



News & Views

Lemudong'o: a new 6 Ma paleontological site near Narok, Kenya Rift Valley

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Introduction

Lemudong'o is located on the western margin of the southern Rift Valley approximately 100 km west of Nairobi (Fig. 1), an area deeply incised by three major permanent river systems. Stratified lavas, air-fall and water-laid tuffs, alluvial, and fluviolacustrine sediments, and paleosols of Late Miocene to Late Pleistocene age crop out over a ~25 × 50 km area. Wright (1967) reconstructed three paleolakes and shoreline facies, assumed to be Plio-Pleistocene in age, in the vicinity of an isolated Basement Complex inselberg. Radiometric dating demonstrates the paleolake deposits exposed at Lemudong'o are Late Miocene in age.

During archaeological surveys and excavations in this region in 1995–96 (Kyule et al., 1997) and 1999–2002 (Ambrose et al., 2000; 2002; Hlusko et al., 2002), 55 new archaeological sites (Acheulean,

Middle Stone Age, Later Stone Age, Neolithic and Iron Age), and several paleontological occurrences were discovered. Here we describe the preliminary results from research at the Late Miocene fossil site of Lemudong'o. The most productive Late Miocene paleontological site in the area is exposed in Lemudong'o Gorge, GvJh15, GvJh32 (Figs. 2 and 3). Lithologic units include paludal (marsh) and lake margin claystones, lacustrine diatomaceous silts and claystones, and coarser alluvial deposits with interstratified tuffs. Similar exposures occur within tens of kilometers, though their correlation to the Lemudong'o strata is not yet confirmed, and fossils are scarce and taxonomically non-diagnostic.

Lemudong'o Gorge is a fault-controlled, deeply incised gully system bounded on the east by the Enkoria fault (Wright, 1967). Fossiliferous sediments are exposed at two localities approximately 500 m apart. Locality 1 (Lemudong'o 1, GvJh15, coordinates: 1°18.19S, 35°58.74E, approximate elevation 1600–1620 m) was discovered in 1994, and is located in the upper reaches of the main gully. It contains the higher levels of the depositional sequence, and the main fossiliferous

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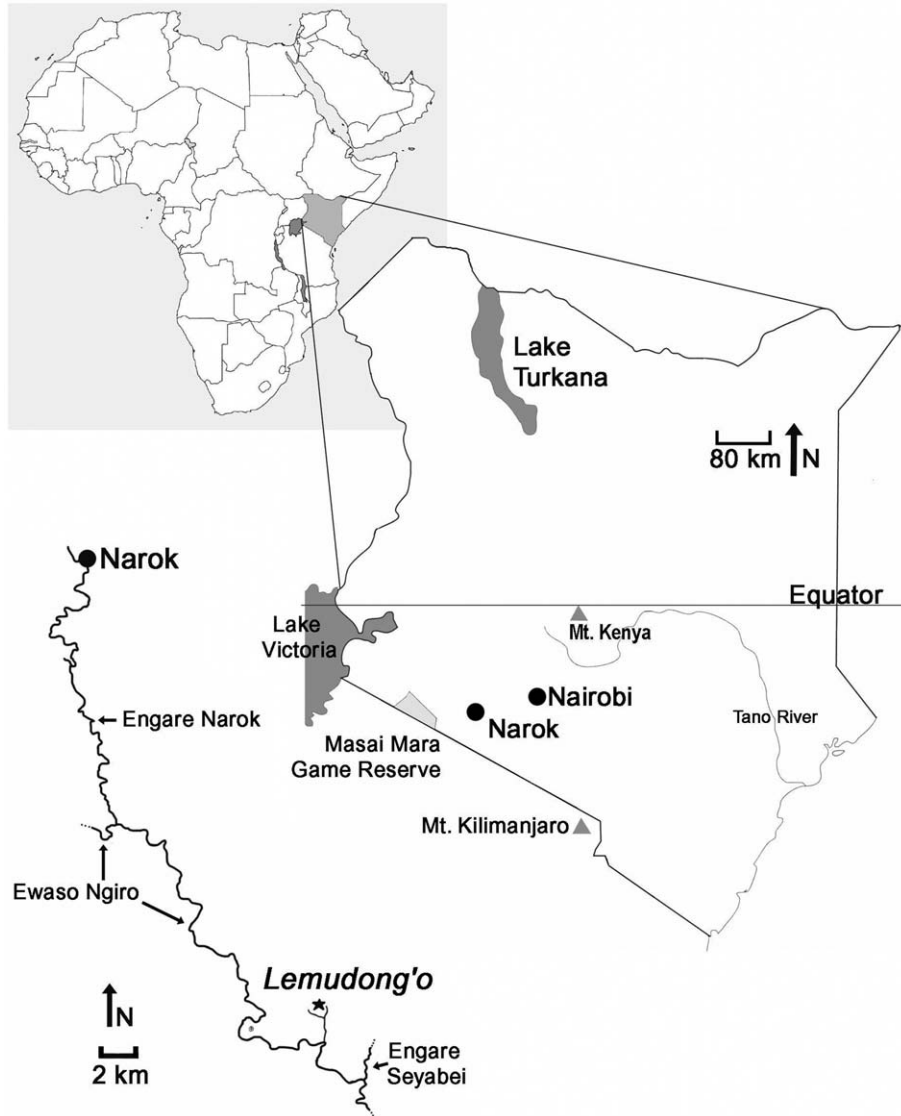


Fig. 1. Map showing the geographic location of Lemudong'o.

horizons. Locality 2 (Lemudong'o 2, GvJh32, coordinates: $1^{\circ}17.98\text{S}$, $35^{\circ}59.04\text{E}$) was discovered in 1999 and includes lower strata and a poorly-exposed horizon with sparse, generally non-diagnostic fossil material. No significant unconformities occur in the main sedimentary sequence.

Stratigraphy

The stratigraphic sequence at Lemudong'o 1 is shown in Fig. 4. Sedimentary depositional environments begin with brown paludal claystones, overlain by yellow diatomaceous silts, marking a change from fluctuating lake margin to lacustrine



Fig. 2. Aerial photograph of Lemudong'o Gorge. Locality 1 is indicated with the large white arrow. Locality 2 is south of Locality 1 after the two gullies converge on the west side of the stream, marked with the smaller arrow. The eastern bend in the Ewaso Ngiro is easily matched with the line drawing in Fig. 1 for determining scale.

environments. This silt thickens rapidly in the northern exposures, reflecting considerable lateral variation in depositional environments. Lake regression is marked by poorly-sorted greenish brown clayey sands, coarse gritty sands and thin lenses of fine gravels. These coarse sediments contain mostly rolled, but some well-preserved fossils of large vertebrates. Above the clayey sands are dark greenish brown strongly pedal clays with two interbedded yellow-green tuffs and thin sand horizons. The upper tuff, informally named the Speckled Tuff, is fossiliferous, and contains numerous micromammals and seeds. The majority of the fossils derive from this tuff, and from the underlying clays and sands above the yellow silt. Fluvial depositional environments of increasing energy predominate in the upper half of the sequence. These coarse sands are occasionally cross-bedded, fining downward into clayey sands, and show considerable lateral variation. Brown/gray ignimbrite unconformably overlies the sandstones.

Lemudong'o 2 (GvJh32) includes strata that extend below those at Lemudong'o 1. The sections are provisionally correlated by the lateral continu-

ation of the yellow silts and the brown-gray ignimbrite (Fig. 4). The lower part of the main section contains four tuff horizons separated by sands and claystones, which lie conformably beneath the yellow silts. Sandstones and silty claystones conformably overly the yellow silt. Two associated elephantid molars and other scarce, nondiagnostic fossil bones were eroding from brown claystones in a poorly exposed small gully 120 m northeast of the main exposures. Their stratigraphic position appears to be within the upper silty claystones.

Geochronology

$^{40}\text{Ar}/^{39}\text{Ar}$ single crystal laser fusion analyses are in progress. Fig. 4 shows the stratigraphic positions of the dated tuffs. Preliminary results indicate ages of 6.04 ± 0.019 , 6.11 ± 0.04 , 6.087 ± 0.015 and 6.108 ± 0.018 Ma for four tuffs that bracket the fossiliferous horizons (Ambrose et al., 2000, 2002; Hlusko et al., 2002). Dates on the lower three tuffs do not differ significantly. They are



Fig. 3. Photograph of Lemudong'o Locality 1. The view is looking westward. Two people can be seen in the bottom center for scale.

close in age to the Speckled Tuff, indicating rapid sedimentation, and providing support for the correlation of sections between the main localities.

Paleontological field techniques

Fossils were collected from the site during five one-day visits (1995–6, 1998–2000). Once the antiquity of Lemudong'o was realized, Meave Leakey visited and made preliminary identifications of some of the material, bolstering the preliminary $^{40}\text{Ar}/^{39}\text{Ar}$ dates with faunal correlation. In 2001 and 2002, L. Hlusko led more intensive paleontological investigations, implementing a 100% collection strategy developed for the depositionally analogous site of Aramis (White et al., 1994; WoldeGabriel et al., 1994). Lemudong'o Locality 1 was systematically crawled and all fossilized material collected during the 2001 and 2002 field seasons. These materials were then sorted taxonomically. Those specimens identifiable to family were incorporated into the museum collection, and the non-identifiable pieces kept in "bulk" specimen repositories also in the museum.

The high expanding clay component and steep faces of the outcrops promotes rapid erosion. A flat-bottomed erosional bay surrounded on three sides by steep cliffs of fossiliferous sediments contains reburied fossils. Sieving of approximately 32 m² (0.1–1 m in depth) of these redeposited silts yielded approximately 40 fossils identifiable to family.

Paleontology

At Lemudong'o Locality 1 over 900 vertebrate fossils identifiable to family level were collected from the thick claystone overlying the diatomaceous silt. There are two primary fossil horizons: (1) the Speckled Tuff and several meters of clays below it, and (2) the coarse gritty sands at the base of the clays just above the yellow silt.

In the Speckled Tuff and clays, terrestrial vertebrate fossils are abundant, and include Colobinae, Bovidae, Equidae, Carnivora, Rodentia, Lagomorpha, Hyracoidea, Aves and Reptilia. The bovid assemblage is dominated by isolated teeth and jaw fragments. Therefore, tribal

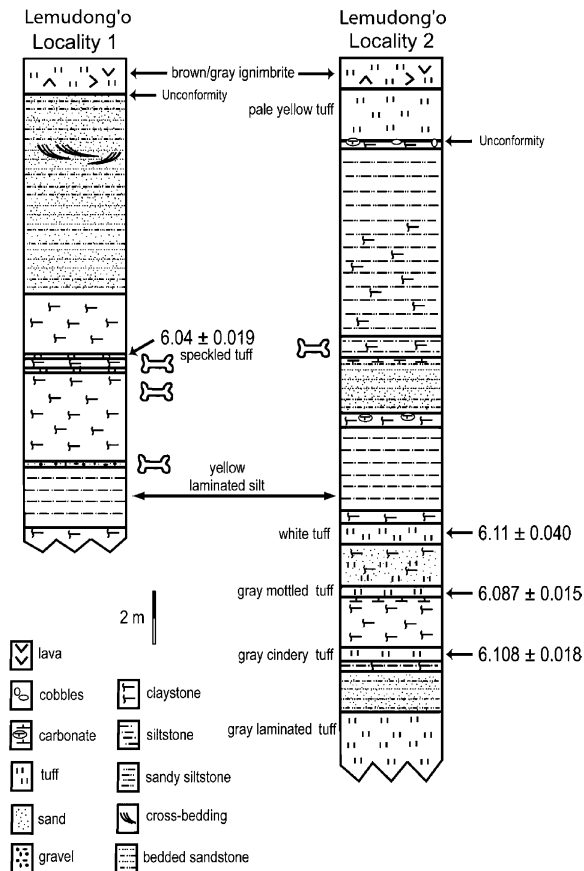


Fig. 4. Stratigraphic section of sediment exposures at Lemudong'o Localities 1 and 2.

level identifications at this time would be premature (Y. Haile-Selassie, pers. com.). The bird assemblage contains two specimens of a large phasianid that is very similar to guineafowl (Numidinae), a strigid owl approximately the size of the extant Wood Owl (*Strix woodfordi*), and a large accipitrid that is most likely a large eagle (T. Stidham, pers. com.). Other fragmentary material may represent additional avian taxa. The few equid specimens are attributed to *Eurygnathohippus* (R. Bernor, pers. com.). The presence of the suid species *Nyanzachoerus syrticus* (= *N. tulotos*) suggests an age greater than 5.6 Ma, which is consistent with the preliminary $^{40}\text{Ar}/^{39}\text{Ar}$ dates of approximately 6 Ma.

Most fossils from this upper fossiliferous horizon range in color from white to buff/pink to light

blue-gray. Preservation of bone surfaces is excellent. The bones are relatively unweathered, but fragmentary, due to swelling and shrinking of the claystone, and to carnivore ravaging, including tooth scratch marks, punctures, and fresh-bone breakage consistent with carnivore damage. The Speckled Tuff varies laterally in thickness, consolidation, and degree of disturbance. It contains a dense micromammal breccia and fossilized seeds. The latter were identified as *Celtis zenkeri* (Ulmaceae), a tall (10–30 m) tree from the elm family (*C. Kabuye*, pers. com.). It is widespread in closed canopy woodlands in tropical Africa (Polhill, 1966).

The lower fossiliferous horizon is a gritty sand containing old stream channels or regressive beach deposits and mostly rolled unidentifiable bone fragments. Some teeth and remains of large animals have been recovered from this horizon. Identifiable fossils are attributable mainly to Crocodylidae, Proboscidea, Hippopotamidae, and Suidae (*Nyanzachoerus*), and include a partial mandible of the proboscidean *Anancus kenyensis*. Most fossils are stained dark green to black.

Conclusion

Study of this fossil assemblage is in the initial stages. However, several lines of evidence suggest the presence of large trees and water in the area 6 Ma: large birds of prey that roost in tall trees, the complete dominance of colobines in the primate assemblage, and the presence of *Celtis zenkeri* seeds. Evidence from penecontemporaneous Late Miocene fossil sites at Lukeino and the Middle Awash Valley suggests hominid habitat preferences for more closed, or woodland habitats (WoldeGabriel et al., 2001; Pickford and Senut, 2001). Lemudong'o provides an opportunity to further evaluate contemporary habitat diversity in eastern Africa, and promises to contribute to our understanding of the evolution of hominids and other African mammals.

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