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Supplement of

Novel method for determining ^{234}U–^{238}U ages of Devils Hole 2 cave calcite (Nevada)

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Supplementary materials

Method

The regression analyses were conducted in OriginPro with "linear fit", "multiple linear regression (MLR)", and "polynomial fit" fitting methods (under the menu "Analysis" -> "Fitting") to establish the model for simple linear regression, MLR, and simple quadratic and cubic regression, respectively. For the multiple quadratic and cubic regression model, we first calculated the square and/or cubic values from the primitive ones, then set them as independent variables and used all the independent and dependent variables together as data input for the MLR method. For the data input, one can calculate the model with or without a weighting method considering the "y error", or the analytical uncertainty of the dependent variable. In the main text, all the models were calculated with no weighting method, mainly due to the obvious correlation between the independent and dependent variables. The results offer a collection of table and plots, among which the key ones include the coefficient of determination (COD) (i.e. R^2, reflecting the percentage of variability of the predictor explained by the model, see Table 3 in the main text), fit parameters (the regression coefficients and the corresponding "t-test" with null hypotheses and the alternative hypotheses; see Table 4 in the main text), and the analysis of variance (ANOVA) (assessing the F value for the F test), and residual analysis (histogram and normal percentile plots; see section 3.2 in the main text). The software is available from: https://www.origin.com/usa/en-us/store/download.

To test the robustness of the MLR models, we additionally built them using an instrumental weighting method with the weight = $1/\sigma^2$, where σ^2 represents the analytical uncertainty of $\delta^{234}U_i$. This was calculated using of 60 %, 74 % and 100 % of total data points, i.e. the three groups we split in the main text. Results show that the three models are closely consistent with each other (see Table S1), i.e. the derived regression model is not dependent on single values. Thus, it is reasonable to establish the model by using the dataset over the past 309 ka. The two residual sequences over the past 309 ka, generated with and without the weighting method, are highly correlated with each other r=0.97 (n=66) at the 95% confidence interval [0.92; 0.98], predominantly due to the smaller uncertainty of $\delta^{234}U_i$ over this period (the average analytical error is about 0.3 %, see Table 1 in the main text). For this study, we the model using MLR method without considering the small analytical uncertainty of $\delta^{234}U_i$ over the past 309 ka, in order to express the data in a simpler yet reliable fashion.

Further, we evaluated the robustness of our MLR model by using the program from Macias-Fauria et al (2012). The results are shown in the Supplementary Table 1 and 2. Tests of significance for various statistics typically used in paleoclimatic calibration–verification procedures were applied to overcome the influence of autocorrelation on the time series (see Table S2). According to these results, the MLR model over the past 309 ka (used in the main text) is confirmed to be robust.

Table S1: Fit parameters from the weighted regression methods (weight = $1/\sigma^2$) by considering different proportional data points and from no weight with the program provided by Macias-Fauria et al. (2012). Corresponding R^2 values are shown in the last column.

Time range	Intercept		Factor of $\delta^{18}O$		Factor of $\delta^{13}C$		Statistics
	Value	1σ error	Value	1σ error	Value	1σ error	R^2
Instrumental weighting with factor=$1/\sigma^2$ for $\delta^{234}U_i$ (using OriginPro)							
0-309	870	190	-61	10	57	17	0.65
0-362	890	170	-61	9.3	57	14	0.65
0-590	900	150	-60	8.0	58	12	0.65
No weighting (calculated with the method in Macias-Fauria et al. (2012))							
0-309	1223		-44		86		0.62
0-362	1414		-32		80		0.55
0-590	1654		-21		108		0.54

Table S2: Coefficient of Determination (R^2), Reduction of Error (RE), Coefficient of Efficiency (CE), and Coefficient of Correlation (r^2) with the 95% and 99% threshold values are shown (Macias-Fauria et al., 2012). All the REs and CEs for the calibration and verification period are positive and significant at 95% confidence level with one exception over the 4-309 ka period. The overall R^2 is significant ($p<0.001$).

	4-309 ka (R^2=0.62, $p<0.001$)		4-355 ka (R^2=0.55, $p<0.001$)		4-590 ka (R^2=0.54, $p<0.001$)	
	Normal (4-204 ka)	Cross Cal./Ver. (204-309 ka)	Normal (4-248 ka)	Cross Cal./Ver. (249-355 ka)	Normal (4-324 ka)	Cross Cal./Ver. (324-590 ka)
RE	0.45	0.50	0.15	0.35	0.35	0.56
RE_95	0.48	0.35	0.32	0.21	0.27	0.23
RE_99	0.62	0.52	0.47	0.37	0.40	0.33
CE	0.30	0.46	0.015	0.31	0.29	0.52
CE_95	0.26	0.12	0.20	0.083	0.21	0.17
CE_99	0.53	0.35	0.36	0.22	0.34	0.25
R^2	0.64	0.68	0.61	0.52	0.62	0.48
R^2_95	0.46	0.78	0.38	0.66	0.37	0.48
R^2_99	0.58	0.87	0.53	0.74	0.47	0.61
r^2	0.56	0.51	0.49	0.51	0.39	0.53
r^2_95	0.66	0.36	0.48	0.28	0.37	0.27
r^2_99	0.81	0.54	0.66	0.41	0.53	0.38

Effective degrees of freedom

The degree of freedom for a timeseries with autocorrelation can be approximately determined as following Panofsky and Brier (1958): DOF = $(N \times \Delta t)/(2T_e)$. T_e is the e-folding decay time of autocorrelation, i.e the persistence time, and Δt is the time interval between data. Using the program of Olgfsdottir and Mudelsee (2014) we obtained the persistent times for $\delta^{234}U_i$ and residual, which are 48 and 14 ka, respectively, using the measured ^{230}Th ages. For the unevenly spaced time series we took the average time interval of ~4.7 ka (N=66). Thus, the approximate effective DOFs of $\delta^{234}U_i$ and residual are 3.2 and 11, respectively. In this case, the adjusted R^2 is 0.89, and the corrected F value is 9.2 which is still higher than the critical value of the F-test, 3.98.

Table S3: U-series ages added to this publication for DH2 core D (+1.8 m r.m.w.t.). Uncertainties are 2σ. U decay constants: λ_{238} = 1.55125x10^{-10} (Jaffey et al., 1971) and λ_{234} = 2.82206x10^{-6} (Cheng et al., 2013). Th decay constant: λ_{230} = 9.1705x10^{-6} (Cheng et al., 2013). Dft* = distance from top. **δ^{234}U = ([^{234}U/^{238}U]$_{activity}$ – 1)x1000. *** $\delta^{234}U_{initial}$ was calculated based on ^{230}Th age (T), i.e., $\delta^{234}U_{initial}$ = $\delta^{234}U_{measured}$ x $e^{\lambda 234 x T}$. Corrected ^{230}Th ages assume the initial ^{230}Th/^{232}Th atomic ratio of 4.4 ±2.2 x10^{-6}. Those are the values for a material at secular equilibrium, with the bulk earth ^{232}Th/^{238}U value of 3.8. The errors are arbitrarily assumed to be 50%. ****BP stands for "Before Present" where the "Present" is defined as the year 1950 A.D.

mm dft*	^{238}U (ppb)	^{232}Th (ppt)	^{230}Th / ^{232}Th (atomic x10^{-6})	^{234}U** (measured)	^{230}Th / ^{238}U (activity)	^{230}Th Age (ka) (uncorrected)	^{230}Th Age (ka) (corrected)	d$^{234}U_{Initial}$*** (corrected)	^{230}Th Age (ka) (corrected BP****)
351.0	526.4 ±0.5	641 ± 13	24550 ±500	651.9 ±1.7	1.8140 ±0.0026	365.4 ±3.8	**365.4 ±3.8**	1828 ±20	**365.3 ±3.8**
426.0	651.0 ±0.7	889 ± 18	20290 ±410	516.6 ±1.6	1.6812 ±0.0026	436.3 ±7.4	**436.3 ±7.4**	1769 ±38	**436.2 ±7.4**
494.0	485.5 ±0.5	37.7 ± 2.5	342000 ±22000	448.9 ±1.7	1.6118 ±0.0021	503 ±12	**503 ±12**	1855 ±63	**503 ±12**
519.8	447.5 ±0.1	192.1 ± 0.1	61310 ±160	437.8 ±0.7	1.5965 ±0.0020	503.2 ±8.5	**503.2 ±8.5**	1811 ±43	**503.1 ±8.5**
534.8	531.7 ±0.1	199.4 ± 0.1	68370 ±150	402.8 ±0.4	1.5552 ±0.0015	536.5 ±8.6	**536.6 ±8.6**	1831 ±45	**536.5 ±8.6**
542.4	532.9 ±0.1	177.6 ± 0.1	76670 ±210	397.2 ±0.4	1.5496 ±0.0019	549 ±12	**549 ±12**	1869 ±63	**549 ±12**
562.0	389.6 ±0.4	31.8 ± 2.1	307000 ±20000	373.5 ±1.7	1.5191 ±0.0021	566 ±22	**566 ±22**	1840 ±110	**566 ±19**
569.4	320.0 ±0.3	53.2 ± 2.0	149900 ±5600	366.2 ±1.7	1.5102 ±0.0024	575 ±25	**575 ±25**	1860 ±130	**575 ±37**
583.4	542.6 ±0.6	35.4 ± 2.7	376000 ±29000	349.0 ±1.7	1.4877 ±0.0027	590 ±31	**590 ±31**	1840 ±160	**590 ±31**
608.20	76.7 ±0.1	19.4 ± 1.7	89700 ±8000	262.7 ±1.7	1.3780 ±0.0035	secular equilibrium (>600 ka)			
611.8	496.6 ±0.5	28.9 ± 2.2	390000 ±30000	262.1 ±1.9	1.3772 ±0.0022	secular equilibrium (>600 ka)			
618.2	306.2 ±0.5	98.8 ± 3.0	86400 ±2600	257.7 ±2.2	1.6921 ±0.0042	secular equilibrium (>600 ka)			
623.4	320.9 ±0.5	83.6 ± 2.6	86500 ±2700	247.6 ±1.6	1.3662 ±0.0031	secular equilibrium (>600 ka)			
625.6	335.7 ±0.5	110.6 ± 3.6	87000 ±2800	245.6 ±2.0	1.7299 ±0.0040	secular equilibrium (>600 ka)			
630.0	404.0 ±0.4	1021 ± 21	8750 ±180	241.0 ±1.5	1.3407 ±0.0021	secular equilibrium (>600 ka)			
634.0	366.2 ±0.5	109.9 ± 3.0	86200 ±2300	232.7 ±1.7	1.5685 ±0.0034	secular equilibrium (>600 ka)			
638.0	480.6 ±0.6	311.3 ± 6.4	33900 ±700	229.4 ±1.5	1.3301 ±0.0022	secular equilibrium (>600 ka)			
639.8	353.5 ±0.6	94.9 ± 3.7	87000 ±3400	228.9 ±1.9	1.4160 ±0.0034	secular equilibrium (>600 ka)			
652.0	353.4 ±0.5	110.3 ± 4.1	86900 ±3200	229.4 ±1.8	1.6443 ±0.0038	secular equilibrium (>600 ka)			

Table S4: Calculated ^{234}U ages using statistically derived (SD) $\delta^{234}U_i$. BP stands for Before Present where the "Present" is defined as the year 1950 A.D.

Depth (mm)	δ^{18}O (‰, VPDB)	δ^{13}C (‰, VPDB)	$\delta^{234}U_p$ (‰) (2σ)	^{230}Th-derived $\delta^{234}U_i$ (‰) (2σ)	SD $\delta^{234}U_i$ (‰) (2σ)	^{230}Th Age (ka BP) (2σ)	^{234}U Age (ka BP) (2σ)
0	-15.72	-2.19	1,716.9 ± 2.4	1741 ±2	1727 ±61	4.890 ±0.045	2 ±13
0.9	-16.06	-2.30	1,713.2 ± 2.4	1752 ±2	1732 ±61	7.940 ±0.075	4 ±13
2.3	-16.12	-2.36	1,707.5 ± 2.8	1747 ±3	1730 ±61	8.020 ±0.085	4 ±13
2.6	-16.13	-2.34	1,705.1 ± 2.3	1744 ±2	1732 ±61	8.01 ±0.10	5 ±13
3.2	-16.03	-2.25	1,706.3 ± 2.1	1750 ±2	1736 ±61	8.810 ±0.040	6 ±13
3.8	-16.50	-2.12	1,705.4 ± 2.5	1769 ±3	1768 ±61	12.920 ±0.095	13 ±13
4	-16.39	-2.02	1,675.7 ± 2.9	1808 ±3	1771 ±61	26.82 ±0.15	19 ±13
5.8	-16.62	-2.07	1,714.5 ± 2.4	1851 ±3	1777 ±61	27.04 ±0.14	12 ±13
7	-16.77	-1.95	1,667.6 ± 2.2	1813 ±2	1794 ±61	29.50 ±0.12	26 ±12
10.2	-16.62	-2.02	1,641.7 ± 2.5	1811 ±3	1781 ±61	34.71 ±0.15	29 ±13
14.8	-16.55	-1.79	1,612.1 ± 2.6	1822 ±3	1798 ±61	43.24 ±0.19	39 ±13
18.9	-16.46	-1.82	1,572.9 ± 2.2	1813 ±3	1792 ±61	50.26 ±0.13	46 ±13
22.4	-16.77	-1.89	1,540.8 ± 2.3	1799 ±3	1799 ±61	54.76 ±0.16	55 ±13
25.9	-16.82	-1.72	1,513.9 ± 2.4	1793 ±3	1815 ±61	59.84 ±0.17	64 ±12
29.9	-16.78	-1.56	1,502.8 ± 2.2	1796 ±3	1827 ±61	63.06 ±0.16	69 ±12
33.9	-16.64	-1.73	1,483.9 ± 2.3	1800 ±3	1807 ±61	68.40 ±0.18	70 ±12
37.2	-16.33	-1.82	1,454.0 ± 2.4	1788 ±3	1786 ±61	73.20 ±0.20	73 ±13
40.8	-16.29	-1.73	1,428.8 ± 2.3	1777 ±3	1791 ±61	77.18 ±0.20	80 ±13
44.6	-15.98	-1.82	1,395.5 ± 2.3	1765 ±3	1770 ±61	83.08 ±0.27	84 ±13
49.8	-16.49	-1.80	1,365.7 ± 2.7	1751 ±4	1794 ±61	88.07 ±0.34	96 ±13
53.9	-16.17	-1.82	1,321.1 ± 2.4	1725 ±4	1779 ±61	94.40 ±0.34	105 ±13
57.4	-16.12	-1.93	1,298.0 ± 2.1	1723 ±3	1767 ±61	100.23 ±0.38	109 ±13
59.9	-16.01	-1.97	1,292.7 ± 2.5	1718 ±4	1758 ±61	100.71 ±0.31	109 ±13
61.4	-15.86	-1.87	1,272.5 ± 1.9	1707 ±3	1760 ±61	104.09 ±0.31	115 ±13
65.4	-16.10	-1.96	1,257.9 ± 2.1	1703 ±3	1763 ±61	107.28 ±0.38	119 ±13
69.4	-16.13	-2.03	1,236.7 ± 2.0	1694 ±3	1759 ±61	111.48 ±0.36	125 ±13
77.7	-15.41	-2.20	1,204.8 ± 2.2	1672 ±4	1712 ±61	116.07 ±0.41	124 ±13
97.4	-14.68	-2.78	1,153.2 ± 2.3	1625 ±4	1630 ±61	121.39 ±0.41	122 ±14
99.4	-14.87	-3.01	1,163.2 ± 1.7	1646 ±3	1618 ±61	122.86 ±0.30	117 ±14
101.4	-15.36	-2.88	1,123.2 ± 2.1	1616 ±4	1651 ±61	128.75 ±0.42	136 ±14
102.9	-15.81	-2.44	1,163.1 ± 2.0	1666 ±3	1709 ±61	127.29 ±0.37	136 ±13
104.4	-16.23	-2.31	1,180.7 ± 2.2	1727 ±4	1739 ±61	134.75 ±0.42	137 ±13
105.9	-16.46	-2.40	1,170.6 ± 2.0	1731 ±4	1742 ±61	138.46 ±0.48	141 ±13
107.4	-16.58	-2.41	1,167.5 ± 2.1	1732 ±4	1746 ±61	139.73 ±0.44	142 ±13
108.9	-16.60	-2.47	1,161.6 ± 2.0	1739 ±4	1741 ±61	143.02 ±0.45	143 ±13
109.9	-16.59	-2.44	1,150.4 ± 2.0	1734 ±4	1744 ±61	145.41 ±0.55	147 ±13
114.4	-16.57	-2.19	1,130.4 ± 2.0	1739 ±4	1765 ±61	152.63 ±0.54	158 ±13
117.4	-16.71	-2.10	1,127.8 ± 2.0	1742 ±4	1779 ±61	154.06 ±0.52	161 ±13
117.4	-16.71	-2.10	1,141.0 ± 2.2	1755 ±4	1779 ±61	152.51 ±0.55	157 ±13
119.4	-16.78	-2.18	1,128.9 ± 2.1	1763 ±5	1774 ±61	157.81 ±0.68	160 ±13
124.4	-16.46	-2.20	1,115.4 ± 1.9	1765 ±4	1758 ±61	162.60 ±0.61	161 ±13
128.4	-16.79	-2.34	1,096.3 ± 1.9	1763 ±5	1761 ±61	168.31 ±0.70	168 ±13
132.4	-16.58	-2.11	1,078.6 ± 2.0	1757 ±5	1772 ±61	172.83 ±0.68	176 ±13
137.8	-16.52	-1.80	1,091.3 ± 1.9	1809 ±5	1795 ±61	178.94 ±0.68	176 ±13
141.8	-16.58	-1.90	1,084.0 ± 1.9	1828 ±5	1789 ±61	185.06 ±0.75	177 ±13
145.8	-16.48	-1.81	1,062.9 ± 2.0	1818 ±6	1793 ±61	190.18 ±0.85	185 ±13

150.4	-16.18	-1.80	1,050.4 ± 2.1	1816 ±6	1781 ±61	193.88 ±0.90	187 ±13
153	-16.06	-1.89	1,050.0 ± 2.0	1823 ±6	1768 ±61	195.36 ±0.83	184 ±13
153	-16.06	-1.89	1,045.9 ± 2.1	1825 ±6	1768 ±61	197.20 ±0.97	186 ±13
155.4	-16.19	-2.03	1,024.8 ± 2.2	1794 ±6	1761 ±61	198.43 ±0.94	192 ±13
158.4	-16.22	-1.96	1,012.1 ± 1.9	1802 ±6	1768 ±61	204.30 ±0.92	198 ±13
200.2	-15.91	-2.08	957.2 ±1.9	1770 ±7	1745 ±61	217.7 ±1.3	212 ±13
205.6	-16.56	-2.13	939.2 ±2.1	1748 ±9	1769 ±61	220.0 ±1.7	224 ±13
208.6	-16.72	-2.09	921.7 ±2.2	1745 ±9	1780 ±61	226.1 ±1.6	233 ±13
230	-15.69	-2.28	889.0 ±2.0	1742 ±9	1718 ±61	238.3 ±1.7	233 ±13
231.2	-15.74	-2.41	877.1 ± 1.9	1736 ±9	1709 ±61	241.9 ±1.7	236 ±13
231.6	-15.83	-2.39	878.3 ± 2.0	1725 ±8	1715 ±61	239.2 ±1.5	237 ±13
233.4	-16.37	-2.20	872.3 ± 2.1	1757 ±9	1755 ±61	248.2 ±1.5	247 ±13
233.4	-16.37	-2.20	873.2 ± 2.0	1764 ±10	1755 ±61	249.2 ±1.8	247 ±13
237	-16.62	-2.01	863.9 ± 2.0	1773 ±11	1782 ±61	254.7 ±2.0	256 ±13
239.6	-16.79	-2.02	842.4 ± 1.9	1805 ±12	1788 ±61	269.9 ±2.1	267 ±13
246.2	-16.91	-1.73	837.6 ± 2.1	1835 ±13	1819 ±61	277.9 ±2.4	275 ±13
248.4	-16.50	-1.83	826.7 ± 2.1	1801 ±14	1792 ±61	275.8 ±2.6	274 ±13
254.2	-16.11	-2.01	800.9 ± 1.9	1810 ±13	1759 ±61	288.9 ±2.5	279 ±13
263.8	-16.62	-1.66	768.7 ± 2.0	1792 ±14	1812 ±61	299.9 ±2.6	304 ±13
271.8	-16.11	-1.90	742.5 ± 1.8	1776 ±14	1768 ±61	309.0 ±2.7	307 ±13
281.8	-16.11	-1.97	717.2 ± 1.8	1768 ±16	1763 ±61	319.6 ±3.0	318 ±13
287.4	-16.09	-1.91	707.7 ± 2.9	1752 ±27	1768 ±61	321.2 ±5.3	324 ±14
291.8	-15.99	-2.03	695.3 ± 1.8	1734 ±16	1752 ±61	323.8 ±3.2	327 ±13
300	-15.51	-2.03	692.4 ± 1.8	1746 ±19	1731 ±61	327.7 ±3.8	325 ±13
325	-15.17	-2.25	668.7 ± 1.9	1745 ±23	1697 ±61	339.8 ±4.5	330 ±14
328.4	-15.11	-2.28	666.1 ±1.7	1678 ±13	1692 ±61	327.3 ±2.6	330 ±14
329.4	-15.26	-2.51	660.0 ±2.0	1705 ±18	1679 ±61	336.3 ±3.6	331 ±14
330.6	-15.43	-2.49	659.3 ±2.0	1731 ±22	1688 ±61	341.9 ±4.3	333 ±14
331.6	-15.42	-2.41	671.1 ±1.9	1790 ±28	1694 ±61	347.7 ±5.5	328 ±14
333	-16.21	-2.25	659.8 ±1.8	1796 ±18	1743 ±61	354.7 ±3.4	344 ±13
333.6	-16.49	-2.01	677.2 ±1.8	1780 ±25	1776 ±61	342.3 ±4.9	341 ±13
335.4	-16.73	-1.82	672.3 ±2.2	1768 ±33	1803 ±61	342.6 ±6.5	349 ±13
337.2	-16.88	-1.73	675.5 ±1.9	1793 ±28	1818 ±61	345.8 ±5.4	351 ±13
344	-17.37	-1.70	663.6 ±1.9	1789 ±25	1842 ±61	351.4 ±4.8	362 ±13
347.2	-17.26	-1.69	659.8 ±1.8	1796 ±18	1837 ±61	354.7 ±3.4	363 ±13
351	-17.05	-1.67	651.9 ±1.7	1828 ±20	1830 ±61	365.3 ±3.8	367 ±13
354	-16.92	-1.67	648.8 ±2.2	1845 ±35	1825 ±61	370.3 ±6.6	366 ±13
355	-16.72	-1.70	644.7 ±1.7	1851 ±32	1813 ±61	373.7 ±6.0	366 ±13
356.8	-16.60	-1.69	638.3 ±1.9	1809 ±33	1809 ±61	369.1 ±6.3	369 ±13
365.8	-16.78	-1.64	620.2 ±1.9	1819 ±31	1821 ±61	381.2 ±5.9	381 ±13
374.8	-16.36	-1.79	604.2 ±1.8	1824 ±35	1789 ±61	391.4 ±6.8	384 ±13
377.2	-16.49	-1.89	600.8 ±1.3	1746 ±19	1786 ±61	377.9 ±3.8	386 ±13
381	-16.31	-1.92	589.6 ±2.4	1794 ±30	1777 ±61	394.3 ±5.8	391 ±14
390.4	-15.84	-1.84	578.7 ±1.8	1728 ±31	1762 ±61	387.5 ±6.3	394 ±14
400.8	-16.24	-1.98	552.3 ±1.8	1716 ±33	1767 ±61	401.6 ±6.8	412 ±13
405.4	-15.37	-2.07	554.3 ±0.8	1749 ±15	1722 ±61	407.1 ±3.1	401 ±13
408.4	-15.36	-2.11	551.0 ±1.7	1702 ±34	1718 ±61	399.7 ±6.9	403 ±14
417	-15.67	-2.31	531.5 ±1.7	1746 ±39	1714 ±61	421.4 ±7.9	415 ±14
420.8	-15.90	-2.49	519.9 ±1.6	1743 ±43	1709 ±61	428.6 ±8.7	422 ±14
422.4	-16.03	-2.51	514.1 ±1.9	1733 ±46	1714 ±61	430.6 ±9.2	426 ±14
423.6	-16.36	-2.38	511.4 ±1.7	1683 ±41	1739 ±61	422.1 ±8.5	433 ±14
424.6	-16.57	-2.40	515.0 ± 1.9	1640 ±30	1746 ±61	410.3 ±6.3	432 ±14
426	-16.59	-2.41	516.6 ±1.6	1769 ±37	1746 ±61	436.1 ±7.4	431 ±13
439.9	-16.84	-2.04	506.8 ±1.8	1801 ±59	1789 ±61	449 ±12	447 ±13
465.2	-16.14	-1.68	487.8 ±1.0	1806 ±49	1789 ±61	475.5 ±6.9	460 ±13
475	-15.95	-1.85	471.7 ±1.9	1808 ±58	1767 ±61	476 ±11	468 ±14
494	-15.62	-2.10	485.5 ±0.5	1855 ±63	1730 ±61	503 ±12	478 ±14
519.8	-15.89	-1.81	437.8 ±0.7	1811 ±43	1767 ±61	503.1 ±8.5	494 ±13
534.8	-16.54	-1.81	402.8 ±0.4	1831 ±45	1796 ±61	536.4 ±8.6	529 ±12
542.4	-16.53	-1.66	397.2 ±0.4	1869 ±63	1808 ±61	549 ±12	537 ±12
562	-16.61	-1.65	373.5 ± 1.7	1840 ±120	1812 ±61	566 ±22	559 ±13
569.4	-16.13	-1.72	366.2 ±1.7	1860 ±130	1785 ±61	575 ±25	561 ±14
577.8	-15.98	-2.11	360.4 ±0.6	1748 ±56	1745 ±61	559 ±11	559 ±13
583.4	-15.96	-1.77	349.0 ±1.7	1850 ±160	1774 ±61	590 ±31	576 ±14

Figure S1: DH2 $\delta^{234}U_i$ (n = 97) versus the reciprocal U concentration. Figure modified from Wendt et al. (2020). Note absence of a significant linear relationship between U content and DH2 $\delta^{234}U_i$.

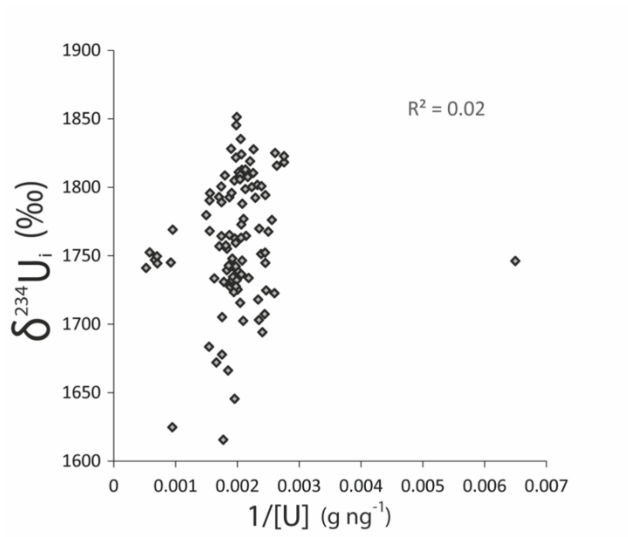


Figure S2: Polished core slab (growth direction from right to left) showing the hiatus identified at 587.4 mm from the top of core. According to the ^{234}U-derived age model presented in this paper, the growth hiatus spans 67 ka BP between 578 and 645 ± 22 ka BP.

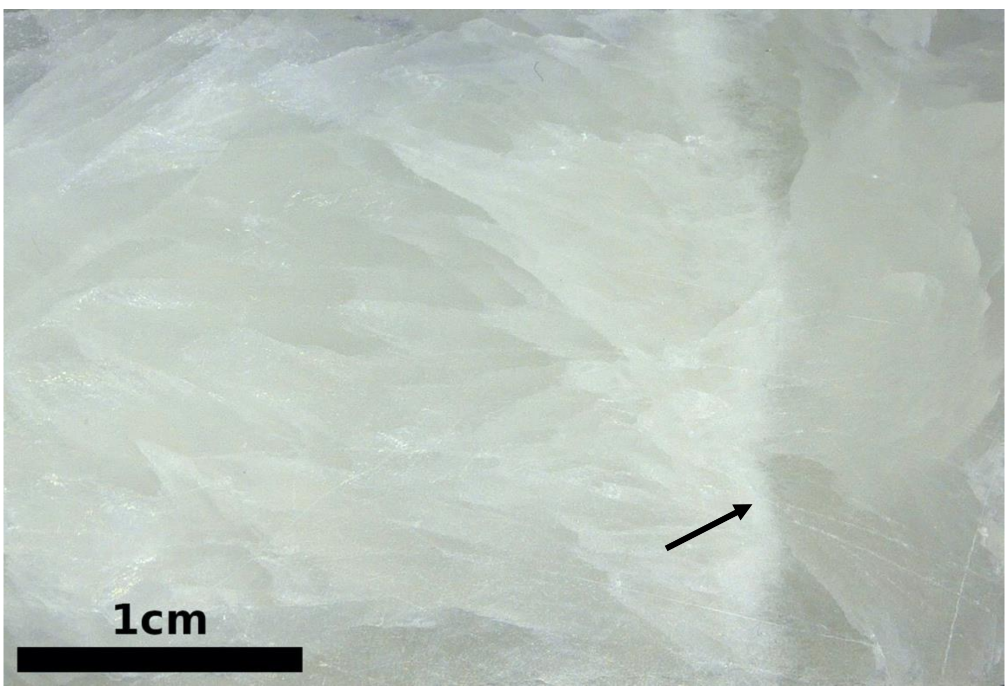
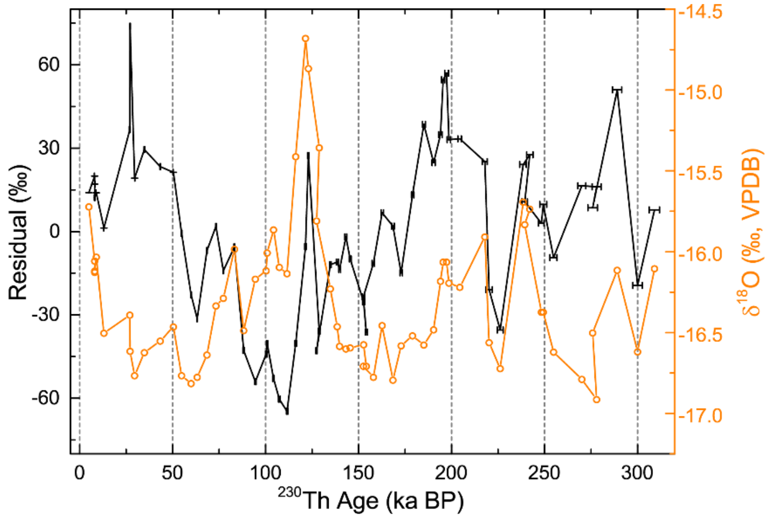


Figure S3: Variability of the residuals and δ18O versus 230Th age between 4 and 309 ka BP. The 2σ error bars for 230Th ages are shown on each point of the residuals. The residuals seemingly exhibit multi-millennial to orbital scale variability, but different from that of δ18O record.



Supplementary materials references

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