

SUPPLEMENTARY MATERIALS

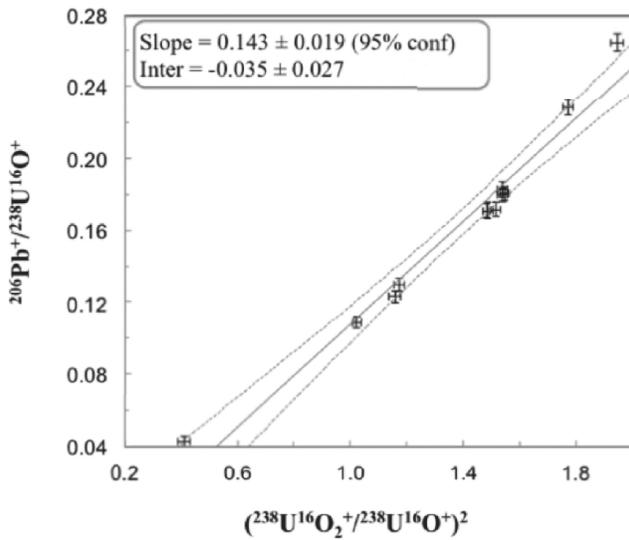
Supplementary Table S1. Chemical compositions of minerals in ALH 84001

	Grain#1			Grain#2			Grain#3	
	(a) Merrillite (%)	(b) Plagioclase glass (%)	(c) Orthopyroxene (%)	(a) Merrillite (%)	(b) Plagioclase glass (%)	(c) Orthopyroxene (%)	(a) Merrillite (%)	(b) Orthopyroxene (%)
	Na ₂ O	2.68	5.21	0.91	3.13	5.61	1.09	2.80
MgO	3.61	0.23	23.82	3.88	0.29	25.77	4.11	25.08
Al ₂ O ₃	—	25.52	0.85	—	25.70	0.93	—	0.79
SiO ₂	—	60.57	53.57	—	59.95	53.46	—	54.90
P ₂ O ₅	42.25	—	—	44.52	—	—	44.10	—
K ₂ O	—	0.62	—	—	0.69	—	—	—
CaO	50.07	7.47	1.80	47.59	7.19	1.99	48.08	2.13
TiO ₂	—	—	0.02	—	—	0.26	—	0.06
MnO	0.12	—	0.69	—	—	0.46	0.04	0.48
FeO	1.27	0.38	18.34	0.90	0.58	16.03	0.87	15.53

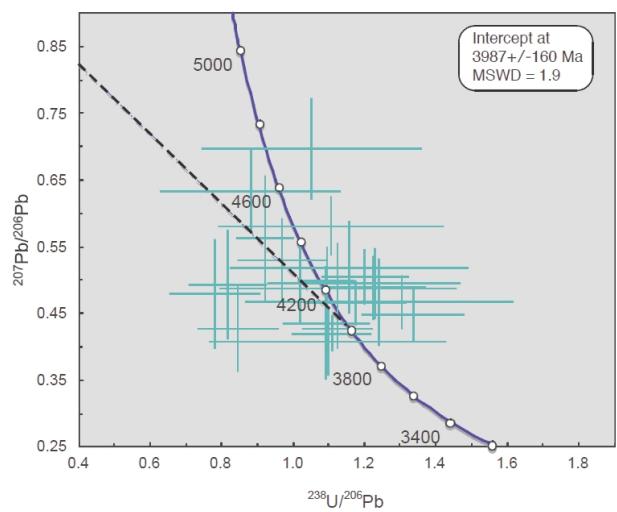
Supplementary Table S2. U concentrations and $^{204}\text{Pb}/^{206}\text{Pb}$, $^{238}\text{U}/^{206}\text{Pb}$, and $^{207}\text{Pb}/^{206}\text{Pb}$ ratios in 3 phosphate grains in ALH 84001

Spot No.	U (ppm)	$^{238}\text{U}/^{206}\text{Pb}$		$^{207}\text{Pb}/^{206}\text{Pb}$		$^{204}\text{Pb}/^{206}\text{Pb}$ ($^{238}\text{U}-^{206}\text{Pb}$)		$^{204}\text{Pb}/^{206}\text{Pb}$ ($^{207}\text{Pb}-^{206}\text{Pb}$)					
Grain #1													
1-2	2.1	1.09	±	0.08	0.50	±	0.05	0.0030	±	0.0005	0.0026	±	0.0018
1-3	1.2	1.12	±	0.10	0.43	±	0.03	0.0042	±	0.0008	0.0022	±	0.0011
1-4	1.5	1.31	±	0.10	0.47	±	0.04	0.0059	±	0.0011	0.0025	±	0.0015
1-5	1.5	1.22	±	0.15	0.49	±	0.05	0.0049	±	0.0010	0.0035	±	0.0020
1-6	1.3	1.17	±	0.14	0.47	±	0.03	0.0043	±	0.0009	0.0037	±	0.0015
1-7	1.6	1.20	±	0.12	0.50	±	0.04	0.0026	±	0.0007	0.0033	±	0.0017
1-8	1.5	1.11	±	0.11	0.42	±	0.03	0.0022	±	0.0014	0.0009	±	0.0006
1-9	2.3	1.23	±	0.24	0.49	±	0.05	0.0105	±	0.0025	0.0049	±	0.0049
1-10	2.7	1.02	±	0.09	0.50	±	0.06	0.0077	±	0.0013	0.0122	±	0.0041
1-11	2.0	1.34	±	0.14	0.45	±	0.04	0.0037	±	0.0008	0.0062	±	0.0022
Grain #2													
2-1	2.0	0.85	±	0.11	0.43	±	0.07	0.0305	±	0.0146	0.0053	±	0.0053
2-2	1.6	0.97	±	0.12	0.53	±	0.06	0.0261	±	0.0141	0.0121	±	0.0066
2-4	2.8	0.82	±	0.11	0.49	±	0.08	0.0306	±	0.0124	0.0084	±	0.0076
2-5	2.4	0.78	±	0.13	0.48	±	0.08	0.0252	±	0.0148	0.0143	±	0.0102
2-6	2.8	1.09	±	0.12	0.44	±	0.09	0.0145	±	0.0097	0.0088	±	0.0089
2-7	3.6	0.92	±	0.08	0.56	±	0.09	0.0182	±	0.0065	0.0200	±	0.0123
Grain #3													
3-1	2.4	0.88	±	0.25	0.63	±	0.06	0.0391	±	0.0101	0.0269	±	0.0087
3-2	1.6	1.16	±	0.33	0.52	±	0.07	0.0189	±	0.0085	0.0083	±	0.0056
3-3	1.5	1.24	±	0.37	0.47	±	0.07	0.0244	±	0.0101	0.0116	±	0.0063
3-4	1.5	1.13	±	0.33	0.49	±	0.07	0.0299	±	0.0115	0.0045	±	0.0041
3-5	1.7	1.11	±	0.31	0.58	±	0.04	0.0201	±	0.0088	0.0205	±	0.0043
3-6	1.7	1.05	±	0.31	0.70	±	0.08	0.0179	±	0.0085	0.0253	±	0.0093
3-7	1.6	1.10	±	0.33	0.41	±	0.05	0.0282	±	0.0108	0.0013	±	0.0016

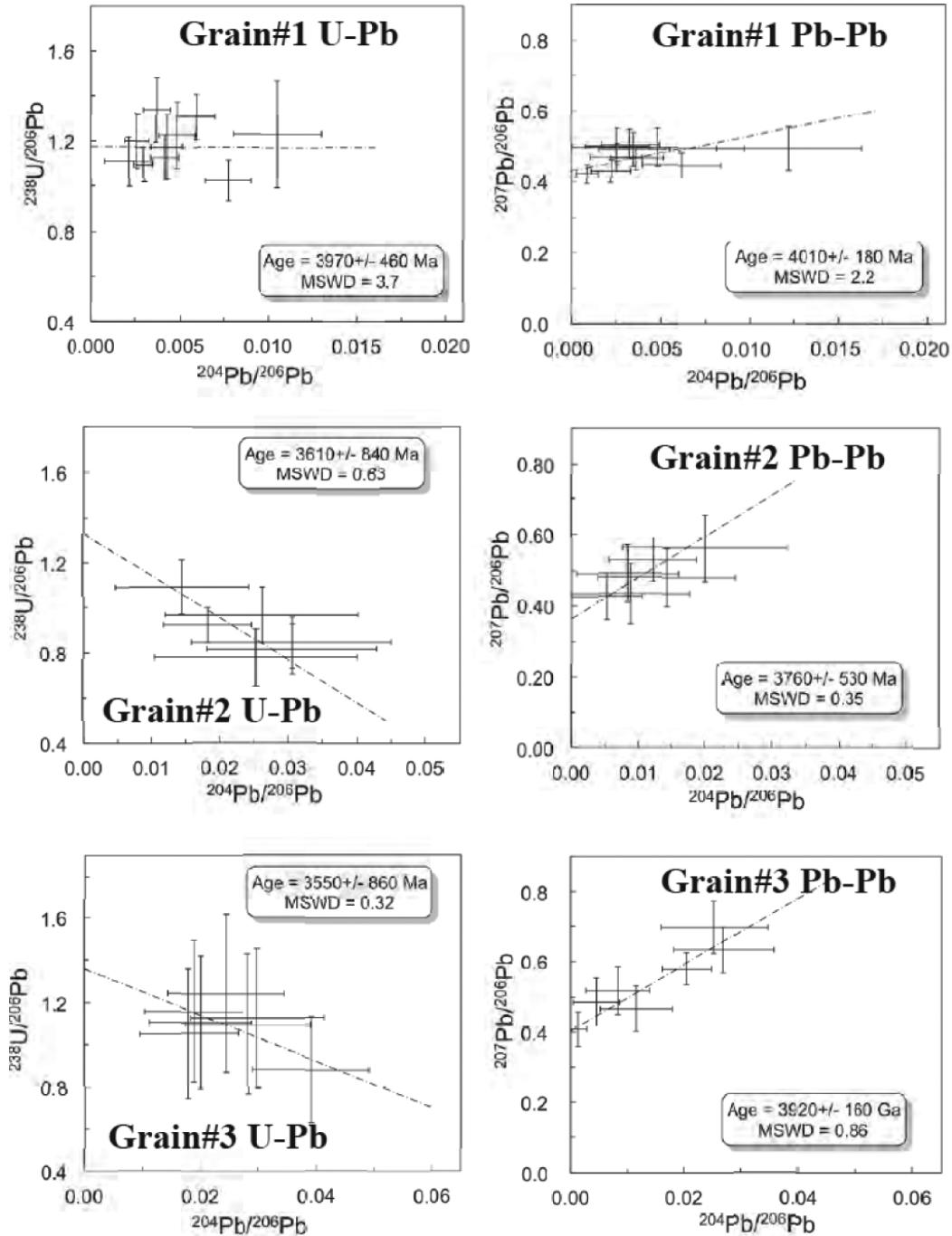
Error assinged to the ratio is 2 sigma.



Supplementary Fig. S1. Correlation diagram between $(^{238}\text{U}^{16}\text{O}_2^+/^{238}\text{U}^{16}\text{O}^+)^2$ and $^{206}\text{Pb}^+/\text{U}^{16}\text{O}^+$ ratios for standard PRAP. A regression line with the slope of 0.143 ± 0.019 and the intercept of -0.035 ± 0.027 was inferred using isoplot3 (Ludwig, 2003).



Supplementary Fig. S2. Results of 3D linear regressions of ALH 84001 merrillites. Data are projected onto the $^{238}\text{U}/^{206}\text{Pb}$ – $^{207}\text{Pb}/^{206}\text{Pb}$ (X–Y) plane. Uncertainties are portrayed at the 2σ level. The solid curve is an evolution of U–Pb systematics (Concordia line). The dashed line is the regression line projected onto the X–Y plane.



Supplementary Fig. S3. Correlation diagrams between $^{204}\text{Pb}/^{206}\text{Pb}$ and $^{238}\text{U}/^{206}\text{Pb}$ ratios, and $^{204}\text{Pb}/^{206}\text{Pb}$ and $^{207}\text{Pb}/^{206}\text{Pb}$ ratios for three merrillite grains of ALH 84001. A regression line and the age with MSWD are calculated for each grain using isoplot3 (Ludwig, 2003). The obtained ages are mutually in agreement, as reported also from a previous study (Terada et al., 2003).