SI Text

Stable Carbon Isotopes in Plants and Teeth

Photosynthetic pathway primarily determines the $\delta^{13}C$ value of a plant. Today in East Africa trees and shrubs use the more primitive and common C_3 pathway, or Calvin cycle, and have a $\delta^{13}C$ value of -23 to -36‰, whereas nearly all grasses and some sedges below 3000 m elevation use the more derived C_4 pathway, or Hatch-Slack cycle, and have a $\delta^{13}C$ value of -14 to -10‰ (1-3). The difference in the $\delta^{13}C$ values between C_3 and C_4 plants is due to the different metabolic pathways plants use to fix atmospheric CO_2 (4). The ~13 ‰ range in $\delta^{13}C$ values of C_3 plants is controlled by environmental conditions. The most negative $\delta^{13}C$ values are found in closed canopy forests (5). The most commonly cited mechanism is the "canopy effect" where respired CO_2 is recycled within the canopy (6). Xeric conditions can lead to $\delta^{13}C$ values several permil more positive the mean C_3 value. In Kenya, modern C_3 plants from open forests and bushlands have $\delta^{13}C$ values of -27.8 ± 0.3 ‰ and -27.0 ± 0.2 ‰, respectively. C_3 plants from Mpala, Kenya sampled in 1998 have an average value of -24.6 ‰ (n=15) (7) . Crassulacean Acid Metabolism (CAM) is a third photosynthetic pathway that some plants use in some arid ecosystems, but it is much less common than the C_3 and C_4 pathways. CAM plants are not widely consumed by extant herbivores in East Africa, and therefore are not considered further here.

During tooth formation, carbon derived from diet is incorporated into enamel as carbonate anions. The difference between the stable isotope ratio of these two phases, the $\delta^{13}C$ of diet ($\delta^{13}C_{diet}$) and $\delta^{13}C$ value of enamel ($\delta^{13}C_{enamel}$), is expressed as an enrichment factor, $\varepsilon^*_{diet\text{-}enamel}$, where $\varepsilon^*_{diet\text{-}enamel} = [(\delta^{13}C_{enamel} + 1000)/ (\delta^{13}C_{diet} + 1000) - 1] *$

1000. The asterisk on ε^* indicates that isotopic enrichment between the two phases is not necessarily limited to equilibrium fractionation processes. The $\varepsilon^*_{diet-enamel}$ for large ruminant ungulates is 14.1 ± 0.5‰ (3). In non-ruminant herbivores, the enrichment between diet and enamel ($\varepsilon^*_{diet-enamel}$) is slightly smaller (12 to 14‰; Passey et al. (8)). However, we use an $\varepsilon^*_{diet-enamel}$ of 14.1‰ for all samples in the preceding discussion. Herbivores with diets that consist of a mixture of C_3 and C_4 vegetation will have intermediate $\delta^{13}C$ values that depend on the mixing proportion of the two plant types.

The $\delta^{13}C$ values of C_3 and C_4 diets

Plants fix atmospheric CO_2 to form biomass, and therefore the $\delta^{13}C$ value of atmospheric CO_2 ($\delta^{13}C_{atm}$) must also be measured or estimated in order to determine a threshold enamel $\delta^{13}C$ value ($\delta^{13}C_{enamel}$) that indicates the presence of C_4 in diet. The current $\delta^{13}C_{atm}$ value is about -8.2‰, but has fluctuated between -6.8 to -4.9‰ over the last 20 Ma (9, 10). We use $\delta^{13}C$ values of the atmosphere ($\delta^{13}C_{atm}$) based on North Atlantic benthic Foraminifera to calculate $\delta^{13}C$ values of enamel ($\delta^{13}C_{enamel}$) for pure C_3 and pure C_4 diets based on the age of the sediments at each site (10). We use the mean $\delta^{13}C_{atm}$ value from the upper limit of the 90% confidence interval from the high resolution or three million year time-averaged benthic Foraminifera record as a conservative value to calculate a maximum $\delta^{13}C_{enamel}$ value for a pure C_3 diet (Table S2). The range of maximum $\delta^{13}C_{enamel}$ values for a pure C_3 diet is from -7.7 to -8.2‰, and the mean is -7.9 ± 0.2‰. We use the lower limit of the 90% confidence interval $\delta^{13}C_{atm}$ value from each time period to conservatively calculate a $\delta^{13}C_{enamel}$ value for a pure C_4 diet. The $\delta^{13}C_{enamel}$ range for a pure C_4 diet is from +2.4 to +3.1‰, and the mean is 2.9 ± 0.2‰.

Statistical Analysis

The $\delta^{13}C$ values are derived from mixed C_3-C_4 ecosystems where the distribution of the $\delta^{13}C$ value of plants is bimodal, and therefore not normally distributed. A Shapiro-Wilk test for normality demonstrates that the data are not distributed normally by age group (Table S2). Only data from one of seven age groups, the Upper Namurungule (9.3 Ma, n= 34), satisfy the null hypothesis of normality. Thus, the median and range of $\delta^{13}C_{enamel}$ (hereafter, $\delta^{13}C$) values are more appropriate than the mean and standard deviation for describing central location and variance of each population. We apply the nonparametric Mann-Whitney *U* test to check for significant difference in the median $\delta^{13}C$ values within each family between successive time periods. The test is only applied to groups with at least five samples per time period.

Mann-Whitney *U* test results indicate significant shifts ($p < 0.05$) in the median $\delta^{13}C$ value between successive age increments (i.e., 9.9 to 9.6 Ma) where there are more than five isotope analyses within a family (Table S3). Shifts in diet do not occur synchronously between families throughout the record. Significant changes in the median $\delta^{13}C$ value occur between 9.9 and 9.6 Ma for all families except gomphotheriids; between 9.6 and 7.4 Ma for hippopotamids ($p = 0.008$) and rhinocerotids ($p = 0.003$); between 9.3 and 7.4 Ma for gomphotheriids and elephantids ($p = 0.0016$); between 7.4 and 6.5 Ma for equids ($p = 0.013$) and hippopotamids ($p = 0.011$); between 6.5 and 4.2 Ma for equids ($p = 0.045$), hippopotamids ($p = 0.039$) and suids ($p = 0.022$); and between 4.2 and 3.2 Ma for suids ($p = 0.011$) (Table S3).

Geology and Age Control

The Nakali Formation is a 340 m thick sequence of volcanoclastic sediments divided into three members (Lower, Middle, and Upper). The Nakali area (1.1850° N, 36.3756° E) was first investigated in 1969 by Emiliano Aguirre and Phillip Leakey (11), but little work was done on the geology of the Nakali Formation until the Japan-Kenya Paleoanthropological Expedition started work there in 2002. The formation is exposed over a ~16 km^2 area on the eastern flank of the Suguta Valley. North-south trending post-depositional normal faults divide the area structurally into three blocks (western, central, and eastern). The Nakali Formation is underlain by the Alengerr tuffs (10.6 ± 0.40 Ma) and overlain unconformably by the Nasorut volcanic sequence (7.74 ± 0.21 Ma) (12). The Lower Member transitions from a lacustrine facies consisting of turbidites and debrites at the base to a fluvio-lacustrine facies near the top of the member. Two $^{40}Ar/^{39}Ar$ ages from single anorthoclase grains separated from a pumiceous tuff at the top of the Lower Member are 9.90 ± 0.09 Ma and 9.82 ± 0.09 Ma (Figure 2). The Middle Member is a 40 m thick pyroclastic flow deposit that has yielded a $^{40}Ar/^{39}Ar$ age on anorthoclase $^{40}Ar/^{39}Ar$ age of 10.10 ± 0.12 Ma. The Upper Member is composed of primarily fluvio-lacustrine deposits interbedded with sparse debris flows and lapilli tuffs (12). A majority of the fauna comes from this member, including the hominoid fossils. Reversed polarity in the Middle Member where the isotopically dated samples were collected securely places the Lower Member in chron C5n.2n, the Middle Member in C5n.1r, and the Upper Member in C5n.1n. The isotopic age data; paleomagnetic data; and evidence for rapid sedimentation; which includes turbidites, debrites, debris flows, lahars, tuffs, and a lack of paleosols; suggests that a single age of 9.9 Ma is most appropriate for the Nakali fauna.

In the Samburu Hills 60 kilometers north of Nakali, five formations make up a non-continuous succession of Neogene sedimentary and volcanic rocks spanning from 19.2 to 4.1 Ma (Figure 1 and (13)). The geology of the area was first described by Baker (14) and since 1980, the Samburu Hills and adjacent Nachola areas have been studied by the Japan-Kenya Paleoanthropological Expedition team (15, 16). The Late Miocene Namurungule Formation is exposed in the western part of the Samburu Hills, near the eastern edge of the Suguta valley (1.7033° N, 36.5262° E). The 100 to 200 m thick formation is divided into a Lower Member and an Upper Member, which are separated by a 14 to 30 m thick lahar (17, 18). The Namurungule Formation is underlain conformably by the Aka Aiteputh Formation, and unconformably overlain by the Kongia Formation (7.3–5.3 Ma)(18). A whole rock K-Ar age on an Upper Aka Aiteputh basalt flow below the contact with the Namurungule has an age of 10.07 ± 0.42 Ma (Fig. 5 of (18)). The Upper Aka Aiteputh contains red calcareous paleosols interbedded with basaltic lavas, and the contact with the Lower Namurungule is defined by a 3 m thick poorly-sorted conglomerate (18). K-Ar ages on sanidine from two pumice-rich tuffs that bracket the hominoid bearing sediments of the Lower Namurungule are 9.57 ± 0.22 Ma and 9.47 ± 0.22 Ma, respectively (19). Based on isotopic age data, paleomagnetic data, and sedimentary facies from the Upper Aka Aiteputh through the Namurungule Formation, Sawada et al. (19) place the Lower Namurungule in chron C4Ar. 2n (9.64 to 9.58 Ma) and the Upper Namurungule in chrons C4Ar.2r to C4Ar.1n, which range from 9.58 to 9.31 Ma (Figure 2). Thus we use an age of 9.6 Ma for the Lower Namurungule fauna and 9.3 Ma for the Upper Namurungule fauna. Saneyoshi et al. (18) provide a detailed review of the geology and depositional environment of the Namurungule Formation.

Lothagam is located in the Turkana Basin approximately 55 km east-southeast of the town of Lodwar, and 140 km north-northwest of the Samburu Hills (Figure 1; 2.9098° N, 36.0455° E). The area (approximately 5 by 10 km) is interpreted as an uplifted footwall block that exposes sediments deposited in the Kerio Basin from the Middle Miocene to the Pliocene (20). Today, two north-south trending ridges define the area. Fossil-bearing sediments are exposed between the ridges and on their flanks. The eastern ridge is a horst called Lothagam Hill (or Lothsegam in the Turkana language) and is the more prominent of the two. The first detailed geological and paleontological study at Lothagam was led by Patterson in 1967 and subsequent work by Behrensmeyer (21) and Powers (22) refined the stratigraphic framework and age. A more comprehensive study of the fauna and geology at Lothagam resulted from a four-year field campaign led by M.G. Leakey from 1989 to 1993 (23). The geologic component of the most recent campaign included determining precise radiometric ages throughout the entire 900 m section by McDougall and Feibel (24), classification of paleosols by Wynn (25), stable isotope analysis of pedogenic carbonates (26), and revision of the stratigraphy by Feibel (27) that built upon the previous work of Powers (22) and Behrensmeyer (21).

In the present study, the Late Miocene to Pliocene fauna from Lothagam come from the Upper and Lower Members of the Nawata Formations and the Apak and Kaiyumung Members of the Nachukui Formation. The Nawata Formation is bounded below by the volcanic Nabwal Arangan Formation. Basalt and phonolite whole rock K-Ar dates from this formation range from 14.2 ± 0.2 Ma at the base to 9.1 ± 0.2 at the top of the formation (Figure 2; (24)). The Nawata Formation is split into an Upper and a

Lower Member. The base of the 137 m thick Lower Nawata member consists of alluvial plain sediments and poorly sorted gravel conglomerates interpreted as ephemeral stream deposits (27). The upper part of the Lower Nawata contains fluvial deposits characteristic of a perennial river system. Paleosols are present throughout the Lower Nawata and are primarily vertisols with occasional calcaric fluvisols or calcaric regosols (25). Carbon isotope values of 14 pedogenic carbonates from 11 paleosols in the Lower Nawata range from -9.0 to -2.2 ‰. These data represent C_3-dominated to mixed C_3/C_4 ecosystems, the latter of which contains significant amounts of C_4 biomass (26). One tuffaceous bed from a series of altered tuffs called the Lower Markers in the lower half of this member has an arithmetic mean $^{40}Ar/^{39}Ar$ age on 33 alkali feldspar crystals of 7.44 ± 0.05 Ma, which we use as an age for all Lower Nawata fauna (24). A majority of the Lower Nawata fauna comes from above this dated tuff.

The informally named Marker Tuff designates the base of the Upper Nawata and provides the only datable material from the Upper Nawata. Ten single crystal alkali feldspars from Marker Tuff yield an arithmetic mean $^{40}Ar/^{39}Ar$ age of 6.54 ± 0.04 Ma (24). The 125 m thick Upper Nawata contains abundant thick, multi-storied sandstones that may suggest increased reworking of sediments due to decreased subsidence rates in the basin (27). The Upper Nawata contains fewer paleosols than the Lower Nawata, despite similar overall thicknesses. Carbon isotope values of five pedogenic carbonates from four paleosols in the Upper Nawata range from -5.9 to -1.3 ‰, which indicate mixed C_3/C_4 ecosystems (26).

The 400 m thick Nachukui Formation overlies the Nawata Formation, probably conformably, and is divided into five members at Lothagam (24). The formation is part of the Plio-Pleistocene Omo Group, which also includes the Koobi Fora and the

Shungura Formations (28). Fauna in this study are from the basal Apak Member and the Kaiyumung Member, neither of which are present in the original type sections from West Turkana. Sites of similar age to the Kaiyumung are present in the Nachukui Formation (e.g., at Lomekwi) along the west side of Lake Turkana.

The Apak Member is a ~100 m thick sequence of fluvial to lacustrine sandstones with occasional mudstones and eight paleosols throughout (24, 25). The upper part of the Apak Member is lacustrine deposits of Lonyumun Lake age (4.1 Ma). The arithmetic mean $^{40}Ar/^{39}Ar$ age of two alkali feldspars from pumice is 4.22 ± 0.03 Ma (24). We use this as the age for all Apak Member fauna. Carbon isotope values of seven pedogenic carbonates from five paleosols in the Apak Member range from -9.4 to -3.0 ‰, which indicate C_3-dominated to mixed C_3/C_4 ecosystems (26). The Lothagam Basalt, assigned an age of 4.20 ± 0.03 Ma based on $^{40}Ar/^{39}Ar$ and K/Ar dating, overlies the Apak Member and underlies the Muruongori Member.

Age spectra from whole rock and plagioclase $^{40}Ar/^{39}Ar$ ages from one sample (K86-2899B) indicate excess argon, probably due to incomplete degassing of the glass component of the basalt at the time of eruption (24). Therefore, the age assigned to the Lothagam Basalt is a maximum age. Stratigraphic and geochemical correlation place the Lothagam Basalt in the Gombe Group Basalts, all of which have reversed polarity that place it securely in the Gilbert Chron (29). In all locations where the Gombe Group Basalts and Moiti Tuff are both present, the tuff overlies the basalt. Thus the age of Moiti tuff, 3.97 ± 0.03, provides a minimum age constraint for the basalts (30).

Fluvial sediments of the 94 m thick Kaiyumung Member conformably overlie the Muruongori Member, but there may be depositional hiatuses within these members. The absence of volcanic deposits in the Kaiyumung Member precludes isotopic dating and correlation by tephrastratigraphy. In particular, the absence of the Moiti, Lokochot, and Tulu Bor tuffs dated at 3.97, 3.60, and 3.48 Ma, respectively, indicates that this time period is missing either due to depositional hiatus or erosion. The Lokochot Tuff and the Tulu Bor Tuff are present at Echawe less than 20 km to the south in the region, and both are present in the Baringo Basin at Kipcherere (31); the Tulu Bor Tuff has also been identified west of Kanapoi and in a fault along the eastern margin of Napedet about 17 km west of Lothagam and the Naibar Tuff, which is only slightly older than the Moiti Tuff (McDougall et al. submitted) is exposed in Naiyenapunedebu about 4 km north of the northern exposures of the Kaiyumung Member. This suggests that the reversed polarity section in the Kaiyumung Member is the Kaena (2An.lr) or Mammoth (2An.2r) subchron of the Gauss magnetochron (2An), and therefore we use an age of 3.2 Ma for the Kaiyumung fauna.

Fauna

Equidae. A single equid species is recognized from the Nakali and Namurungule Formations as member of the three-toed Hipparionini tribe, and has previously been alternately referred to as *Hipparion primigenium, H. sitifense, "Cormohipparion" perimense, H. africanum,* and *H.* aff. *africanum* (12, 32-36). In a recent review of African Equidae, Bernor et al. (37) reject the use of the genus *Hipparion* for all late Miocene African equids, with the exception of those from Sahabi, Libya, and instead use "*Cormohipparion*" or *?"Sivalhippus"*. Therefore, we refer to this taxon as "*Cormohipparion*" aff. *africanum*. The authors note that this part of the Miocene was a period of rapid diversification within the equids, and that the Namurungule equids may be the sister taxon to the genus *Eurygnathohippus* represented by at least three species from Lothagam. *"Cormohipparion"* cf. *primigenium* is rare in the Lower Nawata and absent in the Upper Nawata and Nachukui Formation, whereas *Eurygnathohippus turkanense* and *Eu. feibeli* are ubiquitous in the Upper and Lower Members of the Nawata Formation. In the Apak and Kaiyumung Members of the Nachukui Formation, *Eu.* spp. indet. (small and large forms) are present (38).

Rhinocerotidae. *Kenyatherium bishopi* is the most common rhinocerotid species at Nakali, which is where the type specimen was discovered (39). At least one other species is present, although it has only been identified to family (12). At least five rhinocerotids have been identified over the past three decades from the Namurungule Formation. In the Lower Namurungule, *Brachypotherium sp., Kenyatherium bishopi, Chilotheridium pattersoni*, *Paradiceros mukirii,* and most recently, *Ceratotherium* sp.?, have been identified (32, 33, 35, 36, 40, 41). Fossil material from the Upper Namurungule has only been identified to family. A recent review of African rhinocerotids by Geraads (41) is in agreement with the presence of *K. bishopi* in the Nakali Formation, but suggests that only two rhinocerotids are present in the Namurungule, *K. bishopi* and *Ceratotherium* sp.?

At Lothagam, three rhinocerotid species have been identified. *Brachypotherium lewisi* is the common rhinocerotid in both Members of the Nawata Formation. *Ceratotherium* sp.? is also present (42). *Diceros praecox* first occurs in the Upper Nawata. *D. praecox* and *Ceratotherium* sp.? occur in the Apak Member, but only *Ceratotherium* sp.? specimens have been found in the Kaiyumung Member of the Nachukui Formation (42).

Gomphotheriidae and Elephantidae. Two gomphotheriids, *Anancus* sp. and *Choerolophodon ngorora* (advanced morph), have been identified at Nakali (12, 39, 43). *C. ngorora* and *Tetralophodon* sp. nov are present in the Lower Namurungule (36, 43). As of yet, *Tetralophodon* sp. nov is the only gomphotheriid to come from the Upper Namurungule (36). Elephantids first appear at Lothagam in the Lower Nawata, where *A. kenyensis* is accompanied by the elephantids *Stegotetrabeledon orbus* and *Primelephas gomphotheroides* (44). In the Upper Nawata there is *A. kenyensis*, a trilophodont gomphotheriid (gen. et sp. indet.), *S. orbus*, and *Elephas nawatensis*, which Sanders et al. (43) refer to as *Primelephas korotorensis*. The greatest diversity from these two families occurs in the Apak Member, where there is *A. kenyensis*, *S. orbus*, *Elephas ekorensis* (and cf. *E. ekorensis*), *Loxodonta* sp. indet., and two unidentified elephantids, *Elephas* gen. et sp. incertae sedis A and *E.* gen. et sp. incertae sedis B (44). No gomphotheriid or elephantid specimens have been recovered from the Kaiyumung Member.

Bovidae. Bovids from Nakali include *Tragelaphini* gen. indet., *Boselaphini* gen. indet., and *Gazella* sp. indet. (12, 39). From the Lower Namurungule come *Boselaphini* gen. et sp. nov., *Tragoportax* sp., *Pachytragus* sp., *Antidorcas* sp., and *Bovidae* gen. indet. (35, 36). The Upper Namurungule has one boselaphine (gen. indet.) and at least two antilopines, *Antidorcas* sp., *Gazella* sp., and *Antilopini* gen. indet. (35, 36). Gentry (45) reports the presence of the boselaphine *Miotragocerus* sp. aff. *M. cyrenaicus*, in the Lower Namurungule and the Nawata Formation. There is a high diversity of bovids throughout the Lothagam sequence that includes seventeen species and nine tribes (46). They are the most abundant terrestrial herbivore throughout the succession. Aepycerotini (impalas) are the most common bovid, but decline in abundance throughout the succession, while the Boselaphini decline sharply between the Lower and Upper Nawata. Other tribes present include Tragelaphini, Bovini, Reduncini, Hippotragini, Alcelaphini, Antilopini, and Neotragini (SI Table 1). Harris (46) provides a detailed description and review of the Lothagam bovids.

Hippotamidae. Only one hippopotamid species, the bunodont *Kenyapotamus coryndoni*, has been identified from the Nakali and Namurungule Formations (12, 32-36). *K. coryndoni* material from both sites is mostly isolated or fragmentary teeth. An exception is a mandible from the Namurungule (KNM-SH 15857) that reveals a narrow muzzle and lower jaw morphology similar to that of *Archaeopotamus lothagamensis* from the Lower Nawata (47). In addition to this relatively rare hippopotamid, the larger *Archaeopotamus harvardi* is present from the Lower Nawata through the Apak Member of the Nachukui Formation. *A. harvardi* is the predominant hippopotamid taxon at Lothagam, where hippopotamids comprise 27% of all mammalian fauna from the succession (48). A third hippopotamid, *Hippopotamus* aff. *H. protamphibius,* comes from the Apak Member exclusively (48).

Suidae. Nakali suids are identified only to genus as *Nyanzachoerus* spp., but their presence at this site is significant because it pushes their first appearance back to 9.9 Ma in East Africa (12). Two suids, a smaller form identified as *Nyanzachoerus* cf. *N. devauxi* and larger form, *Nyanzachoerus* sp. (large), come from the Namurungule Formation (36). The latter is similar to *N. syrticus* (49). The smaller form is present in both members, while the placement of the larger form is uncertain (36). In the Lower Nawata, there is one kubanochoere that is similar to unpublished mandibles from Nakoret with extremely large premolars. *N. devauxi* is present throughout the Nawata Formation, but not in the Nachukui Formation (49). *N. syrticus* (conspecific with *N. tulotos*) and *N.* cf. *syrticus*, are also present in the Nawata Formation, and Harris and Leakey (49) note an increase in size and complexity of the upper third molar in Upper Nawata specimens compared to those from the Lower Nawata. Rare potamochoere and cainochoere material also comes from the Nawata Formation. *Nyanzachoerus* cf. *N. australus* appears in the Upper Nawata and is dominant in the Apak Member of the Nachukui. The youngest nyanzachoere to appear in the Lothagam sequence is *N. pattersoni* (= *N. kanamensis)*, which occurs in the Kaiyumung Member. *Notochoerus* is thought to have evolved from the nyanzachoere lineage (50). *Notochoerus jaegeri* first appears at Lothagam in the Apak Member. *Notochoerus euilus* follows, first in the uppermost part of the Apak Member (*Not.* cf. *euilus*), and then as the common suid in the Kaiyumung Member (49).

Deinotheriidae. Deinotheriid material has been recovered from the Nakali Formation and from all members of the Namurungule, Nawata, and Nachukui Formations. All material is identified as *Deinotherium bozasi* or *D.* cf. *bozasi* (12, 35, 36, 51).

Giraffidae. East African giraffids are interpreted as browsers throughout the geologic record, with the exception of the Pliocene sivatheres (52, 53). The Nakali Formation has yielded two giraffids, *Palaeotragus* cf. *germaini* and ?*Samotherium* sp. (12). These taxa are also found in the Lower and Upper Namurungule (35, 36). Although giraffids are rare at Lothagam, *P. germaini* and *Palaeotragus* sp. occur throughout the

Nawata Formation. These taxa are replaced by a more progressive giraffid, *Giraffa stillei*, in the lower part of the Apak Member. *G. stillei* is present through the Kaiyumung Member (54).

Sampling Methods. For all fossil teeth housed in the National Museum of Kenya's (KNM) paleontology collection in Nairobi, enamel was removed using a Dremel® battery-powered drill with diamond powder or carbide bits. One to four mg of powdered enamel was removed from a non-diagnostic part of the tooth, often along fractured enamel surfaces, in a ~1 mm wide groove or pit. Broken teeth are ideal for sampling because it is easy to distinguish enamel from dentin, cementum, or matrix material along fractured enamel surfaces that are normal to the enamel-dentin or cementum-dentin junction curved plane. A subset of samples is tooth fragments that were collected in the field at Lothagam. Enamel powder was collected either by removing dentin, cementum, and matrix material and subsequently crushing the fossil enamel with a mortar and pestle, or by the aforementioned Dremel technique.

Whenever possible, the third molar was sampled because it forms during adulthood and therefore is the best representative of an individual's diet. We treat samples from different teeth of an individual (maxilla or mandible) as discrete samples because each tooth represents a different time period.

Laboratory Methods. Powdered enamel samples were digested in 100 % H_3PO_4 (phosphoric acid) off-line for 36 hours at 25°C in sealed vessels, or online using a Finnigan CarboFlo®. For off-line reactions, 15–50 mg of enamel powder was reacted in the presence of silver wool or foil. The CarboFlo® system is a hybrid positive pressure/vacuum system with a common acid bath (CAB). Approximately 500 μg of fossil enamel is weighed out into a silver capsule, which is used as a precautionary measure to oxidize any SO_2 produced during digestion in phosphoric acid. The silver capsules are dropped into the CAB from an autosampler carousel. The sample reacts in the CAB, which is stirred vigorously at 90° C for 10 minutes. A 60 ml/min stream of He sweeps the liberated H_2O and CO_2 through a dry ice/ethanol trap to remove water and then through a liquid nitrogen (LN) trap to collect the CO_2. Following the 10 minute reaction period, the LN trap is isolated from positive pressure and evacuated with a rotary vacuum pump to ~10^{-3} Torr. The LN trap is removed and the CO_2 is cryogenically transferred to a microvolume held at -170°C. Once transferred to the microvolume, the CO_2 is analyzed through the dual inlet system on the mass spectrometer. Internal laboratory enamel and Carrara carbonate standards are used for data correction of samples.

A subset of enamel samples representing all sites was treated with 3% H_2O_2 for 15-30 minutes, rinsed three times with DI, and dried overnight at 60°C. The difference in $\delta^{13}C$ values between treated and untreated samples was less than ±1 ‰ for most samples. Loss of sample material during treatment was on the order of one to several milligrams. Due to the limited amount of sample (~1–4 mg) collected from the KNM accessioned teeth and minimal effect of treatment and the loss of sample associated with treatment, remaining samples were not treated.

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SI Table Legends

Table S1. Faunal list of analyzed samples
Table S2. Mammalian faunal list for Nakali, the Samburu Hills, and Lothagam
Table S3. $\delta^{13}C_{atm}$ and $\delta^{13}C_{enamel}$ for sites
Table S4. Shapiro-Wilk test for normality
Table S5. Mann-Whitney test results comparing medians for each family by between time periods. Time periods are listed at the top of each column in Ma. Median values in bold are significantly different at the 95% level ($p<0.05$). To perform the test, a minimum of 5 individuals was required for each population.
Table S6. $\delta^{13}C$ data from 452 fossil teeth

Table S1. Large herbivore fauna analyzed for δ[13]C values from the Nakali, Namurungule, Nawata, and Nachukui Formations.

			Site:	Nakali	Samburu Hills		Lothagam		Lothagam		Total #
Order	**Family**	**Tribe or**	**Species** Formation:	**Nakali**	**Namurungule**		**Nawata**		**Nachukui**		**by**
		Subfamily	Member:	**--**	**Lower**	**Upper**	**Lower**	**Upper**	**Apak**	**Kaiyum.**	**Family**
Proboscidea											
	Deinotheriidae		Deinotherium bozasi & D. cf. bozasi	6	5		1	1	2	1	
			Number analyzed	**6**	**5**	**0**	**1**	**1**	**2**	**1**	**16**
	Gomphotheriidae		Anancus kenyensis						4		
			Anancus sp.	1							
			Tetralophodon sp. nov.	1		1					
			Choerolophodon ngorora	4							
			Gomphotheriidae gen. et sp. indet.	1	2	7	4				
			Number analyzed	**7**	**2**	**8**	**4**	**0**	**4**	**0**	**25**
	Elephantidae		Stegotetrabelodon orbus						1		
			Stegotetrabelodon sp.				2	1	1		
			Primelephas gomphotheroides					1			
			Primelephas or S. orbus				1	3			
			Elephantidae gen. et sp. indet.				1	6	3		
			Number analyzed	**0**	**0**	**0**	**4**	**11**	**5**	**0**	**20**
Perissodactyla											
	Equidae		"Cormohipparion" aff. africanum	35	24	13					
			Eurygnathohippus turkanense				1	2			
			Eurygnathohippus feibeli				1				
			Eurygnathohippus sp.				12	4	5		
			Number analyzed	**35**	**24**	**13**	**14**	**6**	**5**	**0**	**97**
Perissodactyla (cont.)											
	Rhinocerotidae										
			Chilotheridium pattersoni		4?						
			Kenyatherium bishopi	11							
			Brachypotherium lewisi			1	11	5	1		
			Ceratotherium sp.		?		2	4	1	3	
			Diceros praecox					4	3		
			Rhinocerotidae gen. et. sp. indet.		8	1	2		6		
			Number analyzed	**11**	**12**	**2**	**15**	**13**	**11**	**3**	**67**
Artiodactyla											
	Bovidae	Tragelaphini	Tragelaphini gen. & sp. indet.	6			1	2			
		Boselaphini	Boselaphini gen. & sp. indet.	1	5						
		Reduncini	Reduncini gen. & sp. indet.				3	1		1	
		Hippotragini	Hippotragini gen. et sp. indet.				1				
		Alcelaphini	Alcelaphini gen. & sp. indet.					1			
		Aepycerotini	Aepyceros sp.					1		1	
		Antilopini	Gazella sp. indet.		1						
			Antilopini gen. et sp. indet.			1					
			Bovidae gen. et sp. indet.	3		1	1	2	6		
			Number analyzed	**10**	**6**	**2**	**6**	**7**	**6**	**2**	**39**
	Giraffidae										
		Samotherinae	? Samotherium sp.	4							
		Palaeotraginae	Palaeotragus germaini				2				
			Palaeotragus cf. germaini		4						
			Palaeotragus sp.				2	1			
			Giraffa stillei							1	
			Giraffidae gen. et sp. indet.	11	3	3					
			Number analyzed	**15**	**7**	**3**	**4**	**1**	**0**	**1**	**31**
	Hippopotamidae		Kenyapotamus cf. coryndoni	7	6	3					
			Archaeopotamus lothagamensis				2	1			
			Archaeopotamus harvardi				4	2			
			Archaeopotamus sp. indet.				2				
			Hippopotamidae gen. et sp. indet.	7			21	25	7		
			Number analyzed	**14**	**6**	**3**	**29**	**28**	**7**	**0**	**87**

Order	Family	Tribe or Subfamily	Species	Site:	Nakali	Samburu Hills		Lothagam		Lothagam		Total # by Family
				Formation:	Nakali	Namurungule		Nawata		Nachukui		
				Member:	--	Lower	Upper	Lower	Upper	Apak	Kaiyum.	
Artiodactyla (cont.)												
	Suidae		Nyanzachoerus spp.		3							
			Nyanzachoerus syrticus					5	8			
			Nyanzachoerus cf. Ny. syrticus			3	2					
			Nyanzachoerus cf. Ny. australis						2	3		
			Nyanzachoerus pattersoni								1	
			Nyanzachoerus devauxi					5	1			
			Nyanzachoerus jaegeri							4		
			Notochoerus euilus & N. cf. euilus								5	
			Suidae gen. et sp. indet.		12	4	1	4	1	6		
			Number analyzed		**15**	**7**	**3**	**14**	**12**	**13**	**6**	**70**
			Total Number Specimens by Site		**113**	**69**	**34**	**91**	**79**	**53**	**13**	**452**

Taxa from the Nakali Formation are compiled from Aguirre & Alberdi, 1974; Aguirre & Leakey, P., 1974; Aguirre & Guerin, 1974; Flynn, 1984; Benefit and Pickford, 1986; Morales and Pickford, 2006; and Kunimatsu et al, 2007. Namurungule Formation fauna are from Nakaya et al, 1984; Nakaya et al, 1987; Nakaya & Watabe, 1990 Nakaya, 1994; and Tsujikawa 2005. Nawata and Nachukui fauna are from Leakey and Harris, 2003. An X indicates presence of a taxon, X? indicates presence of taxon but formation member is unknown. For Nawata and Nachukui fauna, the number represents the number of accessioned specimens by taxon in the National Museum of Kenya's Paleontology Collection.

Table S2. Mammalian Fauna from the Nakali, Namurungule, Nawata, and Nachukui Formations by Member. Nakali Formation taxa are compiled from Aguirre & Alberdi, 1974; Aguirre & Leakey, P., 1974; Aguirre & Guerin, 1974; Flynn, 1984; Benefit and Pickford, 1986; Morales and Pickford, 2006; and Kunimatsu et al, 2007. Namurungule Formation taxa are compiled from Nakaya et al, 1984; Nakaya et al, 1987; Nakaya & Watabe, 1990 Nakaya, 1994; and Tsujikawa 2005a. Nawata and Nachukui fauna are from Leakey and Harris, 2003. Werdelin and Sanders (2010) and chapeters therein are also used. An X indicates presence of a taxon, ?X indicates presence of taxon but formation member is unknown, and a number represents the number of accessioned specimens by taxon in the National Museum of Kenya's Paleontology Collection.

			Site:	Nakali	Samburu Hills		Lothagam		Lothagam	
Order	Family	Tribe or	Species Formation:	Nakali	Namurungule		Nawata		Nachukui	
		Subfamily	Member:	--	Lower	Upper	Lower	Upper	Apak	Kaiyum.
Proboscidea										
	Deinotheriidae		Deinotherium bozasi & D. cf. bozasi	X	9	8	1	1	1	1
			Number Deinotheriidae taxa	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	Gomphotheriidae		Anancus kenyensis				1	2	3	
			Anancus sp.	X						
			Tetralophodon sp. nov.		3	6				
			Choerolophodon ngorora	X	1					
			Gomphotheriidae gen. et sp. indet.						1	
			Number Gomphotheriidae taxa	**2**	**2**	**1**	**1**	**1**	**2**	**0**
	Elephantidae		Stegotetrabelodon orbus				8	1	2	
			Primelephas gomphotheroides				3			
			Primelephas or S. orbus				7			
			Elephas nawatensis					2		
			Elephas ekorensis & cf. E. ekorensis						2	
			Loxodonta sp. indet. (?aff. L. exoptata)						3	
			Elephantidae gen. et sp. indet.				2		1	
			Elephantidae gen. & sp. incertae sedis A					1	1	
			Elephantidae gen. & sp. incertae sedis B						1	
			Number Elephantidae taxa	**0**	**0**	**0**	**4**	**3**	**6**	**0**
Perissodactyla										
	Equidae		"Cormohipparion" aff. africanum	X	107	44				
			"Cormohipparion" cf. "C". primigenium				2			
			Eurygnathohippus turkanense				30	16		
			Eurygnathohippus feibeli				13	24		
			Eurygnathohippus sp. indet. (large)						8	8
			Eurygnathohippus sp. indet. (small)						5	1
			Number Equidae taxa	**1**	**1**	**1**	**3**	**2**	**2**	**2**
	Rhinocerotidae									
			Chilotheridium pattersoni		21					
			Paradiceros mukirii		19	7				
			Kenyatherium bishopi	X	3					
			Brachypotherium lewisi				20	11	2	
			Ceratotherium sp.		?	?	2	6	1	4
			Diceros praecox					4	5	
			Iranotheriinae sp. nov.		10					
			Rhinocerotidae gen. et sp. indet.	X	29	10				
			Number Rhinocerotidae taxa	**2**	**5**	**2**	**2**	**3**	**3**	**1**
	Chalicotheriidae		Chalicotheriidae gen. et sp. indet.			1				
			Number Chalicotheriidae taxa	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Artiodactyla										
	Bovidae	Tragelaphini	Tragelaphus kyaloae					1	7	3
			Tragelaphus cf. T. scriptus							1
			Tragelaphini gen. & sp. indet	X						
		Bovini	Simatherium aff. S. kohllarsoni						1	4
		Boselaphini	Tragoportax cf. T. cyrenaicus				7	1	2	
			Tragoportax sp. A				4	2		
			Tragoportax sp. B				1	2		
			Tragoportax sp. indet		5					
			Boselaphini gen. & sp. indet.	X	47					

Order	Family	Tribe or Subfamily	Species	Site: Nakali	Samburu Hills		Lothagam		Lothagam	
			Formation:	Nakali	Namurungule		Nawata		Nachukui	
			Member:	--	Lower	Upper	Lower	Upper	Apak	Kaiyum.
Artiodactyla (cont.)										
		Reduncini	Kobus presigmoidalis				4	13	4	1
			Kobus laticornis					10		
			Menelikia leakeyi				4	3		
		Hippotragini	Praedamalis ?sp.				2	4		
			Hippotragus sp.				2	2	1	
		Alcelaphini	Damalacra sp. A				4	23	4	
			Damalacra sp. B				2	2	3	2
		Aepycerotini	Aepyceros premelampus				72	58	20	9
		Antilopini	Pachytragus sp.		16					
			Gazella sp. indet.	X		12	1	2	3	
			?Antidorcus sp.		1	2				
			Antilopini gen. et sp. indet.			1				
		Neotragini	Raphiceros sp.				1	1	2	
			Madoqua sp.				1	3	1	
			Bovidae gen. et sp. indet.	X	9	27	25	6		
			Number Bovidae taxa	**4**	**5**	**4**	**14**	**16**	**11**	**6**
	Giraffidae									
		Samotherinae	? Samotherium sp.	X	15	6				
		Sivatherinae	cf. Sivatherium sp.				1			
		Palaeotraginae	Palaeotragus germaini				5	5		
			Palaeotragus cf. germaini	X	84	21				
			Palaeotragus sp.				7	4		
		Giraffinae	Giraffa stillei						9	3
			Number Giraffidae taxa	**2**	**2**	**2**	**3**	**2**	**1**	**1**
	Hippopotamidae		Kenyapotamus coryndoni	X	9	2				
			Archaeopotamus lothagamensis				6			
			Archaeopotamus harvardi				85	63	14	15
			Archaeopotamus sp. indet.				5	3		3
			Hippopotamus cf. H. protamphibius						5	
			Hippopotamidae gen. et sp. indet.	X						
			Number Hippopotamidae taxa	**2**	**1**	**1**	**3**	**2**	**2**	**2**
	Suidae		cf. Kubanochoerus sp.		?X	?X	1			
			Nyanzachoerus spp.	X			1	5		
			Nyanzachoerus syrticus & cf. syrticus		?X	?X	82	49	2	
			Nyanzachoerus devauxi & cf. devouxi		16	6	28	7		
			Nyanzachoerus cf. Ny. australis					4	15	
			Nyanzachoerus pattersoni							3
			Notochoeruss jaegeri						2	
			Notochoerus euilus & No. cf. euilus						1	21
			cf. Potamochoeroides sp.				2	1		
			Cainochoerus cf. C. africanus					1		
			Number Suidae taxa	**?2**	**3**	**3**	**5**	**6**	**4**	**2**
	Tragulidae		Tragulidae indet.			1				
			Number Tragulidae taxa	**0**	**0**	**1**	**0**	**0**	**0**	**0**
Primates										
	Cercopithecinae		Parapapio lothagamensis				76	31		
			cf. Parapapio sp. indet.						4	1
			Theropithecus brumpti & cf. brumpti							12
			Number Cercopithecinae taxa	**0**	**0**	**0**	**1**	**1**	**1**	**2**

				Site:	Nakali	Samburu Hills		Lothagam		Lothagam	
Order	Family	Tribe or	Species	Formation:	Nakali	Namurungule		Nawata		Nachukui	
		Subfamily		Member:	--	Lower	Upper	Lower	Upper	Apak	Kaiyum.
Primates (cont.)											
	Colobinae		Cercopithecoides kerioensis							?1	
			Colobinae species A					4	3		
			Colobinae species B					8	8		
			Colobinae species C							2	
			Colobinae gen. indet. & sp. indet. (small)					4	4		
			Colobinae gen. indet. & sp. indet. (large)								1
			Microcolobus sp.		X						
			Number Colobinae taxa		**1**	**0**	**0**	**3**	**3**	**1**	**1**
	small non-cercopithecoid catarrhine gen. indet. A				**X**						
	small non-cercopithecoid catarrhine gen. indet. B				X						
	Hominoidea &		Hominoidea sp.		X						
	Hominidae		Nakalipithecus nakayamai*		12						
			Samburupithecus kiptalami*			1					
			Hominidae indet.						2	1	
			Kenyanthropus platyops or Australopithecus cf. Au. afarensis								4
			Number Hominidae & Hominoidea taxa		**2**	**1**	**0**	**0**	**1**	**1**	**1**
			**incertae sedis* w/in Hominidae								
Rodentia											
	Rhyzomyidae		Nakalimys lavocati		X						
			Number Rhyzomyidae taxa		**1**	**0**	**0**	**0**	**0**	**0**	**0**
	Thryonomyidae		Paraphiomys sp.		X	1					
			Paraphiomys chororensis					1			
			Paraulacodus sp.			2					
			Paraulacodus cf. P. johanesi					1			
			Thyronomys cf. T. gregorianus								1
			Thyronomys sp. (small)						5		
			Number Thryonomyidae taxa		**1**	**2**	**2**	**2**	**1**	**0**	**1**
	Muridae		Abudhabia sp.						1		
			Karnimata jacobsi sp. nov.					4			
			Saidomys sp.						1		
			Muridae gen. et sp. indet.					1			
			Number Muridae taxa		**0**	**0**	**0**	**2**	**2**	**0**	**0**
	Hystricidae		Hystrix sp. (small)					1			
			Hystrix sp. (large)								1
			Number Hystricidae taxa		**0**	**0**	**0**	**1**	**0**	**0**	**1**
	Sciuridae		Kubwaxerus pattersoni					6			
			Number Sciuridae taxa		**0**	**0**	**0**	**1**	**0**	**0**	**0**
Lagomorpha											
	Leporidae		Alilepus sp.					4			
			Serengetilagus praecapensis							1	
			Number Leporidae taxa		**0**	**0**	**0**	**1**	**0**	**1**	**0**
Carnivora											
	Mustelidae		Mustelidae gen. et sp. indet.		X						
			Ekorus ekakeran					2			
			Erokomellivora lothagamensis						1		
			Mellivoranae gen. et sp. indet.					1	1		
			Vishnuonyx angololensis					1			
			Number Mustelidae taxa		**1**	**0**	**0**	**3**	**2**	**0**	**0**

Order	Family	Tribe or Subfamily	Species	Site: / Formation: / Member:	Nakali / Nakali / --	Samburu Hills / Namurungule / Lower	Samburu Hills / Namurungule / Upper	Lothagam / Nawata / Lower	Lothagam / Nawata / Upper	Lothagam / Nachukui / Apak	Lothagam / Nachukui / Kaiyum.
Carnivora (cont.)											
	Hyaenidae		Hyaenidae gen. et sp. indet.		X	5	2				
			Ictitherium ebu					1		1	
			Hyaenictitherium cf. H. parvum					1	2		
			cf. Hyanictis sp.					3	1	1	
			Ikelohyaena cf. I. abronia					1		1	
			Number Hyaenidae taxa		**1**	**1**	**1**	**4**	**2**	**3**	**0**
	Percrocutidae		Percrocuta leakeyi		X						
			Number Percrocutidae taxa		**1**	**0**	**0**	**0**	**0**	**0**	**0**
	Amphicyonidae		Amphicyonidae gen. et sp. indet.			X?	X?				
			Amphicyonidae sp. A					3			
			Amphicyonidae sp. B						1		
			Number Amphicyonidae taxa		**0**	**1**	**1**	**1**	**1**	**0**	**0**
	Felidae		Machairodontinae gen. et sp. indet.			X					
			Lokotunjailurus emageritus					16	13		
			Metailurus cf. Metailurus sp.					1	6		
			Dinofelis sp.					4	8	6	
	Felidae		Dinofelis aronoki								1
			Leptailurus or Caracal sp.								1
			Number Felidae taxa		**0**	**1**	**1**	**3**	**3**	**1**	**2**
	Viverrdae		Viverra cf. V. leakeyi					1			
			Viverinae sp. indet.					1			
			Viverinae gen. et sp. indet. (large)					1	1		
			Genetta sp. A					2			
			Genetta sp. B						1		
			Number Viverridae taxa		**0**	**0**	**0**	**4**	**2**	**0**	**0**
	Canidae		cf. Canis sp.								1
			Number Canidae taxa		**0**	**0**	**0**	**0**	**0**	**0**	**1**
Hyracoidea											
	Procaviidae		cf. Heterohyrax sp.		X						
	Pliohyracidae		Parapliohyrax gen indet.			1					
			Number Procaviidae taxa		**1**	**1**	**1**	**0**	**0**	**0**	**0**
			Total Number taxa		**23**	**27**	**23**	**62**	**54**	**40**	**24**

Table S3. Calculated δ^{13}C values (‰) for enamel based on C3 and C4 diets using an enrichment factor of 14.1‰ from Cerling and Harris (1999). The δ^{13}C values for paleoatmospheric CO2 are the maximum and minimum (90% confidence interval) values determined by Tipple et al, 2010 using the high resolution and 3 Ma benthic foraminifera records.

Age (Ma)	**Formation/ Member**	**δ^{13}C atm CO_2 high estimate**	**δ^{13}C atm CO_2 low estimate**	**δ^{13}C plant Average C3_plant**	**δ^{13}C plant Max. C3_plant**	**δ^{13}C plant Average C4_plant**	**δ^{13}C_enamel Average C3_enamel**	**δ^{13}C_enamel Max. C3_enamel**	**δ^{13}C_enamel Average C_4_enamel**	**Tipple et al., 2010 dataset**
present		-8.2	--	-27.3	-24.5	-12.8	-13.4	-10.5	1.3	high res benthic
3.22-3.18	Kaiyumung	-5.7	-6.4	-24.8	-22.1	-11.1	-10.9	-8.1	3.1	high res benthic
4.2-4.29	Apak	-5.9	-6.6	-25.0	-22.2	-11.2	-11.0	-8.2	2.9	3myr benthic
6.63-6.46	U. Nawata	-5.8	-7.0	-24.9	-22.2	-11.7	-11.0	-8.2	2.4	high res benthic
7.55-7.40	L. Nawata	-5.3	-6.5	-24.4	-21.7	-11.2	-10.5	-7.7	3.0	high res benthic
9.62-9.31	Namurungule	-5.5	-6.7	-24.6	-21.8	-11.3	-10.6	-7.8	2.8	high res benthic
10.02-9.82	Nakali	-5.3	-6.5	-24.5	-21.7	-11.2	-10.5	-7.7	3.0	high res benthic
10.02-3.0	All sites	-5.6	-6.6	-24.7	-21.9	-11.3	-10.8	-7.9	2.9	high res benthic

Table S4. Shapiro-Wilk test for normality of $\delta^{13}C$ data by age. H_0 = The data are from the Normal distribution; Small p-values reject H_0.

AGE	W	p value	Normal?	n
3.2	0.8115	0.0094	no	13
4.2	0.8125	<0.0001	no	53
6.5	0.9163	<0.0001	no	79
7.4	0.9704	0.0343	no	91
9.3	0.9502	0.1246	yes	34
9.6	0.9519	0.0010	no	69
9.9	0.8523	<0.0001	no	113
ALL	0.9452	<0.0001	no	452

Table S5. Mann-Whitney U test results comparing medians for each family by between time periods. Time periods are listed at the top of each column in Ma. Values in **bold** are significanty different at the 95% level ($p < 0.05$). To perform the test, a minimum of 5 individuals was required for each population.

	3.2 vs. 4.2		4.2 vs. 6.5		6.5 vs. 7.4		7.4 vs. 9.3		7.4 vs. 9.6		9.3 vs. 9.6		9.3 vs. 9.9		9.6 vs. 9.9	
Family	χ^2	**p**	χ^2	**p**	χ^2	**p**	χ^2	**p**	χ^2	**p**	χ^2	**p**	χ^2	**p**	χ^2	**p**
bovid	--	--	1.65	0.1985	0.18	0.6682	--	--	2.08	0.1495	--	--	--	--	7.35	**0.0067**
dein	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5.63	**0.0176**
equid	--	--	4.03	**0.0446**	6.12	**0.0133**	0.72	0.3957	--	--	0.85	0.3562	--	--	30.01	**<0.0001**
ele+gom	--	--	0.01	0.9349	2.56	0.1096	9.94	**0.0016**	--	--	--	--	0	1.0	--	--
giraffid	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.21	**0.0008**
hippo	--	--	4.25	**0.0392**	6.44	**0.0111**	--	--	7.13	**0.0076**	--	--	--	--	11.44	**0.0007**
rhino	--	--	2.73	0.0987	0.39	0.5339	--	--	8.57	**0.0034**	--	--	--	--	11.04	**0.0009**
suid	6.47	**0.0109**	5.24	**0.0221**	1.49	0.2226	--	--	2.52	0.1127	--	--	--	--	11.69	**0.0006**

Table S6. Carbon isotope data of fossil enamel from the Nakali, Namurungule, Nawata, Nachukui and Kaiyumung Formations. Capital and lower case letters indicate upper and lower teeth, respectively; c= canine, d = decidous, i= incisor, p= premolar, m=molar, molar frag= premolar or molar fragment, and x= tooth position unknown.

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Bovidae					
-10.7	Tragelaphini gen. indet.	mx	L. Nakali	NA3-12231	9.9
-10.3	Bovidae gen. indet.	molar frag	L. Nakali	NA11-12243	9.9
-11.2	Bovidae gen. indet.	m frag	U. Nakali	NA60-12039	9.9
-10.6	Tragelaphini gen. indet.	molar frag	U. Nakali	NA2-7745	9.9
-11.8	Tragelaphini gen. indet.	mx	Nakali	KNM-NA 43	9.9
-10.5	Tragelaphini gen. indet.	Mx	Nakali	KNM-NA 44	9.9
-10.1	Tragelaphini gen. indet.	molar frag	Nakali	KNM-NA 48	9.9
-9.9	Tragelaphini gen. indet.	M frag	Nakali	KNM-NA 47	9.9
-9.5	Boselaphini gen. indet.	m3	Nakali	KNM-NA 42	9.9
-8.1	Alcelaphini?	Mx	Nakali	KNM-NA 284	9.9
-10.3	Boselaphini gen. indet.	M1 frag	L. Namarungule	KNM-SH-41903	9.6
-8.8	Boselaphini gen. indet.	M3	L. Namarungule	KNM-SH 37890	9.6
-4.4	Boselaphini gen. indet.	p3 & p4	L. Namarungule	KNM-SH 15735	9.6
-3.7	Boselaphini gen. indet.	M1 frag	L. Namarungule	KNM-SH 15726	9.6
-7.6	Boselaphini sp. small	mx	L. Namarungule	KNM-SH 40125	9.6
-4.5	Gazella sp.	dp4	L. Namarungule	KNM-SH-15736	9.6
-7.6	Antilopini gen. indet.	m1	U. Namarungule	KNM-SH-38324	9.3
-2.1	Bovidae gen. indet.	M2	U. Namarungule	KNM-SH 12334	9.3
-4.5	Bovidae gen. indet.	molar frag	L. Nawata	LOTH-125	7.4
2.2	Hippotragini gen. indet.	m3	L. Nawata	KNM-LT 25432	7.4
-4.9	Reduncini	m1	L. Nawata	KNM-LT 207	7.4
-4.0	Reduncini	m3	L. Nawata	KNM-LT 23624	7.4
-1.0	Reduncini	m1	L. Nawata	KNM-LT 13007	7.4
-7.3	Tragelaphini gen. indet.	m3	L. Nawata	KNM-LT 182	7.4
-9.0	Aepyceros	molar frag	U. Nawata	LOTH-152	6.5
0.2	Alcelaphini	M frag	U. Nawata	KNM-LT 517	6.5
-3.3	Bovidae gen. indet.	molar frag	U. Nawata	LOTH-45	6.5
-2.9	Bovidae gen. indet.	molar frag	U. Nawata	LOTH-41	6.5
-1.8	Reduncini	m frag	U. Nawata	KNM-LT 23693	6.5
-8.5	Tragelaphini gen. indet.	m frag	U. Nawata	KNM-LT 28777	6.5
-7.2	Tragelaphini gen. indet.	m3	U. Nawata	KNM-LT 23613	6.5
-5.8	Bovidae gen. indet.	molar frag	Apak	LOTH-59	4.2
-3.3	Bovidae gen. indet.	molar frag	Apak	LOTH-111	4.2
-2.8	Bovidae gen. indet.	molar frag	Apak	LOTH-103	4.2
-1.7	Bovidae gen. indet.	molar frag	Apak	LOTH-106	4.2
-0.9	Bovidae gen. indet.	molar frag	Apak	LOTH-119	4.2
-0.4	Bovidae gen. indet.	molar frag	Apak	LOTH-100	4.2
-6.6	Aepyceros sp.	m frag	Kaiyumung	KNM-LT 28736	3.2
-2.1	Bovini or Reduncini	m frag	Kaiyumung	KNM-LT 26040	3.2
Deinotheriidae					
-9.5	Deinotherium bozasi	mx	L. Nakali	KNM-NA 47136	9.9
-10.1	Deinotherium bozasi	p4	U. Nakali	KNM-NA 47142	9.9
-11.7	Deinotherium bozasi	m2	Nakali	KNM-NA 1	9.9
-11.5	Deinotherium bozasi	molar frag	Nakali	KNM-NA 3	9.9
-10.7	Deinotherium bozasi	m3	Nakali	KNM-NA 2	9.9

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Deinotheriidae (cont.)					
-10.0	Deinotherium bozasi	M3	Nakali	KNM-NA 259(B)	9.9
-9.8	Deinotherium bozasi	m3	L. Namarungule	KNM-SH 15783	9.6
-9.6	Deinotherium bozasi	m2	L. Namarungule	KNM-SH 12304	9.6
-9.5	Deinotherium bozasi	molar frag	L. Namarungule	KNM-SH 12306	9.6
-9.0	Deinotherium bozasi	m2	L. Namarungule	KNM-SH 12305	9.6
-8.9	Deinotherium bozasi	M1	L. Namarungule	KNM-SH 38331	9.6
-9.7	Deinotherium bozasi	molar frag	L. Nawata	KNM-LT 26346	7.4
-11.4	Deinotherium bozasi	molar frag	U. Nawata	KNM-LT 26344	6.5
-12.5	Deinotherium bozasi	molar frag	Apak	KNM-LT 23806	4.2
-12.0	Deinotherium bozasi	molar frag	Apak	KNM-LT 26345	4.2
-11.1	Deinotherium bozasi	dp4	Kaiyumung	KNM-LT 23677	3.2
Elephantidae					
-5.5	Elephantidae gen indet.	molar frag	L. Nawata	LOTH-137	7.4
-6.2	Stegotetrabelodon or Primelephas	dpx	L. Nawata	KNM-LT 26332	7.4
-1.0	Stegotetrabelodon sp.	molar frag	L. Nawata	KNM-LT 26336	7.4
-1.0	Stegotetrabelodon sp.	molar frag	L. Nawata	KNM-LT 26336	7.4
-2.1	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-159	6.5
-1.5	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-158	6.5
-0.9	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-176	6.5
-0.3	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-162	6.5
-0.2	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-171	6.5
-0.1	Elephantidae gen indet.	molar frag	U. Nawata	LOTH-154	6.5
-1.6	Primelephas sp.	molar frag	U. Nawata	KNM-LT 23783	6.5
-2.0	S.t.belodon or Primelephas	molar frag	U. Nawata	LOTH-64.b	6.5
-1.2	S.t.belodon or Primelephas	molar frag	U. Nawata	LOTH-64.a	6.5
-1.1	S.t.belodon or Primelephas	molar frag	U. Nawata	LOTH-64	6.5
0.3	Stegotetrabelodon sp.	molar frag	U. Nawata	LOTH-66	6.5
-0.4	Elephantidae gen indet.	molar frag	Apak	LOTH-118	4.2
-0.2	Elephantidae gen indet.	molar frag	Apak	LOTH-61	4.2
-0.8	Primelephas sp.	M3	Apak	KNM-LT 26323	4.2
-0.9	Stegotetrabelodon orbus	dp4	Apak	KNM-LT 26337	4.2
-1.1	Stegotetrabelodon sp.		Apak	WT 2632	4.2
Equidae					
-10.5	"Cormohipparion" aff. africanum	m3	L.? Nakali	NA34-11993	9.9
-9.5	"Cormohipparion" aff. africanum	m3	L. Nakali	KNM-NA 47153	9.9
-7.8	"Cormohipparion" aff. africanum	M3	L. Nakali	KNM-NA 47159	9.9
-6.3	"Cormohipparion" aff. africanum	px	L.? Nakali	KNM-NA 47274	9.9
-10.1	"Cormohipparion" aff. africanum	M3	U. Nakali	KNM-NA 47181	9.9
-9.6	"Cormohipparion" aff. africanum	m2	U. Nakali	NA52-12224	9.9
-9.4	"Cormohipparion" aff. africanum	M3	U. Nakali	NA52-11929	9.9
-9.1	"Cormohipparion" aff. africanum	mx	U. Nakali	KNM-NA 47267	9.9
-6.5	"Cormohipparion" aff. africanum	M3	U. Nakali	NA5-11913	9.9
-5.8	"Cormohipparion" aff. africanum	P3	U. Nakali	NA52-12223	9.9
-4.5	"Cormohipparion" aff. africanum	M3	U. Nakali	KNM-NA 47169	9.9
-4.1	"Cormohipparion" aff. africanum	Px	U. Nakali	KNM-NA 47275	9.9
-1.8	"Cormohipparion" aff. africanum	m3	U. Nakali	KNM-NA 47161_a	9.9
-1.4	"Cormohipparion" aff. africanum	m2 or m3	U. Nakali	KNM-NA 47179	9.9
-0.9	"Cormohipparion" aff. africanum	M1or M2	U. Nakali	KNM-NA 47249	9.9

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Equidae (cont.)					
-10.5	"Cormohipparion" aff. africanum	Mx	Nakali	NA36 12305	9.9
-10.4	"Cormohipparion" aff. africanum	m2	Nakali	KNM-NA 179	9.9
-10.2	"Cormohipparion" aff. africanum	P4	Nakali	KNM-NA 173	9.9
-10.1	"Cormohipparion" aff. africanum	P3 or P4	Nakali	KNM-NA 240	9.9
-10.0	"Cormohipparion" aff. africanum	P2	Nakali	KNM-NA 171	9.9
-9.9	"Cormohipparion" aff. africanum	P3	Nakali	KNM-NA 156	9.9
-9.8	"Cormohipparion" aff. africanum	P4	Nakali	KNM-NA 181	9.9
-9.6	"Cormohipparion" aff. africanum	p4	Nakali	KNM-NA 165	9.9
-9.4	"Cormohipparion" aff. africanum	M1	Nakali	KNM-NA 47180	9.9
-9.2	"Cormohipparion" aff. africanum	M3	Nakali	KNM-NA 155	9.9
-9.1	"Cormohipparion" aff. africanum	M2	Nakali	KNM-NA 47273	9.9
-8.6	"Cormohipparion" aff. africanum	P3	Nakali	KNM-NA 184	9.9
-8.5	"Cormohipparion" aff. africanum	P2	Nakali	KNM-NA 47272	9.9
-8.4	"Cormohipparion" aff. africanum	M1	Nakali	KNM-NA 232	9.9
-8.3	"Cormohipparion" aff. africanum	M2	Nakali	KNM-NA 170	9.9
-8.3	"Cormohipparion" aff. africanum	M3	Nakali	KNM-NA 241	9.9
-8.2	"Cormohipparion" aff. africanum	p2	Nakali	KNM-NA 47270	9.9
-7.7	"Cormohipparion" aff. africanum	p3	Nakali	KNM-NA 177	9.9
-7.4	"Cormohipparion" aff. africanum	M1 or M2	Nakali	KNM-NA 152	9.9
-7.3	"Cormohipparion" aff. africanum	m2	Nakali	KNM-NA 162	9.9
-6.6	"Cormohipparion" aff. africanum	mx	L. Namarungule	KNM-SH 14774	9.6
-6.2	"Cormohipparion" aff. africanum	mx	L. Namarungule	KNM-SH 15648	9.6
-5.5	"Cormohipparion" aff. africanum	Mx or P4	L. Namarungule	KNM-SH 15653	9.6
-5.3	"Cormohipparion" aff. africanum	p3	L. Namarungule	KNM-SH 14773	9.6
-5.1	"Cormohipparion" aff. africanum	P4	L. Namarungule	KNM-SH 15656	9.6
-4.8	"Cormohipparion" aff. africanum	dP	L. Namarungule	KNM-SH 12302	9.6
-4.7	"Cormohipparion" aff. africanum	m1	L. Namarungule	KNM-SH 40132	9.6
-4.5	"Cormohipparion" aff. africanum	M2	L. Namarungule	KNM-SH 12246	9.6
-4.2	"Cormohipparion" aff. africanum	M2	L. Namarungule	KNM-SH 12248	9.6
-3.7	"Cormohipparion" aff. africanum	unkn	L. Namarungule	KNM-SH 18007	9.6
-2.8	"Cormohipparion" aff. africanum	m3	L. Namarungule	KNM-SH 12287	9.6
-2.6	"Cormohipparion" aff. africanum	M1	L. Namarungule	KNM-SH 15662	9.6
-1.7	"Cormohipparion" aff. africanum	dP2	L. Namarungule	KNM-SH 15706	9.6
-1.6	"Cormohipparion" aff. africanum	mx	L. Namarungule	KNM-SH 12203	9.6
-1.4	"Cormohipparion" aff. africanum	m2	L. Namarungule	KNM-SH 12266	9.6
-1.2	"Cormohipparion" aff. africanum	M2	L. Namarungule	KNM-SH 12245	9.6
-1.0	"Cormohipparion" aff. africanum	M1	L. Namarungule	KNM-SH 15818	9.6
-1.0	"Cormohipparion" aff. africanum	M1 or M2	L. Namarungule	KNM-SH 14763	9.6
-0.7	"Cormohipparion" aff. africanum	M3	L. Namarungule	KNM-SH 15664	9.6
-0.7	"Cormohipparion" aff. africanum	m2	L. Namarungule	KNM-SH 38436	9.6
-0.6	"Cormohipparion" aff. africanum	m2	L. Namarungule	KNM-SH 12283	9.6
-0.6	"Cormohipparion" aff. africanum	M2	L. Namarungule	KNM-SH 12242	9.6
-0.3	"Cormohipparion" aff. africanum	M3	L. Namarungule	KNM-SH 15652	9.6
0.7	"Cormohipparion" aff. africanum	M3	L. Namarungule	KNM-SH 15658	9.6
-4.8	"Cormohipparion" aff. africanum	M1	U. Namarungule	KNM-SH 12202	9.3
-4.4	"Cormohipparion" aff. africanum	mx or p4	U. Namarungule	KNM-SH 15650	9.3
-3.5	"Cormohipparion" aff. africanum	M1	U. Namarungule	KNM-SH 12241	9.3
-2.8	"Cormohipparion" aff. africanum	M2	U. Namarungule	KNM-SH 12243	9.3
-2.7	"Cormohipparion" aff. africanum	mx	U. Namarungule	KNM-SH 12252	9.3
-2.2	"Cormohipparion" aff. africanum	m3	U. Namarungule	KNM-SH 15649	9.3
-1.9	"Cormohipparion" aff. africanum	m3	U. Namarungule	KNM-SH 12260	9.3

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Equidae (cont.)					
-1.8	"Cormohipparion" aff. africanum	m1	U. Namarungule	KNM-SH 12261	9.3
-1.6	"Cormohipparion" aff. africanum	unkn	U. Namarungule	KNM-SH 12249	9.3
-0.5	"Cormohipparion" aff. africanum	M3	U. Namarungule	KNM-SH 12247	9.3
-0.4	"Cormohipparion" aff. africanum	P4	U. Namarungule	KNM-SH 12205	9.3
-0.3	"Cormohipparion" aff. africanum	Mx	U. Namarungule	KNM-SH 12239	9.3
0.2	"Cormohipparion" aff. africanum	Mx or Px	U. Namarungule	KNM-SH 12244	9.3
-1.9	Eurygnathohippus feibeli	molar frag	L. Nawata	KNM-LT 23107	7.4
-3.8	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-133	7.4
-3.0	Eurygnathohippus sp.	mx	L. Nawata	LOTH-83	7.4
-2.9	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-128	7.4
-1.4	Eurygnathohippus sp.	I	L. Nawata	LOTH-77	7.4
-1.1	Eurygnathohippus sp.	M frag	L. Nawata	LOTH-40	7.4
-0.8	Eurygnathohippus sp.	Mx	L. Nawata	LOTH-94	7.4
-0.7	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-124	7.4
-0.6	Eurygnathohippus sp.	Mx	L. Nawata	LOTH-82	7.4
-0.6	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-123	7.4
-0.2	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-130	7.4
-0.1	Eurygnathohippus sp.	P3 or M3	L. Nawata	LOTH-91	7.4
0.4	Eurygnathohippus sp.	molar frag	L. Nawata	LOTH-127	7.4
-2.9	Eurygnathohippus turkanense	M1	L. Nawata	KNM-LT 25436	7.4
-0.1	Eurygnathohippus feibeli	m1	U. Nawata	KNM-LT 25475	6.5
-0.5	Eurygnathohippus sp.	molar frag	U. Nawata	LOTH-47	6.5
-0.3	Eurygnathohippus sp.	molar frag	U. Nawata	LOTH-48	6.5
-0.3	Eurygnathohippus sp.	Mx	U. Nawata	LOTH-50	6.5
-0.1	Eurygnathohippus sp.	molar frag	U. Nawata	LOTH-54	6.5
0.5	Eurygnathohippus turkanense	P3	U. Nawata	KNM-LT 25484	6.5
-0.2	Eurygnathohippus sp.	molar frag	Apak	LOTH-57	4.2
-1.8	Euygnathohippus sp.	molar frag	Apak	LOTH-110	4.2
-1.3	Euygnathohippus sp.	molar frag	Apak	LOTH-97	4.2
-1.0	Euygnathohippus sp.	molar frag	Apak	LOTH-101	4.2
-0.5	Euygnathohippus sp.	molar frag	Apak	LOTH-120	4.2
Giraffidae					
-11.5	Giraffidae gen. indet.	P3	L. Nakali	KNM-NA 47189	9.9
-9.8	Giraffidae gen. indet.	molar frag	L. Nakali	KNM-NA 45720	9.9
-9.5	Giraffidae gen. indet.	molar frag	L. Nakali	NA11-12008	9.9
-9.1	Giraffidae gen. indet.	m3	L. Nakali	KNM-NA 47191	9.9
-8.7	Giraffidae gen. indet.	molar frag	L. Nakali	KNM-NA 47150	9.9
-12.3	Giraffidae gen. indet.	m1 or m2	L.? Nakali	KNM-NA 47190	9.9
-11.3	Giraffidae gen. indet.	molar frag	U. Nakali	KNM-NA 47183	9.9
-9.8	Giraffidae gen. indet.	molar frag	U. Nakali	NA37 12205	9.9
-8.3	Giraffidae gen. indet.	mx	U. Nakali	NA1-11960	9.9
-11.0	Samotherium (?)	m1 or m2	Nakali	KNM-NA 292	9.9
-11.0	Samotherium (?)	M1 or M2	Nakali	KNM-NA 201	9.9
-10.8	Giraffidae gen. indet.	molar frag	Nakali	KNM-NA 325	9.9
-10.8	Giraffidae gen. indet.	m frag	Nakali	NA16-11974	9.9
-9.6	Samotherium (?)	m3	Nakali	KNM-NA 275	9.9
-8.0	Samotherium (?)	M1 or M2	Nakali	KNM-NA 290	9.9
-8.2	Giraffidae gen. indet.	Mx	L. Namarungule	KNM-SH-37898	9.6
-7.5	Giraffidae gen. indet.	M1or M2	L. Namarungule	KNM-SH 37895	9.6

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Giraffidae (cont.)					
-6.3	Giraffidae gen. indet.	mx	L. Namarungule	KNM-SH-37897	9.6
-8.7	Palaeotragus cf. germaini	m3 frag	L. Namarungule	KNM-SH 15846	9.6
-8.4	Palaeotragus cf. germaini	M3 frag	L. Namarungule	KNM-SH 12234	9.6
-7.7	Palaeotragus cf. germaini	M1	L. Namarungule	KNM-SH 14759	9.6
-7.1	Palaeotragus cf. germaini	p3	L. Namarungule	KNM-SH 12232	9.6
-10.7	Giraffidae gen. indet.	Px frag	U. Namarungule	KNM-SH 12238	9.3
-7.6	Giraffidae gen. indet.	m3	U. Namarungule	KNM-SH 12229_A	9.3
-7.3	Giraffidae gen. indet.	p4	U. Namarungule	KNM-SH 12233	9.3
-10.5	Palaeotragus germaini	M3	L. Nawata	KNM-LT 26262	7.4
-9.1	Palaeotragus germaini	M3	L. Nawata	KNM-LT 414	7.4
-11.4	Palaeotragus sp.	molar frag	L. Nawata	KNM-LT 23639	7.4
-8.1	Palaeotragus sp.	molar frag	L. Nawata	KNM-LT 23150	7.4
-12.2	Palaeotragus sp.	m1	U. Nawata	KNM-LT 29066	6.5
-9.4	Sivatherium maurusium	unkn	Kaiyumung	WT 17472	3.2
Gomphotheriidae					
-7.7	Choerolophodon ngorora	M2	L. Nakali	KNM-NA 47146	9.9
-6.9	Tetralophodon sp.	m2	U.? Nakali	KNM-NA 47397	9.9
-9.6	Choerolophodon ngorora	M1	Nakali	KNM-NA 4	9.9
-8.5	Anancus sp.	unkn	Nakali	KNM-NA 260	9.9
-8.4	Choerolophodon sp.	molar frag	Nakali	KNM-NA 47137	9.9
-7.6	Gomphotheriidae gen. indet.	unkn	Nakali	KNM-NA 6	9.9
-7.0	Choerolophodon ngorora	mx	Nakali	KNM-NA 86	9.9
-10.4	Gomphotheriidae gen. indet.	m1	L. Namarungule	KNM-SH 12377	9.6
-6.7	Gomphotheriidae gen. indet.	dm or dM	L. Namarungule	KNM-SH 15781	9.6
-9.1	Gomphotheriidae gen. indet.	molar frag	U. Namarungule	KNM-SH 12380	9.3
-9.0	Gomphotheriidae gen. indet.	molar frag	U. Namarungule	KNM-SH 12374	9.3
-8.6	Gomphotheriidae gen. indet.	M2	U. Namarungule	KNM-SH 12373	9.3
-8.4	Gomphotheriidae gen. indet.	M1	U. Namarungule	KNM-SH 12309	9.3
-7.4	Gomphotheriidae gen. indet.	molar frag	U. Namarungule	KNM-SH 12379	9.3
-6.9	Gomphotheriidae gen. indet.	P4	U. Namarungule	KNM-SH 12310	9.3
-4.6	Gomphotheriidae gen. indet.	M2	U. Namarungule	KNM-SH 12307	9.3
-8.1	Tetralophodon sp.	unkn	U. Namarungule	KNM-SH 12308	9.3
-3.9	Gomphotheriidae gen. indet.	M frag	L. Nawata	LOTH-84	7.4
-2.4	Gomphotheriidae gen. indet.	molar frag	L. Nawata	LOTH-75	7.4
-1.8	Gomphotheriidae gen. indet.	molar frag	L. Nawata	LOTH-72	7.4
0.7	Gomphotheriidae gen. indet.	M frag	L. Nawata	LOTH-90	7.4
-2.2	Anancus kenyensis	dP4	Apak	KNM-LT 28567	4.2
-0.9	Anancus kenyensis	m1	Apak	KNM-LT 361	4.2
-0.8	Anancus kenyensis	M frag	Apak	KNM-LT 23790	4.2
-0.7	Anancus kenyensis	m3	Apak	KNM-LT 341	4.2
Hippopotamidae					
-10.1	Hippopotamidae gen. indet.	m frag	L. Nakali	NA3-11953	9.9
-10.2	Kenyapotamus coryndoni	mx	L. Nakali	KNM-NA 45756	9.9
-9.1	Kenyapotamus coryndoni	p4 or p3	L. Nakali	KNM-NA 45754	9.9
-9.7	Hippopotamidae gen. indet.	m3	U. Nakali	KNM-NA 47284	9.9
-9.0	Hippopotamidae gen. indet.	p4	U. Nakali	NA28-11970	9.9
-11.2	Kenyapotamus coryndoni	Mx frag	U. Nakali	KNM-NA 47283	9.9

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Hippopotamidae (cont.)					
-9.8	Kenyapotamus coryndoni	Mx	U. Nakali	KNM-NA 47292	9.9
-10.3	Hippopotamidae gen. indet.	molar frag	Nakali	KNM-NA 146	9.9
-10.0	Hippopotamidae gen. indet.	m3	Nakali	KNM-NA 250 (C)	9.9
-9.7	Hippopotamidae gen. indet.	tusk frag	Nakali	KNM-NA 250 (A)	9.9
-9.7	Kenyapotamus coryndoni	m3	Nakali	KNM-NA 45735	9.9
-9.5	Kenyapotamus coryndoni	m3	Nakali	KNM-NA 246	9.9
-9.1	Kenyapotamus coryndoni	mx	Nakali	KNM-NA 192	9.9
-8.0	Hippopotamidae gen. indet.	molar frag	Nakali	KNM-NA 143	9.9
-8.5	Kenyapotamus coryndoni	M1	L. Namarungule	KNM-SH 14789	9.6
-6.8	Kenyapotamus coryndoni	mx	L. Namarungule	KNM-SH 18001	9.6
-6.8	Kenyapotamus coryndoni	p3	L. Namarungule	KNM-SH-40142	9.6
-6.4	Kenyapotamus coryndoni	M1	L. Namarungule	KNM-SH 15851	9.6
-6.2	Kenyapotamus coryndoni	m3	L. Namarungule	KNM-SH 14792	9.6
-5.2	Kenyapotamus coryndoni	m3	L. Namarungule	KNM-SH 15850	9.6
-6.5	Kenyapotamus coryndoni	m3	U. Namarungule	KNM-SH-15857	9.3
-5.6	Kenyapotamus coryndoni	tusk	U. Namarungule	SHS-188	9.3
-3.8	Kenyapotamus coryndoni	tusk	U. Namarungule	SHS-189	9.3
-3.4	Archaeopotamus harvardi	I	L. Nawata	KNM-LT 23270	7.4
-2.6	Archaeopotamus harvardi	p4	L. Nawata	KNM-LT 23872	7.4
-2.2	Archaeopotamus harvardi	P3	L. Nawata	KNM-LT 23269	7.4
-0.7	Archaeopotamus harvardi	P3	L. Nawata	KNM-LT 23831	7.4
-7.8	Archaeopotamus lothagamensis	tusk	L. Nawata	KNM-LT 23879	7.4
-2.1	Archaeopotamus lothagamensis	m3	L. Nawata	KNM-LT 22864	7.4
-4.1	Archaeopotamus sp indet.	p4	L. Nawata	KNM-LT 8585	7.4
-2.2	Archaeopotamus sp. indet.	M3	L. Nawata	KNM-LT 23874	7.4
-9.2	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-92	7.4
-7.9	Hippopotamidae gen. indet.	Px	L. Nawata	LOTH-135	7.4
-7.2	Hippopotamidae gen. indet.	M frag	L. Nawata	LOTH-78	7.4
-5.8	Hippopotamidae gen. indet.	PM3, M1, dP3, C	L. Nawata	LOTH-93	7.4
-5.7	Hippopotamidae gen. indet.	PM3, M1, dP3, C	L. Nawata	LOTH-93	7.4
-5.5	Hippopotamidae gen. indet.	M frag	L. Nawata	LOTH-74	7.4
-5.4	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-126	7.4
-5.4	Hippopotamidae gen. indet.	PM3, M1, dP3, C	L. Nawata	LOTH-93	7.4
-5.1	Hippopotamidae gen. indet.	Px	L. Nawata	LOTH-95	7.4
-5.0	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-122	7.4
-4.2	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-138	7.4
-4.0	Hippopotamidae gen. indet.	M frag	L. Nawata	LOTH-81	7.4
-3.8	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-85	7.4
-3.4	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-69	7.4
-3.2	Hippopotamidae gen. indet.	tusk	L. Nawata	LOTH-86	7.4
-3.1	Hippopotamidae gen. indet.	I	L. Nawata	LOTH-89	7.4
-3.0	Hippopotamidae gen. indet.	tusk	L. Nawata	LOTH-86	7.4
-2.8	Hippopotamidae gen. indet.	tusk	L. Nawata	LOTH-71	7.4
-2.1	Hippopotamidae gen. indet.	molar frag	L. Nawata	LOTH-69	7.4
-1.7	Hippopotamidae gen. indet.	tusk	L. Nawata	LOTH-87	7.4
-0.7	Hippopotamidae gen. indet.	M frag	L. Nawata	LOTH-73	7.4
-2.4	Archaeopotamus harvardi	tusk	U. Nawata	KNM-LT 23856	6.5
-1.0	Archaeopotamus harvardi	M2	U. Nawata	KNM-LT 409	6.5
-5.2	Archaeopotamus lothagamensis	m2	U. Nawata	KNM-LT 23871	6.5
-7.6	Hippopotamidae gen. indet.	Px	U. Nawata	LOTH-42	6.5
-5.2	Hippopotamidae gen. indet.	tusk	U. Nawata	LOTH-56	6.5

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Hippopotamidae (cont.)					
-5.1	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-172	6.5
-4.7	Hippopotamidae gen. indet.	dx & mx	U. Nawata	LOTH-49	6.5
-4.3	Hippopotamidae gen. indet.	M3	U. Nawata	LOTH-44	6.5
-3.7	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-151	6.5
-3.6	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-51	6.5
-3.2	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-173	6.5
-3.2	Hippopotamidae gen. indet.	dP and P	U. Nawata	LOTH-65	6.5
-3.1	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-150	6.5
-3.1	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-51	6.5
-2.9	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-160	6.5
-2.8	Hippopotamidae gen. indet.	P2	U. Nawata	LOTH-55	6.5
-2.6	Hippopotamidae gen. indet.	dI	U. Nawata	LOTH-68	6.5
-2.6	Hippopotamidae gen. indet.	dx & mx	U. Nawata	LOTH-49	6.5
-2.5	Hippopotamidae gen. indet.	M	U. Nawata	LOTH-43	6.5
-1.6	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-168	6.5
-1.0	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-175	6.5
-1.0	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-174	6.5
-0.6	Hippopotamidae gen. indet.	tusk	U. Nawata	LOTH 87	6.5
-0.4	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-156	6.5
-0.3	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH 157	6.5
0.6	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-46	6.5
0.8	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-153	6.5
0.9	Hippopotamidae gen. indet.	molar frag	U. Nawata	LOTH-165	6.5
-8.2	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-112	4.2
-7.0	Hippopotamidae gen. indet.	M	Apak	LOTH-99	4.2
-4.6	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-104	4.2
-4.4	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-62	4.2
-3.6	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-102	4.2
-3.3	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-63	4.2
-0.9	Hippopotamidae gen. indet.	molar frag	Apak	LOTH-109	4.2
Rhinocerotidae					
-11.6	Rhinocerotidae gen indet.	M3	L. Nakali	KNM-NA 47424	9.9
-9.2	Rhinocerotidae gen indet.	M1 or M2	L. Nakali	KNM-NA 47406	9.9
-8.7	Rhinocerotidae gen indet.	molar frag	L. Nakali	KNM-NA 47419	9.9
-6.5	Rhinocerotidae gen indet.	M3	U. Nakali	KNM-NA 47409	9.9
-9.0	Rhinocerotidae gen indet.	M3	U.? Nakali	KNM-NA 47534	9.9
-11.2	Rhinocerotidae gen indet.	M2	Nakali	KNM-NA 89_a	9.9
-10.3	Rhinocerotidae gen indet.	M3	Nakali	KNM-NA 255(C)	9.9
-9.6	Rhinocerotidae gen indet.	m1	Nakali	KNM-NA 106	9.9
-9.4	Rhinocerotidae gen indet.	unkn	Nakali	KNM-NA 104	9.9
-9.3	Rhinocerotidae gen indet.	unkn	Nakali	KNM-NA 93	9.9
-9.1	Rhinocerotidae gen indet.	unkn	Nakali	KNM-NA 92	9.9
-2.4	Brachypotherium sp.	m3	L. Namarungule	KNM-SH 12143	9.6
-5.7	Chilotheridium pattersoni	m3	L. Namarungule	KNM-SH 15769	9.6
-3.2	Chilotheridium pattersoni	mx	L. Namarungule	KNM-SH 15751	9.6
-1.0	Chilotheridium pattersoni	M3	L. Namarungule	KNM-SH 15831	9.6
-1.0	Chilotheridium pattersoni	M3	L. Namarungule	KNM-SH 15832	9.6
-7.1	Elasmotherinae	M1 or M2	L. Namarungule	KNM-SH 15824	9.6
-1.2	Elasmotherinae	M3	L. Namarungule	KNM-SH 15828	9.6

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Rhinocerotidae (cont.)					
-9.6	Rhinocerotidae gen indet.	p3 or p4	L. Namarungule	KNM-SH 15768	9.6
-8.1	Rhinocerotidae gen indet.	unkn	L. Namarungule	KNM-SH 15767	9.6
-8.0	Rhinocerotidae gen indet.	m1	L. Namarungule	KNM-SH 15749	9.6
-8.0	Rhinocerotidae gen indet.	M2	L. Namarungule	KNM-SH 15833	9.6
-2.4	Rhinocerotidae gen indet.	m1	L. Namarungule	KNM-SH 15757	9.6
-9.7	Brachypotherium sp.	mx frag	U. Namarungule	KNM-SH 12145	9.3
-4.9	Rhinocerotidae gen indet.	mx frag	U. Namarungule	KNM-SH 12378	9.3
-11.0	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 86	7.4
-10.6	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 23960	7.4
-10.6	Brachypotherium lewisi	M2	L. Nawata	KNM-LT 22874	7.4
-9.7	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 24290	7.4
-9.2	Brachypotherium lewisi	M3	L. Nawata	KNM-LT 24290	7.4
-9.1	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 28735	7.4
-8.5	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 23965	7.4
-7.9	Brachypotherium lewisi	m	L. Nawata	KNM-LT 81	7.4
-7.1	Brachypotherium lewisi	M3	L. Nawata	KNM-LT 93	7.4
-7.0	Brachypotherium lewisi	m frag	L. Nawata	KNM-LT 26280	7.4
-4.0	Brachypotherium lewisi	P2	L. Nawata	KNM-LT 99	7.4
-9.8	Ceratotherium sp.	M2	L. Nawata	KNM-LT-89-en	7.4
-9.1	Ceratotherium sp.	M2	L. Nawata	KNM-LT 89	7.4
-8.9	Rhinocerotidae gen indet.	molar frag	L. Nawata	LOTH-70	7.4
-7.1	Rhinocerotidae gen indet.	PM, PM, M	L. Nawata	LOTH-121	7.4
-10.9	Brachypotherium lewisi	molar frag	U. Nawata	KNM-LT-95	6.5
-9.8	Brachypotherium lewisi	p1	U. Nawata	KNM-LT 23967	6.5
-9.5	Brachypotherium lewisi	P2	U. Nawata	KNM-LT 22872	6.5
-8.0	Brachypotherium lewisi	M3	U. Nawata	KNM-LT 30651	6.5
-7.0	Brachypotherium lewisi	p1	U. Nawata	KNM-LT 23962	6.5
-10.8	Ceratotherium sp.	m1 frag	U. Nawata	KNM-LT 96	6.5
-4.0	Ceratotherium sp.	molar frag	U. Nawata	KNM-LT-23772-en	6.5
-2.1	Ceratotherium sp.	m2?	U. Nawata	KNM-LT 26278	6.5
-1.3	Ceratotherium sp.	m1	U. Nawata	KNM-LT 82	6.5
-10.7	Diceros praecox	P	U. Nawata	KNM-LT 23961	6.5
-10.5	Diceros praecox	m1	U. Nawata	KNM-LT 84	6.5
-6.3	Diceros praecox	m frag	U. Nawata	KNM-LT 26285	6.5
-4.3	Diceros praecox	M1	U. Nawata	KNM-LT 23665	6.5
-5.5	Brachypotherium lewisi	molar frag	Apak	KNM-LT-90	4.2
-2.4	Ceratotherium sp.	m frag	Apak	KNM-LT 83	4.2
-10.7	Diceros praecox	M3	Apak	KNM-LT 28563	4.2
-3.6	Diceros praecox	m1	Apak	KNM-LT 28762	4.2
-2.5	Diceros praecox	m3	Apak	KNM-LT 23971	4.2
-11.2	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-58	4.2
-2.4	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-117	4.2
-2.3	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-117	4.2
-2.2	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-117	4.2
-2.1	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-115	4.2
-2.0	Rhinocerotidae gen indet.	molar frag	Apak	LOTH-116	4.2
-0.6	Ceratotherium sp.	P2	Kaiyumung	KNM-LT 23969	3.2
0.5	Ceratotherium sp.	p2	Kaiyumung	KNM-LT 23968	3.2
0.8	Ceratotherium sp.	molar frag	Kaiyumung	KNM-LT-26283	3.2

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Suidae					
-9.0	Nyanzachoerus sp.	m3	L. Nakali	KNM-NA 45736	9.9
-8.7	Nyanzachoerus sp.	M1 or M2	L. Nakali	NA10-12008	9.9
-8.6	Nyanzachoerus sp.	Px	L. Nakali	KNM-NA 45737	9.9
-8.6	Nyanzachoerus sp.	m3	L. Nakali	KNM-NA 47242	9.9
-8.5	Nyanzachoerus sp.	m2	L. Nakali	KNM-NA 45743	9.9
-8.5	Nyanzachoerus sp.	molar frag	L. Nakali	KNM-NA 47280	9.9
-8.5	Nyanzachoerus sp.	p3 or p4	L. Nakali	KNM-NA 45739A	9.9
-8.2	Nyanzachoerus sp.	m frag	L. Nakali	NA12-12033	9.9
-8.2	Nyanzachoerus sp.	molar frag	L. Nakali	KNM-NA 45755	9.9
-7.8	Nyanzachoerus sp.	p4	L. Nakali	KNM-NA 47305	9.9
-10.8	Nyanzachoerus sp.	molar frag	U. Nakali	KNM-NA 47644	9.9
-9.8	Nyanzachoerus sp.	m frag	U. Nakali	NA38-11901	9.9
-9.1	Nyanzachoerus sp.	p4	U. Nakali	KNM-NA 47643	9.9
-8.8	Nyanzachoerus sp.	M3	U. Nakali	KNM-NA 47246	9.9
-6.3	Nyanzachoerus sp.	mx	U. Nakali	KNM-NA 47278	9.9
-7.4	Nyanzachoerus aff. syrticus	M1	L. Namarungule	KNM-SH 12418	9.6
-6.6	Nyanzachoerus aff. syrticus	M2	L. Namarungule	KNM-SH 18003	9.6
-3.5	Nyanzachoerus aff. syrticus	M1	L. Namarungule	KNM-SH 14760	9.6
-7.0	Nyanzachoerus sp.	molar frag	L. Namarungule	KNM-SH 18006	9.6
-6.5	Nyanzachoerus sp.	M1	L. Namarungule	KNM-SH 41910	9.6
-6.0	Nyanzachoerus sp.	m2	L. Namarungule	KNM-SH 40152	9.6
-5.3	Nyanzachoerus sp.	Mx frag	L. Namarungule	SH 6218 99	9.6
-7.9	Nyanzachoerus aff. syrticus	M3 frag	U. Namarungule	KNM-SH 12400	9.3
-5.1	Nyanzachoerus aff. syrticus	m2 frag	U. Namarungule	KNM-SH 12399	9.3
-8.4	Nyanzachoerus sp.	m2	U. Namarungule	KNM-SH 12420	9.3
-8.3	Nyanzachoerus devauxi	m3	L. Nawata	KNM-LT 26127	7.4
-8.3	Nyanzachoerus devauxi	m3	L. Nawata	KNM-LT 26116	7.4
-7.9	Nyanzachoerus devauxi	M3	L. Nawata	KNM-LT 110	7.4
-7.0	Nyanzachoerus devauxi	m3	L. Nawata	KNM-LT 303	7.4
-5.6	Nyanzachoerus devauxi	molar frag	L. Nawata	KNM-LT 22967	7.4
-9.6	Nyanzachoerus syrticus	m3	L. Nawata	KNM-LT 26115	7.4
-7.7	Nyanzachoerus syrticus	molar frag	L. Nawata	LOTH-132	7.4
-7.2	Nyanzachoerus syrticus	molar frag	L. Nawata	LOTH-129	7.4
-7.1	Nyanzachoerus syrticus	p4	L. Nawata	KNM-LT 26122	7.4
-5.7	Nyanzachoerus syrticus	m3	L. Nawata	KNM-LT 301	7.4
-8.6	Suidae gen. indet.	molar frag	L. Nawata	LOTH-134	7.4
-6.7	Suidae gen. indet.	i	L. Nawata	LOTH-96	7.4
-6.1	Suidae gen. indet.	molar frag	L. Nawata	LOTH-131	7.4
-6.1	Suidae gen. indet.	molar frag	L. Nawata	LOTH-80	7.4
-3.6	Nyanzachoerus cf. australis	M3	U. Nawata	KNM-LT 23627	6.5
-2.3	Nyanzachoerus cf. australis	m3	U. Nawata	KNM-LT 285	6.5
-5.7	Nyanzachoerus devauxi	M3	U. Nawata	KNM-LT 29096	6.5
-9.1	Nyanzachoerus syrticus	P4	U. Nawata	KNM-LT 26088	6.5
-8.6	Nyanzachoerus syrticus	M1	U. Nawata	KNM-LT 26088	6.5
-8.3	Nyanzachoerus syrticus	M2	U. Nawata	KNM-LT 26088	6.5
-6.5	Nyanzachoerus syrticus	m frag	U. Nawata	KNM-LT 24084	6.5
-5.9	Nyanzachoerus syrticus	molar frag	U. Nawata	KNM-LT 7709	6.5
-5.8	Nyanzachoerus syrticus	M2	U. Nawata	LOTH-67	6.5
-3.1	Nyanzachoerus syrticus	molar frag	U. Nawata	KNM-LT 23743	6.5
-2.7	Nyanzachoerus syrticus	M3	U. Nawata	KNM-LT 23747	6.5
-2.0	Suidae gen. indet.	molar frag	U. Nawata	LOTH-140	6.5

$\delta^{13}C$	Taxon	Part	Fm./Mbr.	Sample	Age (Ma)
Suidae (cont.)					
-4.0	Notochoerus jaegeri	M3	Apak	KNM-LT 311	4.2
-5.9	Nyanzachoerus cf. australis	m3	Apak	KNM-LT 26076	4.2
-2.6	Nyanzachoerus cf. australis	M3	Apak	KNM-LT 26092	4.2
-2.5	Nyanzachoerus cf. australis	M3	Apak	KNM-LT 26092	4.2
-1.9	Nyanzachoerus cf. australis	molar frag	Apak	LOTH-98	4.2
-1.8	Nyanzachoerus cf. australis	molar frag	Apak	KNM-LT 308	4.2
-1.5	Nyanzachoerus cf. australis	M3	Apak	KNM-LT 26084	4.2
-4.8	Suidae gen. indet.	molar frag	Apak	LOTH-105	4.2
-4.7	Suidae gen. indet.	molar frag	Apak	LOTH-105	4.2
-4.6	Suidae gen. indet.	molar frag	Apak	LOTH-105	4.2
-4.2	Suidae gen. indet.	I	Apak	LOTH-114	4.2
-2.9	Suidae gen. indet.	molar frag	Apak	LOTH-107	4.2
-2.5	Suidae gen. indet.	M	Apak	LOTH-113	4.2
-2.0	Notochoerus euilus	m3	Kaiyumung	KNM-LT 289	3.2
-1.8	Notochoerus euilus	m3	Kaiyumung	KNM-LT 23767	3.2
-1.2	Notochoerus euilus	M3	Kaiyumung	KNM-LT 26074	3.2
-0.5	Notochoerus euilus	M3	Kaiyumung	KNM-LT 24050	3.2
-0.2	Notochoerus euilus	m3	Kaiyumung	KNM-LT 26596	3.2
-2.9	Nyanzachoerus pattersoni	M3	Kaiyumung	KNM-LT 26137	3.2