

Fossil Bovidae (Mammalia, Artiodactyla) from the Late Pliocene of Ledi-Geraru (Afar, Ethiopia)

FAYSAL BIBI,^{*,1,2} JOHN ROWAN,³ and KAYE REED,³

¹Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Invalidenstrasse 43, 10115 Berlin, Germany, faysal.bibi@mfn-berlin.de;

²Department of Mammalogy, American Museum of Natural History, Central Park West at 79th Street, New York, New York 10024, U.S.A.;

³Institute of Human Origins, School of Human Evolution and Social Change, Arizona State University, Tempe, Arizona 85287, USA, jjrowan@asu.edu, kaye.reed@asu.edu

*Corresponding author

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SUPPLEMENTARY DATA

Ledi-Geraru Bovidae Indet.

Indeterminate bovid fossils from Ledi-Geraru are listed along with all other specimens in Supplementary Table 1. We include notes here on some of the more interesting specimens.

LD 279-1 and LD 110-1 are horn core fragments that bear some resemblance to *Oryx* (or *Praedamalis*). LD 155-3 is a left lower m3 fragment missing the anterior lobe. It has a thin and short basal pillar between the second and third lobes, and is not very hypsodont. It resembles *Bovini*, except for its smaller size, which is suggestive of *Hippotragini*.

LD 128-1 is a horn core fragment that may be comparable with *Budorcas churcheri* from Hadar (Gentry, 1996) or ?*Caprinae* sp. from Olduvai (Gentry and Gentry, 1978, pl.41)

Horn core fragments (most without basal portions) assigned to Bovidae indet. cf. *Aepycerotini* have certain features suggestive of *Aepyceros*, but others not quite fitting the impala. Most of these pieces, for example, exhibit widely spaced transverse ridges and some indication of torsion, but lack any clear posterolateral edge or keel, or flattening of the posteromedial surface, and some possess a large single groove running longitudinally along the posterior surface. Compression is weak to moderate mediolaterally. *Beatragus* is an alcelaphin with lyrate, anticlockwise-spiralling horns, fragments of which might be difficult to separate from *Aepyceros*. Ultimately, these pieces are too fragmentary to be certain of their affinities.

LD 306-10 might be impala or alcelaphin. It exhibits enlarged frontal sinus but these do not entirely hollow out the pedicel. The lack of a clear postcornual fossa, large parietal boss, and the raising of the frontal between the horn cores are alcelaphin-like features. From the pedicel break, it seems the horn core may have been round and little compressed, like some impala. Its basal measurements fall within the range of *A. shungurae*.

LD 318-1 (Bovidae indet. cf. Alcelaphini) is a horn core fragment broken near the base, resembling *Kobus*, with prominent transverse ridges and a very flattened (lateral?) surface, clear (anticlockwise?) torsion, but also with a pedicel sinus at the proximal break. The lack of deep longitudinal grooving along the anterior surface is a difference from *Beatragus* and *Menelikia*.

LD 304-3 and LD 384-1 are basal horn cores comparable with a specimen from Shungura Member G (Omo 75-1970-979) and *Damaliscus* sp. at Daka (Gilbert, 2008, fig. 3.7).

LD 113-1, LD 139-1, LD 170-1, LD 251-1, LD 342-1, LD 346-2, and LD 349-1 are mainly midsections and distal sections of horn cores that may belong to *Kobus sigmoidalis*.

LD 230-1 is a left horn core midsection (43.9 x 37.6 at proximal break) that resembles a reduncin, but the strong transverse ridges, lack of wide grooving on the anterior surface, and lack of torsion and strong liration are different from *Menelikia* (LD 661-2 and 659-1). In these features it resembles the Hadar 'Kobus sp. B' (A.L. 208-8), but remains slightly larger and with thicker and much more widely spaced transverse ridges. Such widely spaced ridges can be found in *Aepyceros* or *Kobus*, but the liration and torsion are more than expected in *Kobus*, and they are not as developed as hoped for a secure *Aepyceros* identification. Among *Aepyceros*, LD 230-1 would be larger than *A. shungurae*, *A. datoadeni*, or the living *A. melampus*, but in the size range of the larger and older species *A. afarensis* and *A. dietrichi*. Another comparison is with the alcelaphin *Awashia suwai* from the Middle Awash (Vrba, 1997). LD 230-1 differs from the type specimen of *A. suwai* in larger size and stronger transverse ridges, but these could be male-female differences.

A.L. 74-19, LD 77-2, LD 157-1, LD 190-2, and LD 386-1 are distal horn core fragments that are flat posteriorly, rounded anteriorly, with some vestige of an anterior keel on some specimens, and some with a longitudinal groove running along the posterolateral edge. They are most likely tragelaphin, and may be of *Tragelaphus rastafari*, but normally distal horn cores of that species tend to have stronger keels and a more triangular cross-section.

Revision of some Hadar Bovid Specimens

What follows are a few revisions to some of the taxonomic assignments in Geraads et al. (2012). They only change the faunal list from Hadar in minor ways (relevant to specialized treatments), and do not change any of the main findings or conclusions of that paper.

A.L. 475-3: *Kobus* sp. B (in part) -> *Kobus* cf. *sigmoidalis*—A.L. 475-3, a horn core from KH2 referred by Geraads et al. (2012) to Gentry's (1981) *Kobus* sp. B, may extend the range of *Kobus sigmoidalis* into the Hadar Formation. It is differentiated from *Kobus* sp. B. (exemplified by A.L. 208-8A and B) in lacking lryation and torsion, being much straighter in anterior view, and having a sigmoidal course in lateral view. It has greater posterior curvature basally than in most specimens of *K. sigmoidalis*, but may be compatible with the Ledi-Geraru *K. sigmoidalis*.

A.L. 241-1: ?*Alcelaphini* sp. C -> *Parmularius* aff. *pachyceras*—A.L. 241-1 is a right horn core with frontlet fragment that matches the partial horn core A.L. 192-10, described and illustrated by Geraads et al. (2012) as *Parmularius* cf. *pachyceras*. The Hadar and Ledi-Geraru specimens are different enough from the Chadian material on which *P. pachyceras* is based, so we believe an assignation of aff. (rather than cf.) is more appropriate. We determined this to be a right horn core (rather than a left) based on the presence of some mid-frontal suture, fronto-parietal suture, and a shallow postcornual groove. Curvature then become posterolateral (rather than anteromedial), fitting *P. aff. pachyceras*, and A.L. 241-1 then becomes the best representative specimen of this species at Hadar.

The long axis of the horn core basal cross-section is interpreted as greatly rotated to the skull midline, resulting in lateral and anterior surfaces that face anterolaterally and anteromedially, respectively. The horn arises right at the midline, shows a clear posterolateral curvature, basal swelling of the medial horn core, slightly greater flattening on the lateral surface, and farthest extension of the horn core inferiorly at the posterolateral corner, where the horn core is in very high relief compared to the pedicel surface. The deep longitudinal grooving is on the medially-facing surface (the rotated anterior surface). This also allows for reorientation of specimen A.L. 192-10, which is probably also a right horn core, and is shown in fig 5E in Geraads et al. (2012) in medial, not lateral, view, with the subtle distal recurvature then directed anteromedially (also A.L. 241-1 in fig 5H is correct as posteromedial, but 5I is in fact anteromedial, not posterolateral).

A.L. 457-1: *Tragelaphus* aff. *gaudryi* -> *Tragelaphus* cf. *pricei*—A.L. 457-1 KH2, is a right horn core of a small tragelaphin assigned by Geraads et al. (2012) to *T. aff. gaudryi* (along with a mandible). Since then, the left frontlet of the same individual was found and conjoined to the right side. This small *Tragelaphus* differs from *T. gaudryi* in its smaller size, the presence of a very regular triangular cross-section with three strong keels (quadrangular with anterior keel most prominent in *T. gaudryi*), weak anteroposterior compression (mediolateral in *T. gaudryi*), and less torsion (estimated at ~270° in A.L. 457-1; >360° in *T. gaudryi*).

A.L. 457-1 is basically a small *Tragelaphus* with conserved (primitive) horn core morphology, similar to that of a small sitatunga or nyala. It is not really distinguishable from the late Miocene *T. moroitu* (e.g. the holotype ALA-VP-2/2), which is also small, with weak to no anteroposterior compression, and a triangular cross-section with strong keels (Haile-Selassie et al., 2009). Over time between about 6 and 4 Ma, *T. moroitu* developed greater anteroposterior compression and a weaker anterior keel, as if evolving towards *T. kyaloe* and *T. saraitu*. In contrast, A.L. 457-1 must represent a separate lineage that retained primitive characters into the late Pliocene.

Following Bibi (2009), other specimens of this rare tragelaphin of small size and primitive morphology include: OMO L144-1 and L144-2 from Shungura C9 assigned by Gentry (1985) to '*T. ?pricei*'; KNM LT-24057 from the Kaiyumung Member (3.9–3.0Ma) at Lothagam described by Harris (2003) as *T. cf. pricei*; and possibly OMO YS-1968-2078 (from the Mursi Formation ~4Ma) assigned by Gentry (1985) to *T. aff. gaudryi*. The name *T. pricei* (Wells and Cooke, 1956) is best left unused since this South African species is founded on dental material, and therefore poorly diagnosed. The eastern African small fossil *Tragelaphus* needs a name, but this is problematic if it is characterized entirely by the retention of primitive features, and cannot be distinguished from early specimens of *T. moroitu*.

Supplementary Tables S1-4, Captions

TABLE 1S. Spreadsheet of all Ledi-Geraru bovid specimens identified in this work.

TABLE 2S. Basal horn core measurements for all isolated horn cores.

TABLE 3S. Measurements of dental specimens.

TABLE 4S. Measurements of postcranial bones of LD 390-1, *Connochaetes africanus*.

TABLE 5S. Astragalus measurements following Barr (2014) and discriminant function habitat category assignments.

TABLE 6S. Discrete character scores for phalanges following DeGusta and Vrba (2005) and resulting habitat assignments.

TABLE 7S. Raw hypsodonty data used in Figure 11.

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