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Supplemental Information

Sourcing Elephant Ivory from a Sixteenth-Century Portuguese Shipwreck

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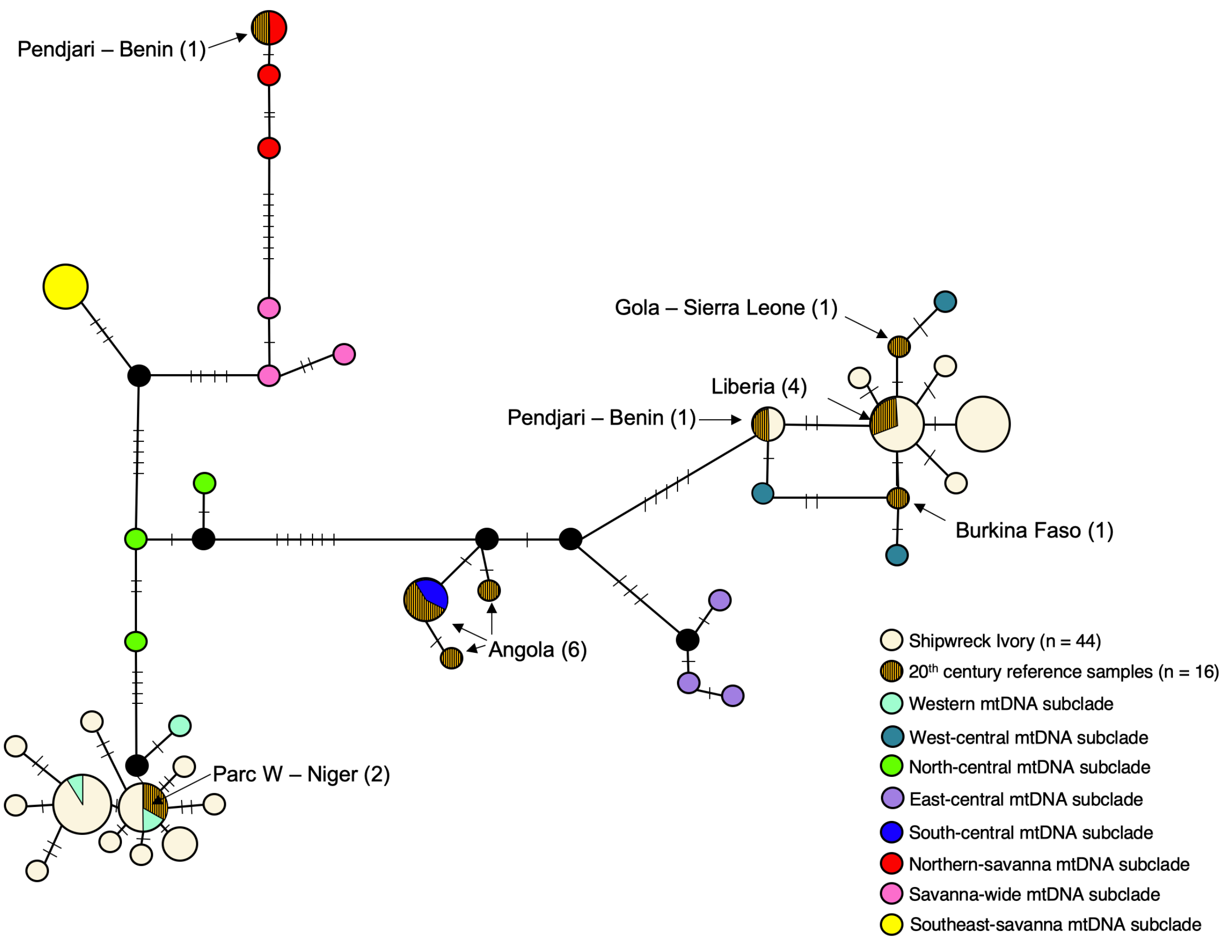

Figure S1. The shipwreck ivory haplotypes grouped with haplotypes of the newly sequenced elephants that were from West Africa. Related to Figure 3.

A median-joining haplotype network (based on pairwise distances between haplotypes) compares shipwreck ivory mtDNA reference sequences (ivory colored) to newly sequenced 20th century reference samples (of known geographic origin) from the University of Cape Town collection (brown with black vertical stripes), and the 8 mtDNA subclades reported by [S1]. The shipwreck ivory haplotypes grouped with the haplotypes reported for 20th century elephants from West Africa, and not within mtDNA subclades common among savanna or central African forest elephants. Branch length is proportional to the number of mutational differences (indicated as cross-hatches) between haplotypes, circle size is related to the number of individuals carrying a haplotype.

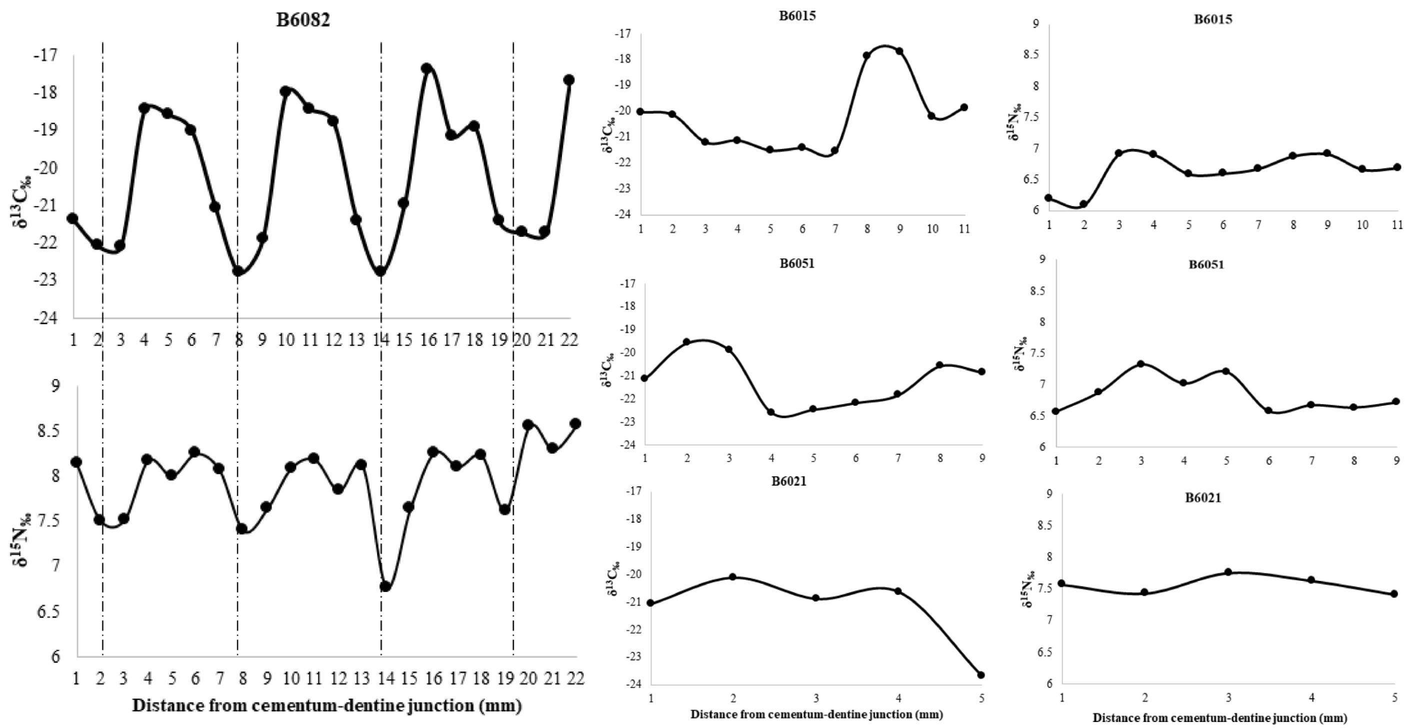

Figure S2. $\delta^{13}C$ and $\delta^{15}N$ values from successive growth increments for four of the shipwreck tusks (B6082, B6015, B6051, B6021) to explore variation in isotope values within one individual elephant. Related to Figure 4.

These four tusks were sampled from transverse sections, with incremental samples taken radially at every 1mm from the cementum – dentine junction inward towards the pulp cavity, following [S2]. $\delta^{13}C$ values measured in the four tusks ranged from -24.0 to -17.1‰ and $\delta^{15}N$ values from 5.7 to 8.3‰. Sample B6082 is the only tusk with enough measurements to see cyclical patterns related to seasonal switching between browse and graze in dry and wet seasons, respectively, as documented in modern and historic African elephant populations that live in mixed savanna and woodland habitats [S2, S3]. Dashed vertical lines on the graph for B6082 suggest possible yearly cycles, which we have associated with the dips in $\delta^{15}N$ and $\delta^{13}C$ values at approximately every 6 incremental samples. This would mean that each incremental sample for B6082 represents approximately 8 weeks of growth and that all 22 samples together record approximately 176 weeks or 3.4 years of growth. If we apply this growth rate to the other three tusks, it would explain why we do not see seasonal, cyclical patterns as we do for B6082: there are too few samples to record variation over multiple years of growth.

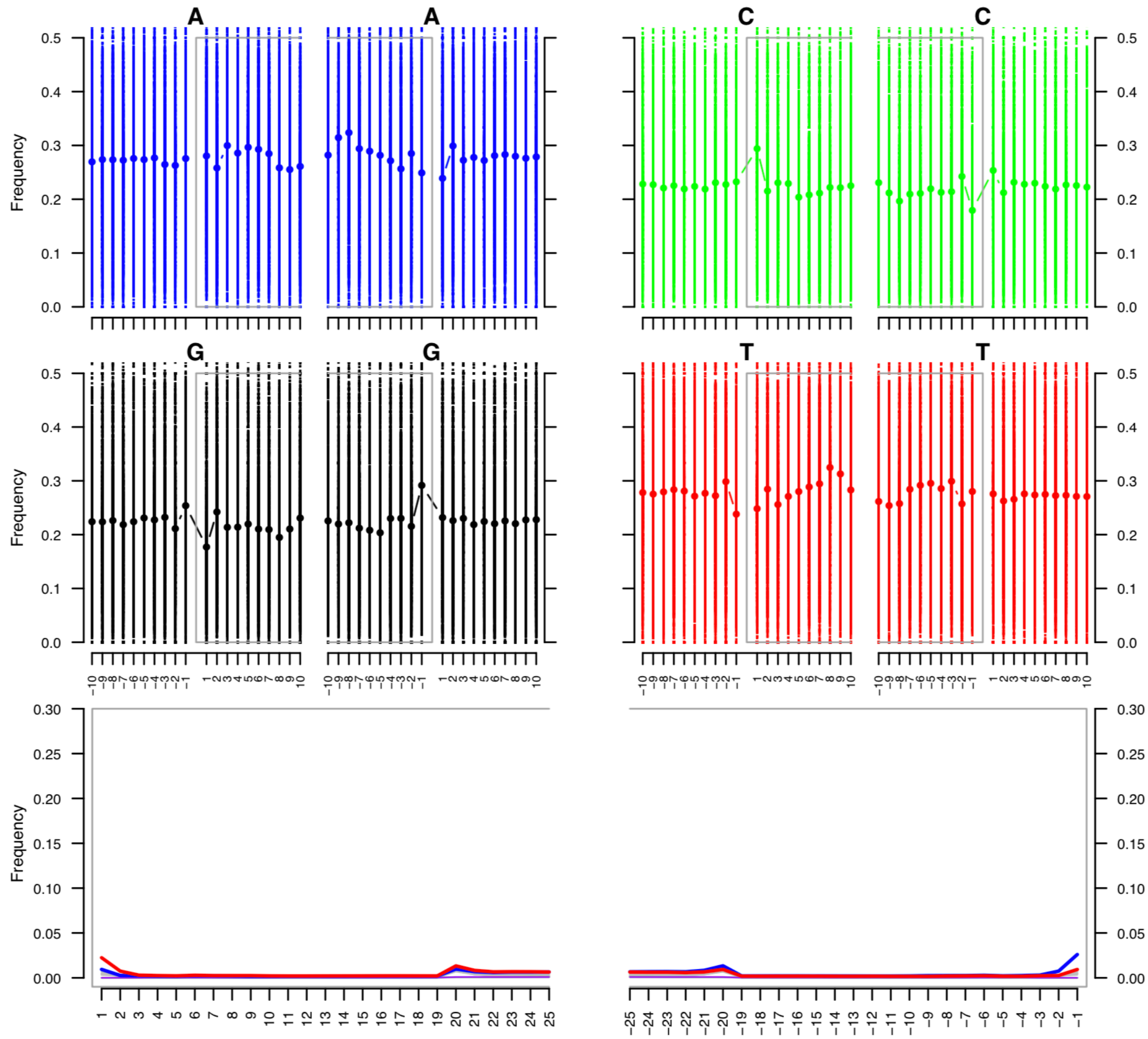

Figure S3. The shipwreck ivory DNA shows damage patterns characteristic of ancient DNA. Related to Figure 3.

The fragment misincorporation plots illustrated above are for a single individual (B6059 belonging to the Western mtDNA subclade – see Figure 1D) and are typical of the damage patterns observed in all of the ancient ivory samples. The smaller top four panels show the base frequency outside and inside the read sequence (the open grey box indicates the read span), and the bottom two plots are the base positions of substitutions from the 5' (left) and the 3' end (right). The bottom plot shows C to T substitutions in red, G to A substitutions in blue, and all other substitutions in grey. This figure was produced using the program mapDamage2 [S4].

	BGN-s2								PHKA2-s1		PHKA2-s2		PLP-s1		
ID[1]	472	485	499	508	513	515	516	570	39	71	871	872	319	345	361
Loxodonta africana	A	T	D[2]/T	G	G	G/D	D/G	C	T	A	T	G	G	T	A
Loxodonta cyclotis	A/G	C	D	T	G	D	D	T	C	A	C	G/A	G/A	T	G
Elephas maximus	A	C	T	G	A	G	D	T	C	G	C	G	G	C	G
Ancient Ivory	A	C	D	T	G	D	D	T	C	A	C	A	G/A	T	G

Table S1. Species diagnostic single nucleotide polymorphisms (SNPs). Related to Figure 3. SNPs in regions of the nuclear genes *BGN*, *PHK*, and *PLP* which were sequenced in shipwreck ivory samples matched SNP character states found in African forest elephants (*Loxodonta cyclotis*). Species diagnostic SNPs are described by [S5].

[1]Reported by [S5].

[2]D indicates a deletion

[3]When considering unlinked chromosome segments, we were able to amplify a set of eight SNPs for 12 individuals for the BGN-s2 gene region (total: 96 SNPs), a set of two SNPs for PHKA2-s1 for 18 individuals and one set of two SNPs for PHKA2-s2 for two individuals for the PHKA2 gene region, and a set of three SNPs for 8 individuals for the PLP-s1 gene region. A total of 24 SNP loci on 3 genes (*BGN*, *PHKA2*, *PLP*) were examined. For DNA sequences that differentiate between African forest and savanna elephants, DNA from each of the sequenced ancient ivory samples matched the character states found in the African forest elephant, while none of the ancient ivory sequences matched character states unique to the African savanna elephant.

Genbank accession or local catalog number	Geographic information	Species, region, or mtDNA subclade	Additional information
Samples used to determine ivory mtDNA subclades (from GenBank)			
JQ438737	WA4012 (Waza, Cameroon)	Northern savanna mtDNA subclade	
JQ438322	GR0023 (Garamba, DRC[1])	Northern savanna mtDNA subclade	
JQ438214	BE4059 (Benoue, Cameroon)	Northern savanna mtDNA subclade	
JQ438674	SW0907 (Sengwa, Zimbabwe)	Southeast savanna mtDNA subclade	
JQ438459	KR0014 (Kruger National Park, South Africa)	Southeast savanna mtDNA subclade	
JQ438139	AM0004 (Amboseli National Park, Kenya)	Southeast savanna mtDNA subclade	
JQ438649	SE2051 (Serengeti, Tanzania)	East central mtDNA subclade	
JQ438608	NG2182 (Ngorongoro, Tanzania)	East central mtDNA subclade	
JQ438316	GR0015 (Garamba, DRC[1])	East central mtDNA subclade	
JQ438637	SA1008 (Savuti, Botswana)	South central mtDNA subclade	
JQ438588	NA4704 (Pan point, Namibia)	South central mtDNA subclade	
JQ438382	HW0151 (Hwange, Zimbabwe)	South central mtDNA subclade	
JQ438503	LO3502 (Lope National Park, Gabon)	West central mtDNA subclade	
JQ438206	BE4035 (Benoue, Cameroon)	West central mtDNA subclade	
JQ438745	WA4023 (Waza, Cameroon)	West central mtDNA subclade	
JQ438501	SL0001 (Sierra Leone)	Western mtDNA subclade	
AY741327	AY741079 (Cote d'Ivoire)	Western mtDNA subclade	
AY741079	AY741079 (Liberia)	Western mtDNA subclade	
JQ438125	AB4527 (Aberdates, Kenya)	Savanna wide mtDNA subclade	
JQ438407	KE4546 (Laikipia, Kenya)	Savanna wide mtDNA subclade	
JQ438220	CH0883 (Chobe, Botswana)	Savanna wide mtDNA subclade	
JQ438329	GR0038 (Garamba, DRC[1])	North central mtDNA subclade	
JQ438260	DS1501 (Dzanga Sangha, CAR[2])	North central mtDNA subclade	
JQ438208	BE4037 (Benoue, Cameroon)	North central mtDNA subclade	
Samples used to examine clustering of ivory sequences with West and West-central mitochondrial subclades (from Genbank)			
AY359266	DRC[1]	Central Africa	
AY359265	Gabon	Central Africa	
AY359278	Gabon	Central Africa	
AF527643	Ghana	West Africa	
AF527641	Ghana	West Africa	
AF527676	Ghana	West Africa	
AF527645	Ghana	West Africa	
AF527678	Ghana	West Africa	
AF527679	Ghana	West Africa	
AF527642	Ghana	West Africa	
AF527675	Ghana	West Africa	
AF527667	Mali	West Africa	
AF527683	Ghana	West Africa	
AF527672	Cote d'Ivoire	West Africa	
AF527673	Cote d'Ivoire	West Africa	
AF527669	Mali	West Africa	
EU096116	CAR[2], Gabon	Central Africa	
EU096117	CAR[2]	Central Africa	
EU096119	Republic of Congo, Gabon	Central Africa	
EU096120	Republic of Congo, Gabon	Central Africa	
EU096121	Gabon	Central Africa	
EU096123	Gabon	Central Africa	
EU096126	Gabon	Central Africa	
EU096128	Gabon	Central Africa	
EU096129	Gabon	Central Africa	
AF106243	Ghana	West Africa	

Genbank accession or local catalog number	Geographic information	Species, region, or mtDNA subclade	Additional information
AF106242	Ghana	West Africa	
AF106245	Ghana	West Africa	
AF106244	Ghana	West Africa	
AY741079	Liberia	West Africa	
AY741327	Cote d'Ivoire	West Africa	
AF527677	Ghana	West Africa	
AF527680	Ghana	West Africa	
AF527674	Ghana	West Africa	
AF527668	Mali	West Africa	
AF527670	Cote d'Ivoire	West Africa	
AF527671	Cote d'Ivoire	West Africa	
UCT collection of georeferenced 20th century elephant samples (newly sequenced)			
UCT 16396	Angola		Ivory sample
UCT 16403	Angola		ivory sample
UCT 16402	Angola		Ivory
UCT 16400	Angola		Ivory
UCT 16401	Angola		Ivory
UCT16399	Angola		Ivory
UCT 16422	Burkina Faso		Ivory/bone
UCT 16425	Parc W, Niger		Ivory/bone
UCT 16411	Parc W, Niger		Ivory/bone
UCT16419	Sapo National Park, Liberia		Ivory/bone
UCT 16417	Sapo National Park, Liberia		Ivory/bone
UCT 16428	Sapo National Park, Liberia		Ivory/bone
UCT 16416	Sapo National Park, Liberia		Ivory/bone
UCT 18745	Pendjari National Park, Benin		Molar
UCT 18744	Pendjari National Park, Benin		Molar
UCT 16421	Gola Forest, Sierra Leone		Ivory/bone
Mitogenome analysis-reference samples			
KY616976	Dzanga Sanga, CAR	*L. cyclotis*	
KY616979	Lope National Park, Gabon	*L. cyclotis*	
KY616978	Lope National Park, Gabon	*L. cyclotis*	
KJ557423	Lope National Park, Gabon	*L. cyclotis*	
KJ557424	Cote d'Ivoire: Tai NP	*L. cyclotis*	
JN673263	Central African Republic: Dzanga Sangha	*L. cyclotis*	
JN673264	Sierra Leone	*L. cyclotis*	
AJ224821	No location information	*L. africana*	
AB443879	No location information	*L. africana*	
EU155210	Siberia	*M. primigenius*	
EU153449	Siberia	*M. primigenius*	
Mitogenome analysis-newly sequenced shipwreck samples			
B6130	*Bom Jesus*	Western mtDNA subclade	16100 bp[3]; 36.55 X[4]
B6074	*Bom Jesus*	Western mtDNA subclade	11842 bp; 5.62 X
B6059	*Bom Jesus*	Western mtDNA subclade	15091 bp; 8.78 X
B8030	*Bom Jesus*	Western mtDNA subclade	16066 bp; 24.69 X
B6079	*Bom Jesus*	Western mtDNA subclade	15925 bp; 25.15 X
B6022	*Bom Jesus*	Western mtDNA subclade	12616 bp; 6.59 X
B6062	*Bom Jesus*	Western mtDNA subclade	14649 bp; 8.05 X
B5051	*Bom Jesus*	Western mtDNA subclade	15663 bp; 4.21 X
B6520	*Bom Jesus*	Western mtDNA subclade	13851 bp; 6.49 X
B6025	*Bom Jesus*	West central mtDNA subclade	13040 bp; 6.03 X
B6021	*Bom Jesus*	West central mtDNA subclade	6516 bp; 2.54 X
B6056	*Bom Jesus*	West central mtDNA subclade	15952 bp; 14.88 X
B6015	*Bom Jesus*	West central mtDNA subclade	13040 bp; 9.31 X
B6047	*Bom Jesus*	West central mtDNA subclade	6403 bp; 2.50 X

Genbank accession or local catalog number	Geographic information	Species, region, or mtDNA subclade	Additional information
B6044	*Bom Jesus*	West central mtDNA subclade	12307 bp; 4.63 X
B6522	*Bom Jesus*	West central mtDNA subclade	8505 bp; 3.00 X
B6528		West central mtDNA subclade	7954 bp; 2.84 X
		Average for all mitogenomes:	12678 bp; 10.11 X

Table S2. Elephant mitochondrial sequences used in analyses. Related to Figure 3.

[1]DRC: Democratic Republic of Congo

[2]CAR: Central African Republic

[3]bp: Nucleotide base-pair (bp) consensus sequence length. The complete reference African forest elephant mitogenome consists of 16,109 bp

[4]X: Average coverage was calculated as the depth of coverage across the genome for all positions in the genome, including positions with no coverage

UCT No.	Sample No.	$\delta^{15}N$(‰)	$\delta^{13}C$(‰)	%N	%C	C:N	mtDNA
15387	B 6116	7.4	-21.1	14.3	39.1	3.2	
15388	B 6059	7.9	-19.0	15.0	41.1	3.2	x
15389	B 6522	7.1	-21.0	15.1	41.5	3.2	x
15390	B 6127	5.4	-18.7	14.5	39.5	3.2	x
15391	B 6026	7.2	-17.9	15.1	41.7	3.2	
15392	B 6056	7.8	-21.0	14.7	40.2	3.2	x
15393	B 6123	7.9	-17.7	14.1	38.3	3.2	
15394	B 6074	7.2	-17.4	14.1	38.4	3.2	x
15395	B 6019	7.3	-21.1	14.8	40.2	3.2	x
15396	B 6525	7.1	-20.1	14.1	38.1	3.2	x
15583	B 6014	7.5	-18.7	16.0	43.5	3.2	x
15584	B 6055	7.6	-20.1	16.1	44.7	3.2	x
15585	B 6053	7.1	-21.6	16.0	43.5	3.2	x
15586	B 6528	6.8	-20.9	13.5	37.1	3.2	x
15587	B 6022	6.0	-22.0	13.4	36.8	3.2	x
15588	B 6531	7.3	-17.9	15.9	43.2	3.2	x
15589	B 6020	5.6	-22.1	14.8	40.5	3.2	
15590	B 6086	7.4	-21.1	15.9	42.9	3.2	x
15591	B 6028	6.8	-19.9	16.0	43.3	3.2	x
15592	B 8030	6.6	-19.7	15.4	42.0	3.2	x
16088	B 8303	7.7	-20.1	14.1	38.6	3.2	x
16089	B 6085	6.7	-19.6	15.8	43.0	3.2	
16090	B 6129	5.6	-20.9	15.9	43.6	3.2	
16091	B 6073	7.2	-20.2	14.3	39.2	3.2	
16092	B 6044	6.8	-21.2	15.6	43.1	3.2	
16093	B 6078	6.9	-20.2	15.8	43.6	3.2	x
16094	B 8033	6.8	-20.7	15.8	43.4	3.2	
16095	B 6025	7.0	-22.1	15.8	43.6	3.3	x
16096	B 6047	6.0	-18.8	15.7	43.6	3.3	x
16097	B 6082	8.5	-20.5	15.0	41.2	3.2	
16238	B 8043	6.3	-21.3	13.9	38.0	3.2	
16239	B 6031	6.4	-21.9	15.1	40.9	3.2	
16240	B 6012	7.2	-20.8	13.5	36.8	3.2	
16241	B 6032	5.9	-21.6	15.1	40.8	3.1	
16242	B 6065	7.6	-19.7	15.0	42.0	3.3	
16243	B 6057	7.2	-19.9	15.7	42.9	3.2	
16244	B 6033	5.6	-20.5	15.8	43.0	3.2	x

16245	B 6130	6.7	-19.6	15.9	43.5	3.2	x
16246	B 6070	8.6	-21.8	15.5	42.4	3.2	
16247	B 6072	7.2	-21.3	15.0	40.3	3.1	
16248	B 6530	7.4	-21.4	16.0	43.6	3.2	x
16249	B 6122	6.1	-21.6	15.1	41.2	3.2	
16250	B 6136	7.2	-19.3	15.3	41.9	3.2	x
16251	B 6520	6.8	-20.0	15.1	41.0	3.2	x
16252	B 6523	5.1	-21.4	14.9	41.2	3.2	
16253	B 6133	5.0	-18.7	14.8	40.8	3.2	
16254	B 6123	6.8	-20.3	14.0	38.2	3.2	
16255	B 6118	7.6	-21.2	14.8	41.1	3.2	
16256	B 6058	6.7	-21.4	14.7	40.7	3.2	x
16258	B 6062	5.9	-20.6	15.7	42.9	3.2	x
16259	B 6255	6.3	-21.5	13.0	35.5	3.2	
16261	B 6131	8.1	-19.6	14.2	40.4	3.3	
16262	B 6046	6.9	-22.2	15.1	42.9	3.3	
16263	B 6524	6.5	-20.7	15.1	41.7	3.2	
16264	B 6048	7.6	-21.8	15.7	43.1	3.2	
16265	B 6045	6.1	-21.2	15.1	41.0	3.2	
16266	B 6128	6.5	-18.1	15.8	42.9	3.2	x
16267	B 6054	9.0	-19.2	15.8	43.6	3.2	
16268	B 6521	7.0	-20.4	13.2	36.0	3.2	
16271	B 6527	6.9	-20.5	13.6	37.2	3.2	
16272	B 6076	5.8	-19.8	14.8	40.9	3.2	
16274	B 6027	4.8	-21.7	13.1	35.7	3.2	
16275	B 6529	6.3	-19.9	14.2	38.4	3.1	x
16276	B 6526	8.0	-21.6	14.2	38.7	3.2	
16277	B 6087	6.6	-21.9	14.6	39.7	3.2	
16278	B 6023	6.8	-21.0	15.3	41.7	3.2	x
16279	B 6083	7.2	-20.1	15.0	41.2	3.2	x
16280	B 6075	7.4	-19.3	14.1	39.3	3.3	x
16281	B 6077	5.4	-19.9	13.7	37.2	3.2	x
16282	B 6084	7.3	-20.5	14.5	39.4	3.2	
16283	B 6060	5.8	-19.8	15.0	41.4	3.2	x
16284	B 6052	6.4	-20.3	15.0	41.2	3.2	
16286	B 6068	5.2	-18.8	14.4	40.1	3.2	x
16287	B 6067	6.7	-19.7	14.6	39.9	3.2	
16290	B 6527	7.3	-19.4	15.2	41.3	3.2	
16291	B 6064	6.2	-19.5	14.7	40.8	3.2	x

16292	B 6029	6.4	-21.9	11.8	33.5	3.3	
16293	B 6088	6.0	-21.0	14.5	40.1	3.2	x
16294	B 6061	5.8	-20.3	15.2	42.1	3.2	x
16296	B 6066	6.0	-16.9	15.5	42.1	3.2	
16333	B 6079	7.3	-21.3	15.4	42.1	3.2	x
16334	B 6030	6.8	-18.6	15.2	41.3	3.2	x
16335	B 6016	6.3	-20.7	14.6	39.8	3.2	
16336	B 6024	6.7	-20.9	14.5	39.5	3.2	
16337	B 6071	7.2	-17.6	15.9	43.2	3.2	x
16338	B 6081	7.4	-19.6	14.0	38.5	3.2	
16339	B 6069	7.0	-20.0	15.1	40.7	3.1	
16340	B 6021	7.3	-20.1	14.0	38.3	3.2	x
16341	B 6532	7.9	-19.3	14.6	39.3	3.1	
16342	B 6063	8.0	-22.0	14.1	38.4	3.2	
16343	B 6049	7.7	-19.8	13.8	37.6	3.2	
16344	B 6132	5.9	-21.6	15.1	41.2	3.2	
16345	B 6017	7.0	-20.2	14.7	39.5	3.1	
16346	B 6051	7.0	-20.9	14.7	39.8	3.2	x
16347	B 6050	7.4	-20.0	15.0	40.7	3.2	
16348	B 6015	6.6	-20.3	14.2	38.9	3.2	x
16356	B 6013	6.3	-20.5	12.1	34.6	3.4	

Table S3. **Shipwreck ivory UCT laboratory number, National Museum of Namibia sample number, $\delta^{15}N$ and $\delta^{13}C$ values as well as collagen quality indicators: %N, %C and C:N (atomic) ratios. Related to Figure 4.**

Collagen extracts in this study had C:N ratios ranging from 3.1 to 3.4, with %C (by weight) from 33.5 to 44.7 and %N from 11.8 to 16.1. C:N ratios between 2.9 and 3.6 indicate well preserved collagen [S6, S7]. In the last column, “x” indicates samples for which mtDNA was analyzed.

UCT No.	Sample No.	Distance (mm)	$\delta^{15}N$	$\delta^{13}C$	C:N
16097	B6082	1	8.1	-20.9	2.9
		2	7.5	-21.5	2.8
		3	7.5	-21.5	2.9
		4	8.2	-18.1	2.9
		5	8.0	-18.0	2.9
		6	8.3	-18.7	2.9
		7	8.1	-20.7	2.9
		8	7.4	-22.2	3.1
		9	7.6	-21.5	2.8
		10	8.1	-17.7	2.8
		11	8.2	-18.1	2.8
		12	7.8	-18.5	2.8
		13	8.1	-21.1	2.8
		14	6.8	-22.4	3.6
		15	7.6	-20.4	3.0
		16	8.3	-17.1	2.8
		17	8.1	-18.8	2.8
		18	8.2	-18.6	2.8
		19	7.6	-21.1	2.8
		20	8.6	-21.4	2.8
		21	8.3	-21.4	2.8
		22	8.6	-17.4	2.8
16348	B6015	1	6.2	-19.5	3.0
		2	6.1	-19.6	3.0
		3	6.9	-20.6	3.0
		4	6.9	-20.5	3.0
		5	6.6	-20.9	3.2
		6	6.6	-20.8	3.2
		7	6.7	-21.0	3.2
		8	6.9	-17.3	3.0
		9	6.9	-17.3	3.0
		10	6.7	-19.6	3.3
		11	6.7	-19.3	3.3
16346	B6051	1	6.6	-20.7	3.6
		2	6.9	-19.2	3.2
		3	7.3	-19.5	3.1

		4	7.0	-22.2	3.2
		5	7.2	-21.8	3.1
		6	6.6	-21.5	3.3
		7	6.7	-21.2	3.2
		8	6.6	-20.0	3.5
		9	6.7	-20.2	3.6
16340	6021	1	7.6	-20.7	3.4
		2	7.4	-19.8	3.0
		3	7.8	-20.3	2.9
		4	7.6	-20.0	2.9
		5	7.4	-23.3	3.6

Table S4. $\delta^{13}C$ and $\delta^{15}N$ values from successive growth increments for four of the shipwreck tusks (B6082, B6015, B6051, B6021) to explore variation in isotope values within one individual elephant. Related to Figure 4 and Figure S2.

UCT No.	Location	Tissue	$\delta^{15}N$(‰)	$\delta^{13}C$(‰)	%N	%C	C:N	mtDNA[1]
16399	Angola	ivory	6.2	-21.3	15.8	43.2	3.2	x
16398	Angola	ivory	7.3	-21.1	15.2	42.1	3.2	
16400	Angola	ivory	8.6	-20.9	14.8	42.0	3.3	x
16404	Angola	ivory	8.9	-20.9	14.6	40.7	3.2	
16403	Angola	ivory	9.4	-20.6	15.4	43.1	3.3	x
16405	Angola	ivory	7.9	-20.2	14.6	40.4	3.2	
16401	Angola	ivory	9.7	-19.5	15.0	41.6	3.2	x
16396	Angola	ivory	8.5	-19.4	15.5	42.4	3.2	x
16397	Angola	ivory	9.2	-18.6	14.2	39.7	3.3	
16402	Angola	ivory	11.3	-17.8	14.9	41.4	3.2	x
18744	Benin	molar	6.8	-22.6	15.5	43.0	3.2	x
18745	Benin	molar	6.8	-22.5	15.4	42.8	3.2	x
18748	Benin	molar	6.0	-22.3	15.5	43.0	3.2	
18746	Benin	molar	8.9	-22.3	15.4	43.0	3.2	
18747	Benin	molar	6.6	-21.8	15.4	43.0	3.2	
18027	Benin	molar	5.4	-21.0	15.4	42.0	3.2	
16410	Burkina Faso	bone	4.8	-21.7	15.2	41.9	3.2	
16422	Burkina Faso	bone	5.2	-21.5	15.4	42.3	3.2	x
18024	Chad	molar	7.3	-21.0	14.7	40.2	3.2	
18023	Chad	molar	9.7	-20.8	15.2	41.6	3.2	
18025	Chad	molar	8.8	-20.7	15.0	41.1	3.2	
18022	Chad	molar	7.8	-20.6	15.4	42.1	3.2	
18021	Chad	molar	8.1	-20.5	15.3	41.5	3.2	
18026	Chad	molar	8.5	-20.4	15.0	41.0	3.2	
16423	Liberia	bone	7.1	-27.2	16.0	43.9	3.2	
16428	Liberia	bone	7.2	-27.1	14.8	44.8	3.5	x
16419	Liberia	bone	7.4	-27.1	16.4	45.1	3.2	x
16416	Liberia	bone	7.4	-27.1	15.3	42.4	3.2	x
16426	Liberia	bone	7.6	-27.1	15.8	43.6	3.2	
16417	Liberia	bone	7.1	-26.5	15.7	43.2	3.2	x
16412	Liberia	bone	7.5	-26.4	15.9	43.2	3.2	
16414	Liberia	bone	8.3	-26.2	14.7	40.1	3.2	
16413	Liberia	bone	8.0	-26.2	15.9	43.2	3.2	
16424	Malawi	bone	6.3	-19.9	15.4	42.8	3.2	
16431	Malawi	bone	6.2	-19.6	16.0	44.0	3.2	
16411	Niger	bone	5.2	-21.8	16.0	43.7	3.2	x

16425	Niger	bone	5.3	-21.8	15.1	42.5	3.3	x
16430	Niger	bone	5.3	-21.4	15.5	42.7	3.2	
16418	Niger	bone	5.3	-21.3	15.9	43.1	3.2	
16421	Sierra Leone	bone	8.4	-24.4	15.5	42.4	3.2	x
16432	South Africa	bone	12.7	-17.2	12.5	34.4	3.2	
16406	South Africa	ivory	8.2	-22.0	15.3	42.0	3.2	
16407	South Africa	ivory	8.4	-19.7	14.8	40.7	3.2	
16409	South Africa	ivory	8.3	-19.1	14.8	40.4	3.2	
16408	South Africa	ivory	7.4	-20.2	16.0	44.0	3.2	
16429	South Africa	bone	13.1	-16.9	15.5	42.8	3.2	
16433	South Africa	bone	8.5	-19.2	15.7	43.7	3.3	
16434	South Africa	bone	9.5	-18.6	15.4	42.1	3.2	
16435	South Africa	bone	8.2	-19.5	15.5	41.7	3.2	
16436	South Africa	bone	7.8	-20.4	15.8	43.3	3.2	
16437	South Africa	bone	9.6	-18.3	15.7	42.5	3.2	

Table S5. Unpublished twentieth century reference samples from the University of Cape Town collections, including $\delta^{15}N$ and $\delta^{13}C$ values as well as collagen quality indicators: %N, %C and C:N (atomic) ratios. Related to Figure 4 and Figure S2.

[1] In the last column, "x" indicates samples for which mtDNA was analyzed

Supplemental References

S1. Ishida, Y., Georgiadis, N.J., Hondo, T., and Roca, A.L. (2013). Triangulating the provenance of African elephants using mitochondrial DNA. Evol. Appl. *6*, 253–265.

S2. Codron, J., Codron, D., Sponheimer, M., Kirkman, K., Duffy, K.J., Raubenheimer, E.J., Mélice, J.-L., Grant, R., Clauss, M., and Lee-Thorp, J.A. (2012). Stable isotope series from elephant ivory reveal lifetime histories of a true dietary generalist. Proc. R. Soc. B Biol. Sci. *279*, 2433–2441.

S3. Cerling, T.E., Wittemyer, G., Ehleringer, J.R., Remien, C.H., and Douglas-Hamilton, I. (2009). History of animals using isotope records (HAIR): a 6-year dietary history of one family of African elephants. Proc. Natl. Acad. Sci. *106*, 8093–8100.

S4. Jónsson, H., Ginolhac, A., Schubert, M., Johnson, P.L.F., and Orlando, L. (2013). mapDamage2. 0: fast approximate Bayesian estimates of ancient DNA damage parameters. Bioinformatics *29*, 1682–1684.

S5. Ishida, Y., Demeke, Y., van Coeverden de Groot, P.J., Georgiadis, N.J., Leggett, K.E.A., Fox, V.E., and Roca, A.L. (2011). Distinguishing forest and savanna African elephants using short nuclear DNA sequences. J. Hered. *102*, 610–616.

S6. Ambrose, S.H. (1990). Preparation and characterization of bone and tooth collagen for isotopic analysis. J. Archaeol. Sci. *17*, 431–451.

S7. Van Klinken, G.J. (1999). Bone collagen quality indicators for palaeodietary and radiocarbon measurements. J. Archaeol. Sci. *26*, 687–695.