APPENDIX I. SUPPLEMENTARY INFORMATION.

1. Detail Methods. Modern herbivore mammal samples were collected from 30 national parks and reserves and other regions in Kenya, Ethiopia, Uganda, Gabon, and the Democratic Republic of Congo (Table S1); these modern samples were supplemented with museum collections (University of Addis Ababa, American Museum of National History, Lwiro-CRSN, Field Museum, National Museums of Kenya) and using published values. The habitat localities included a range of biomes from desert shrublands to closed forests (Table S1). We use the classification of White (53) for discussion of African vegetation (Appendix, Section 2).

Fossils from the Turkana Basin from 4.3 to 1.0 Ma in age were sampled from the collections of the National Museums of Kenya. Bovids were identified to tribe; most other samples were identifiable to genus. We note in Dataset II when our taxonomic or stratigraphic assignments differ from the NMK catalog (*ca*. 20 of >900 specimens). For discussion of diets through geological time, we use taxonomic classification to tribe for the Bovidae, and to genus for all other large mammal families. Groupings were made by time-intervals, using the established correlations, stratigraphic nomenclature, and geochronologies of the Koobi Fora Formation, the Nachukui Formation, Kanapoi, and Shungura Formations (2-16). See Figure 2 for stratigraphic relationships.

$^{13}C/^{12}C$ ratios of hair, collagen, and tooth enamel were analyzed using standard methods (i.e, combustion in O_2 for organic material; reaction with H_3PO_4 for tooth enamel). Stable carbon isotopes were measured on hair or collagen samples on an isotope ratio mass spectrometer operating in continuous-flow mode after combustion at 1,600 °C in an elemental analyzer. Most bioapatites were pretreated using standard methods (3%

H_2O_2 followed by 0.1 M buffered acetic acid) and then were reacted with 100% H_3PO_4 with the resulting CO_2 being analyzed on a dual-inlet isotope ratio mass spectrometer; ivory samples were treated as in (17). Some fossil samples were too small for pre-treatment due to sampling restrictions: such small samples were corrected by comparison with samples run with and without treatment: the correction was 0.4‰ or less for these samples (see discussion in SI). Results are reported in the standard per mil (‰) notation:

$$\delta^{13}C = (R_{sample}/R_{standard}-1) * 1000$$

where R_{sample} and $R_{standard}$ are the $^{13}C/^{12}C$ ratios of the sample and standard, respectively. The isotope standard is Vienna Pee Dee Belemnite (VPDB).

Bioapatite was assumed to be 11.1‰ enriched relative to hair, and 8.5‰ enriched relative to collagen as determined earlier (18, 19). $\delta^{13}C$ values of modern hair, collagen, and bioapatite were corrected to a common reference time near the beginning of the Industrial Revolution, considered to be 1750, using atmospheric $\delta^{13}C$ data for the change in isotopic ratio of atmosphere due to human activities (20, 21); the $\delta^{13}C_{1750}$ value for atmospheric CO_2 is taken to be -6.3‰. $\delta^{13}C$ of deep-sea carbonates shows that the $\delta^{13}C$ of the atmosphere, and therefore the end-members for C_3 and C_4 plants, is essentially constant back to *ca*. 6 Ma (35, 36). Plant data from Cerling and Harris (18) were used to estimate mixing lines for C_3- and C_4-plants, corrected to $\delta^{13}C_{1750}$. All analyses from a single individual for both fossils and modern mammals were averaged to give a single isotopic ratio for that individual.

Due to small sample size, some fossil samples were not treated prior to analysis. We compared the results for treated and untreated samples for >200 samples; the average difference was *ca*. 0.4‰ (see Figure S1). We corrected untreated samples using the relationship

$$\delta^{13}C_{corrected} = 1.13\ \delta^{13}C_{untreated} + 0.64$$

Reported results are for the corrected $\delta^{13}C$ values.

2. Classification of African vegetation. Various schemes have been used to classify African vegetation (1, 22). Woody cover is readily quantified using a variety of methods, and so we adopt a vegetation classification system that is based primarily on woody cover (the United Nations Educational, Scientific, and Cultural Organization (UNESCO) classification of African vegetation; Ref 1). The principal vegetation types include forest, woodlands and grasslands, with some areas being mixed on the landscape scale (e.g., riparian woodlands associated with open woodlands or open grasslands). Forests have a continuous stand of trees at least 10-m tall with interlocking crowns; Woodland: an open-stand of trees at least 8-m tall with woody cover > 40% and a field layer dominated by grasses; Bushland: an open-stand of bushes usually between 3- and 8-m tall with woody cover > 40%; Thicket: a closed-stand of bushes and climbers usually between 3- and 8-m tall; Shrubland: an open- or closed-stand of shrubs up to 2-m tall; Wooded grassland: land covered with grasses and other herbs, with woody cover between 10 and 40%; Grassland: land covered with grasses and other herbs, with woody cover < 10%; Desert: Arid landscapes with a sparse cover dominated by sandy, stony or rocky substrate. This classification does not define a boundary between forest and woodland in terms of woody cover, we will consider that “forest” has > 80% woody cover based on the requirement for “interlocking crown canopies”. Within this structure, the scale at which fossil collections are made in both space (often 10s of km^2) and time (often 10^2 to 10^5 years) the mixing of habitats occurs: we consider mixed habitats as having elements both of forest (especially riparian forests or woodlands) with more open wooded grasslands or grasslands (i.e., savanna).

Woody cover in modern ecosystems can be quantified from ground observations and from satellite photography with results usually giving very close estimates (e.g., Ref 23). Here we make no distinction between woodland (woody cover > 8 m tall), bushland (woody cover 3 to 8 m tall) and shrubland (woody cover < 3 m tall) and use "woodland" synomously for all three vegetation structure classes. It is useful therefore, to further subdivide the classification above as follows: 0 to 10% woody cover: *grassland*; 10 to 20 percent woody cover: *open woody grassland*; 20 to 40 percent woody cover: *wooded grassland*; 40 to 60 percent woody cover: *open grassy woodland*; 60 to 80 percent woody cover: *woodland*; 80 to 100 % woody cover: *forest*.

In the text, we minimize use of the term “savanna”, which suffers from colloquial misuse and, for that reason, is not recognized in the UNESCO classification. Still, a modern ecological definition of the term "savanna" is comprehensive and includes structural, functional and evolutionary aspects. Structurally, a savanna is a “mixed tree-grass systems characterized by a discontinuous tree canopy in a conspicuous grass layer” (24). This, and other common usage of the term would include at least “wooded grasslands” and “grasslands” in the UNESCO structural categories described above, although woody cover varies significantly within the savannas (25, 26). Rainfall is widely recognized as the primary determinant of woody cover along with tolerance to fire, herbivory, and soil fertility (26-28).

3. **Principal biome collection areas for modern mammals.** We collected the major large mammal extant taxa from 30 different regions in Eastern and Central Africa; collection regions, climate and ecological information is given in Table S1. Museum collections supplemented the collections we were able to make by visiting these localities. Collections were principally from National Parks (NP) and National Reserves (NR). Broader geographic regions were included as follows:

ABER Aberdares. Collections were from the park Headquarters (HQ) and local ranger stations; additional samples were collected by Kenya Wildlife Service (KWS) personnel. Museum samples included samples collected from forests north of Nairobi on the southern flanks of the Aberdares, but regions which are now outside the park boundaries.

AMBO Amboseli. Samples were from Koch (29) and Bocherens (30), with additional samples collected by KWS personnel.

ATHI Athi plains. Samples were from regions outside of the nearby Nairobi National Park. Samples were from game ranches and from museum collections.

AWSH Awash. Samples were from the Awash National Park HQ and samples collected within the park, with additional specimens from the larger Awash NP region from museum collections.

BALE Bale Mtns. Samples were from Bale NP and also from museum collections from nearby mountain regions of Ethiopia (south and east of Addis Ababa, elevation > 2500 m).

CHYU Chyulu Hills. Samples are from the Chyulu Hills NP; collections made by KWS personnel.

ETHR Ethiopian Rift lakes. Samples were from Rift Lake region of Ethiopia, including Nechisar NP.

GMBA Garamba. Samples are from Garamba NP in DR Congo.

ITRI Ituri Forest. Samples are from the Ituri NP in DR Congo.

KBLE Kibale National Park. Samples from Kibale NP; also includes data of Nelson (31).

KCST Kenya Coast. Samples are from the Boni NR and Arabuko-Sokoki NP, supplemented with museum samples collected from the coastal regions; also includes samples collected by KWS in the Tana delta region.

KDPO Kidepo. Samples from Kidepo NP.

KZBG Kuhuzi-Biega. Samples are from the mountain sector of Kahuzi-Biega NP and from forested mountains near Lake Kivu. "L" and "LP" samples are from the museum at CNRS-Lwiro.

LAIK Laikipia. Samples are from the Laikipia plateau region of Kenya.

LEDW Lake Edward. Samples are from Queen Elizabeth Park in Uganda, and the Ishango and Lulimbi regions of Virunga Park of DR Congo, all bordering Lake Edward.

LOPÉ. Samples were collected over 20 year period in Lopé National Park (data from Ref 32).

MAGO Omo / Mago. Samples are from the lower Omo Valley, principally from park headquarters region.

MARA Masai Mara. Samples are from the Serengeti plains, principally the Masai Mara region in Kenya with samples collected by KWS, but also including published samples in Tanzania (33, 34). Also includes museum specimens.

MBRO. Samples from Lake Mburo NP.

MERU. Samples from Meru NP, Bisandi NR, Kora NP and nearby regions.

MTKE Mt Kenya. Samples are from the Mt Kenya forests, including museum specimens.

NAKG Nakuru - shore. Samples are from the alkali grasslands in Nakuru NP.

NBNP Nairobi NP. Samples are from Nairobi National Park, including the grasslands, the woodland - grassland transition, and the riparian corridors.

RFTV Kenya Rift Valley. Samples are from the plains region from Lake Naivasha to Nakuru. This is principally wooded grasslands and grasslands; includes riparian woodlands and bushlands. Includes data from Ambrose and DeNiro (35).

SAMB Samburu NR. Samples were principally from Samburu and Buffalo Springs NRs, supplemented by museum samples collected before NR boundaries were established.

SIME Simien Mtns. Samples are from the Simien Mountains NP.

TANA lower Tana River. Samples are from the plains of the lower Tana River, between Garissa and Garsen; samples do not include the Tana River delta region, which are grouped in KCST.

TRKG Turkana - grassland. Samples were from the alkali grasslands on the eastern shore of Lake Turkana; from near Koobi Fora to Ileret. Includes data from (36).

TRKX Turkana - regional. Samples were from the inland parts of the Turkana region, principally on the east side of Lake Turkana, but not including the alkali grasslands immediately adjacent to the lake. Also includes a few specimens on the west side of Lake Turkana. Includes data from (36).

TSVO Tsavo NP. Samples were from both Tsavo East NP and Tsavo West NP and the greater region. Includes data from (37).

4. Mixing lines and $\delta^{13}C$ assignments for C_3-browsing, mixed C_3/C_4, and C_4-grazing.

Mixing lines for different estimating the fraction of C_3- and C_4-biomass contributions to herbivores are considered in the context of the range of $\delta^{13}C$ plants found in African ecosystems, and on the range of isotope enrichment factors which are likely related to digestive physiology (38). Figure S2 shows the mixing lines derived using $\delta^{13}C_{1750}$ values from modern African vegetation as discussed in the text, and the resulting mixing lines accounting for differences in isotope enrichment factors for enamel derived from diets of C_3 and C_4 biomass. The isotope mixing equation for biomass is:

$$\delta^{13}C_{i,mix} = f_{i,C3}\, \delta^{13}C_{i,C3} + f_{i,C4}\, \delta^{13}C_{i,C4}$$

Where *i,mix* is the mixture for xeric ($i = x$) ecosystems or mesic ($i = m$) ecosystems, respectively; $f_{i,C3}$ is the fractional contribution of C_3 biomass to the xeric ecosystem or mesic ecosystem, respectively; $f_{i,C4}$ is the fractional contribution of C_4 biomass to the xeric ecosystem or mesic ecosystem, respectively; $\delta^{13}C_{i,C3}$ is $\delta^{13}C_{1750}$ value of C_3 biomass end-member for the xeric ecosystem or mesic ecosystem, respectively; $\delta^{13}C_{i,C4}$ is $\delta^{13}C_{1750}$ value of C_4 biomass end-member for the xeric ecosystem or mesic ecosystem, respectively. End-member $\delta^{13}C_{1750}$ values for C_3 and C_4 plants are taken to be -25.6‰ and -11.2‰, respectively for xeric ecosystems; end-member $\delta^{13}C_{1750}$ values are -26.6‰ and -10.0‰, respectively, for mesic ecosystems (see text). The mixing line for tooth enamel is 13.3 to 14.6‰ enriched relative diet (38). Therefore, the thickness of the mixing line for tooth enamel – and the projected fractions of C_3- and C_4-contributions to diet – results from the uncertainty in the end-member values for C_3- and C_4-dietary end-members and the isotope enrichment values.

To discuss dietary categories, it is necessary to define some terms. The isotope difference between C_3- and C_4-vegetation makes the grazing-browsing continuum easier to quantify. Because tropical grasses (below *ca*. 2500 m elevation) are almost exclusively C_4, we define C_4-grazers as having a predominantly C_4-diet. *Hypergrazers* have a diet indistinguishable from 100% C_4-diet; in Figure S2 this corresponds to tooth enamel values have $\delta^{13}C_{1750} > + 2‰$. C_3-dominated diets are considered to be browsers; note that this means that C_3 forbs contribute to the C_3-browse diet as well as do the C_3-woody plants. *Hyperbrowsers* have a diet indistinguishable from 100% C_3-diet; in Figure S2 this corresponds to a $\delta^{13}C_{1750}$ values <-12‰. In closed canopy forests, the understory can be very depleted in ^{13}C; a hyperbrowser with $\delta^{13}C_{1750} < -14‰$ is likely to be a *closed canopy C_3-browser*. The continuum of diets between the hypergrazers and hyperbrowsers is arbitrarily divided into C_3-browsers, mixed C_3-C_4 feeders, and C_4-browsers. For convenience we define *C_3-browsers* to have a C_3-dominated diet (> *ca*. 75% C_3) and *C_4-grazers* to have diets dominated by C_4 biomass (> *ca*. 75% C_4). Those with intermediate diets are called *C_3-C_4 mixed feeders*. For this paper, this gives the following ranges for the stable isotope dietary classification as derived from Figure S2:

$\delta^{13}C_{1750} > 2‰$: C_4-hypergrazers

$\delta^{13}C_{1750} > -1‰$: C_4-grazers

$\delta^{13}C_{1750} > -1‰$ and $< -8‰$: C_3-C_4 mixed feeders

$\delta^{13}C_{1750} < -8‰$: C_3-browsers

$\delta^{13}C_{1750} < -12‰$: C_3-hyperbrowsers

$\delta^{13}C_{1750} < -14‰$: C_3-closed canopy browsers

We note that the isotope enrichment factor may vary by >1‰ in the mammals considered in this paper, and that some minor differences in the $\delta^{13}C_{1750}$ values for enamel when comparing different taxa (e.g., suids to bovids) could arise from this difference. Evaluation of these enrichment factors could play a role in the future understanding the paleo-physiologies of digestion of the fossil mammal taxa. Given this uncertainty, we expect that the $\delta^{13}C_{1750}$ ranges used here may be changed in the future to recognize such physiological differences for certain taxa.

Table S2 shows the average $\delta^{13}C_{1750}$ values for the individual species analyzed in this study. Table S3 shows the distribution of C_4-grazers, mixed C_3-C_4 feeders, and C_3-browsers in each of the modern ecosystems considered in this study. Table S4 shows the average $\delta^{13}C$ values (tribe or genus) for modern and fossil time intervals for East and Central African large herbivore taxa (tribe/genus), summarized from Datasets I and II. Figures S4 and S5 show the trend over time for the diets of major lineages in the Turkana Basin for the normalized proportions of C_4-grazers, C_3-C_4 mixed, and C_3-browsers (G:M:B) with comparison to the modern diets of those lineages.

5. Diets of mammalian lineages in the Pliocene and Pleistocene. The mammalian lineages considered here derive from different members of the Kanapoi, Koobi Fora, and Nachukui formations and are of comparable age to the Shungura Formation in the lower Omo Valley as shown in Figure 2. Time intervals employed are as follows from oldest to youngest: > 4 Ma; 4.0 to 3.6 Ma, 3.6 to 3.4 Ma; 3.4 to 3.0; 3.0 to 2.5 Ma; 2.5 to 2.35 Ma; 2.35 to 1.9 Ma; 1.9 to 1.5 Ma; 1.5 to 1.3 Ma; 1.3 to 1.0 Ma.

Artiodactyla: Bovidae. The Bovidae comprise the most diverse large mammal family in Africa today, with dietary specialties ranging from closed-canopy C_3-hyperbrowsers to C_4-hypergrazers. Isotopic results on modern bovid specimens confirm previous observations (39, 40) for diets of East African and southern African bovids; however, as is shown below, many fossil bovids have a distinctly different diet than that of their modern counterparts.

Aepycerotini are today represented by the impala (*Aepyceros melampus*), which has a mixed diet throughout most of its modern range with an average $\delta^{13}C_{1750}$ value of -3.9 ± 2.6 (n = 66); the relative proportions of modern individuals with grazing:mixed:browsing (G:M:B) diets is 15:77:8 (Table 1 and Table S2). Aepycerotini from the > 4.0 Ma interval have a G:M:B diet of 25:50:25 (n =24), whereas those from all younger intervals together have a G:M:B diet of 53:47:0 (n = 43). Modern Aepycerotini have diets closer to their relatives 4.3 to 4.0 Ma in age, whereas from 4.0 to 1.0 Ma the Aepycerotini had a stronger grazing component to their diet than do their modern relatives

Alcelaphini consistently have the highest $\delta^{13}C$ of any bovid tribe or of any other APP taxa in East and Central Africa. All four genera of modern alcelaphins (*Alcelaphus, Beatragus, Connochaetes, Damaliscus*) have average $\delta^{13}C_{1750}$ values >2‰, indicating a pure or nearly pure-C_4 diet; few other modern APP taxa achieve such positive $\delta^{13}C_{1750}$ values. As previously noted (39, 40) such high values indicate either extreme selectivity in diets or that the isotope enrichment factor is especially high for alcelaphins compared to other mammals including other bovids.

Throughout the Pliocene and Pleistocene record in the Turkana Basin, alcelaphins have the highest, or second highest $\delta^{13}C$ value for any mammalian taxon within any time interval, with average values between -0.2 and 2.0‰ (G:W:B = 93:7:0; n = 129 individuals in the fossil record). Fossil specimens have slightly more negative $\delta^{13}C$ values than modern alcelaphins; thus, using the $^{13}C/^{12}C$ ratios defining hypergrazers discussed in this paper, none of the fossil alcelaphins are hypergrazers whereas most modern alcelaphins are hypergrazers.

Antilopini in our study include four extant genera—*Eudorcas* (Thomson's gazelle), *Litocranius* (gerenuk), *Nanger* (Grant's and Soemmering's gazelles), and *Oreotragus* (klipspringer). *Eudorcas* is primarily a grazer, *Litocranius* and *Oreotragus* are browsers, and *Nanger* is a mixed-feeder to browser (Table S2). Fossil Antilopini are difficult to distinguish from fossil Aepycerotini using only the dental material available for isotopic study; as a result, these fossil specimens are provisionally classified as Antilopini based on the judgment of the authors and generally agree with identifications in the Turkana Basin fossil catalog (41). Fossil Antilopini from the Turkana basin had diets with a much higher fraction of C_4-grass than those of modern Antilopini, especially the larger members of the tribe. From *ca*. 4.3 to 2.35 the G:M:B proportion of antilopins is *ca*. 17:75:8 (n = 12), but from 2.35 to 1.0 Ma it is 54:46:0 (n = 26).

Bovini are today represented in Africa by the Cape buffalo (*Syncerus caffer*); domestic cattle are not reported here. The diet of the Cape buffalo ranges from pure-grazing in most open ecosystems to pure-browsing in closed forests. Fossil Bovini in the Turkana Basin were primarily C_4-grazers but with some C_3-C_4 mixed feeders (G:M:B = 76:24:0, n = 21). *Syncerus* are primarily C_4-grazers in most non-forested regions of East Africa.

Caprini are represented today in East and Central Africa by the Walia ibex (*Capra walie*), which has a C_3 diet (Table S2); it is restricted to high mountains in Ethiopia. Domestic caprins (sheep and goats) are present throughout East and Central Africa but are not reported here. Caprins are very rare in the Kanapoi, Nachukui or Koobi Fora Formations and none have been sampled for stable isotopes.

Cephalophini are represented in Africa today by the forest duikers (*Cephalophus* and *Philantomba*) and the bush duiker (*Sylvicapra*). All are C_3-browsers (Table S2). Cephalophini fossils are rare in the Kanapoi, Nachukui or Koobi Fora Formations; no fossil duikers have been sampled for stable isotopes from these formations.

Hippotragini are C_4-grazers today (G:M:B = 89:11:0; n =38) as were most fossil hippotragins younger than 2.5 Ma (G:M:B = 80:20:0; n =10). However, hippotragins from early stratigraphic intervals *ca*. 4 to 2.35 Ma in age, had a mixed C_3-C_4 diet (G:M:B = 29:71:0; n = 7) although the sample size is limited.

Neotragini today are mostly C_3-browsers with the exception of the oribi (*Ourebia ourebi*), which is a mixed C_3-C_4 feeder to C_4-grazer. Neotragin fossils are very rare in the Kanapoi, Nachukui, and Koobi Fora Formations.

Reduncini are today represented in 17 of the ecosystems we consider and are represented by four species: the waterbuck (*Kobus ellipsiprymnus*), the Ugandan kob (*Kobus kob*), Chanler's reedbuck (*Redunca fulvorufula*), and the Bohor reedbuck (*Redunca redunca*). The modern reduncins that we examined are primarily C_4 -grazers (Table S2), with only a few mixed C_3-C_4 feeders that are generally associated with mountain habitats (e.g., Mt. Kenya, Bale Mountains; see Dataset I). Fossil reduncins in the Nachukui and Koobi Fora Formations are also primarily grazers (Dataset II and Figure S4).

Tragelaphini, the spiral-horned antelopes, today have diets strongly skewed towards browsing (Table 1 and Table S2). Although stable isotope data show the bongo and bushbuck to be hyper-browsers, all others are browsers. The eland, lesser kudu, and greater kudu have $\delta^{13}C_{1750}$ values averaging between *ca*. -8.5‰ and -10‰ and some individuals have a mixed C_3-C_4 diet (i.e., average $\delta^{13}C_{1750}$ between -1‰ and -8‰). However, the average $\delta^{13}C$ for fossil tragelaphins from all stratigraphic intervals is > -8‰ indicating that, on average, tragelaphins had a mixed C_3-C_4 diet for the period from 4 to 1 Ma. The extant tragelaphin with the most positive $\delta^{13}C_{1750}$ value is the eland (*Taurotragus oryx*, $\delta^{13}C_{1750}$ = -8.5 ± 2.1, n = 35; G:M:B = 0:31:69); its $\delta^{13}C$ values are significantly different (P = 0.0002) than the average of all fossil specimens of tragelaphins ($\delta^{13}C$ = -5.9 ± 2.9, n = 43; G:M:B = 7:67:26). Thus, fossil tragelaphins in the Nachukui and Koobi Fora regions record a diet different than that of any extant tragelaphin species in East and Central Africa: fossil tragelaphins were predominantly mixed C_3-C_4 feeders, but extant tragelaphins are browsers or hyperbrowsers. Studies of tragelaphini in the Shungura Formation, in the lower Omo Valley, have previously noted $\delta^{13}C$ values that are more enriched in ^{13}C than extant tragelephins (42).

Artiodactyla: Giraffidae. The Giraffidae were represented in Africa from 4.3 Ma to the present Ma by 3 genera: *Giraffa*, *Okapia*, and *Sivatherium*. Extant giraffes live in open woodland habitats and the okapi is a forest-dweller. *Sivatherium* became extinct by *ca*. 1 Ma.

Extant giraffes are primarily browsers with only a small fraction being mixed feeders based on carbon isotope data ($\delta^{13}C_{1750}$= -10.6 ± 1.6 (n=61); G:M:B = 0:7:93). Fossil *Giraffa* from the Kanapoi, Nachukui and Koobi Fora Formations had a similar diet ($\delta^{13}C$ = -11.4 ± 1.1 (n =38); G:M:B = 0:0:100). Thus, *Giraffa* has not significantly changed its diet from 4 Ma to present.

African sivatheres were large bodied, short-necked giraffids that changed diet over time with associated morphological changes (43). *Sivatherium* specimens older than 2.35 Ma have a $\delta^{13}C$ = -10.4 ± 1.6‰ (n = 10; G:M:B = 0:10:90) indicating a diet dominated by C_3-biomass; *Sivatherium* specimens from 2.35 to 1.9 have a $\delta^{13}C$ = -4.6 ± 2.5‰ (G:M:B = 0:80:20; n = 5); *Sivatherium* specimens younger than 1.9 Ma have a $\delta^{13}C$ = -1.2 ± 2.3 (G:M:B = 67:33:0; n = 9). Thus, between 3 and 1.5 Ma *Sivatherium* changed from a C_3-browsing to a C_4-grazing giraffid. The sample size so far is too small to determine the details of the timing of this change.

Artiodactyla: Hippopotamidae. In East and Central Africa *Hippopotamus amphibius*, the extant hippo, has a diet that ranges from C_3-dominated to C_4-dominated (44-46). The 186 modern *H. amphibius* sampled have an average $\delta^{13}C_{1750}$ value of -2.1 ± 2.6‰ (G:M:B 36:61:3) indicating a predominantly mixed diet although approximately 40% of modern hippos have a grazing diet.

Two genera of hippos have been recognized in the Kanapoi, Nachukui, and Koobi Fora Formations. Early workers identified these as *Hippopotamus* and *Hexaprotodon* (47) but the latter is referred to cf. *Hippopotamus* (48) pending selection of a new name for this genus. In this paper we group *Hippopotamus* and cf. *Hippopotamus* as *Hippopotamus* sensu lato.

The Pliocene and earliest Pleistocene hippos in the Kanapoi, Nachukui, and Koobi Fora Formations (4.3 to 2.35 Ma) have an average $\delta^{13}C$ value of -3.3 ± 2.9 (G:M:B = 23:71:6, n = 48). However, hippos 2.35 to 1.0 Ma in age have an average $\delta^{13}C$ value of -1.1 ± 1.4‰ (G:M:B = 49:51:0). Thus, through the past 4.3 Ma hippos in East Africa have had diets that are strongly biased towards C_4-vegetation, with overall G:M:B proportions between *ca*. 75:25:0 to *ca*. 25:75:0. Although many hippos are predominantly C_4-grazers, occasional opportunistic individuals, both modern and fossil, have isotopic values that record a very high fraction (i.e., >75%) of C_3 biomass in the diet such that they are considered to be C_3-browsers.

Artiodactyla: Suidae. The three genera of suids in East and Central Africa—*Hylochoerus* (the forest hog), *Phacochoerus* (warthog), and *Potamochoerus* (bush and red river hogs)—have different $\delta^{13}C$ dietary niches (49) with average $\delta^{13}C_{1750}$ values of -14.1 ± 3.3‰ (n = 26), -0.1 ± 2.4‰ (n = 101), and -10.9± 3.9‰ (n = 46), respectively; these genera have corresponding G:M:B proportions of 0:0:100; 80:18:2, and 2:22:76, respectively. *Hylochoerus* is a C_3-hyperbrowser (i.e., $\delta^{13}C_{1750}$ < -12‰) in forested regions (Ituri, Kahuzi-Biega, Kibale, Mt. Kenya, Aberdares); many individuals from these forests have $\delta^{13}C_{1750}$ values < -14‰ indicating a diet derived from closed canopy understory (49, 50). *Potamochoerus* is a C_3-hyperbrowser in the Kahuzi-Biega and Ituri closed forests.

Four lineages of suids are found in the Plio-Pleistocene of East Africa: *Nyanzachoerus—Notochoerus*, *Kolpochoerus–Hylochoerus*, *Metridiochoerus—Phacochoerus*, and *Potamochoerus*. Evolutionary trends of suids related to dental changes from 4 to 1 Ma were discussed by Harris and Cerling (49). *Notochoerus* specimens were predominantly a mixed C_3-C_4 feeder between 4.3 and 4.0 Ma ($\delta^{13}C$ = -3.4 ± 2.7, G:M:B = 25:75:0; (n = 8), but were predominantly C_4-grazers by 2.0 Ma (Upper Burgi Member in the Koobi Fora Formation; $\delta^{13}C$ = -0.7 ± 0.5; G:M:B = 83:17:0, n = 12). *Kolpochoerus* and *Metridiochoerus* were predominantly grazers throughout the intervals sampled with high C_4-grazer proportions (G:M:B = 82:18:0 (n = 38) and 93:7:0 (n = 67, respectively)). By 2.0 Ma, the region had three sympatric genera of suids that were C_4-grazers. Of these, the *Nyanzachoerus-Notochoerus* lineage became extinct, the *Kolpochoerus-Hylochoerus* lineage exploited more closed habitats and became C_3-browsers in the past 1 Ma, and the *Metridiochoerus-Phacochoerus* lineage continued as C_4-grazers.

Perissodactyla: Equidae. Today, African equids are represented by species of the genus *Equus*. Extant *Equus* is a C_4-grazer with an average $\delta^{13}C_{1750}$ value of 1.3 ± 1.4‰ (n = 147) with G:M:B proportions of 91:8:1. The most positive $\delta^{13}C$ value is 3.7‰, approximately one per mil less enriched in ^{13}C than the most positive alcelaphin. This difference in isotope values for equids compared to alcelaphins, both widely thought to be pure C_4-grazers, may be related to the difference in isotopic enrichment by hind-gut fermenting equids compared to ruminating bovids (see 18, 38).

Fossil equids in the Nachukui and Koobi Fora Formations are represented by two genera. The hippionin *Eurygnathohippus* (51, 52) is present from before 4 Ma to *ca*. 1.5 Ma; it is a C_4-grazer with an average $\delta^{13}C$ value of -0.3 ± 1.2‰ (n =33) and G:M:B proportions of 79:21:0. *Equus* is present in the Omo-Turkana Basin from 2.3 Ma onwards; its average $\delta^{13}C$ value is -0.1 ± 1.1‰ (n = 39) with G:M:B proportions of 82:18:0. Thus, there is virtually no difference in diets of the two equid lineages based on stable isotope evidence.

Of the two C_4-grazing equids present in the Nachukui and Koobi Fora Formations, *Eurygnathohippus*, representing the *Hipparion* lineage, became extinct in Africa during the middle Pleistocene (52). *Equus* has been a C_4-grazing equid since its first appearance in Africa during the late Pliocene.

Perissodactyla: Rhinocerotidae. The two extant genera of rhinos in East and Central Africa, *Diceros* and *Ceratotherium*, have distinctly different diets. *Diceros* is a C_3-browser with an average $\delta^{13}C_{1750}$ value of enamel of -10.2 ± 1.2‰ (n = 145; G:M:B = 0:6:94) while *Ceratotherium* is a C_4-grazer with a $\delta^{13}C_{1750}$ value of +1.4 ± 1.2‰ (n = 13; G:M:B = 100:0:0).

Many of the fossil rhinocerotids analyzed were so fragmentary that identification to genus was not possible. We grouped analyses into "B" (values with $\delta^{13}C < -5‰$) and "G" (values with $\delta^{13}C > -5‰$); this resulted in a clear separation into two groups as no analyses were between -1‰ and -7‰. "Rhino B" and "Rhino G" had an average $\delta^{13}C$ values of -10.1 ± 1.2‰ (n = 17; G:M:B 0:6:94) and 0.3 ± 0.8 (n = 19; G:M:B = 100:0:0), respectively. These values are indistinguishable from those of modern *Diceros* and *Ceratotherium*, respectively. However, many Miocene rhinos in East Africa, older than those sampled here, had C_3-C_4 mixed diets (53).

Thus, the fossil record of rhinos in the Nachukui and Koobi Fora Formations comprises two groups of rhinos with similar $\delta^{13}C$ values to the two modern extant rhinos.

Proboscidea; Deinotheriidae. Deinotheres are an extinct family of proboscideans that were present in Africa for the past 25 or so million years, becoming extinct in the early to middle Pleistocene. Deinotheres from the Nachukui and Koobi Fora Formations are C_3-browsers, with an average $\delta^{13}C$ of -12.7 ± 0.8 (n = 28; G:M:B = 0:0:100). *Deinotherium* has, in most stratigraphic intervals, the most ^{13}C-depleted $\delta^{13}C_{enamel}$ of any fossil taxon in the basin.

Proboscidea; Elephantidae. *Loxodonta* is the only extant elephantid genus in Africa. *Loxodonta* is a C_3-browser to C_3-C_4-mixed feeder (54). Modern *Loxodonta* is represented by two species. The savanna elephant, *Loxodonta africana* has an average $\delta^{13}C_{1750}$ value of -9.2 ± 2.4‰ (G:M:B = 0:24:76; n = 225); the forest elephant, *Loxodonta cyclotis*, has a $\delta^{13}C_{1750}$ value of -14.1 ± 1.3 (G:M:B = 0:0:100; n = 55).

Two elephant genera are recorded in the stratigraphic intervals under discussion: *Elephas* and *Loxodonta*. *Elephas* was more abundant than *Loxodonta* from 4 to 1 Ma in the Turkana Basin. *Elephas* had a C_3-C_4-mixed diet from 4.3 to 4.0 Ma ($\delta^{13}C$ = -2.7 ± 1.1‰ (n = 7; G:M:B = 0:100:0)) but had evolved into a C_4-grazer by the early Pleistocene ($\delta^{13}C$ = -0.4 ± 1.2‰ (n=17; G:M:B = 82:18:0)). *Loxodonta* shows a similar trend: for the lowest stratigraphic intervals, from 4.0 to 2.35 Ma, *Loxodonta* was a mixed C_3-C_4- feeder (average $\delta^{13}C$ = -2.1 ± 1.6 (n=12; G:M:B = 17:83:0) whereas it was a C_4-grazer for the period from 2.35 to 1.9 Ma (average $\delta^{13}C$ = 0.1 ± 0.4 (n = 5; G:M:B = 100:0:0)).

The two elephantids present in the Turkana Basin from 4 to 1 Ma were both mixed C_3-C_4-feeders at 4 Ma and gradually changed their diets to become C_4-grazers by 2 Ma. *Elephas* became extinct in the middle to late-Pleistocene; *Loxodonta* persists but extant *Loxodonta* is a C_3-browser to C_3-C_4- mixed feeder.

Proboscidea: Gomphotheriidae. *Anancus* is the only gomphotheriid recovered from this stratigraphic interval, becoming extinct in the basin in the Pliocene. A single *Anancus* tooth from the sub-A stratigraphic interval has a $\delta^{13}C$ value of -0.1‰, indicating a C_4-grazing diet.

6. Comparison of dietary guilds. The fossil record has only rare specimens of the bovid tribes Neotragi and Cephalophini. Therefore, we have used the modern collections for comparison but in Figures 3 and 4 we have excluded the modern and fossil Neotragini and Cephalophini from the analysis. Figure S3 shows that modern the fractions of C_4-

grazing, mixed C_3-C_4, and C_3-browing taxa have similar proportions for the 30 modern ecosystems, whether including all taxa (Figure S3A) or excluding the Neotragini and Cephalophini (Figure S3B) in the analysis. All data from Dataset I.

7. Datasets

7.1. Dataset I. Dataset I includes $\delta^{13}C$ values as measured for >1900 modern individual mammals from East and Central Africa. Geographic origin, estimated year of death, and ecosystem groupings presented. $\delta^{13}C$ values presented as the original data for enamel, keratin, or collagen, with the equivalent $\delta^{13}C$(enamel), and the enamel value corrected to $\delta^{13}C_{1750}$ (see text). Data is from this study and references (18, 29-37, 44–45, 49–50, 54–56). Geographic location and date of death is estimated from information provided by collector and vary in degree of accuracy.

7.2 Dataset SI II. Dataset II includes $\delta^{13}C$ values for fossils collected from the Kanapoi, Nachukui, and Koobi Fora Formations in the Omo-Turkana Basin, Kenya. Data is from this study and from references (37, 49, 54, 57–58)

8. Supplementary Information References

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Table S1. Locations, climate parameters, and dominant biomes of modern sites in East and Central Africa.

Abbrev[1]	location[2]	Country[3]	MAT[4]	MAP[5]	lat[6]	long[7]	elev[8]	Ref[9]	vegetation description[10]	UNESCO[11]
ABER	Aberdares	Kenya	11.6	1420	0.4 S	36.8 E	2700*	59	evergreen montane forest	forest
AMBO	Amboseli	Kenya	24.0	350	2.6 S	37.2 E	1140	60	grassland to wooded grassland	wooded grassland
ATHI	Athi plains	Kenya	19.4	850	1.5 S	37.1 E	1640	61	grassland to wooded grassland	wooded grassland
AWSH	Awash	Ethiopia	25.0	480	8.9 N	40.0 E	1050	61	acacia wooded grassland with riparian woodland	riparian with wooded grassland
BALE	Bale Mtns	Ethiopia	9.0	1220	6.9 N	39.6 E	3500*	96	Afro-Alpine forest to moorland	Afro-alpine
CHYU	Chyulu Hills	Kenya	21.0	650	2.6 S	37.9 E	1850*	45	wooded grassland to grassy woodland	wooded grassland
ETHR	Ethiopian Rift lakes	Ethiopia	20.2	510	6.0 N	37.7 E	1540	63	wooded grassland	wooded grassland
GMBA	Garamba	DRC	24.4	1250	4.0 N	29.5 E	800	64	grassland to woodland, gallery forests	wooded grassland
ITRI	Ituri Forest	DRC	22.4	1640	1.8 N	29.9 E	800	65,66	evergreen forest	closed canopy forest
KBLE	Kibale	Uganda	19.0	1660	0.5 N	30.5 E	1250*	67	evergreen forest	open to closed canopy forest
KCST	Kenya Coast	Kenya	25.3	1230	3.3 S	39.9 E	30	59	coastal lowland forest	open to closed forest
KDPO	Kidepo	Uganda	25.1	810	3.9 N	33.8 E	1120	68	wooded grassland	wooded grassland
KZBG	Kahuzi-Biega	DRC	20.1	1610	2.3 S	28.6 E	2000*	69	evergreen montane forest	closed canopy forest
LAIK	Laikipia	Kenya	21.8	640	0.3 N	36.9 E	1700	70	wooded grassland	wooded grassland
LEDW	Lake Edward	Uganda, DRC	25.3	680	0.2 S	29.9 E	924	71	forest to wooded grassland	wooded grassland
LOPÉ	Lope	Gabon	25.5	1490	0.5 S	11.5 E	400	72	rainforest	closed canopy forest
MAGO	Omo / Mago	Ethiopia	26.0	830	5.5 N	36.3 E	600	73,74	semi-desert bushland with riparian forest	riparian with wooded grassland
MARA	Masai Mara	Kenya	20.5	1000	1.4 S	35.0 E	1600	75,76	grassland, with riparian woodland	wooded grassland
MBRO	Lake Mburo	Uganda	21.3	890	0.6 S	31.0 E	1300	77	wooded grassland to grassy woodland	wooded grassland / grassy woodland
MERU	Meru NP	Kenya	23.5	380	0.1 N	38.2 E	500	59,78	wooded grassland with riparian woodland	riparian with wooded grassland
MTKE	Mt Kenya	Kenya	7.4	1250	0.3 S	37.2 E	2700*	79	evergreen forest	forest
NAKG	Nakuru - shore	Kenya	17.7	870	0.4 S	36.1 E	1850	59,80	alkali grassland	grassland
NBNP	Nairobi NP	Kenya	18.8	910	1.4 S	36.8 E	1700	59	grassland to woodland	mixed woodland to grassland
RFTV	Kenya Rift Valley	Kenya	17.3	620	0.5 S	36.1 E	1900	59	grassland to woodland	mixed woodland to grassland
SAMB	Samburu	Kenya	23.5	380	0.6 N	37.5 E	880	59	semi-desert bushland with riparian woodland	riparian with wooded grassland
SIME	Simean Mtns	Ethiopia	8.7	1600	13.1 N	38.4 E	3200*	61	Afro-Alpine forest to moorland	Afro-alpine
TANA	lower Tana River	Kenya	27.5	475	1.9 S	40.1 E	40	59	semi-desert bushland with riparian forest	riparian with wooded grassland
TRKG	Turkana - grassland	Kenya	29.2	180	4.0 N	36.2 E	370	59	alkali grassland	grassland
TRKX	Turkana - regional	Kenya	29.2	180	4.2 N	36.3 E	400	59	semi-desert bushland with riparian woodlands	dwarf shrubland
TSVO	Tsavo region	Kenya	24.9	550	3.4 S	38.6 E	530	59	semi-desert bushland with riparian woodland	riparian with wooded grassland

1 abbreviation
2 locality
3 country
4 Mean annual temperature
5 Mean annual precipitation
6 latitude
7 longitude
8 reference elevation (*sites with high variability in elevation)
9 Reference for climate parameters
10 colloquial description of vegetation
11 UNESCO classification for African vegetation (Ref 1).

Table S2. $\delta^{13}C_{1750}$ values for modern East African large mammal by species (except *Madoqua* and *Phacochoerus*) in this study; also classified by the percentage of individuals that are C_4-grazers (G), mixed C_3-C_4 (M), or C_3-browsers (B) based on the isotope values ($\delta^{13}C_{1750}$ values > -1‰, > -1‰ and < -8‰, and <-8‰, respectively). See Dataset I for complete data.

Taxon	number	$\delta^{13}C_{1750}$ (±1σ)	percent G	percent M	percent B
Artiodactyla					
Bovidae					
Aepycerotini					
Aepyceros melampus	66	-3.9 ±2.6	15	77	8
Alcelaphini					
Alcelaphus buselaphus	54	3.3 ±1.3	100	0	0
Beatragus hunteri	2	2.0 ±0.4	100	0	0
Connochaetes taurinus	67	3.0 ±1.2	100	0	0
Damaliscus lunatus	18	3.2 ±1.0	100	0	0
Antilopini					
Eudorcas thomsonii	22	-1.6 ±2.4	55	45	0
Litocranius walleri	17	-10.9 ±1.0	0	0	100
Nanger granti	73	-8.5 ±3.2	1	36	63
Nanger soemmerringii	1	-10.5	0	0	100
Ourebia ourebi	6	-2.6 ±4.5	0	0	100
Bovini					
Syncerus caffer	167	0.9 ±3.3	84	13	4
Caprini					
Capra walie	1	-11.1	0	0	100
Cephalophini					
Cephalophus adersi	2	-10.6 ±3.3	0	0	100
Cephalophus callipygus	4	-11.7 ±4.0	0	25	75
Cephalophus dorsalis	2	-13.9 ±0.9	0	0	100
Cephalophus leucogaster	2	-13.3 ±0.3	0	0	100
Cephalophus natalensis	6	-11.4 ±1.3	0	0	100
Cephalophus nigrifrons	13	-14.3 ±1.5	0	0	100
Cephalophus sylvicultor	2	-13.1 ±0.8	0	0	100
Cephalophus weynsi	2	-12.7 ±2.5	0	0	100
Philantomba monticola	6	-12.0 ±1.6	0	0	100
Sylvicapra grimmia	16	-11.1 ±1.1	0	0	100
Hippotragini					
Hippotragus equinus	4	2.0 ±3.0	75	25	0
Hippotragus niger	5	3.9 ±0.3	100	0	0
Oryx beisa	29	0.8 ±1.9	90	10	0
Neotragini					
Madoqua sp.	52	-10.4 ±1.7	0	10	90
Neotragus batesi	1	-24.1	0	0	100
Neotragus moschatus	13	-12.6 ±0.7	0	0	100
Oreotragus oreotragus	9	-10.9 ±1.4	33	67	0
Raphicerus campestris	12	-10.7 ±1.0	0	0	100
Reduncini					
Kobus ellipsiprymnus	55	1.9 ±1.3	96	4	0
Kobus kob	17	2.3 ±1.0	100	0	0
Redunca fulvorufula	4	2.3 ±1.0	100	0	0
Redunca redunca	14	0.7 ±4.0	71	29	0
Tragelaphini					

Taurotragus oryx	35	-8.5 ±2.0	0	31	69
Tragelaphus buxtoni	5	-11.4 ±1.0	0	0	100
Tragelaphus euryceros	5	-14.9 ±0.9	0	0	100
Tragelaphus imberbis	18	-9.2 ±2.0	0	28	72
Tragelaphus scriptus	48	-12.1 ±1.7	0	0	100
Tragelaphus spekei	5	-13.1 ±5.1	0	20	80
Tragelaphus strepsiceros	10	-9.6 ±2.2	0	20	80
Giraffidae					
Giraffa camelopardalis	61	-10.6 ±1.6	0	7	93
Okapia johnstoni	2	-19.5 ±0.1	0	0	100
Hippopotamidae					
Choeropsis liberiensis	1	-15.2	0	0	100
Hippopotamus amphibius	186	-2.1 ±2.6	36	61	3
Suidae					
Hylochoerus meinertzhageni	26	-14.1 ±3.3	0	0	100
Phacochoerus sp.	101	0.1 ±2.4	80	18	2
Potamochoerus larvatus	23	-8.7 ±4.2	4	39	57
Potamochoerus porcus	23	-13.1 ±2.0	0	4	96
Tragulidae					
Hyemoschus aquaticus	1	-13.9	0	0	100
Perissodactyla					
Equidae					
Equus burchellii	129	1.5 ±1.3	96	4	0
Equus grevyi	28	-0.6 ±2.2	68	29	4
Rhinocerotidae					
Ceratotherium simum	13	1.4 ±1.2	100	0	0
Diceros bicornis	145	-10.2 ±1.2	0	6	94
Proboscidea					
Elephantidae					
Loxodonta africana	225	-9.2 ±2.4	0	24	76
Loxodonta cyclotis	55	-14.1 ±1.3	0	0	100

TABLE S3. Percentages of APP taxa that are C_4-grazers (G), mixed C_3-C_4 feeders (M), and C_3-browsers (B) based on stable isotopes for ecosystems considered in this study. N is the total number of large mammal taxa analyzed in each locale/ecosystem.

Locale	Ecosystem	N	G	M	B
ABER	forest	10	10	20	70
AMBO	wooded grassland	10	50	30	20
ATHI	wooded grassland	11	36	18	45
AWSH	riparian with wooded grassland	9	44	22	33
BALE	Afro-alpine	6	0	50	50
CHYU	wooded grassland	9	33	33	33
ETHR	wooded grassland	9	44	22	33
GMBA	wooded grassland	8	50	25	25
ITRI	closed canopy forest	10	0	0	100
KBLE	open to closed canopy forest	5	20	0	80
KCST	open to closed forest	7	14	14	71
KDPO	wooded grassland	7	71	0	29
KZBG	closed canopy forest	5	0	0	100
LAIK	wooded grassland	15	47	13	40
LEDW	wooded grassland	8	50	13	38
LOPE	closed canopy forest	5	0	20	80
MAGO	riparian with wooded grassland	10	40	30	30
MARA	wooded grassland	13	38	31	31
MBRO	wooded grassland / grassy woodland	8	75	13	13
MERU	riparian with wooded grassland	11	45	18	36
MTKE	forest	9	0	33	67
NAKG	grassland	8	75	25	0
NBNP	mixed woodland to grassland	11	36	27	36
RFTV	mixed woodland to grassland	10	50	20	30
SAMB	riparian with wooded grassland	12	42	17	42
SIME	Afro-alpine	5	0	0	100
TANA	riparian with wooded grassland	14	36	36	29
TRKG	grassland	6	83	17	0
TRKX	dwarf shrubland	9	33	0	67
TSVO	riparian with wooded grassland	14	43	21	36

Table S4. Average $\delta^{13}C$ values for fossil APP (Artiodactyla, Perrisodactyla, and Proboscidea) taxa in the Turkana Basin by time interval, and average $\delta^{13}C$ values for equivalent taxa in East and Central Africa.

Taxon used	N	$\delta^{13}C$ - Age intervals (Ma)									Modern	N	$\delta^{13}C$
		4.3 to 4.0	4.0 to 3.4	3.4 to 3.0	3.0 to 2.5	2.5-2.35	2.35 to 1.9	1.9 to 1.5	1.5 to 1.3	1.3 to 1.0			
Artiodactyla											Artiodactyla		
Bovidae											Bovidae		
Aepycerotini	67	-4.3	-0.5	-2.2	-2.0		-0.2	-1.2	-1.1	-1.4	Aepycerotini	66	-3.9
Alcelaphini	129	1.0	-0.2	0.8	1.1	1.0	1.2	1.1	1.0	2.0	Alcelaphini	141	3.1
Antilopini	38	-7.6	-2.0	-2.9	-0.9		-2.1	-0.7	-2.5		Antilopini	122	-7.7
Bovini	21		-2.6	-2.7	-1.9		-0.2	0.7	1.0	2.1	Bovini	167	0.9
Caprini											Caprini	1	-11.1
Cephalophini											Cephalophini	63	-12.5
Hippotragini	17			-3.6	-2.2		0.5	0.6	-0.3		Hippotragini	38	1.3
Neotragini	1	-11.6									Neotragini	84	-10.4
Reduncini	43				-0.2	-0.8	-0.2	0.5	0.3	0.6	Reduncini	90	1.8
Tragelaphini	43	-7.8	-9.3	-6.0	-7.3	-3.0	-4.0	-5.6	-6.0	-4.1	Tragelaphini	126	-10.6
Camelidae											Camelidae		
Camelus	2			-10.0	-7.3						domestic only		
Giraffidae											Giraffidae		
Giraffa	38	-11.5	-12.2	-11.2	-11.6	-12.8	-11.2	-11.6	-10.8		*Giraffa*	61	-10.6
											Okapia	2	-19.5
Sivatherium	24	-10.2		-10.9	-9.8		-4.6	-1.5	0.9		*Sivatherium*		Extinct
Hippopotamidae											Hippopotamidae		
Hippopotamus s.l.	115	-3.0	-4.4	-3.7	-2.9	-2.3	-0.9	-1.4	-1.3	0.0	*Hippopotamus*	186	-2.1
Suidae											Suidae		
Kolpochoerus	38				-1.7		0.2	-0.6	-0.4		*Hylochoerus*	26	-14.1
Metridiochoerus	67				-0.2		-0.3	-0.2	0.1	0.0	*Phacochoerus*	101	0.1
Notochoerus	28	-3.9	-2.8	-1.4	-0.8		-0.7	-1.6			*Notochoerus*		Extinct
Nyanzachoerus	7	-2.3	-2.7	-2.9							*Nyanzachoerus*		Extinct
											Potamochoerus	46	-10.9
Tragulidae											Tragulidae		
											Hyemoschus	1	-13.9
Perissodactyla											Perissodactyla		
Equidae											Equidae		
Equus	39						0.0	0.2	-0.6	-0.7	Equus	157	1.1
Eurygnathohippus	33	1.2	-0.9	-1.3	-0.1		0.7	-0.3	-0.2		*Eurygnathohippus*		Extinct
Rhinocerotidae											Rhinocerotidae		
Rhino G	19	-0.2	-0.8	0.1		-0.3	0.9	0.3		1.3	*Ceratotherium*	13	1.4
Rhino B	17	-10.2		-11.9	-9.3			-8.9			*Diceros*	145	-10.2
Proboscidea											Proboscidea		
Deinotheriidae											Deinotheriidae		
Deinotherium	28	-12.6	-13.0	-11.1	-13.3	-13.2	-12.6	-11.8			*Deinotherium*		Extinct

Gomphotheriidae											Gomphotheriidae		
Anancus	1	-0.1									*Anancus*		Extinct
Elephantidae											Elephantidae		
Elephas	43	-2.7	-2.1	-0.6	-0.7	-2.5	0.1	-0.4	-1.5	-0.2	*Elephas*		Extirpated
Loxodonta	18	-2.3	-2.1	-1.8	0.4		0.1	0.3			*Loxodonta*	280	-10.2
Total number of taxa		17	14	18	19	8	19	20	15	10	All East/Central Africa	21	
(ex. Neotragini and Cephalophini)		(16)	(14)	(18)	(19)	(8)	(19)	(20)	(15)	(10)		(19)	

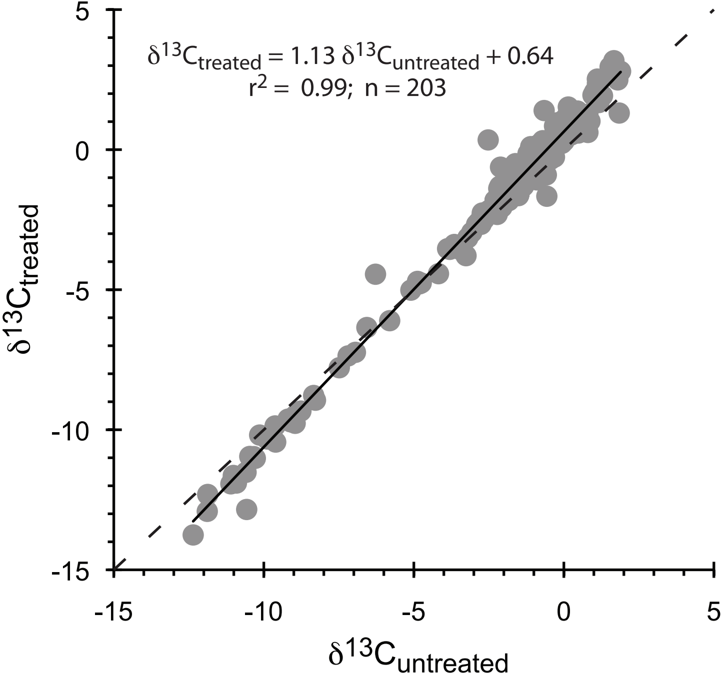

Figure S1. $\delta^{13}C$ comparing results for treated and untreated sample powders. The least squares best-fit is shown as a solid line; the 1:1 line is shown as a dashed line.

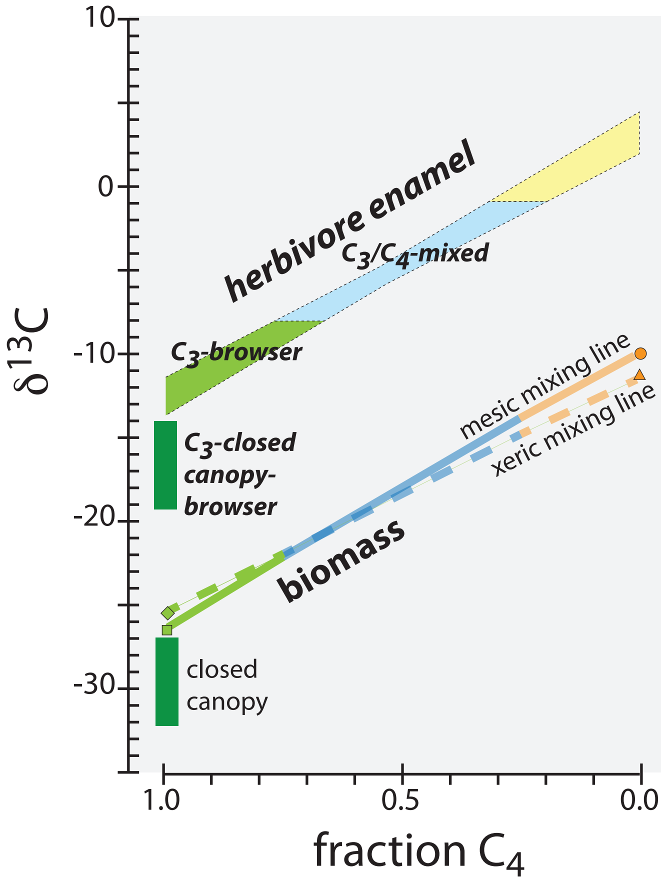

Figure S2. Mixing lines for vegetation from xeric and mesic biomes (lower lines) based on $\delta^{13}C_{1750}$ values on previously published data (23, 86): xeric (lower dashed line) is based on C_3 and C_4 plants from Samburu, Mpala, and Turkana with end-member $\delta^{13}C_{1750}$ values of -25.6 (green diamond) and -11.2‰ (orange triangle), respectively; mesic (lower solid line) is based on C_3 and C_4 plants from the Aberdares (forest) and the Athi plains (wooded grassland to grassland) with $\delta^{13}C_{1750}$ values of -26.6 (green square) and -10.2‰ (orange circle), respectively; closed canopy is based on C_3 plants from the Ituri Forest. Isotope enrichment (23, 28) of ^{13}C from biomass to tooth enamel ranges from 13.3‰ (suids) to 14.6‰ (bovid ruminants) and results in the upper shaded mixing line for enamel; the thickness of the line is due to the uncertainty in end-member values for C_3 and C_4 plants in xeric and mesic ecosystems and to the range in isotope enrichment values. Diets derived from closed canopy vegetation are considered to have $\delta^{13}C_{1750}$ enamel values < -14‰ (dark green); C_3-browsers are from -14‰ to-8‰ (green); mixed C_3/C_4 are from -8‰ to 1‰ (blue); and C_4-grazers are > -1‰ (yellow).

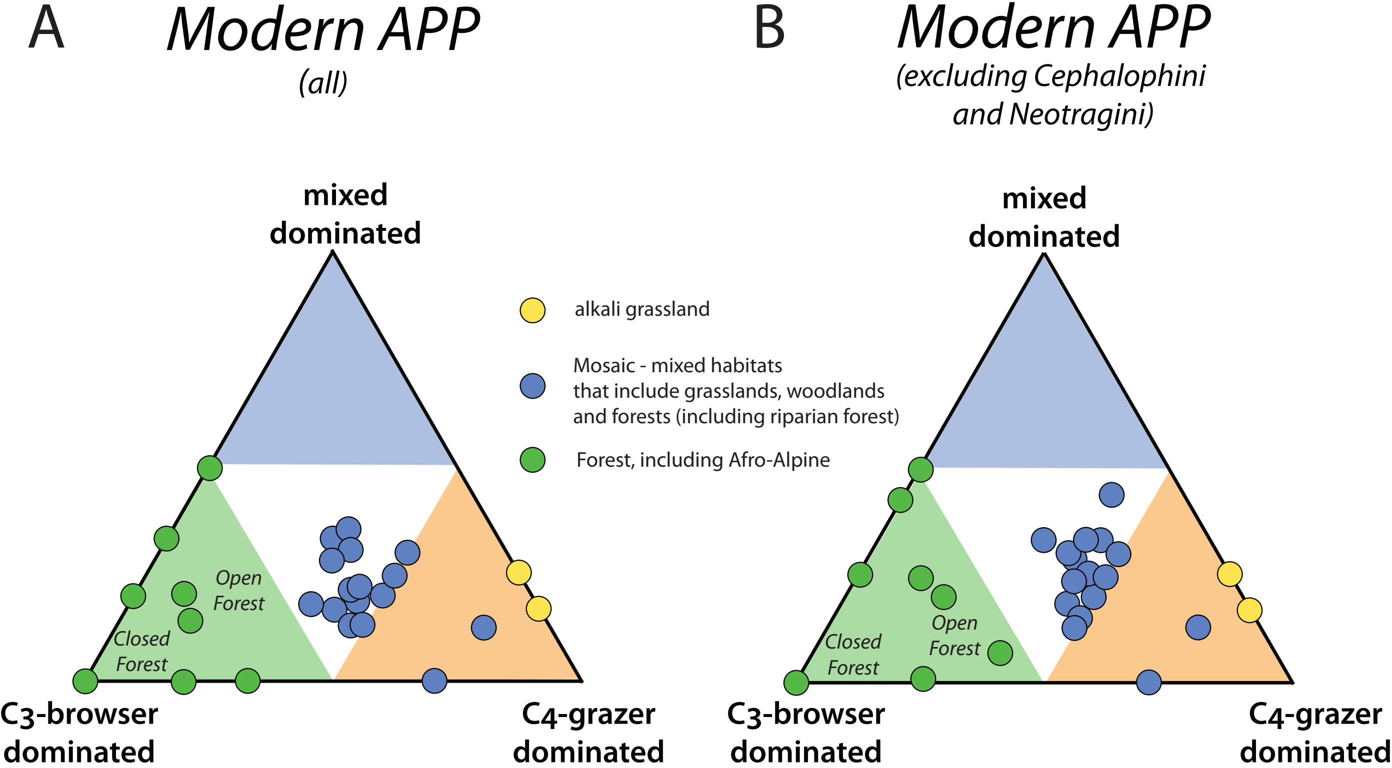

Figure S3. Ternary plot of Artiodactyla-Perrisodactyla-Proboscidea (APP) C_3-browsing, mixed C_3-C_4, and C_4-grazing taxa from the modern sites considered in this study. Each taxon in each locality is represented by the average $\delta^{13}C$ value for that respective taxon (data from Dataset SI I). The green, blue, and orange triangles represent regions where > 50% of the taxa are C_3-browsers, C_3-C_4 mixed feeders, or C_4-grazers, respectively. A. All APP taxa. B. APP taxa, but excluding Neotragini and Cephalophini.

Figure S4. Percent G:M:B (shaded yellow, blue, and green, respectively) of APP major lineages through time in the Kanapoi, Koobi Fora, and Nachukui Formations. Modern fractions shown on the left side for each lineage. Compiled from Datasets I and II.

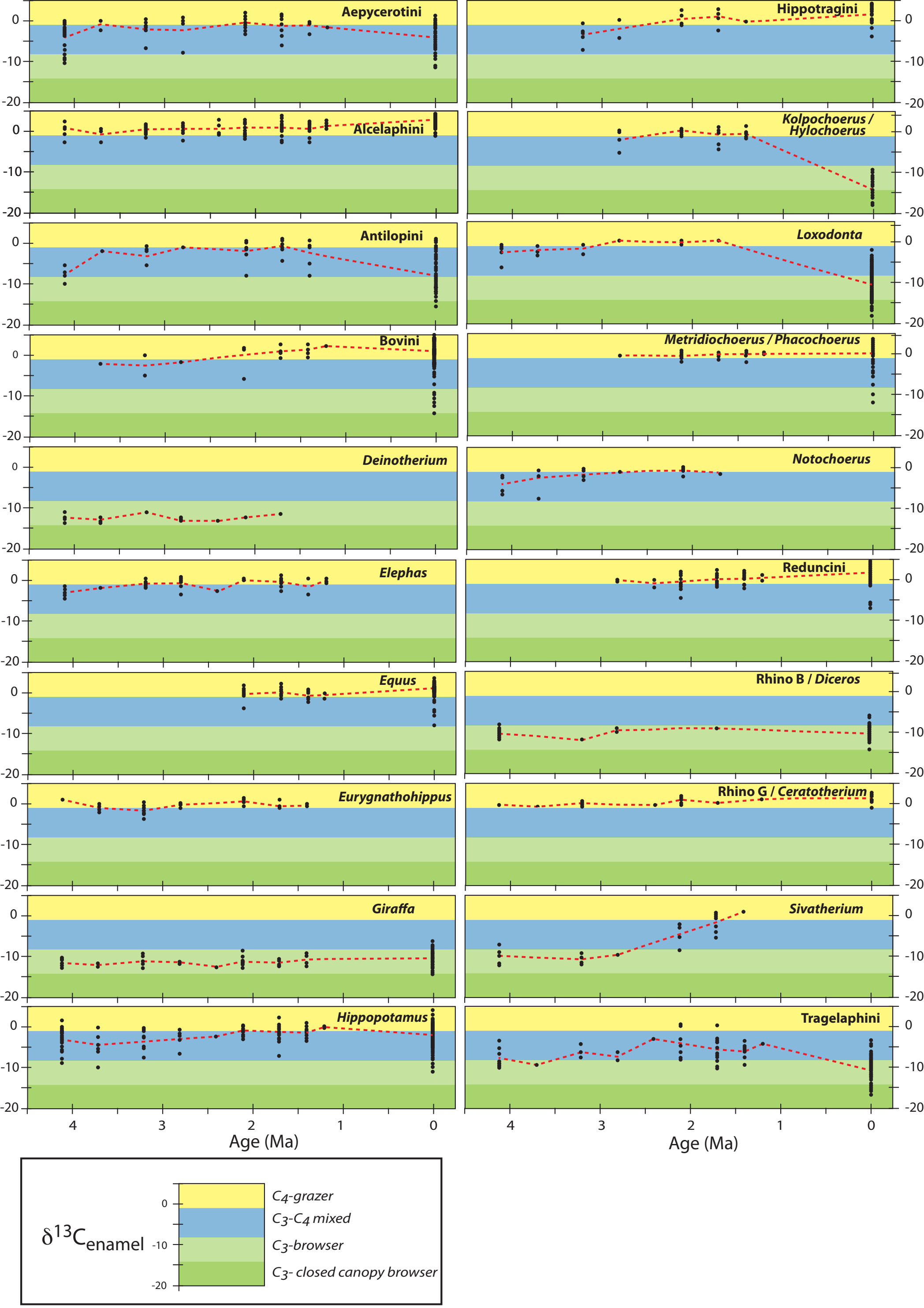

Figure S5. $\delta^{13}C$ values of major APP lineages through time in the Kanapoi, Koobi Fora, and Nachukui Formations (from Dataset II); modern values includes all samples from East and Central Africa in Dataset I for each taxon plotted. Shaded fields (yellow, blue, green, dark green) show C_4-grazers, C_3-C_4-mixed feeders, C_3-browsers, and C_3-closed canopy browsers, respectively.