypocone, Pa – paracone, Pr – protocone, Ps – parastyle, Me – metacone, Mf – mesial fovea, Tb – trigon basin, 1 – preprotocrista, 2 – postprotocrista, 3 – endoparacrista, 4 – preparacrista, 5 – postparacrista, 6 – endometacrista, 7 – premetacrista, 8 – postmetacrista, 9 – distal cingulum, 10 – posthypocrista, 11 – prehypocrista, 12 – preparastyle crista, 13 – postparastyle crista (scale: 1 mm).

Systematic Description

Order Primates Linnaeus, 1758

Suborder Strepsirrhini Geoffroy Saint Hillaire, 1812

Infraorder Lorisiformes Gregory, 1915

Superfamily Lorisoidea Gray, 1821

Family Lorisidae Gray, 1821

Genus *Namaloris* nov.

Etymology.- *Namaloris* is a combination of the word *Nama*, meaning desert or wasteland, and *loris*, the genus name of the slow loris (*Loris tardigradus*) on account of the basic similarities between the structures of the upper molars of the two forms.

Type species *Namaloris rupestris* nov.

Diagnosis.- Small lemuriform in which the upper molar is appreciably broader than it is long, has a capacious trigon basin with tall sharp rims, a low hypocone positioned more

lingually than the apex of the protocone, a parastyle that projects slightly mesially, a small, shallow, mesial fovea, a continuous, sharp distal cingulum, weak ectoflexus, marked distal waist but no mesial waist and no protoconule.

Differential diagnosis.- *Namaloris rupestris* differs from *Saharagalago misrensis* Seiffert, Simons & Attia, 2003, by the less detached hypocone and the absense of a protoconule. It differs from *Karanisia clarki* Seiffert, Simons & Attia, 2003, in a number of features (narrower distal cingulum, prehypocrista not extending right around the protocone, less square occlusal outline of the crown, lack of a crista running lingually from the protocone). It differs from *Omanodon minor* Gheerbrant *et al.,* 1993, by its less square occlusal outline and by the higher mesial sill of its trigon basin.

Species *Namaloris rupestris* nov.

Etymology.- The Latin word *rupestris* was selected to reflect the cliff-like geomorphology of the deposits from which the fossil tooth was recovered.

Type locality and age.- Eocliff Limestone site EC 9, Bartonian.

Holotype.- GSN Nr 1, unworn right upper molar.

Diagnosis.- As for the genus.

Description

GSN Nr I is a rootless, unworn, right upper molar, measuring 1.6 mm mesio-distally by 2.1 mm bucco-lingually (Fig. 2). The crown comprises three large pointed cusps (protocone, paracone and metacone) accompanied by low hypocone and parastyle. There is no sign of a protoconule.

Crista running from the apices of the trigon enclose a deep and capacious trigon basin which has three v-shaped sills, one mesially where the preprotocrista joins the endoparacrista, one distally where the postprotocrista joins the endometacrista, and a third buccally where the postparacrista joins the premetacrista. These sills are well above the floor of the trigon basin. The hypocone is separated from the protocone by a shallow valley and it is positioned more lingually than the apex of the protocone. There is a subtle fold along the mesial margin of the protocone representing a weakly expressed cingulum. Crests run from the base of the hypocone, one mesially wrapping around the distal half of the protocone, the other buccally which terminates at the inflection in the posterior margin of the crown. The protocone has two sharp crests (preprotocrista, postprotocrista) which lead buccally to wall off the lingual half of the trigon basin. The paracone has three crista, one leading lingually to wall off the anterior side of the trigon basin, one leading mesially towards the base of the parastyle, and a third directed distally where it joins the premetacrista. The metacone has three crests, one leading lingually to wall off the rear of the trigon basin, one mesially towards the paracone, the third disto-buccally. The parastyle is distinct and has two low crests which run lingually and distally, the lingual one walling off a small, shallow fovea (mesial fovea). There is in addition a low but sharp distal cingulum running from the disto-buccal corner of the crown towards the distal waist of the tooth where it merges into the posthypocrista. The buccal margin of the tooth is slightly invaginated to produce an ectoflexus, the distal margin also has a waist but the mesial margin is not indented although the parastyle projects slightly mesially.

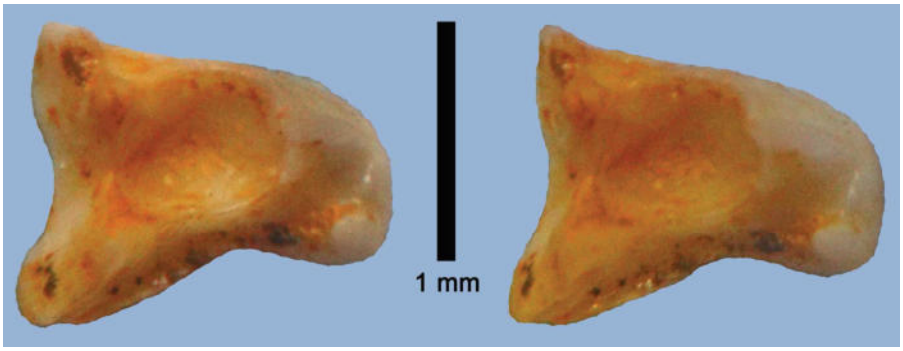

Figure 2. Holotype specimen of *Namaloris rupestris* (GSN Nr 1) from Eocliff, EC 9, Sperrgebiet, Namibia. Stereo occlusal view (scale: 1 mm).

Discussion

The previous description of primates from the Eocene of Namibia concerned two specimens attributed to basal anthropoids by Pickford *et al.* (2008) a maxilla containing M2/ and M3/ from Black Crow, and a lower p/4 from Silica North attributed to *Namaia bogenfelsi*. The genus name *Namaia* turned out to be a synonym of *Namaia*, an ostracod genus, so Pickford & Uhen (2013) renamed the Namibian primate *Notnamaia* (for *Notos* – south (and for not) attached to *Namaia*). The upper molars of this taxon are relatively bunodont, with rounded edges to the crista, unlike the sharp crests that occur in *Namaloris*. Furthermore, *Notnamaia bogenfelsi* possesses a low cusplet (metaconule) between the protocone and the metacone, weak hypocone crista (or cingula) and a sharp mesial cingulum, and its occlusal outline is more square than that of *Namaloris rupestris*. The Black Crow specimen is Lutetian, but the primate premolar from Silica North is slightly younger than originally thought, being the same age as the Eocliff specimen on the basis of the similarity in rodents (*Silicamys* and *Prepomonomys* in particular) in the two faunas.

Godinot (2014) considered that the maxilla from Black Crow had overall similarities to European anchomomyine adapiforms, but with some significant differences from this group. He agreed that the lower premolar from Silica North might have simian affinities and would therefore represent a second taxon. Thus Lutetian deposits of Namibia have yielded a primate of enigmatic affinities while the younger Bartonian layers have yielded a small anthropoid and a lorisiform, making a total of three primates in the Eocene of the country.

Namaloris differs from *Saharagalago* Seiffert *et al.* (2003) by the less detached hypocone and the absense of a protoconule. *Namaloris* differs from *Karanisia* Seiffert *et al.* (2003) in a number of features, notably its narrower distal cingulum, the prehypocrista (or cingulum) not extending right around the protocone, the less square occlusal outline of the crown, and the lack of a crista running lingually from the protocone. *Namaloris* differs from *Omanodon* Gheerbrant *et al.* (1993), by its less square occlusal outline and by the higher mesial sill of its trigon basin.

Namaloris differs from the primitive Late Eocene Tunisian anthropoid *Amamria* Marivaux *et al.* (2014) by its larger hypocone, the taller mesial sill of the trigon basin, the lack of cingulum on the lingual and mesial sides of the protocone and the lack of a mesostyle. It differs from Eocene *Djebelemur* Hartenberger & Marandat (1992) by much the same characters (Marandat *et al.* 2013). *Namaloris* differs from the roughly coeval, primitive anthropoid from Peru, *Perupithecus* Bond *et al.* (2015) by the taller mesial sill of its trigon basin, by the less continuous mesial and lingual cingulum, the lack of a lingually directed protocone crista and its much weaker mesial cingulum.

It is concluded that there are three taxa of Primates represented in the Eocene of Namibia, and that none of them have been recorded in the North African sites in Morocco, Tunisia, Libya and Egypt, nor in the Omani localities (Godinot, 2010). Nor are they known in the Eurasian or North American fossil records which are reasonably well endowed in fossil primate remains. This suggests that the south-western part of the

African continent enjoyed endemic to semi-endemic evolution during the Eocene. However, the Namibian fossil record of Palaeogene Primates is restricted to three specimens, and it is thus difficult to propose robust scenarios concerning their affinities to Primates from other parts of the world, including South America.

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