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News and Views

New primate remains from Mwenirondo, Chiwondo Beds in northern Malawi

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Introduction

The Hominid Corridor Research Project (HCRP) undertook its long-term paleontological survey of Plio-Pleistocene deposits of the Malawi Rift, the Chiwondo Beds, in 1983 (Bromage et al., 1985, 1995a). The project has recovered a vertebrate assemblage important for its geographic location between the well-known hominid-bearing sites of eastern and southern Africa. Primate remains are rare among the fauna of the Chiwondo Beds (<1% of total mammalian collection). To date, these include two hominins: a maxillary fragment of *Paranthropus boisei* from Malema locality RC 11, (Kullmer et al., 1999), and a mandible of *Homo rudolfensis* from Uraha locality U 18 (Schrenk et al., 1993; Bromage et al., 1995a), as well as 13 cercopithecoid primate cranio-dental remains, including three jaw fragments (Bromage and Schrenk, 1987; Frost and Kullmer, 2008). Here, we report on three new primate dentognathic specimens (one hominin and two cercopithecine) from the Mwenirondo localities in the vicinity of Malema.

Geology and biostratigraphy

The sedimentology and geology of the Northern Malawi Rift are described by Ring and Betzler (1995) and Betzler and Ring (1995). The Chiwondo Beds are separated into Units 1–4 (numbered stratigraphically from lowest to highest), which refer to lake-beds and fluviatile deposits. Unit 5 is distinguished as the Chitimwe Beds and consists of alluvial fan deposits.

The silty fine to middle sand deposits at Malema locality RC 11 where the *P. boisei* maxilla was found (Kullmer et al., 1999) have been previously described as part of a delta plain belonging to stratigraphic Unit 3A (Sandrock et al., 1999, 2007). The Mwenirondo area, including localities MR 10 and MR 11 where the new specimens come from, is located immediately to the north of Malema. Localities MR 10 and MR 11 are part of a tributary system further inland, and consist of fluviatile middle to coarse sands also belonging to Unit 3A. Further west of MR 10 and MR 11, the Mwenirondo sediments change to lake deposits with bioclastic beaches of high-energy ramp associations characteristic of Unit 2 (Betzler and Ring, 1995). No mammalian fossils have been recovered from Unit 2 at Mwenirondo.

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The Plio-Pleistocene age of the Chiwondo Beds relies on faunal correlation with radiometrically dated biostratigraphic units in eastern Africa (Bromage et al., 1995a; Kullmer, 2008). In general, the faunal assemblage is taphonomically biased toward the representation of large terrestrial mammals, crocodiles and fish (Sandrock et al., 1999). Unit 3A is dated to between 3.75 and 1.8 Ma (Bromage et al., 1995a; Sandrock et al., 2007). Analysis of fossil suids differentiates an older biozone 3A-1 (3.75–2.7 Ma) with *Notochoerus euilus*, from a younger biozone 3A-2 (2.7–1.8 Ma) yielding *Notochoerus scotti* and *Metridiochoerus andrewsi* I/II (Kullmer, 2008).

The Mwenirondo large mammal fauna consists of bovids, equids, suids, rhinos, giraffids, hippopotamids, cercopithecids (see Table 1, Sandrock et al., 2007) and a newly discovered hominid. A refined attribution of the Mwenirondo MR 10 and MR 11 fauna into biozone 3A-1 or 3A-2 is not possible at the present stage. Among the primates described so far, *Parapapio* sp. is known from the Mwenirondo area, whereas *Theropithecus* sp. and *Parapapio* sp. are known from adjacent Malema localities (Bromage and Schrenk, 1987; Sandrock et al., 2007; Frost and Kullmer, 2008).

Description

The new primate material consists of two isolated dental fragments and a partial mandible with teeth (Figs. 1–4) collected through surface survey at Mwenirondo localities in 2009 and 2010.

Specimen HCRP-MR-1106 from locality MR 10 represents a strongly eroded and rounded fragment of a heavily and flatly worn hominin lower molar that is likely from the right side (Fig. 1) with a maximum preserved buccolingual width of 13.06 mm and maximum preserved mesio-distal length of 9.91 mm. The dental fragment comprises the anterior half of the crown and both branches of the mesial root. Dentine is exposed mesially on the occlusal surface due to *postmortem* enamel damage, although most of the visible dentine on the occlusal surface is from a large wear basin; this fact does not allow for any cusp delineation on the surface. There is a short dendritic remnant of a fissure traceable in the buccolingual direction along the enamel surface on the lingual occlusal aspect (Fig. 1e). The transverse break through the crown reveals a low pulp chamber surrounded by thick dentine towards the occlusal surface. Lateral enamel thickness along the middle third of the fracture through the lingual cusp (Fig. 1a) is on average 1.8 mm. While this measurement may not present the original thickness due to the diagenetic effects of transport and minor acid dissolution, the typical fading of Hunter-Schreger bands approximately 0.4 mm from the outer surface enamel suggests that the enamel thickness is reasonably intact. The plate-like root morphology and flatly worn and relatively thick enamel are typically hominin (Fig. 1). The transverse µCT cross-section halfway between the root bifurcation and the apex of HCRP-MR-1106 (Fig. 2) shows that the root has two near-circular lingual and buccal columns which are connected by a mesio-distally compressed bar (Fig. 3). Comparison of µCT radiographic cross-sections with other fossil hominins from eastern Africa, modern humans, great apes and cercopithecoids shows that the so-called dumbbell-shaped root outline (Ward et al., 1982) is characteristic for the M_1s and M_2s of early hominins such as *P. boisei* (KNM-ER-729) and *Homo habilis/rudolfensis* (HCRP-UR-501, KNM-ER-1802, KNM-ER-1805) (Figs. 2 and 3). Furthermore, dumbbell-shaped mandibular molar roots have been described in *P. robustus* from Swartkrans (Robinson, 1956) and *A. afarensis* from Hadar (Ward et al., 1982). Even though there is a considerable overlap in mesio-distal constriction of the mesial molar root in the comparative sample, it seems less

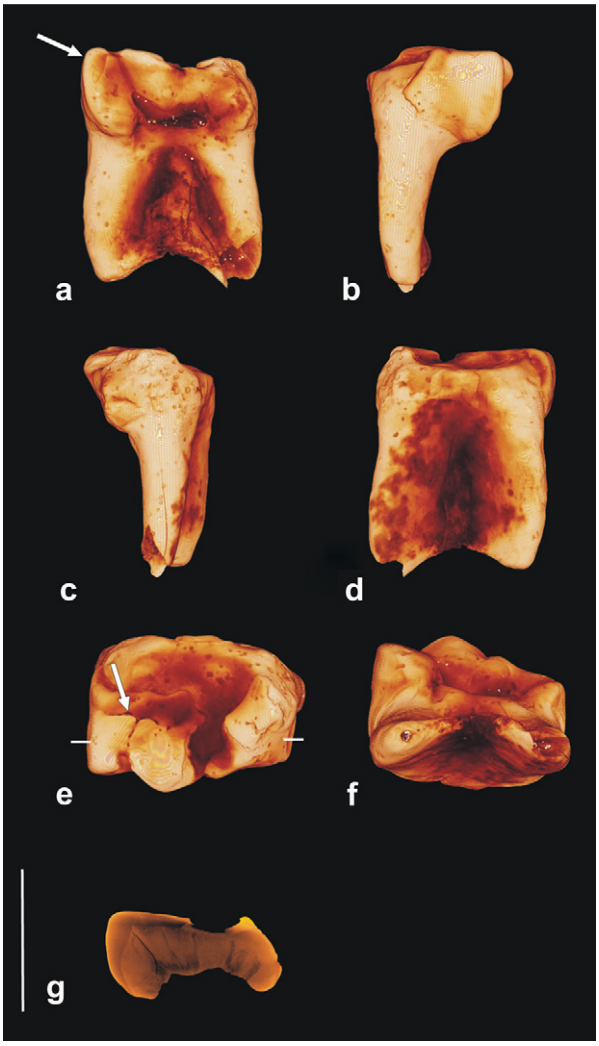

Figure 1. Virtual 3D reconstruction of the lower right molar fragment HCRP-MR-1106, *H. rudolfensis*, derived from µCT-data using the volume texture rendering "Voltex" in AMIRA® 5.3 (Visage Imaging GmbH), (a) distal view, arrow points to the location where enamel thickness and micro-anatomical measures were taken; (b) lingual view; (c) buccal view; (d) mesial view, (e) occlusal view (mesial above, lingual left), arrow points to fissure remnant; (f) apical view; (g) transverse crown cross-section taken as indicated in (e) by white lines; scale bar = 1 cm.

Table 1
Comparative enamel micro-anatomical measures of HCRP-MR-1106, HCRP-UR-501, *H. rudolfensis* and other East African hominids.

Trait	*HCRP-UR-501, RM_2	*H. rudolfensis	HCRP-MR-1106	**EAF ROB	**EAF HOM
Lateral enamel thickness (LT) (mm)	2.33	1.6–1.8	1.8	2.2	1.9
I degrees (°)	79		71	52	62
D degrees (°)	32		***11 (cervical third)	23	31
HSBW (µm) (middle third of lateral enamel)	56		61	52.8	62
HSBC (middle third of lateral enamel)	***4 (cuspal third)	1–2	1–2	1–2	4–5

*Bromage et al., 1995b; **Beynon and Wood, 1986; ***Measures for the other specimens in this trait category are taken from the middle third of lateral enamel and caution must be exercised in comparisons to other values in the row.