

Supplemental Information for:

Ancient DNA is preserved in fish fossils from tropical lake sediments

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Figure S1 Relationship between aDNA fragment size and age of fish fossils. The median value of smoothed read length distributions of mapped reads of taxonomically assigned samples decreases with increasing sample age. The second-order polynomial regression detects a relationship between sample age and median fragment length that is compatible with fragmentation of DNA being fast in the beginning, then slowing down. However, this pattern of DNA fragmentation slowing down with time might also be an artefact of differences between samples in the duration and conditions of sample storage prior to extraction, lake-specific preservation conditions, and size-selective steps in DNA extraction and library preparation.

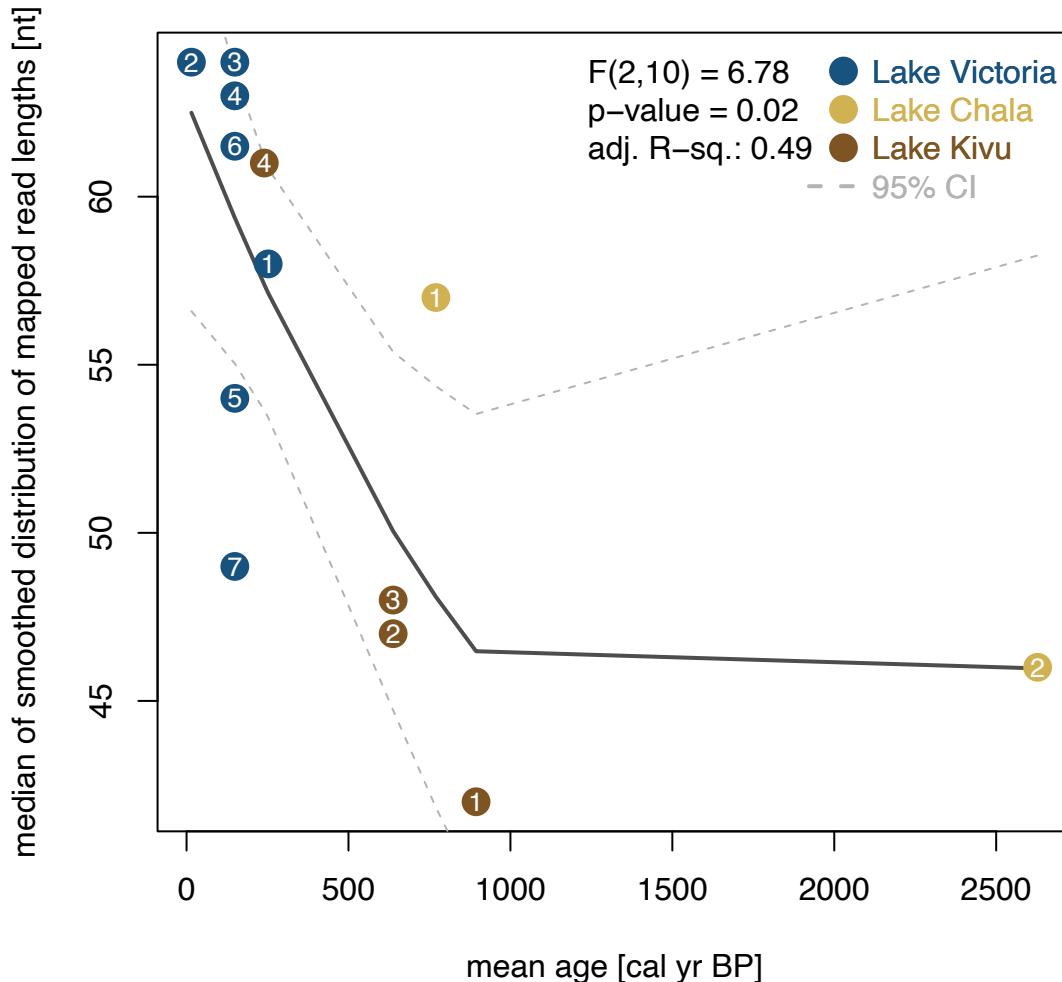


Figure S2 Modelled age-depth relationship for core KIVU12-10A. Shown are calendar age distributions from calibration of ^{14}C dates (horizontal violin plots) and their 95% CIs (coloured boxes), the calculated model (solid black line) and its 95% CI (grey envelope) as produced by the program clam (Blaauw, 2010). Plotted in red is date ETH 95797.1.1 which was derived from insect parts. It was considered to be an outlier and was not used to construct the age-depth model. Depth is given in cm in section 3 of the core, the top of which corresponds to 173.5 cm in the composite.

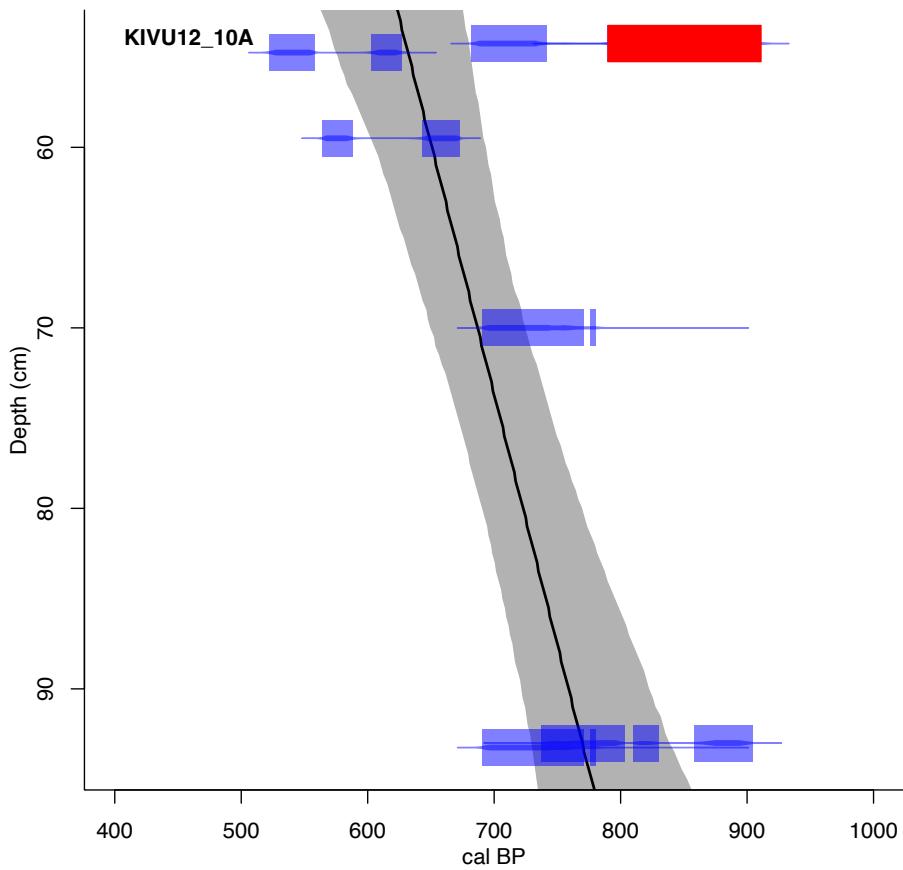


Table S1 Information on fish fossil samples, sequencing libraries and sequencing runs. It contains:

- Name of the core and depth in core from which the fish fossils were isolated and the reconstructed ages of those sediment core intervals.
- Details on experimental procedures that were applied to the sample, the library, or the sequencing run.
- Results of the mapping for taxonomic assignment and the statistical analysis.

One fish fossil sample can be represented by several rows, which correspond to different libraries constructed from the same sample, or different sequencing runs involving the same library. NA, not available.

Table S1 is provided as separate, tab-delimited text file.

Table S2 Genomic references used for taxonomic assignment, mapping, and as extant representatives in the phylogenetic analysis. The first three columns indicate in which analysis the reference was used. Columns “mitochondrial genome”, “ND2”, “D-loop”, and “nuclear genome” contain accession codes from the genbank data repository. Column “reference label” contains labels used to identify individual specimens in the studies that produced the data.

Table S2 is provided as separate, tab-delimited text file.

Table S3 Measurements of the accelerator mass spectrometric radiocarbon dating and their errors.

ETH nr.	sample label	sample label #	sample description	¹⁴ C counts	¹² C (μA)	weight (μg C)*	F ¹⁴ C	error F ¹⁴ C	¹⁴ C age (y)	error age (y)	δ ¹³ C (‰)	composite core depth top [cm]	composite core depth bottom [cm]	used for age model?
95797.1.1	KIVU12_10A_1K_3	53.5-55cm	insects	771'601	33.9	779	0.8919	0.0022	920	20	-17.5	227	228.5	no
95802.1.1	KIVU12_10A_1K_3	53.5-55cm	charcoal	761'331	33.5	983	0.9046	0.0022	805	20	-26.5	227	228.5	yes
95807.1.1	KIVU12_10A_1K_3	54.5-55cm	charcoal	755'358	35.1	988	0.9342	0.0023	545	20	-25.6	228	228.5	yes
95808.1.1	KIVU12_10A_1K_3	59-60cm	charcoal	754'232	34.7	977	0.9196	0.0023	675	20	-12.2	232.5	233.5	yes
95803.1.1	KIVU12_10A_1K_3	69-71cm	charcoal	788'624	35.6	999	0.9025	0.0022	825	20	-24.4	242.5	244.5	yes
95806.1.1	KIVU12_10A_1K_3	92.5-93.5cm	wood	586'850	27.9	562	0.8952	0.0023	890	20	-16.7	266	267	yes
95805.1.1	KIVU12_10A_1K_3	93-93.5cm	plant	656'770	31.7	690	0.9023	0.0023	825	20	-27.5	266.5	267	yes

Table S4 Confidence intervals (95%) of calendar age estimates from calibration of Lake Kivu ^{14}C dates produced with clam and IntCal13.

ETH nr.	composite depth (cm)	estimate age (min. yr)	estimate age (max. yr)	probability
95797.1.1	227.75	790	911	95
95802.1.1	227.75	682	742	95
95807.1.1	228.25	522	558	70.3
		603	627	24.5
95808.1.1	233	564	588	33.4
		643	673	61.6
95803.1.1	243.5	691	771	92.8
		776	780	2.1
95806.1.1	266.5	737	803	52.5
		810	830	8.9
		858	904	33.5
95805.1.1	266.75	691	771	92.8
		776	780	2.1

Table S5 Estimates of calibrated ages and 95% CI derived from the age-depth model of core KIVU12-10A. Intervals that contained analysed fish fossils Kivu 1-3 are highlighted in green.

composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate	composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate	composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate
174.5	270	588	438	202.5	436	635	539	230.5	588	685	640
175	273	589	440	203	439	636	541	231	591	687	642
175.5	276	590	442	203.5	441	637	543	231.5	594	688	644
176	279	591	444	204	444	637	545	232	597	689	645
176.5	282	592	446	204.5	446	638	546	232.5	600	690	647
177	285	592	447	205	449	639	548	233	603	691	649
177.5	288	593	449	205.5	452	640	550	233.5	606	693	651
178	291	594	451	206	454	641	552	234	609	694	653
178.5	294	595	453	206.5	457	641	554	234.5	611	695	654
179	296	596	455	207	460	642	555	235	613	697	656
179.5	299	597	456	207.5	463	643	557	235.5	616	698	658
180	302	598	458	208	466	644	559	236	618	699	660
180.5	305	599	460	208.5	469	645	561	236.5	620	700	662
181	307	600	462	209	472	645	563	237	622	702	663
181.5	310	601	464	209.5	475	646	564	237.5	624	704	665
182	313	602	465	210	478	647	566	238	626	705	667
182.5	316	603	467	210.5	480	648	568	238.5	629	707	669
183	318	604	469	211	483	649	570	239	631	708	671
183.5	321	605	471	211.5	485	650	572	239.5	633	709	672
184	324	605	473	212	488	651	573	240	635	711	674
184.5	327	606	474	212.5	490	652	575	240.5	638	713	676
185	329	607	476	213	493	653	577	241	640	714	678
185.5	332	607	478	213.5	496	654	579	241.5	642	716	680
186	335	608	480	214	498	655	581	242	644	719	681
186.5	338	609	482	214.5	501	655	582	242.5	647	721	683
187	341	610	483	215	503	656	584	243	648	722	685
187.5	344	611	485	215.5	506	657	586	243.5	650	724	687
188	347	612	487	216	508	658	588	244	653	726	689
188.5	350	613	489	216.5	511	659	590	244.5	654	728	690
189	353	614	491	217	514	659	591	245	657	730	692
189.5	357	614	492	217.5	517	660	593	245.5	659	733	694
190	360	615	494	218	519	661	595	246	662	735	696
190.5	363	616	496	218.5	522	662	597	246.5	664	737	698
191	366	617	498	219	524	663	599	247	666	739	699
191.5	369	618	500	219.5	527	664	600	247.5	668	741	701
192	372	618	501	220	531	664	602	248	670	743	703
192.5	375	619	503	220.5	534	665	604	248.5	672	745	705
193	379	620	505	221	537	666	606	249	674	747	707
193.5	382	621	507	221.5	540	667	608	249.5	676	749	708
194	385	622	509	222	543	668	609	250	678	752	710
194.5	388	622	510	222.5	546	669	611	250.5	680	754	712
195	391	623	512	223	549	670	613	251	681	756	714
195.5	394	624	514	223.5	551	671	615	251.5	683	759	716
196	398	625	516	224	554	672	617	252	685	761	717
196.5	401	625	518	224.5	556	673	618	252.5	687	764	719
197	404	626	519	225	559	673	620	253	689	766	721
197.5	406	627	521	225.5	561	674	622	253.5	691	769	723
198	409	628	523	226	564	675	624	254	693	771	725
198.5	412	629	525	226.5	567	676	626	254.5	695	773	726
199	414	629	527	227	570	677	627	255	696	776	728
199.5	418	630	528	227.5	572	679	629	255.5	698	779	730
200	421	631	530	228	574	680	631	256	699	781	732
200.5	424	632	532	228.5	577	681	633	256.5	701	784	734
201	427	632	534	229	579	682	635	257	702	787	735
201.5	430	633	536	229.5	582	683	636	257.5	704	789	737
202	433	634	537	230	584	684	638	258	706	792	739

Table S5 continued

composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate
258.5	707	795	741
259	709	798	743
259.5	710	801	744
260	712	804	746
260.5	713	806	748
261	715	809	750
261.5	716	812	752
262	717	815	753
262.5	719	818	755
263	721	820	757
263.5	722	822	759
264	723	825	761
264.5	725	827	762
265	726	831	764
265.5	727	833	766
266	729	835	768
266.5	730	838	770
267	731	842	771
267.5	732	845	773
268	733	848	775
268.5	734	852	777
269	735	855	779
269.5	736	858	780
270	737	862	782
270.5	737	864	784
271	738	867	786
271.5	739	870	788
272	740	873	789
272.5	741	875	791
273	742	878	793
273.5	742	881	795
274	743	884	797
274.5	744	887	798
275	745	890	800
275.5	746	893	802
276	747	895	804
276.5	747	898	806
277	748	901	807
277.5	749	904	809
278	750	907	811
278.5	751	910	813
279	752	912	815
279.5	753	915	816
280	754	918	818
280.5	754	921	820
281	755	924	822
281.5	756	927	824
282	757	929	825
282.5	758	933	827
283	759	936	829
283.5	760	938	831
284	761	941	833
284.5	762	944	834
285	763	946	836
285.5	764	950	838
286	765	953	840

composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate
286.5	766	956	842
287	766	958	843
287.5	767	961	845
288	768	964	847
288.5	769	966	849
289	769	969	851
289.5	770	972	852
290	771	975	854
290.5	771	978	856
291	772	981	858
291.5	773	983	860
292	774	986	861
292.5	774	989	863
293	775	992	865
293.5	776	995	867
294	777	998	869
294.5	778	1002	870
295	779	1005	872
295.5	779	1008	874
296	780	1011	876
296.5	781	1014	878
297	782	1017	879
297.5	782	1020	881
298	783	1023	883
298.5	784	1026	885
299	784	1029	887
299.5	785	1032	888
300	786	1035	890
300.5	787	1038	892
301	787	1041	894
301.5	788	1044	896
302	789	1047	897
302.5	789	1050	899
303	790	1053	901
303.5	791	1056	903
304	792	1060	905
304.5	792	1063	906
305	793	1066	908
305.5	794	1069	910
306	795	1072	912
306.5	796	1075	914
307	797	1078	915
307.5	798	1081	917
308	799	1084	919
308.5	800	1087	921
309	800	1090	923
309.5	801	1093	924
310	802	1096	926
310.5	803	1099	928
311	804	1102	930
311.5	805	1105	932
312	806	1108	933
312.5	807	1111	935
313	808	1114	937
313.5	809	1117	939
314	809	1120	941

composite depth (cm)	modelled age (min95%)	modelled age (max95%)	modelled age, best estimate
314.5	810	1123	942
315	811	1126	944
315.5	812	1130	946
316	813	1133	948
316.5	814	1136	950
317	815	1139	951
317.5	815	1142	953
318	816	1145	955
318.5	817	1148	957
319	818	1151	959
319.5	819	1154	960
320	820	1157	962
320.5	821	1160	964
321	822	1163	966
321.5	823	1166	968
322	824	1169	969
322.5	824	1172	971
323	825	1175	973
323.5	826	1178	975