Santos et al. Evaluating possible sources of error in tree-ring ^{14}C data using multiple trees across South America
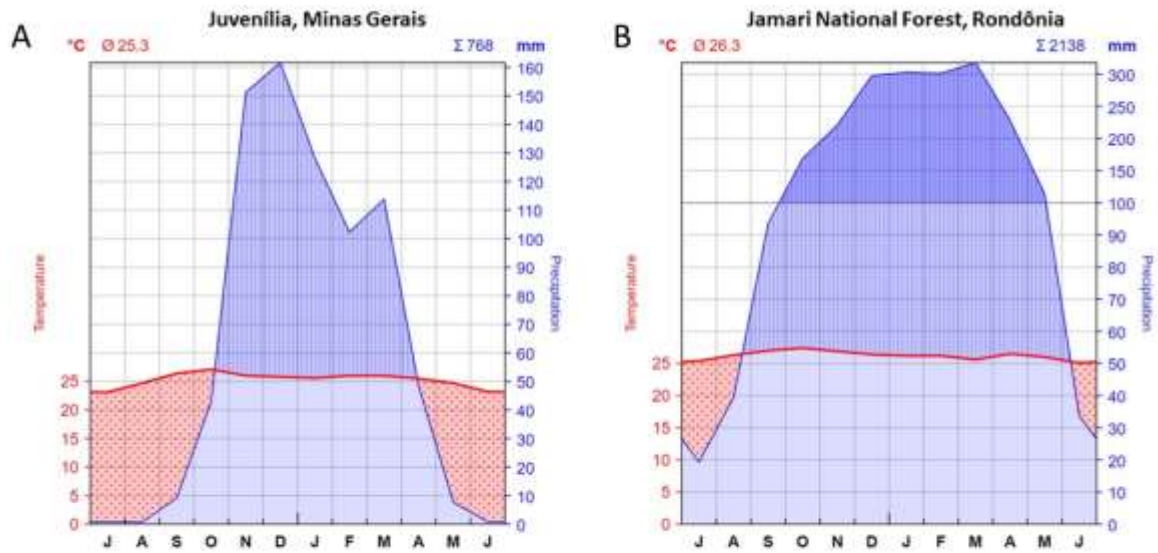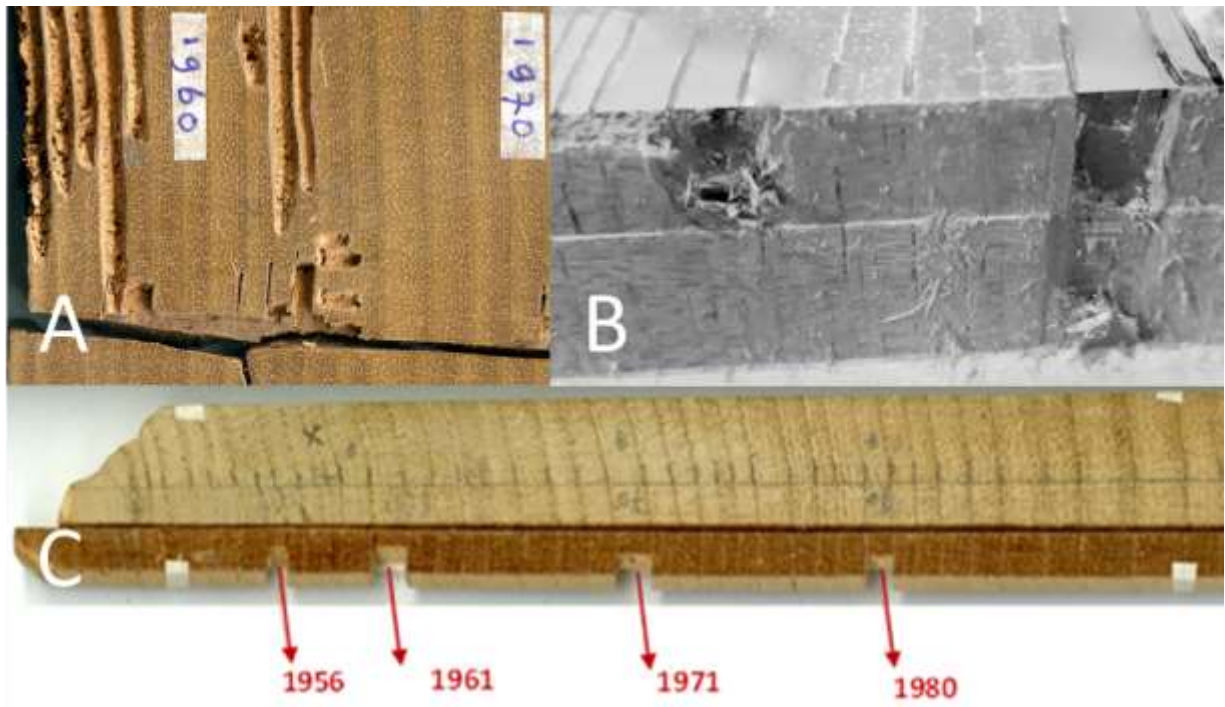
Supplementary material

Figure S1. Climate diagrams based on Köppen climate classification for (A) Juvenília, Minas Gerais and (B) Jamari National Forest sites.


Figure S2. Images of basic tree-ring sampling methods, such as (A) cross-section, and (B) increment core.

Figure S3. Panels A and B show examples of inadequate sampling of single tree rings extracted from wood slabs using non-uniform milling/drilling (A) and inexact cutting/chiseling (B). Panel C on the other hand exemplifies precise razor excision of tree rings for atmospheric ^{14}C reconstruction. (Panel A: courtesy of Dr. Groenendijk).
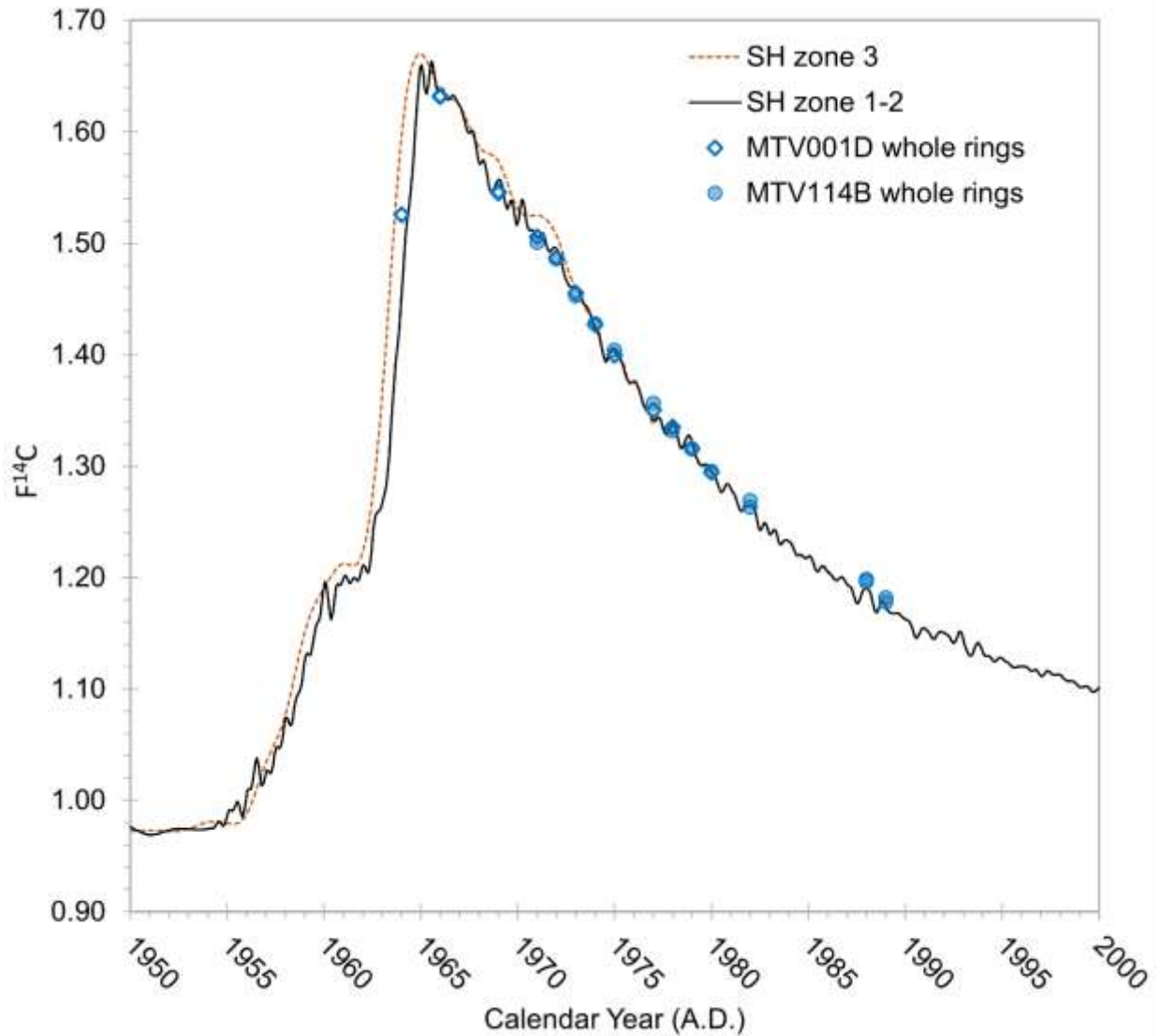
Figure S4. Annual growth pattern of the trees from Juvenília, Brazil. All ^{14}C results are shown as fraction modern carbon (F^{14}C) signatures of each calendar year's individual tree rings, and compared with the atmospheric record for SH1-2 and SH3 (Hua et al., 2022). The statistical uncertainties, shown as error bars, are smaller than the symbols. Refer to Fig. 2A in the main text to see details regarding wood samples. This image is seen in the bottom-right corner of figure 4 (main text).
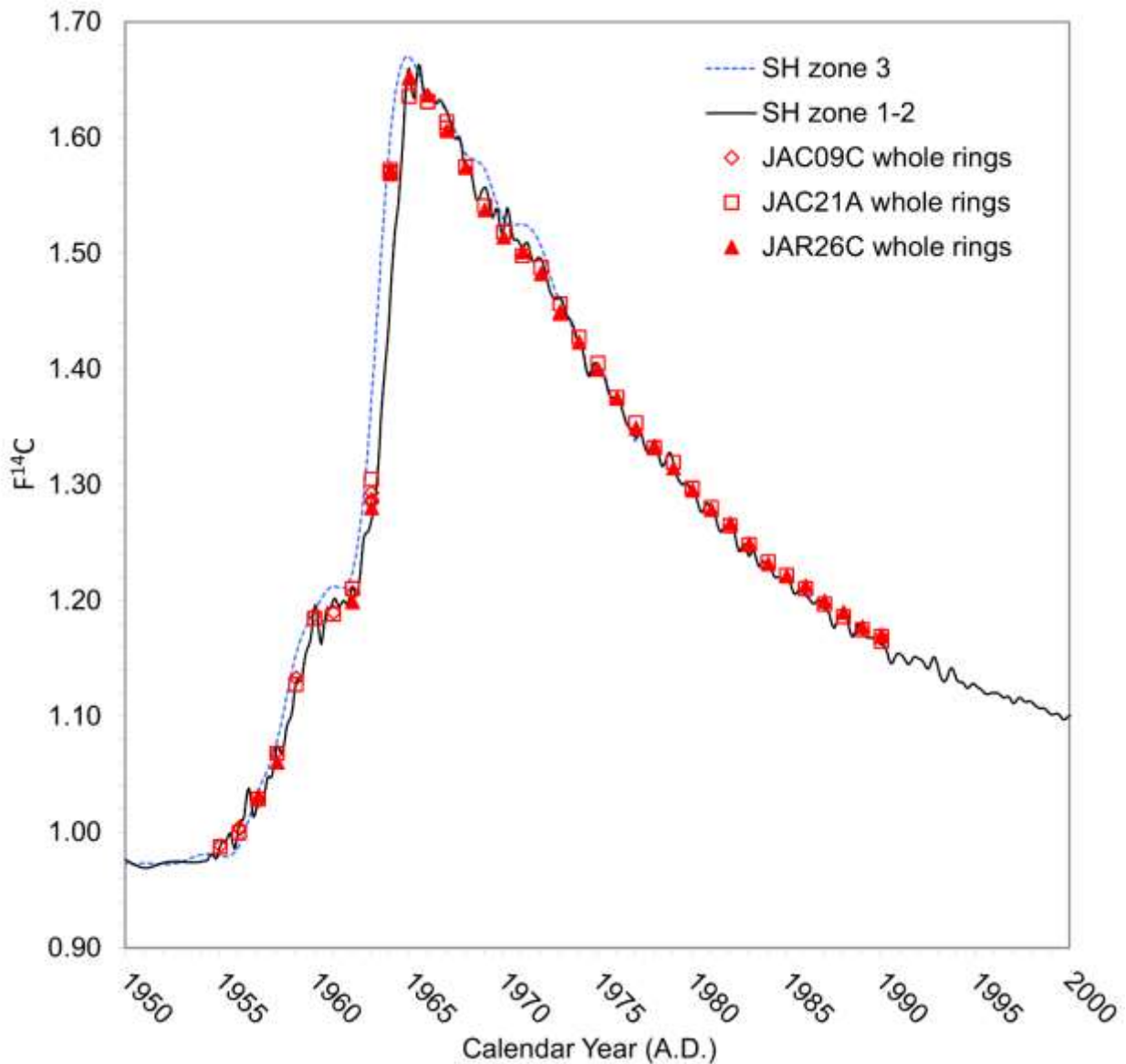
Figure S5. Annual growth pattern of the trees from Jamari, Brazil. All ^{14}C results are shown as fraction modern carbon (F^{14}C) signatures of each calendar year's individual tree rings, and compared with the atmospheric record for SH1-2 and SH3 (Hua et al., 2022). The statistical uncertainties, shown as error bars, are smaller than the symbols. Refer to Fig. 2B in the main text to see details regarding wood samples. This image is seen in the bottom-right corner of figure 5 (main text).

Table S1. Intercorrelation of tree-ring width series of the trees MTV001 and MTV114 from Juvenília, Minas Gerais. Segments examined are 50 years lagged successively by 25 years. The intercorrelation between the series is r=0.692.

Series	Time spam	1875-1924	1900-1949	1925-1974	1950-1999	1975-2024
MTV001A	1882 - 1980	0.65	0.9	0.87	0.88	
MTV001B	1882 - 1980	0.54	0.83	0.86	0.84	
MTV001C	1886 - 1980	0.68	0.87	0.84	0.85	
MTV001D	1900 - 1995		0.82	0.78	0.55	
MTV114A	1944 - 2015			0.49	0.61	0.73
MTV114B	1947 - 2015			0.49	0.6	0.72
Segment correlation		**0.62**	**0.86**	**0.72**	**0.72**	**0.73**

Table S2. Extended ¹⁴C data for *Cedrela fissilis* trees from Juvenília, Brazil. All ¹⁴C results are shown as Fraction modern carbon (F¹⁴C) signatures. The individual statistical error bars of ±1σ were based on counting statistics, and propagated uncertainties due to normalization and processing blank. Results of 15 duplicates are also shown based on weighed mean F¹⁴C and standard error. Calibrated calendar years were derived using CALIBomb (refer to main text for more details).

¹⁴C-AMS #	Sample ID	Calendar year (A.D.)	F¹⁴C	±1σ	Weighed Mean F¹⁴C (‰)	Standard Error	Av. ¹⁴C cal. year	Error cal. Year
UCIAMS#251764	MTV001D-1964(1)	1964	1.5256	0.0021	1.5256	0.0015	1964.33	0.06
UCIAMS#251765	MTV001D-1964(2)	1964	1.5256	0.0022				
UCIAMS#251766	MTV001D-1966(1)	1966	1.6314	0.0021	1.6319	0.0015	1966.37	0.80
UCIAMS#251767	MTV001D-1966(2)	1966	1.6324	0.0022				
UCIAMS#251770	MTV001D-1969(1)	1969	1.5450	0.0021	1.5457	0.0015	1968.90	0.59
UCIAMS#251771	MTV001D-1969(2)	1969	1.5463	0.0020				
UCIAMS#241067	MTV001D-1971	1971	1.5057	0.0020	1.5036	0.0025	1971.08	0.67
UCIAMS#241071	MTV114B-1971	1971	1.5006	0.0024				
UCIAMS#241068	MTV001D-1972	1972	1.4866	0.0020	1.4863	0.0014	1972.19	0.21
UCIAMS#241072	MTV114B-1972	1972	1.4859	0.0020				
UCIAMS#241069	MTV001D-1973	1973	1.4554	0.0020	1.4541	0.0014	1973.04	0.52
UCIAMS#241073	MTV114B-1973	1973	1.4526	0.0021				
UCIAMS#251772	MTV001D-1974	1974	1.4267	0.0020	1.4271	0.0014	1973.94	0.19
UCIAMS#251779	MTV114B-1974	1974	1.4274	0.0019				
UCIAMS#251774	MTV001D-1975	1975	1.3995	0.0024	1.4023	0.0021	1974.77	0.65
UCIAMS#252867	MTV114B-1975	1975	1.4039	0.0018				
UCIAMS#251776	MTV001D-1977	1977	1.3504	0.0020	1.3535	0.0029	1976.61	0.33
UCIAMS#252868	MTV114B-1977	1977	1.3563	0.0019				
UCIAMS#251777	MTV001D-1978	1978	1.3351	0.0019	1.3338	0.0016	1977.82	0.59
UCIAMS#252869	MTV114B-1978	1978	1.3318	0.0023				
UCIAMS#251778	MTV001D-1979	1979	1.3157	0.0019	1.3155	0.0013	1979.07	0.16
UCIAMS#252870	MTV114B-1979	1979	1.3154	0.0018				
UCIAMS#241070	MTV001D-1980	1980	1.2943	0.0018	1.2947	0.0013	1979.83	0.56
UCIAMS#241074	MTV114B-1980	1980	1.2953	0.0020				
UCIAMS#252872	MTV114B-1982(1)	1982	1.2688	0.0018	1.2657	0.0029	1981.75	0.74
UCIAMS#252873	MTV114B-1982(2)	1982	1.2630	0.0017				
UCIAMS#252880	MTV114B-1988(1)	1988	1.1984	0.0019	1.1971	0.0012	1986.61	0.55
UCIAMS#255240	MTV114B-1988(2)	1988	1.1963	0.0016				
UCIAMS#252881	MTV114B-1989(1)	1989	1.1816	0.0017	1.1795	0.0020	1988.84	0.23
UCIAMS#252882	MTV114B-1989(2)	1989	1.1776	0.0017				

Table S3. Extended ^{14}C data for *Cedrela fissilis* and *Peltogyne paniculata* trees from Jamari, Brazil. All ^{14}C results are shown as Fraction modern carbon ($F^{14}C$) signatures. The individual statistical error bars of ±1σ were based on counting statistics, and propagated uncertainties due to normalization and processing blank. Results of 36 pairs/sets are also shown based on weighed mean $F^{14}C$ and standard error. Calibrated calendar years were derived using CALIBomb (refer to main text for more details).

^{14}C-AMS #	Sample ID	Calendar year (A.D.)	$F^{14}C$	±1σ	Weighed Mean $F^{14}C$ (‰)	Standard Error	Av. ^{14}C cal. year	Error cal. Year
UCIAMS#246828	JAC09C-1955	1955	0.9880	0.0018	0.9874	0.0011	1955.89	0.48
UCIAMS#271576	JAC21A-1955	1955	0.9870	0.0014				
UCIAMS#246829	JAC09C-1956(1)	1956	1.0025	0.0018				
UCIAMS#246830	JAC09C-1956(2)	1956	1.0038	0.0018	1.0015	0.0020	1956.32	0.28
UCIAMS#271577	JAC21A-1956	1956	0.9993	0.0015				
UCIAMS#241053	JAC09C-1957	1957	1.0272	0.0014				
UCIAMS#241045	JAR26C-1957	1957	1.0312	0.0014	1.0290	0.0018	1956.90	0.20
UCIAMS#271578	JAC21A-1957	1957	1.0284	0.0016				
UCIAMS#241054	JAC09C-1958	1958	1.0689	0.0014				
UCIAMS#241046	JAR26C-1958	1958	1.0605	0.0016	1.0661	0.0037	1957.79	0.30
UCIAMS#271579	JAC21A-1958	1958	1.0679	0.0016				
UCIAMS#246831	JAC09C-1959	1959	1.1331	0.0019	1.1298	0.0028	1958.70	0.13
UCIAMS#273208	JAC21A-1959	1959	1.1275	0.0016				
UCIAMS#246832	JAC09C-1960	1960	1.1877	0.0021	1.1858	0.0015	1959.85	0.35
UCIAMS#273209	JAC21A-1960	1960	1.1846	0.0017				
UCIAMS#246833	JAC09C-1961	1961	1.1896	0.0021	1.1887	0.0013	1959.94	0.30
UCIAMS#271582	JAC21A-1961	1961	1.1880	0.0017				
UCIAMS#241055	JAC09C-1962	1962	1.2068	0.0016				
UCIAMS#241047	JAR26C-1962	1962	1.1989	0.0017	1.2053	0.0046	1960.99	1.17
UCIAMS#271584	JAC21A-1962	1962	1.2101	0.0018				
UCIAMS#241056	JAC09C-1963	1963	1.2868	0.0017				
UCIAMS#256927	JAC09C-1963(1)	1963	1.2849	0.0017				
UCIAMS#241057	JAC09C-1963(2)	1963	1.2931	0.0017	1.2899	0.0084	1962.60	0.14
UCIAMS#241048	JAR26C-1963	1963	1.2802	0.0018				
UCIAMS#271585	JAC21A-1963	1963	1.3046	0.0018				
UCIAMS#263525	JAR26C-1964(1)	1964	1.5707	0.0021				
UCIAMS#273217	JAR26C-1964(2)	1964	1.5727	0.0021				
UCIAMS#271586	JAC21A-1964(1)	1964	1.5721	0.0020	1.5709	0.0015	1963.87	0.08
UCIAMS#273211	JAC21A-1964(2)	1964	1.5700	0.0020				
UCIAMS#273212	JAC21A-1964(3)	1964	1.5683	0.0023				
UCIAMS#273218	JAR26C-1965(1)	1965	1.6525	0.0021				
UCIAMS#263526	JAR26C-1965(2)	1965	1.6511	0.0023	1.6457	0.0080	1966.06	1.15
UCIAMS#263412	JAC21A-1965	1965	1.6353	0.0020				
UCIAMS#263528	JAR26C-1966	1966	1.6364	0.0021				
UCIAMS#263413	JAC21A-1966(1)	1966	1.6305	0.0022	1.6327	0.0027	1966.43	0.81
UCIAMS#273214	JAC21A-1966(2)	1966	1.6309	0.0021				
UCIAMS#263529	JAR26C-1967	1967	1.6061	0.0022				
UCIAMS#263415	JAC21A-1967(1)	1967	1.6084	0.0022	1.6094	0.0032	1967.34	0.41
UCIAMS#273215	JAC21A-1967(2)	1967	1.6136	0.0022				
UCIAMS#270415	JAR26C-1968	1968	1.5740	0.0021	1.5744	0.0015	1968.72	0.72
UCIAMS#263416	JAC21A-1968	1968	1.5748	0.0022				
UCIAMS#263531	JAR26C-1969	1969	1.5374	0.0019	1.5390	0.0018	1969.93	0.62
UCIAMS#263417	JAC21A-1969	1969	1.5410	0.0022				
UCIAMS#263532	JAR26C-1970	1970	1.5142	0.0019	1.5160	0.0019	1971.11	1.30
UCIAMS#263418	JAC21A-1970	1970	1.5181	0.0021				

Table S3. Continued.

¹⁴C-AMS #	Sample ID	Calendar year (A.D.)	F¹⁴C	±1σ	Weighed Mean F¹⁴C (‰)	Standard Error	Av. ¹⁴C cal. year	Error cal. Year
UCIAMS#241051	JAR26C-1971(1)	1971	1.5013	0.0020				
UCIAMS#263533	JAR26C-1971(2)	1971	1.5016	0.0019	1.5003	0.0017	1971.11	1.30
UCIAMS#270424	JAC21A-1971	1971	1.4977	0.0021				
UCIAMS#241052	JAR26C-1972(1)	1972	1.4824	0.0022				
UCIAMS#263534	JAR26C-1972(2)	1972	1.4829	0.0019	1.4843	0.0023	1972.43	0.27
UCIAMS#270425	JAC21A-1972	1972	1.4877	0.0021				
UCIAMS#270416	JAR26C-1973(1)	1973	1.4497	0.0020				
UCIAMS#273220	JAR26C-1973(2)	1973	1.4482	0.0019	1.4511	0.0035	1973.20	0.45
UCIAMS#263421	JAC21A-1973	1973	1.4563	0.0021				
UCIAMS#263536	JAR26C-1974	1974	1.4234	0.0021	1.4252	0.0019	1973.99	0.27
UCIAMS#263422	JAC21A-1974	1974	1.4271	0.0021				
UCIAMS#263537	JAR26C-1975	1975	1.3999	0.0021	1.4025	0.0026	1974.81	0.67
UCIAMS#263423	JAC21A-1975	1975	1.4050	0.0021				
UCIAMS#263538	JAR26C-1976	1976	1.3749	0.0020	1.3750	0.0014	1975.94	0.42
UCIAMS#263424	JAC21A-1976	1976	1.3751	0.0020				
UCIAMS#263539	JAR26C-1977	1977	1.3491	0.0019	1.3509	0.0019	1976.88	0.60
UCIAMS#263425	JAC21A-1977	1977	1.3530	0.0021				
UCIAMS#263540	JAR26C-1978	1978	1.3332	0.0019	1.3326	0.0014	1977.84	0.59
UCIAMS#263426	JAC21A-1978	1978	1.3318	0.0021				
UCIAMS#263541	JAR26C-1979	1979	1.3144	0.0019	1.3170	0.0025	1978.71	0.65
UCIAMS#263427	JAC21A-1979	1979	1.3194	0.0019				
UCIAMS#263542	JAR26C-1980	1980	1.2955	0.0019	1.2962	0.0014	1979.78	0.58
UCIAMS#263428	JAC21A-1980	1980	1.2969	0.0019				
UCIAMS#263543	JAR26C-1981	1981	1.2785	0.0019	1.2792	0.0014	1980.75	0.62
UCIAMS#263429	JAC21A-1981	1981	1.2800	0.0020				
UCIAMS#263545	JAR26C-1982	1982	1.2666	0.0020	1.2655	0.0014	1981.76	0.69
UCIAMS#263430	JAC21A-1982	1982	1.2646	0.0019				
UCIAMS#263546	JAR26C-1983	1983	1.2490	0.0018	1.2486	0.0014	1982.80	0.69
UCIAMS#263432	JAC21A-1983	1983	1.2481	0.0021				
UCIAMS#263547	JAR26C-1984	1984	1.2318	0.0019	1.2325	0.0013	1983.80	0.60
UCIAMS#263433	JAC21A-1984	1984	1.2331	0.0019				
UCIAMS#263548	JAR26C-1985	1985	1.2214	0.0017	1.2216	0.0012	1984.67	0.75
UCIAMS#263434	JAC21A-1985	1985	1.2217	0.0017				
UCIAMS#263549	JAR26C-1986	1986	1.2128	0.0018	1.2115	0.0014	1985.59	0.58
UCIAMS#263435	JAC21A-1986	1986	1.2101	0.0019				
UCIAMS#263550	JAR26C-1987	1987	1.1998	0.0018	1.1983	0.0016	1986.56	0.61
UCIAMS#263436	JAC21A-1987	1987	1.1966	0.0018				
UCIAMS#263551	JAR26C-1988	1988	1.1902	0.0018	1.1881	0.0022	1987.98	0.39
UCIAMS#263437	JAC21A-1988	1988	1.1858	0.0019				
UCIAMS#263552	JAR26C-1989	1989	1.1775	0.0017	1.1763	0.0014	1988.85	0.30
UCIAMS#263438	JAC21A-1989	1989	1.1747	0.0020				
UCIAMS#263553	JAR26C-1990	1990	1.1702	0.0017				
UCIAMS#263439	JAC21A-1990(1)	1990	1.1690	0.0019	1.1681	0.0023	1989.47	0.67
UCIAMS#271587	JAC21A-1990(2)	1990	1.1649	0.0019				