**Supplemental Information**

**Paleoenvironmental reconstructions of catarrhine-bearing sites**

**1 Moroto (Kogole Beds), 20.6 Ma, Uganda**

The site of Moroto, some 13km from the Moroto volcano, is extremely important because at 20.6Ma (Gebo et al., 1997) it is one of the oldest catarrhine yielding fossil sites of the early Miocene in Africa (see Pickford et al., 2003 for a younger age assesment). In addition, the mammalian fauna include certain unique species (Pickford and Mein, 2006), of which the non-cercopithecoid catarrhine *Morotopithecus bishopi* is regarded by some as the leading candidate for the oldest hominoid(Gebo et al., 1997; Maclatchy, 2004; MaClatchy et al., 2000). It is thus unfortunate that detailed environmental assessments of Moroto are few (Kingston et al. 2009; 2011). The fossils were deposited in fluvial deposits and the presence of aquatic fauna demonstrates permanent water. Some of the fauna indicate that some closed-canopy woodland or forest was present, but some open areas likely existed as well (Pickford and Mein, 2006).

**2 Tinderet (Songhor, Koru), 20–19 Ma, Western Kenya**

The numerous Koru (Tinderet) localities are located on the slope of the ancient Tinderet volcano (Cote, 2008; Pickford and Andrews, 1981). Songhor is a single large site that, while also part of the Tinderet set of localities, differs slightly from the rest in its catarrhine assemblage (Cote, 2008; Harrison, 2010). The newly discovered nearby locality of Lower Kapurthay is possibly very similar to Songhor (Cote et al., 2014). In general, both Songhor and Koru are forests and despite some differences in the catarrhine and artiodactyls at Songhor compared to the Koru localities, any differences among them are very subtle and hard to recognize by comparing the vertebrate fauna (Cote, 2008). Several paleonvironmental reconstructions of Songhor argue that it was perhaps similar to a modern tropical forest (Andrews et al., 1997) or a modern montane or submontane forest (Pickford, 1995). Microwear analyses of tragulid teeth suggest some open areas at Songhor (Ungar et al., 2012). Hill et al.’s (2013) summary of faunal analyses indicates low forest habitats at the Tinderet localities. However, based on primate fossil distributions, these authors argued that Koru was a wetter forest than Songhor. Fossil land snails at these localities indicate a wet rainforest with a mean annual rainfall of 1270–1780 mm at Koru, but a drier forest with a mean annual rainfall up to 1020 mm at Songhor (Pickford, 1983). Fossil-bearing strata at Songhor are thought to have accumulated under fluvial or lacustrine conditions and, during subaerial exposure, through volcanic and/or volcaniclastic sedimentation on floodplains or exposed mudflats (Pickford and Andrews, 1981; Hill et al., 2013).

**3 Napak, 20–19 Ma, Uganda**

The Napak localities are located on modern day Akisim, the remains of the slopes of the ancient Napak volcano (Cote, 2008). Faunal analyses highlight Napak's similarity to the Tinderet sequence sites, suggesting a similar age (Pickford et al., 1986; Cote, 2008; Grossman et al., 2014). Analyses of gastropods indicate that forest conditions at Napak perhaps varied between dry forest and rainforest (Pickford, 2004), making it difficult to distinguish from either Tinderet or Koru (Cote, 2008). Two newly discovered localities at Napak indicate variable paleoenvironments (Cote et al., 2014b): one represents a montane forest, whereas the other typifies a more open habitat. Pickford et al. (2010) suggest that the localities at Napak are sampling a mosaic of woodland and forest on the slopes of the volcano, but Cote’s detailed analyses do not support more open habitats at Napak (Cote, 2008). Depositional environments at Napak were fluvial for the older sites and subaerial for the younger sites. Whether the lower and upper sites differ much in age and represent different members is debated (see: Cote, 2008; Pickford et al., 2010).

**4 Kisingiri (Rusinga Island: Hiwegi Formation, and Karungu: Ngira Formation) >18 Ma, Western Kenya**

The Miocene deposits at Rusinga Island include numerous localities, with the majority of the fossils, including most of the catarrhines, coming from localities within the Hiwegi Formation (Drake et al., 1988; Werdelin, 2010). Early analyses of the fossil flora of Rusinga indicated tropical rainforest (Chesters, 1957), but other researchers reconstructed more open habitats from the floral remains (e.g., Kortlandt, 1983). Analyses that focused primarily on the fauna reconstructed forested conditions (Andrews, 1981, 1992; Andrews et al., 1979) but these combined fossils from many localities are probably time-averaged localities from slightly different ages (Lukens et al., 2017). Interpretations of the environment(s) of individual localities of the Hiwegi Formation range from a forest at R3 (Michel et al., 2014) to woodland conditions indicated by the fossil flora at locality R117 (Collinson et al., 2009). What is clear is that while the Rusinga localities are all from some kind of woodland, they are sampling diverse depositional environments, including riparian conditions and floodplains (Andrews et al., 1997), and varying climatic conditions that led to a mosaic of open woodland to forest habitats.

The fossil fauna at the Ngira locality in Karungu does not differ from the Hiwegi Formation in the types of species found, but perhaps differs in the relative abundance of species, particularly the catarrhine primates (Lukens et al., 2017). Recent analyses of the soil structure and composition of the Ngira locality, particularly NG15, indicate that this was a relatively open riparian woodland to grassy woodland, with at least some C4 plants, growing in a seasonally dry, warm climate (Driese et al., 2016; Lukens et al., 2017), indicating that Ngira was probably more open than the Hiwegi Formation localities at Rusinga.

**5 Buluk and Nabwal Hill (Bakate Formation), >17.2 Ma, West Lake Chew Bahir, Kenya**

The depositional setting of Buluk began as lacustrine, but was replaced by fluvial and volcanic sedimentation higher in the section as the lake regressed (Harris and Watkins, 1974). The fossils at Buluk are retrieved from channel deposits of the Buluk Member of the Bakate Formation, east of Lake Turkana. The Buluk Member is composed of claystones with coarse sandstone and conglomerate channel fill. The fauna from Buluk requires further analysis and its current sample lacks small mammals (Geraads and Miller, 2013; Grossman, 2008). However, there are certain differences in the faunal composition of Buluk compared to contemporaneous sites in West Turkana such as Kalodirr and Moruorot (Leakey et al., 2011), even though all the non-cercopithecoid catarrhines found at Buluk are found at Kalodirr and Moruorot. Whether these differences in the fauna were caused by environmental, geographical, or some other factor cannot be ascertained at this time.

Nabwal and Irilie are catarrhine-bearing sites located about 20km north of Buluk (Fig. 1). The vertebrate fossils are found within fluvial deposits (McDougall and Watkins, 2005) and are very similar to those found at Buluk (McDougall and Watkins, 2005), although the cercopithecoids, at least, are distinct species (Miller et al., 2009). Fejej, another nearby site within the Bakate Formation, has a small faunal assemblage that includes a non-cercopithecoid catarrhine ulna whose morphology is consistent with arboreal climbing (Richmond et al., 1998), suggesting the presence of trees. Fossil wood from a close-by locality at Fejej indicates a dense tropical woodland of deciduous forest lacking a fully closed canopy (Wheeler et al., 2007). Currently, this provides the best hypothesis about the environment at Buluk.

**6 Kalodirr and Moruorot (Lothidok Formation), 17.7-16.6Ma, West Turkana**

The two sites, Kalodirr and Moruorot, represent a single region and their fauna are similar (Grossman, 2008; Grossman et al., 2014; Leakey et al., 2011). The sites share non-cercopithecoid catarrhines with Buluk, but lack any cercopithecoid remains. Unlike the primates, Kalodirr and Moruorot differ from Buluk in many of their large mammals, especially the suids and rhinos (Leakey et al., 2011). Kalodirr and Moruorot include some taxa not known from other early Miocene sites (Adrian et al., 2018; Grossman et al., 2013; Grossman and Holroyd, 2009). Based on their fauna, they are reconstructed as wooded rather than forested habitats with meandering streams and some possible swampland (Grossman, 2008; Grossman and Holroyd, 2009; Leakey et al., 2011).

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