APPENDIX DR1

METHODS

Dry, homogenized sediment samples were extracted with 90% dichloromethane and 10% methanol using an accelerated solvent extractor. Extracts were separated by column chromatography (column: 5 cm x 40 mm Pasteur pipette, NH_2 sepra bulk packing, 60Å) eluting with 2:1 dichloromethane with isopropanol, followed by 4% formic acid in diethyl ether yielding neutral and acid fractions respectively. Acid fractions were transesterified to corresponding fatty acid methyl esters (FAMEs) with 5% hydrochloric acid and 95% methanol at 70°C for 12hrs ($\delta^{13}C_{methanol}$ = -47.25 ± 0.10, *n*=3). Excess milliQ water was added to the hydrolyzed products and the lipids were partitioned into hexane, and dried by passing through a column of anhydrous sodium sulfate. They were further purified by column chromatography (column: 5 cm x 40 mm Pasteur pipette, 5% water-deactivated silica-gel, 100-200 mesh) eluting with hexane, followed by FAMEs eluted with dichloromethane.

The carbon isotopic composition of lipid extracts was analyzed with a Thermo Scientific Trace GC equipped with a Rxi®-5ms column (30m x 0.25mm, film thickness 1µm) and a PTV injector operated in solvent-split mode, connected via an Isolink combustion furnace (at 1030°C) to a Delta V Plus mass spectrometer for determination of $\delta^{13}C$ values at the University of Southern California (USC). For those samples analyzed at the Woods Hole Oceanographic Institution (WHOI) measurements were obtained using an HP6890 GC (equipped with a CP sil 5 CB column (60m × 0.25mm, film thickness 0.25µm); and a Gerstel programmable injector interfaced via a combustion furnace at 850°C to a Finnigan MAT Delta^{Plus} MS as reported previously (Feakins et al., 2005). Samples were interspersed with standard compound mixtures of known isotopic composition. Reference peaks of CO_2 gas were co-injected between *n*-alkanoic acid peaks during the course of the GC-IRMS run. Two of these peaks were used for standardization of the isotopic analyses, while the remainders were treated as unknowns to assess accuracy. Replicate analyses were made for a large number of samples to determine precision. The isotopic composition of C added during derivatization of fatty acids as methyl esters was estimated by measuring the $\delta^{13}C$ of methanol batches offline (methanol used for samples prepared at USC was: -25.24‰ $1\sigma = 0.43$‰, n=3). Correction for C added by methylation was then made by mass balance. Data were normalized to the Pee Dee Belemnite isotopic scale by comparison to external standard containing a mixture of 8 fatty acid methyl esters with $\delta^{13}C$ values ranging from -30.92 to -23.24‰ (Isotopic standard issued by A. Schimmelmann, University of Indiana). The results are reported using conventional delta notation (ie, $\delta^{13}C$ values) in permil (‰).

APPENDIX DR2

TABLE DR2. AGE MODEL FOR DSDP SITE 231

Datum	Depth (mbsf)	Reference	Age (Ma)	Dating method
Tephra				
Silbo Tuff	35.25	B	0.75 ± 0.02	$^{40}Ar/^{39}Ar$
Kokiselei Tuff	118.60	B	2.43 ± 0.05	interpolation
B-Tulu Bor Tuff	160.80	SW, B	3.40 ± 0.03	$^{40}Ar/^{39}Ar$
Lokochot Tuff	168.76	F	3.58 ± 0.01	orbitally tuned
Lomogol Tuff	170.75	B	3.60	interpolation
Wargolo Tuff	179.70	SW, B	3.80	interpolation
Moiti Tuff	188.35	SW, B	3.92 ± 0.04	$^{40}Ar/^{39}Ar$
Nannofossils				
S. neoabies HO	171.98	Ro, Bu, R	3.65 ± 0.01	orbitally tuned
S. abies HO	171.98	Ro, Bu, R	3.65 ± 0.01	orbitally tuned
C. acutus LO	258.33	Ro, Bu, R	5.35 ± 0.02	orbitally tuned
D. quinqueramus LO	266.55	Ro, Bu, R	5.54 ± 0.04	orbitally tuned
D. hamatus HO	475.10	Ro, Bu, R	9.69 ± 0.12	orbitally tuned
D. neohamatus LO	486.20	Ro, Bu, R	9.69 ± 0.11	orbitally tuned
D. hamatus LO	521.85	Ro, Bu, R	10.55 ± 0.12	orbitally tuned
C. miopelagicus HO	523.28	Ro, Bu, R	11.02 ± 0.10	orbitally tuned

Note: Ages provided in references have been updated to current orbital solutions. References: B = Brown et al., 1992; SW = Sarna-Wojcicki et al., 1985; F = Feakins et al., 2007; Ro = Roth, 1974; Bu = Bukry, 1974; R = Raffi et al., 2006; and references therein. LO = lowest occurrence; HO = highest occurrence.

APPENDIX DR3

TABLE DR3 POLLEN COUNTS FOR DSDP SITE 231

Depth (mbsf)	79.99	80.67	84.00	86.01	87.39	93.48	96.01	98.39	104.47	107.01	113.01	115.51	117.55	122.50	124.99	132.00
Age (Ma)	1.65	1.67	1.73	1.77	1.80	1.92	1.97	2.02	2.15	2.20	2.32	2.37	2.41	2.52	2.58	2.74
Acacia I	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Acacia III	0	0	1	0	0	1	0	1	0	1	2	0	1	0	0	0
Acalypha	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Acanthaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Acanthus*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Achyranthes aspera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aerva lanata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Albizia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abutilon*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchemilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchornea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allophylus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aloe*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amaranthaceae	93	83	61	91	70	127	69	44	59	44	79	79	93	44	153	77
Anogeissus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthospermum	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Aphania senegalensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apiaceae	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0
Artemisia	1	0	1	2	2	1	1	0	2	0	1	1	2	0	0	2
Asteraceae cichoriae	0	0	1	1	1	1	0	1	1	0	0	2	1	4	2	1
Asteraceae tubuliflorae	3	4	1	5	4	6	11	2	5	1	4	0	9	3	7	3
Asystasia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Balanites aegyptiaca**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barleria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borassus* includes Hyphaene	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0
Boscia*	0	0	1	2	0	0	1	0	0	0	1	0	0	1	0	0
Bridelia ferruginea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buxus hildebrandtii	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0
*Capparis fascicularis**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carduus*	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Cassia didymobotrya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caucanthus	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Celastraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Celosia trigyna*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celtis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centaurea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chenopodium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrystiana africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cissus quadrangularis*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Clematis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Combretaceae	1	0	1	1	2	0	1	0	2	0	0	1	0	0	0	0
Commelina benghalensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commiphora africana	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0
Convolvulus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cornulacca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Croton*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyathula orthocantha*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyperaceae	5	13	18	13	31	18	11	17	19	25	17	13	37	24	10	27
Cyphostemma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delonix elata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichrostachys cinerea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digera muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diospyros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dodonaea viscosa	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Dombeya*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ekebergia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entada*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephedra	3	4	0	2	0	1	0	1	0	0	2	2	2	1	3	0
Erhetia	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ericaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Euclea	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Euphorbia	0	0	1	0	0	0	1	0	1	1	2	2	1	0	0	1
Fabaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Faidherbia albida	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hagenia abyssinica	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Hallea rubrostipulata*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Helioptropium steudneri**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Hirpicium*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenocardia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenodictyon floribundum	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hypoestes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ilex mitis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Indigofera*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ipomoea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juniperus procera	1	1	0	1	1	2	0	1	3	0	1	2	1	3	1	1
*Justicia flava**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Justicia anselliana*	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Justicia odora*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lannea*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lantana ukambensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laurembergia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loranthaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macaranga	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Maerua*	0	0	0	1	0	1	0	2	1	0	1	0	1	0	2	0
Mallotus oppositifolius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Depth (mbsf)	79.99	80.67	84.00	86.01	87.39	93.48	96.01	98.39	104.47	107.01	113.01	115.51	117.55	122.50	124.99	132.00
Age (Ma)	1.65	1.67	1.73	1.77	1.80	1.92	1.97	2.02	2.15	2.20	2.32	2.37	2.41	2.52	2.58	2.74
Monocotyledonae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Moraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Myrica	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Myrtaceae	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Nuxia/Dobera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Olea capensis	0	0	1	2	0	0	0	0	1	0	0	2	0	2	0	0
Olea europaea ssp. africana	1	1	0	0	4	5	1	2	1	4	2	1	3	5	0	1
Onagraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paronychia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavetta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentadesma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phoenix reclinata	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Phyllanthus amarus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pinus	0	0	0	0	0	0	1	0	5	1	1	1	1	0	0	0
Pistacia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Plantago africana**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plantago lanceolata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae	4	13	41	19	19	23	3	25	22	29	28	34	53	44	10	17
Podocarpus	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Polycarpaea*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polygala*	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Prunus africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte Lygodium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte monolete	0	1	3	2	0	0	0	2	0	6	1	7	5	8	0	0
Pteridophyte trilete	1	0	0	0	1	0	1	0	2	1	0	1	1	13	0	1
Pteridophyte trilete botrychium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhamnaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizophora	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhus natalense*	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0
Rubiaceae	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0
Rumex	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salvadora persica*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sapindaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sapotaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shirakia elliptica*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solanum	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Sterculia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stoebe kilimandscharica	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Suada monoïca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syzygium guineense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarindus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarix	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Thymeleaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiliaceae	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tribulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichilia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Typha	0	1	0	0	0	0	0	2	0	0	0	0	2	0	0	0
Urticaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vepris nobilis*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Vernonieae	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0
Zanthoxylum usambarense*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not determined	3	0	4	0	2	5	0	1	1	1	0	0	3	4	1	1
Total	199	207	224	234	231	292	200	203	232.6	230.2	268.3	271.9	345	298	317.6	267.7
Anthocerotaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae %	2	6	18	8	8	8	2	12	9	13	10	13	15	15	3	6

Depth (mbsf)	134.52	136.38	138.00	141.38	144.02	146.52	151.00	152.51	153.86	159.97	161.05	162.53	164.02	169.88	171.38	174.99	177.38	179.00
Age (Ma)	2.80	2.84	2.88	2.95	3.01	3.07	3.17	3.21	3.24	3.38	3.41	3.44	3.47	3.59	3.63	3.71	3.75	3.79
Acacia I	1	1	1	0	0	0	0	0	0	0	0	1	2	0	0	0	0	1
Acacia III	1	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0
Acalypha	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Acanthaceae	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Acanthus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Achyranthes* aspera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aerva* lanata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Albizia	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Abutilon*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchemilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchornea	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0
Allophylus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aloe*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amaranthaceae	93	92	71	64	93	84	48	83	58	72	57	53	35	35	84	45	44	51
Anogeissus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthospermum	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Aphania* senegalensis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Apiaceae	0	1	0	0	0	0	0	1	0	1	0	0	0	0	2	0	0	0
Artemisia	1	0	0	0	0	2	0	0	0	0	0	0	0	3	2	0	0	0
Asteraceae cichoriae	0	0	0	0	2	4	0	0	0	1	0	0	0	0	1	2	2	0
Asteraceae tubuliflorae	2	2	3	7	2	7	2	3	5	4	3	5	0	3	4	4	2	5
Asystasia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Balanites aegyptiaca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barleria	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Borassus* includes Hyphaene	0	0	0	0	0	3	0	1	2	0	0	0	2	0	1	1	0	0
Boscia*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridelia ferruginea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buxus hildebrandtii	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capparis fascicularis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carduus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassia didymobotrya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caucanthus	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Celastraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celosia* trigyna	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celtis	0	0	0	0	0	0	0	1	0	0	0	0	1	4	0	0	0	1
Centaurea*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chenopodium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chrystiana africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cissus* quadrangularis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clematis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Combretaceae	1	3	0	0	0	0	1	1	1	2	0	0	1	0	2	0	0	1
Commelina* benghalensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commiphora africana	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Convolvulus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cornulacca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Croton*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cyathula* orthocantha	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyperaceae	13	26	22	17	27	22	35	18	23	10	29	23	53	62	18	14	30	44
Cyphostemma*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Delonix elata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Dichrostachys cinerea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digera muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diospyros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dodonaea viscosa	0	0	0	0	2	0	0	0	1	0	0	1	3	3	0	1	0	0
Dombeya*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ekebergia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entada*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ephedra	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Erhetia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ericaceae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Euclea	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Euphorbia	0	1	3	0	0	0	2	0	0	1	1	0	1	1	0	0	0	0
Fabaceae	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Faidherbia albida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hagenia abyssinica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hallea* rubrostipulata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helioptropium steudneri*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hirpicium*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenocardia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenodictyon floribundum	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Hypoestes*	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0
Ilex mitis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indigofera*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ipomoea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Juniperus procera	1	2	1	1	1	0	2	0	0	0	1	1	4	2	2	1	0	0
Justicia flava*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Justicia* anselliana	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Justicia* odora	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lannea*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lantana* ukambensis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laurembergia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loranthaceae	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Macaranga	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maerua*	0	1	0	0	0	0	0	0	0	0	0	2	1	0	2	1	0	0
Mallotus* oppositifolius	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Depth (mbsf)	134.52	136.38	138.00	141.38	144.02	146.52	151.00	152.51	153.86	159.97	161.05	162.53	164.02	169.88	171.38	174.99	177.38	179.00
Age (Ma)	2.80	2.84	2.88	2.95	3.01	3.07	3.17	3.21	3.24	3.38	3.41	3.44	3.47	3.59	3.63	3.71	3.75	3.79
Monocotyledonae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Moraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Myrica	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Myrtaceae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Nuxia/Dobera	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0
Olea capensis	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0
Olea europaea ssp. africana	1	4	0	3	1	1	0	2	0	0	2	2	1	3	0	1	0	0
Onagraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paronychia*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavetta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentadesma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phoenix reclinata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1
Phyllanthus amarus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pinus	2	1	0	0	0	0	1	0	0	1	0	0	1	0	0	2	1	0
Pistacia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Plantago africana**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plantago lanceolata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae	14	29	32	34	33	27	37	28	24	17	12	36	38	45	25	26	18	37
Podocarpus	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polycarpaea*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polygala*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Prunus africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pteridophyte Lygodium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte monolete	0	4	2	1	3	2	1	1	0	1	0	2	4	6	1	2	1	5
Pteridophyte trilete	0	0	2	0	2	0	2	0	2	0	1	1	3	1	1	0	0	2
Pteridophyte trilete botrychium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhamnaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizophora	0	0	0	0	0	0	0	0	1	0	0	3	3	0	0	0	2	3
Rhus natalense*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rubiaceae	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rumex	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salvadora persica*	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Sapindaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sapotaceae	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Shirakia elliptica*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solanum	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Sterculia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stoebe kilimandscharica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suada monoïca*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Syzygium guineense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarindus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarix	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Thymeleaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiliaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tribulus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Trichilia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Typha	0	0	0	0	1	2	1	0	0	0	0	1	2	2	2	1	1	2
Urticaceae	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	0	0	1
Vepris nobilis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vernonieae	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Zanthoxylum usambarense*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not determined	2	0	0	1	0	2	2	0	3	1	1	1	2	0	3	1	1	0
Total	276.3	314.2	284.9	275.3	322	315.6	291.2	296.7	281.1	276.4	273.5	304	333.5	353.5	328	283.7	289.1	344.8
Anthocerotaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae %	5	9	11	12	10	9	13	9	9	6	4	12	11	13	8	9	6	11

						#	#				#						#	#	#	#	
Depth (mbsf)	180.90	183.34	186.00	187.98	189.47	205.00	209.00	211.47	219.01	224.88	238.20	249.98	274.95	295.48	299.37	305.48	309.70	311.50	315.00	321.50	325.00
Age (Ma)	3.82	3.85	3.89	3.91	3.94	4.26	4.34	4.39	4.54	4.66	4.94	5.17	5.71	6.12	6.19	6.31	6.40	6.43	6.50	6.63	6.70
Acacia I	0	1	0	1	1	0	1	1	0	0	1	0	0	0	0	0	1	0	2	4	0
Acacia III	1	0	0	0	0	1	2	0	1	0	3	3	0	0	0	0	2	3	1	1	0
Acalypha	0	0	1	0	1	0	1	0	0	0	5	0	2	0	0	0	3	3	1	1	0
Acanthaceae	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acanthus*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Achyranthes aspera*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	4	4	3	0
Aerva lanata*	0	0	0	0	0	6	0	0	0	0	6	0	0	0	0	0	6	6	9	18	0
Albizia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Abutilon*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchemilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchornea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allophylus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aloe*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Amaranthaceae	77	50	22	48	59	14	26	38	70	49	6	42	37	101	170	81	7	24	8	29	68
Anogeissus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Anthospermum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphania senegalensis*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Apiaceae	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Artemisia	5	10	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Asteraceae cichoriae	4	0	1	3	0	4	4	0	0	0	2	0	1	1	1	1	12	10	4	12	1
Asteraceae tubuliflorae	4	3	0	2	0	6	6	1	1	1	9	4	0	4	4	4	7	26	5	12	3
Asystasia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Balanites aegyptiaca**	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barleria	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borassus* includes Hyphaene	2	0	1	0	3	4	3	1	0	0	8	6	4	2	0	0	4	1	0	0	2
Boscia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Bridelia ferruginea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buxus hildebrandtii	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
*Capparis fascicularis**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carduus*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassia didymobotrya	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caucanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celastraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celosia trigyna*	0	0	0	0	0	9	4	0	0	0	9	0	0	0	0	0	23	10	8	20	0
Celtis	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Centaurea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chenopodium	0	0	0	0	0	7	6	0	0	0	6	0	0	0	0	0	0	7	14	12	0
Chrystiana africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cissus quadrangularis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clematis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Combretaceae	1	0	3	0	3	3	1	2	0	0	2	0	0	1	0	1	0	0	2	1	0
Commelina benghalensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commiphora africana	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Convolvulus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cornulacca	0	0	0	0	0	5	4	0	0	0	3	0	0	0	0	0	8	13	11	18	0
Croton*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyathula orthocantha*	0	0	0	0	0	2	1	0	0	0	3	0	0	0	0	0	0	5	0	1	0
Cyperaceae	12	21	31	24	21	36	20	27	32	26	49	32	63	7	5	1	25	17	15	14	8
Cyphostemma*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Delonix elata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichrostachys cinerea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digera muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Diospyros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Dodonaea viscosa	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Dombeya*	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ekebergia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Entada*	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Ephedra	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	0
Erhetia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ericaceae	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2	3	3	2	0
Euclea	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Euphorbia	1	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fabaceae	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0
Faidherbia albida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ficus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hagenia abyssinica	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Hallea rubrostipulata*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
*Helioptropium steudneri**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hirpicium*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenocardia	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenodictyon floribundum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hypoestes*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ilex mitis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indigofera*	0	0	0	0	2	0	2	0	0	0	4	0	0	0	0	0	0	3	3	2	0
Ipomoea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juniperus procera	3	2	2	2	0	0	0	1	3	0	4	0	2	0	0	0	3	4	0	1	0
*Justicia flava**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
Justicia anselliana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Justicia odora*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lannea*	0	0	1	0	0	1	2	0	0	0	1	0	1	0	0	0	5	0	0	0	0
Lantana ukambensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laurembergia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loranthaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macaranga	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Maerua*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Mallotus oppositifolius*	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

Depth (mbsf)	180.90	183.34	186.00	187.98	189.47	205.00	209.00	211.47	219.01	224.88	238.20	249.98	274.95	295.48	299.37	305.48	309.70	311.50	315.00	321.50	325.00
Age (Ma)	3.82	3.85	3.89	3.91	3.94	4.26	4.34	4.39	4.54	4.66	4.94	5.17	5.71	6.12	6.19	6.31	6.40	6.43	6.50	6.63	6.70
Monocotyledonae	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Moraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Myrica	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Myrtaceae	0	0	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Nuxia/Dobera	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Nyctaginaceae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olea capensis	0	0	0	0	0	0	1	1	1	0	5	0	4	0	0	0	5	0	1	0	0
Olea europaea ssp. africana	0	0	5	1	0	0	0	2	2	0	0	2	1	0	0	1	0	0	0	0	0
Onagraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	0
Paronychia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavetta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0
Pentadesma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Phoenix reclinata	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Phyllanthus amarus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pinus	1	0	1	0	2	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0
Pistacia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
*Plantago africana**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Plantago lanceolata	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae	11	19	27	42	20	95	71	23	23	44	134	51	110	20	18	8	104	79	139	194	38
Podocarpus	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polycarpaea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygala*	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Prunus africana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte Lygodium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte monolete	0	0	1	1	0	6	0	6	3	5	13	2	10	0	0	1	9	4	1	2	0
Pteridophyte trilete	0	0	0	0	0	1	6	1	1	5	14	2	3	0	1	0	5	13	8	10	2
Pteridophyte trilete botrychium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhamnaceae	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizophora	0	2	1	6	0	0	0	2	3	5	2	2	2	0	0	0	0	1	3	1	0
Rhus natalense*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rubiaceae	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rumex	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Salvadora persica*	0	0	0	0	0	12	0	0	0	0	8	0	0	0	0	0	12	9	16	13	0
Sapindaceae	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sapotaceae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Shirakia elliptica*	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Solanum	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Sterculia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stoebe kilimandscharica	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suada monoïca*	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	6	5	0
Syzygium guineense	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Tamarindus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Tamarix	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thymeleaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Tiliaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Tribulus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Trichilia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Typha	0	0	0	1	0	5	3	1	0	0	5	0	0	0	1	1	1	8	5	4	0
Urticaceae	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
Vepris nobilis*	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Vernonieae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	1	0	0
Zanthoxylum usambarense*	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not determined	1	7	2	0	2	0	0	1	0	0	1	2	1	1	2	0	0	3	0	1	0
Total	312.7	307.2	299.9	332.9	317.4	445.3	380.3	331.9	375.6	369.5	556.1	409.2	523.7	441.6	508.6	411.8	576.1	582.9	606.5	711.1	456.7
Anthocerotaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Poaceae %	4	6	9	13	6	21	19	7	6	12	24	12	21	5	4	2	18	14	23	27	8

				#	#	#	#	#	#	#	#	#							
Depth (mbsf)	344.98	349.98	352.98	354.50	361.00	364.00	365.00	369.00	373.50	380.00	385.50	394.47	398.98	425.99	473.48	542.98	549.98	551.48	561.98
Age (Ma)	7.10	7.20	7.26	7.29	7.42	7.48	7.50	7.58	7.67	7.80	7.91	8.08	8.17	8.71	9.65	11.08	11.22	11.25	11.46
Acacia I	0	0	0	5	4	3	1	0	0	0	0	1	0	0	0	0	0	1	0
Acacia III	0	0	0	2	1	0	4	1	1	1	0	0	0	0	0	0	0	0	0
Acalypha	0	0	0	0	0	4	3	0	0	1	3	0	0	0	0	1	0	0	0
Acanthaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Acanthus*	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	5	0	3
Achyranthes aspera*	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
Aerva lanata*	0	0	0	3	7	13	7	2	6	9	2	7	0	0	0	0	0	0	0
Albizia	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Abutilon*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alchemilla	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Alchornea	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	1
Allophylus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aloe*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Amaranthaceae	68	47	84	13	5	12	9	4	17	0	0	6	69	51	47	19	9	23	20
Anogeissus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthospermum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aphania senegalensis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apiaceae	0	0	2	2	0	0	1	0	0	0	0	0	1	0	0	0	1	0	2
Artemisia	2	0	4	0	0	1	1	0	2	0	0	0	0	0	0	0	0	0	0
Asteraceae cichoriae	0	0	1	7	1	5	6	1	8	4	2	6	0	0	0	0	0	0	1
Asteraceae tubuliflorae	7	4	5	6	14	17	6	1	12	13	3	8	3	4	3	1	5	3	2
Asystasia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
*Balanites aegyptiaca**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Barleria	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Borassus* includes Hyphaene	0	1	1	1	7	0	0	1	4	1	0	1	0	2	1	0	0	0	0
Boscia*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridelia ferruginea	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0
Buxus hildebrandtii	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	3	1	0	1
*Capparis fascicularis**	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Carduus*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Cassia didymobotrya	0	0	0	1	0	0	5	0	0	1	0	0	0	0	0	0	0	0	0
Caucanthus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celastraceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Celosia trigyna*	0	0	0	10	17	27	17	5	23	32	10	14	0	0	0	0	0	0	0
Celtis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Centaurea*	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Chenopodium	0	0	0	2	0	6	2	0	29	9	3	5	0	0	0	0	0	0	0
Chrystiana africana	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Cissus quadrangularis*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clematis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Combretaceae	1	1	0	2	0	1	7	0	4	9	0	0	1	0	4	0	2	1	2
Commelina benghalensis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Commiphora africana	0	0	0	0	2	0	0	0	2	0	0	0	0	0	2	1	0	0	0
Convolvulus*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Cornulacca	0	0	0	6	2	9	14	3	21	7	0	8	0	0	0	0	0	0	0
Croton*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cruciferae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyathula orthocantha*	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyperaceae	1	13	10	10	23	18	20	5	27	9	7	9	18	7	9	6	29	8	9
Cyphostemma*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Delonix elata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dichrostachys cinerea	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Digera muricata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diospyros	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
Dodonaea viscosa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dombeya*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ekebergia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Entada*	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Ephedra	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2
Erhetia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ericaceae	0	0	0	0	0	1	0	0	0	1	0	0	0	0	2	0	1	0	0
Euclea	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0
Euphorbia	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	1
Fabaceae	0	0	0	0	4	0	1	0	3	0	0	0	0	0	0	1	0	0	1
Faidherbia albida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Ficus	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Hagenia abyssinica	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hallea rubrostipulata*	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Helioptropium steudneri**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hirpicium*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenocardia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hymenodictyon floribundum	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Hypoestes*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Ilex mitis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indigofera*	0	0	0	2	4	1	3	1	0	0	0	3	0	0	0	0	0	0	0
Ipomoea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Juniperus procera	2	0	1	1	5	4	2	0	4	1	3	1	0	2	2	0	3	0	1
*Justicia flava**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Justicia anselliana*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Justicia odora*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lannea*	0	0	0	0	0	2	0	0	0	1	0	1	0	0	0	0	0	0	0
Lantana ukambensis*	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Laurembergia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Loranthaceae	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Macaranga	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Maerua*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mallotus oppositifolius*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Depth (mbsf)	344.98	349.98	352.98	354.50	361.00	364.00	365.00	369.00	373.50	380.00	385.50	394.47	398.98	425.99	473.48	542.98	549.98	551.48	561.98
Age (Ma)	7.10	7.20	7.26	7.29	7.42	7.48	7.50	7.58	7.67	7.80	7.91	8.08	8.17	8.71	9.65	11.08	11.22	11.25	11.46
Monocotyledonae	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	1	0	0
Moraceae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Myrica	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
Myrtaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Nuxia/Dobera	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nyctaginaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Olea capensis	0	13	1	0	4	0	17	0	2	5	0	0	0	1	0	1	1	0	0
Olea europaea ssp. africana	0	9	0	0	3	0	2	0	1	1	0	0	2	0	0	0	0	0	1
Onagraceae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Paronychia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavetta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pentadesma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phoenix reclinata	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0
Phyllanthus amarus*	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pinus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pistacia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
*Plantago africana**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Plantago lanceolata	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Poaceae	30	70	45	116	122	149	78	46	95	88	69	56	26	30	41	41	90	17	39
Podocarpus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Polycarpaea*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polygala*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prunus africana	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pteridophyte Lygodium	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Pteridophyte monolete	1	3	1	2	12	4	8	1	8	1	1	6	0	4	5	6	7	0	3
Pteridophyte trilete	0	7	10	10	19	9	5	2	7	7	12	7	3	0	3	9	10	0	5
Pteridophyte trilete botrychium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhamnaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhizophora	0	0	0	0	2	1	0	0	4	0	1	1	0	0	0	0	2	0	0
Rhus natalense*	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0
Rubiaceae	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	1	0	0
Rumex	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Salvadora persica*	0	0	0	5	9	15	16	3	10	13	2	0	0	0	0	0	0	0	0
Sapindaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sapotaceae	0	1	0	0	0	0	1	0	0	0	0	1	0	3	0	4	0	0	2
Shirakia elliptica*	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Solanum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sterculia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Stoebe kilimandscharica	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suada monoïca*	0	0	0	4	0	0	5	1	5	0	0	0	0	0	0	0	0	0	0
Syzygium guineense	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Tamarindus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tamarix	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Thymeleaceae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Tiliaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Tribulus	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichilia	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Typha	0	1	0	0	0	6	4	0	4	0	2	0	0	0	0	0	0	0	0
Urticaceae	0	0	0	0	1	1	0	0	0	3	1	1	0	0	0	0	0	0	0
Vepris nobilis*	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Vernonieae	0	0	0	0	1	2	0	0	0	0	3	0	0	0	0	0	0	1	1
Zanthoxylum usambarense*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not determined	0	1	2	0	0	0	0	0	2	0	1	1	0	0	4	3	1	0	1
Total	467.1	532.2	528.2	575.8	648.4	695.5	632.5	454.6	694.2	612.8	528.4	548.6	530.2	542.7	618.1	662.1	739.2	618.7	674.4
Anthocerotaceae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poaceae %	6	13	9	20	19	21	12	10	14	14	13	10	5	6	7	6	12	3	6

Footnotes:

= 16 samples newly reported in this study; other samples were previously published in part in Bonnefille, 2010, and are enhanced with full reporting of individual species counts here.

* = in these instances, pollen type from similar but different species or genera of plants have the same pollen morphology, thus represents uncertainty in the attribution of the pollen to a specific genus or species.

Acacia notes: Acacia I and III refers to distinct characters of the tectum. In Acacia I the tectum is smooth, whereas in Acacia III the tectum is perforated; Acacia II is not present in Africa. Both categories include many species among the genus Acacia; *Faidherbia albida* was formerly known as *Acacia Albida*.

Amaranthaceae notes: Amaranthaceae, includes pollen taxa that belong to the former Chenopodiaceae category, and were referred to as Amaranthaceae/Chenopodiaceae in Bonnefille et al., 2010. We note that East Africa is a center of diversification for Amaranthaceae, evident since at least 10 Ma in the pollen counts. The pollen of many genera in the Amaranthaceae family are morphologically distinct and separately listed (e.g., Aerva, Achyranthes, Cyathula, Celosia, Digera distinguished in the new pollen counts; Riollet and Bonnefille, 1976).

APPENDIX DR4

TABLE DR4: LEAF WAX CARBON ISOTOPIC COMPOSITION

Age (Ma)	Depth (mbsf)	$\delta^{13}C\ C_{30}$ (‰)	std. dev. (‰)	Lab	Published
0.060	1.00	-26.6	0.6	WHOI	*
0.063	1.15	-24.9	0.8	WHOI	*
0.069	1.45	-25.3	0.7	WHOI	*
1.360	65.50	-24.7	0.4	WHOI	*
1.372	66.10	-26.9	0.1	WHOI	*
1.375	66.25	-25.6	0.5	WHOI	*
1.378	66.40	-25.8	0.7	WHOI	*
1.381	66.55	-25.2	0.4	WHOI	*
1.390	67.00	-24.6	0.2	WHOI	*
1.393	67.15	-24.8	0.2	WHOI	*
1.402	67.60	-22.3	0.1	WHOI	*
1.405	67.75	-22.5	0.3	WHOI	*
1.408	67.90	-23.0	0.4	WHOI	*
1.411	68.05	-24.3	0.4	WHOI	*
1.414	68.20	-24.6	0.1	WHOI	*
1.417	68.35	-24.4	0.3	WHOI	*
1.420	68.50	-23.9	0.2	WHOI	*
1.423	68.65	-24.2	0.3	WHOI	*
1.426	68.80	-24.7	0.3	WHOI	*
1.639	79.35	-24.5	0.7	WHOI	*
1.642	79.50	-23.8	0.9	WHOI	*
1.645	79.65	-24.1	0.0	WHOI	*
1.648	79.80	-24.0	0.6	WHOI	*
1.651	79.95	-23.8	1.0	WHOI	*
1.654	80.10	-24.1	0.3	WHOI	*
1.657	80.25	-25.2	0.2	WHOI	*
1.660	80.40	-24.3	0.6	WHOI	*
1.663	80.55	-24.3	0.2	WHOI	*
1.666	80.70	-24.5	0.5	WHOI	*
1.669	80.85	-25.0	0.9	WHOI	*
1.672	81.00	-24.3	0.5	WHOI	*
1.728	83.75	-24.6	0.3	WHOI	
1.731	83.90	-24.5	0.2	WHOI	
1.734	84.05	-23.6	0.1	WHOI	
1.737	84.20	-23.7	0.0	WHOI	
1.743	84.50	-23.9	0.0	WHOI	
1.746	84.65	-24.2	0.3	WHOI	
1.749	84.80	-24.5	0.1	WHOI	
1.752	84.95	-25.5	0.2	WHOI	
1.755	85.10	-26.1	0.0	WHOI	
1.758	85.25	-25.8	0.6	WHOI	
1.761	85.40	-26.0	0.4	WHOI	
1.764	85.55	-25.8	0.2	WHOI	
1.767	85.70	-25.8	0.2	WHOI	
1.770	85.85	-25.5	0.1	WHOI	
1.773	86.00	-25.3	0.2	WHOI	
1.776	86.15	-25.3	0.1	WHOI	
1.779	86.30	-25.0	0.4	WHOI	
1.782	86.45	-25.6	0.2	WHOI	
1.785	86.60	-25.5	0.2	WHOI	
1.788	86.75	-25.5	0.0	WHOI	
1.791	86.90	-23.7	0.3	WHOI	
1.794	87.05	-25.4	0.2	WHOI	
1.797	87.20	-24.7	0.2	WHOI	

1.910	92.80	-25.8	0.4	WHOI	
1.913	92.95	-25.8	0.3	WHOI	
1.916	93.10	-25.5	0.0	WHOI	
1.919	93.25	-25.5	0.2	WHOI	
1.922	93.40	-25.3	0.2	WHOI	
1.925	93.55	-25.4	0.2	WHOI	
1.928	93.70	-25.2	0.2	WHOI	
1.931	93.85	-25.1	0.2	WHOI	
1.934	94.00	-25.0	0.2	WHOI	
1.937	94.15	-25.5	0.4	WHOI	
1.941	94.30	-25.1	0.1	WHOI	
1.944	94.45	-25.1	0.3	WHOI	
1.947	94.60	-24.7	0.5	WHOI	
1.950	94.75	-25.5	0.1	WHOI	
1.953	94.90	-25.5	0.4	WHOI	
1.956	95.05	-25.2	0.2	WHOI	
1.959	95.20	-25.6	0.5	WHOI	
1.965	95.50	-25.5	0.4	WHOI	
1.968	95.65	-25.4	0.6	WHOI	
1.971	95.80	-25.2	0.1	WHOI	
1.974	95.95	-25.5	0.2	WHOI	
1.977	96.10	-25.3	0.3	WHOI	
1.980	96.25	-24.9	0.3	WHOI	
1.983	96.40	-25.1	0.2	WHOI	
1.986	96.55	-25.4	0.5	WHOI	
1.989	96.70	-25.2	0.9	WHOI	
1.992	96.85	-25.5	0.6	WHOI	
1.995	97.00	-26.4	0.1	WHOI	
1.998	97.15	-25.6	0.1	WHOI	
2.001	97.30	-25.9	0.2	WHOI	
2.004	97.45	-25.5	0.2	WHOI	
2.007	97.60	-26.7	0.4	WHOI	
2.010	97.75	-25.6	0.4	WHOI	
2.013	97.90	-24.9	0.8	WHOI	
2.016	98.05	-27.2	0.7	WHOI	
2.019	98.20	-26.5	0.3	WHOI	
2.022	98.35	-24.9	0.3	WHOI	
2.127	103.55	-25.1	0.2	WHOI	
2.129	103.65	-25.6	0.2	WHOI	
2.132	103.80	-26.2	0.6	WHOI	
2.378	116.00	-25.0	0.3	WHOI	*
2.381	116.15	-25.4	0.9	WHOI	*
2.384	116.30	-25.8	0.2	WHOI	*
2.387	116.45	-25.8	0.6	WHOI	*
2.390	116.60	-25.8	0.1	WHOI	*
2.393	116.75	-26.0	0.6	WHOI	*
2.396	116.90	-25.8	0.2	WHOI	*
2.399	117.05	-26.2	0.3	WHOI	*
2.402	117.20	-26.0	0.1	WHOI	*
2.405	117.35	-25.9	0.4	WHOI	*
2.408	117.50	-25.9	0.4	WHOI	*
2.411	117.65	-26.5	0.3	WHOI	*
2.414	117.80	-26.9	0.2	WHOI	*
2.417	117.95	-26.0	0.2	WHOI	*
2.420	118.10	-26.8	0.2	WHOI	*
2.423	118.25	-25.9	0.5	WHOI	*
2.426	118.40	-24.8	0.2	WHOI	*
2.429	118.55	-24.7	0.4	WHOI	*
2.432	118.70	-25.3	0.4	WHOI	*
2.436	118.85	-25.8	0.1	WHOI	*
2.742	132.15	-25.3	0.2	WHOI	*
2.745	132.30	-25.3	0.2	WHOI	*
2.748	132.45	-25.8	0.2	WHOI	*
2.752	132.60	-25.8	0.2	WHOI	*
2.755	132.75	-25.5	0.2	WHOI	*
2.759	132.90	-25.9	0.2	WHOI	*
3.209	152.50	-26.1	0.6	WHOI	*
3.213	152.65	-25.7	0.7	WHOI	*
3.216	152.80	-26.4	0.2	WHOI	*
3.220	152.95	-26.1	0.2	WHOI	*

3.223	153.10	-26.2	0.3	WHOI	*
3.227	153.25	-26.2	0.2	WHOI	*
3.400	160.80	-27.1	0.2	WHOI	*
3.409	161.25	-28.3	0.6	WHOI	*
3.421	161.85	-26.5	0.5	WHOI	*
3.431	162.32	-27.1	0.3	WHOI	*
3.440	162.77	-27.0	0.5	WHOI	*
3.454	163.50	-27.8	0.2	WHOI	*
3.773	178.50	-27.4	0.5	WHOI	*
3.773	178.60	-26.8	0.3	WHOI	
3.778	178.70	-25.7	0.2	WHOI	
3.780	178.80	-25.3	0.5	WHOI	
3.784	179.00	-25.5	0.2	WHOI	
3.791	179.30	-25.9	0.1	WHOI	
3.793	179.40	-25.9	0.4	WHOI	
3.796	179.50	-25.5	0.1	WHOI	
3.798	179.60	-26.0	0.4	WHOI	
3.800	179.70	-26.4	0.5	WHOI	
3.801	179.80	-25.9	0.7	WHOI	
3.803	179.90	-26.9	0.1	WHOI	
3.804	180.00	-26.7	0.6	WHOI	
3.806	180.10	-27.4	0.6	WHOI	
3.807	180.20	-27.2	0.8	WHOI	*
3.808	180.30	-27.7	0.2	WHOI	*
3.810	180.40	-26.4	0.3	WHOI	*
3.811	180.50	-26.2	0.2	WHOI	*
3.813	180.60	-26.9	0.24	WHOI	
3.814	180.70	-26.6	0.2	WHOI	*
3.815	180.80	-28.2	0.2	WHOI	*
3.817	180.90	-28.9	0.1	WHOI	*
3.819	181.10	-29.5	0.1	WHOI	*
3.821	181.20	-27.5	0.4	WHOI	*
3.822	181.30	-27.0	0.9	WHOI	*
3.824	181.40	-28.7	0.2	WHOI	*
3.825	181.50	-29.0	N.D.	USC	
3.825	181.50	-26.5	0.4	WHOI	*
3.826	181.60	-27.7	N.D.	USC	
3.826	181.60	-26.7	0.4	WHOI	*
3.828	181.70	-26.9	N.D.	USC	
3.829	181.80	-27.6	N.D.	USC	
3.831	181.90	-27.8	N.D.	USC	
3.832	182.00	-27.4	0.0	WHOI	*
3.832	182.00	-27.8	N.D.	USC	
3.833	182.10	-28.0	N.D.	USC	
3.836	182.30	-28.3	N.D.	USC	
3.837	182.40	-27.9	N.D.	USC	
3.839	182.50	-27.8	N.D.	USC	
3.840	182.60	-28.8	0.2	USC	
3.842	182.70	-28.0	N.D.	USC	
3.843	182.80	-27.8	N.D.	USC	
3.847	183.10	-28.3	N.D.	USC	
3.850	183.30	-29.0	N.D.	USC	
3.851	183.40	-28.4	N.D.	USC	
3.852	183.45	-26.5	0.1	USC	
3.853	183.50	-28.0	0.1	USC	
3.854	183.60	-29.1	N.D.	USC	
3.855	183.70	-28.0	0.4	USC	
3.857	183.80	-27.9	N.D.	USC	
3.880	185.50	-28.4	N.D.	USC	
3.882	185.60	-28.6	N.D.	USC	
3.883	185.70	-28.7	N.D.	USC	
3.885	185.80	-28.6	N.D.	USC	

3.886	185.90	-28.8	N.D.	USC
3.887	186.00	-27.7	N.D.	USC
3.887	186.00	-26.8	1.1	USC
3.889	186.10	-28.5	N.D.	USC
3.892	186.30	-28.7	N.D.	USC
3.894	186.50	-27.8	N.D.	USC
3.896	186.60	-29.0	N.D.	USC
3.897	186.70	-28.1	0.3	USC
3.898	186.80	-28.0	N.D.	USC
3.900	186.90	-28.0	N.D.	USC
3.915	187.98	-27.0	0.2	USC
3.915	188.00	-27.7	0.1	USC
3.917	188.10	-26.9	N.D.	USC
3.918	188.20	-27.5	0.2	USC
3.919	188.30	-27.8	N.D.	USC
3.921	188.40	-29.3	N.D.	USC
3.923	188.50	-27.8	N.D.	USC
3.925	188.60	-28.0	N.D.	USC
3.927	188.70	-28.1	N.D.	USC
3.931	188.90	-28.3	N.D.	USC
3.933	189.00	-27.9	N.D.	USC
3.937	189.20	-27.8	N.D.	USC
3.939	189.30	-28.4	N.D.	USC
3.941	189.40	-27.5	N.D.	USC
3.943	189.47	-26.3	1.0	USC
3.943	189.50	-28.4	N.D.	USC
3.945	189.60	-28.6	N.D.	USC
3.947	189.70	-29.8	N.D.	USC
3.950	189.80	-29.4	N.D.	USC
3.952	189.90	-28.3	N.D.	USC
3.954	190.00	-28.5	N.D.	USC
3.956	190.10	-27.3	N.D.	USC
3.958	190.20	-27.9	N.D.	USC
3.960	190.30	-27.8	N.D.	USC
3.964	190.50	-27.4	N.D.	USC
3.966	190.60	-27.3	N.D.	USC
3.968	190.70	-27.8	N.D.	USC
3.970	190.80	-28.3	N.D.	USC
3.972	190.90	-29.2	N.D.	USC
3.974	191.00	-29.3	N.D.	USC
3.976	191.10	-27.3	N.D.	USC
3.978	191.20	-28.4	N.D.	USC
3.980	191.30	-26.0	N.D.	USC
3.984	191.50	-26.2	N.D.	USC
3.986	191.60	-26.4	0.2	USC
3.988	191.70	-25.9	N.D.	USC
3.990	191.80	-25.6	N.D.	USC
3.994	192.00	-25.5	N.D.	USC
3.996	192.10	-27.2	N.D.	USC
3.998	192.20	-27.4	N.D.	USC
4.000	192.30	-26.7	0.3	USC
4.002	192.40	-27.7	N.D.	USC
4.005	192.50	-29.0	N.D.	USC
4.007	192.60	-26.5	N.D.	USC
4.009	192.70	-27.8	N.D.	USC
4.011	192.80	-27.1	0.1	USC
4.013	192.90	-26.9	N.D.	USC
4.015	193.00	-28.2	N.D.	USC

4.017	193.10	-26.8	N.D.	USC
4.019	193.20	-25.3	N.D.	USC
4.021	193.30	-24.9	N.D.	USC
4.023	193.40	-25.6	N.D.	USC
4.025	193.50	-25.3	N.D.	USC
4.027	193.60	-26.4	N.D.	USC
4.029	193.70	-27.5	0.2	USC
4.031	193.80	-25.2	N.D.	USC
4.033	193.90	-28.6	N.D.	USC
4.035	194.00	-25.9	N.D.	USC
4.037	194.10	-26.2	N.D.	USC
4.039	194.20	-25.2	0.2	USC
4.041	194.30	-26.8	N.D.	USC
4.043	194.40	-27.4	N.D.	USC
4.045	194.50	-26.9	N.D.	USC
4.047	194.60	-28.3	N.D.	USC
4.049	194.70	-28.2	0.0	USC
4.051	194.80	-27.4	N.D.	USC
4.123	198.30	-26.5	N.D.	USC
4.125	198.40	-27.1	N.D.	USC
4.127	198.50	-28.0	0.2	USC
4.129	198.60	-28.6	N.D.	USC
4.131	198.70	-27.6	N.D.	USC
4.133	198.80	-28.4	N.D.	USC
4.135	198.90	-29.5	0.1	USC
4.137	199.00	-26.7	N.D.	USC
4.139	199.10	-27.5	N.D.	USC
4.143	199.30	-28.0	N.D.	USC
4.145	199.40	-27.0	N.D.	USC
4.147	199.50	-26.9	N.D.	USC
4.153	199.80	-26.5	N.D.	USC
4.159	200.10	-25.8	N.D.	USC
4.161	200.20	-25.8	N.D.	USC
4.163	200.30	-26.2	N.D.	USC
4.167	200.50	-27.4	N.D.	USC
4.169	200.60	-27.6	N.D.	USC
4.171	200.70	-25.5	N.D.	USC
4.174	200.80	-27.0	N.D.	USC
4.176	200.90	-26.7	0.0	USC
4.178	201.00	-25.6	N.D.	USC
4.180	201.10	-24.7	N.D.	USC
4.182	201.20	-26.0	N.D.	USC
4.184	201.30	-25.5	N.D.	USC
4.186	201.40	-24.9	N.D.	USC
4.192	201.70	-26.7	N.D.	USC
4.194	201.80	-25.8	N.D.	USC
4.200	202.10	-28.8	0.2	USC
4.202	202.20	-28.5	N.D.	USC
4.204	202.30	-26.7	N.D.	USC
4.206	202.40	-27.6	N.D.	USC
4.208	202.50	-25.7	N.D.	USC
4.212	202.70	-25.8	N.D.	USC
4.214	202.80	-26.5	N.D.	USC
4.216	202.90	-25.6	0.0	USC
4.222	203.20	-25.8	N.D.	USC
4.224	203.30	-25.6	N.D.	USC

4.226	203.40	-25.2	N.D.	USC	
4.228	203.50	-24.3	N.D.	USC	
4.231	203.60	-25.4	N.D.	USC	
4.237	203.90	-26.3	N.D.	USC	
4.243	204.20	-29.2	N.D.	USC	
4.245	204.30	-27.4	N.D.	USC	
4.247	204.40	-27.2	N.D.	USC	
4.249	204.50	-27.0	N.D.	USC	
4.251	204.60	-26.5	N.D.	USC	
4.253	204.70	-29.5	N.D.	USC	
4.255	204.80	-28.3	N.D.	USC	
4.257	204.90	-29.1	N.D.	USC	
4.263	205.20	-29.3	0.1	USC	
4.265	205.30	-29.7	N.D.	USC	
4.267	205.40	-28.5	N.D.	USC	
4.271	205.60	-29.9	N.D.	USC	
4.273	205.70	-29.7	N.D.	USC	
4.292	206.60	-27.5	N.D.	USC	
4.294	206.70	-29.2	N.D.	USC	
4.296	206.80	-30.2	0.0	USC	
4.298	206.90	-28.5	N.D.	USC	
4.300	207.00	-29.4	N.D.	USC	
4.302	207.10	-28.3	N.D.	USC	
4.312	207.60	-26.3	N.D.	USC	
4.316	207.80	-27.2	N.D.	USC	
4.318	207.90	-26.4	N.D.	USC	
4.320	208.00	-27.0	N.D.	USC	
4.322	208.10	-27.9	0.1	USC	
4.324	208.20	-26.6	N.D.	USC	
4.326	208.30	-28.4	N.D.	USC	
4.328	208.40	-29.6	N.D.	USC	
4.330	208.50	-29.0	N.D.	USC	
4.332	208.60	-28.1	0.4	USC	
4.334	208.70	-28.5	N.D.	USC	
4.336	208.80	-28.1	N.D.	USC	
4.338	208.90	-27.0	N.D.	USC	
4.340	209.00	-26.8	N.D.	USC	
4.343	209.10	-28.1	N.D.	USC	
4.345	209.20	-28.5	N.D.	USC	
4.347	209.30	-26.8	N.D.	USC	
4.349	209.40	-28.9	N.D.	USC	
4.351	209.50	-28.9	N.D.	USC	
4.391	211.48	-24.9	0.5	USC	
4.545	219.04	-25.1	0.7	USC	
4.857	234.38	-23.9	1.4	USC	
5.175	249.98	-25.4	0.8	USC	
5.707	274.95	-25.4	0.3	USC	
6.115	295.48	-26.2	N.D.	USC	
6.192	299.33	-25.8	0.6	USC	
6.317	305.64	-26.4	0.2	USC	
6.703	325.03	-26.0	0.6	USC	
7.100	344.98	-25.8	0.3	USC	
7.198	349.94	-26.7	0.1	USC	
7.258	352.94	-26.4	0.6	USC	
8.173	398.96	-26.1	0.7	USC	
8.710	425.97	-25.8	0.7	USC	
9.385	488.00	-28.6	0.0	WHOI	*
9.389	488.20	-29.7	0.7	WHOI	*
9.391	488.30	-28.8	0.2	WHOI	*

9.393	488.40	-28.6	0.2	WHOI	*
9.396	488.60	-28.8	0.3	WHOI	*
9.398	488.70	-28.5	0.2	WHOI	*
9.400	488.80	-28.4	0.3	WHOI	*
9.402	488.90	-28.0	0.1	WHOI	*
9.404	489.00	-28.2	0.3	WHOI	*
9.405	489.10	-28.6	0.2	WHOI	*
9.407	489.20	-28.0	0.1	WHOI	*
9.409	489.30	-27.9	0.2	WHOI	*
9.411	489.40	-28.0	0.1	WHOI	*
9.686	475.04	-28.7	0.3	USC	
11.089	543.49	-30.2	0.8	USC	
11.249	551.45	-29.3	0.1	USC	

* = previously published in Feakins et al., (2005). #N.D. = not determined.

APPENDIX DR5

REFERENCES

Aronson, J. L., Hailemichael, M., and Savin, S. M., 2008, Hominid environments at Hadar from paleosol studies in a framework of Ethiopian climate change: Journal of Human Evolution, v. 55, p. 532–550.

Brown, F. H., Sarna-Wojcicki, A. M., Meyer, C. E., and Haileab, B., 1992, Correlation of Pliocene and Pleistocene tephra layers between the Turkana Basin of East Africa and the Gulf of Aden: Quaternary International, v. 13–14, p. 55–67.

Bukry, D., 1974, Coccolith zonation of cores from the western Indian Ocean and the Gulf of Aden, Deep Sea Drilling Project Leg 24: Government Printing Office, 24, 995–996.

Cerling, T. E., and Hay, R. L., 1986, An isotopic study of paleosol carbonates from Olduvai Gorge: Quaternary Research, v. 25, p. 63–78.

Cerling, T. E., Bowman, J. R., and O'Neil, J. R., 1988, An isotopic study of a fluvial-lacustrine sequence: the Plio-Pleistocene Koobi Fora sequence, East Africa: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 63, p. 335–356.

Cerling, T. E., 1992, Development of grasslands and savannas in East Africa during the Neogene: Palaeogeography, Palaeoclimatology, Palaeoecology, v. 97, p. 241–247.

Cerling, T. E., Harris, J. M., and Leakey, M. G., 2003, Isotope paleoecology of the Nawata and Nachukui Formations at Lothagam, Turkana Basin, Kenya, *in* Leakey, M. G., and Harris, J. M., eds., Lothagam: The Dawn of Humanity in Eastern Africa: New York, Columbia University Press, p. 605–614.

Cerling, T. E., Wynn, J. G., Andanje, S. A., Bird, M. I., Korir, D. K., Levin, N. E., Mace, W., Macharia, A. N., Quade, J., and Remien, C. H., 2011, Woody cover and hominin environments in the past 6 million years: Nature, v. 476, p. 51–56.

Feakins, S., deMenocal., P., and Eglinton, T., 2005, Biomarker records of Late Neogene Changes in East African Vegetation: Geology, v. 33, p. 977–980.

Kingston, J. D., 1992, Stable isotopic evidence for hominid paleoenvironments in East Africa [Ph.D. Dissertation thesis]: Harvard University.

Kingston, J. D., Fine Jacobs, B., Hill, A., and Deino, A., 2002, Stratigraphy, age and environments of the late Miocene Mpesida Beds, Tugen Hills, Kenya: Journal of Human Evolution, v. 42, p. 95–116.

Levin, N. E., Quade, J., Simpson, S. W., Semaw, S., and Rogers, M. J., 2004, Isotopic evidence for Plio-Pleistocene environmental change at Gona, Ethiopia: Earth and Planetary Science Letters, v. 219, p. 93–110.

Levin, N. E., Brown, F. H., Behrensmeyer, A. K., Bobe, R., and Cerling, T. E., 2011, Paleosol carbonates from the Omo Group: isotopic records of local and regional environmental change in East Africa: Palaeogeography Palaeoclimatology Palaeoecology, v. 307, p. 75–89.

Passey, B. H., Levin, N. E., Cerling, T. E., Brown, F. H., and Eiler, J. M., 2010, High-temperature environments of human evolution in East Africa based on bond ordering in paleosol carbonates: Proceedings of the National Academy of Sciences of the United States of America, v. 107, p. 11245–11249.

Plummer, T., Bishop, L. C., Ditchfield, P., and Hicks, J., 1999, Research on Late Pliocene Oldowan sites at Kanjera South, Kenya: Journal of Human Evolution, v. 36, p. 151–170.

Plummer, T. W., Ditchfield, P. W., Bishop, L. C., Kingston, J. D., Ferraro, J. V., Braun, D. R., Hertel, F., and Potts, R., 2009, Oldest Evidence of Toolmaking Hominins in a Grassland-Dominated Ecosystem: PLoS ONE, v. 4, p. e7199, doi: DOI: 10.1371/journal.pone.0007199.

Quinn, R. L., Lepre, C. J., Wright, J. D., and Feibel, C. S., 2007, Paleogeographic variations of pedogenic carbonate $\delta^{13}C$ values from Koobi Fora, Kenya: implications for floral compositions of Plio-Pleistocene hominin environments: Journal of Human Evolution, v. 53, p. 560–573.

Raffi, I., Backman, J., Fornaciari, E., Palike, H., Rio, D., Lourens, L., and Hilgen, F., 2006, A review of calcareous nannofossil astrobiochronology encompassing the past 25 million years: Quaternary Science Reviews, v. 25, no. 23-24, p. 3113–3137.

Sarna-Wojcicki, A. M., Meyer, C. E., Roth, P. H., and Brown, F. H., 1985, Ages of tuff beds at East African early hominid sites and sediments in the Gulf of Aden: Nature, v. 313, p. 306–308.

Semaw, S., Simpson, S. W., Quade, J., Renne, P. R., Butler, R. F., McIntosh, W. C., Levin, N., Dominguez-Rodrigo, M., and Rogers, M. J., 2005, Early Pliocene hominids from Gona, Ethiopia: Nature, v. 433, p. 301–305.

Sikes, N. E., 1994, Early hominid habitat preferences in East Africa: Paleosol carbon isotopic evidence: Journal of Human Evolution, v. 27, p. 25–45.

Sikes, N. E., Potts, R., and Behrensmeyer, A. K., 1999, Early Pleistocene habitat in Member 1 Olorgesailie based on paleosol stable isotopes: Journal of Human Evolution, v. 37, p. 721–746.

Sikes, N. E., and Ashley, G. M., 2007, Stable isotopes of pedogenic carbonates as indicators of paleoecology in the Plio-Pleistocene (upper Bed I), western margin of the Olduvai Basin, Tanzania: Journal of Human Evolution, v. 53, p. 574–594.

Quade, J., Levin, N., Semaw, S., Stout, D., Renne, P. R., Rogers, M., and Simpson, S., 2004, Paleoenvironments of the earliest stone toolmakers, Gona, Ethiopia: Geological Society of America Bulletin, v. 116, p. 1529–1544.

White, T. D., WoldeGabriel, G., Asfaw, B., Ambrose, S., Beyene, Y., Bernor, R. L., Boisserie, J.-R., Currie, B., Gilbert, H., Haile-Selassie, Y., Hart, W. K., Hlusko, L. J., Howell, F. C., Kono, R. T., Lehmann, T., Louchart, A., Lovejoy, C. O., Renne, P. R., Saegusa, H., Vrba, E. S., Wesselman, H., and Suwa, G., 2006, Asa Issie, Aramis and the origin of *Australopithecus*: Nature, v. 440, p. 883–889.

WoldeGabriel, G., White, T. D., Suwa, G., Renne, P., de Heinzelin, J., Hart, W. K., and Heiken, G., 1994, Ecological and temporal placement of early Pliocene hominids at Aramis, Ethiopia: Nature, v. 371, p. 330–333.

WoldeGabriel, G., Haile-Selassie, Y., Renne, P. R., Hart, W. K., Ambrose, S. H., Asfaw, B., Heiken, G., and White, T., 2001, Geology and palaeontology of the Late Miocene Middle Awash valley, Afar rift, Ethiopia: Nature, v. 412, p. 175–178.

WoldeGabriel, G., Gilbert, W. H., Hart, W. K., Renne, P. R., and Ambrose, S. H., 2008, Geology and Geochronology, *in* Gilbert, W. H., and Asfaw, B., eds., *Homo erectus*: Pleistocene evidence from the Middle Awash, Ethiopia: Berkeley, University of California Press, p. 13–43.

WoldeGabriel, G., Ambrose, S. H., Barboni, D., Bonnefille, R., Bremond, L., Currie, B., DeGusta, D., Hart, W. K., Murray, A. M., Renne, P. R., Jolly-Saad, M. C., Stewart, K. M., and White, T. D., 2009, The Geological, Isotopic, Botanical, Invertebrate, and Lower Vertebrate Surroundings of Ardipithecus ramidus: Science, v. 326, no. 5949, doi:10.1126/science.1175817.

Wynn, J. G., 2000, Paleosols, stable carbon isotopes, and paleoenvironmental interpretation of Kanapoi, northern Kenya: Journal of Human Evolution, v. 39, p. 411–432.

Wynn, J. G., 2004, Influence of Plio-Pleistocene aridification on human evolution: evidence from paleosols of the Turkana Basin, Kenya: American Journal of Physical Anthropology, v. 123, p. 106–118.

Wynn, J. G., Alemseged, Z., Bobe, R., Geraads, D., Reed, D., and Roman, D. C., 2006, Geological and palaeontological context of a Pliocene juvenile hominin at Dikika, Ethiopia: Nature, v. 443, p. 332–336.

Yellen, J., Brooks, A., Helgren, D., Tappen, M., Ambrose, S. H., Bonfille, R., Feathers, J., Goodfriend, G., Ludwig, K., Renne, P., and Stewart, K., 2005, The Archaeology of Aduma Middle Stone Age Sites in the Awash Valley, Ethiopia: Paleoanthropology, v. 10, p. 25–100.

Leaf wax carbon isotopic, pollen, and age model data for Deep Sea Drilling Project (DSDP) Site 231 can also be found at the National Climatic Data Center(National Oceanic and Atmospheric Administration): ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/feakins2013/feakins2013.txt, and ftp://ftp.ncdc.noaa.gov/pub/data/paleo/contributions_by_author/feakins2013/feakins2013.xls. The soil carbonate compilation is published at the Integrated Earth Data Applications (IEDA) EarthChem data repository: doi:10.1594/IEDA/100231.