Supporting information

Content

1. Petrography and mineral chemistry of CE5 basalts

Petrography. Approximately 40% of the lithic clasts on a total of 13 sample mounts used in this study are basalt clasts, consisting mainly of pyroxene, plagioclase, olivine, and ilmenite, with minor silica, troilite, Si-K-rich mesostasis, apatite, and trace merrillite (Figs. S1 and S2). The basalt clasts display subophitic, poikilitic, porphyritic, and equigranular textures (Fig. S1 and S2), similar to those reported by ref. [1]. Most pyroxene gains are compositionally zoned with dark and low FeO cores and bright and high FeO rims in BSE images (Fig. S1) and EDS. Ilmenite occurs as laths partially enclosed by pyroxene, suggestive of early crystallization (Fig. S1). Eight melt inclusions in ilmenite were identified with a diameter of ~4 to ~50 μm and round shapes (Fig. S1 and Extended Data Table 1). Some of the melt inclusions experienced partial crystallization (~0-40%) with pyroxene and merrillite embedded in glassy matrix (Fig. S1). Most grains of apatite occur in the fine-grained interstitial materials, coexisting with fayalite and K-Si-rich mesostasis (Fig. S2). A few euhedral grains of apatite are enclosed in the margins pyroxene and FeO-rich olivine (Fig. S2). Most grains of apatite are smaller than 10 μm, and the detailed information is summarized in Extended Data Table 1.

Mineral Chemistry. Both pyroxene and olivine from various CE5 basalt clasts are chemically zoned, with higher FeO-contents at the rims (Fs~85.9 mol% and Fa~98.6 mol%) than in the cores (En~39.6 mol% and Fa~43.0 mol%) (Figs. S3 and S4 and Table S1). Plagioclase is relatively homogeneous with a composition of $An_{74.8\text{-}92.3}Ab_{7.4\text{-}21.6}Or_{0.3\text{-}4.7}$ (Fig. S4 and Table S1). Ilmenite displays a homogeneous composition of ~52.9 wt% TiO_2 and 44.9 wt% FeO, with minor SiO_2 (<0.45 wt%), Cr_2O_3 (<0.32 wt%), MnO (0.34-0.47 wt%) and MgO (<1.47 wt%) (Table S2). Most of the melt inclusions in ilmenite are SiO_2-rich (61.2-77.1 wt%), and have wide ranges of Al_2O_3 (5.59-16.2 wt%), FeO (2.79-24.4 wt%) and CaO (0.72-15.6 wt%) (Table S2). In the diagram of MgO vs. SiO_2, Al_2O_3, FeO, CaO, and Na_2O (Fig. S5), the melt inclusions plot close to the low-MgO endmember, consistent with the data sets of melt inclusions in olivine and pyroxene from Apollo basalts reported by Ref. [2]. The apatite grains contain 2.35 to 3.28 wt% F and 0.11 to 0.87 wt% Cl (Table S2), plotting close to the fluorapatite in the F-Cl-OH ternary diagram (Fig. S6). The OH contents of the apatite grains are calculated ranging from ~0 to 0.24 wt% based on stoichiometry.

2. Estimation of water content in the mantle source of the CE5 basalts

5.1. The melt inclusions in ilmenite

The melt inclusions analyzed in this work display two distinct populations in the water abundance and δD values (Fig. 2). Eight analyses on five individual basalt clasts define a negative correlation (main trend) between the water abundances (13 ± 4 $\mu g.g^{-1}$ to 367 ± 29 $\mu g.g^{-1}$) and δD values (-332 ± 182‰ to 202 ± 390‰) (Extended Data Table 3), obviously distinct from the analyses of the apatite grains in CE5 basalts (Fig. 2) and Apollo mare basalts[3-8]. The other three analyses of the ilmenite-hosted melt inclusions located in other three

basalt clasts are more D-enriched (271 ± 113‰ to 869 ± 224‰) and contain 93 ± 15 μg.g^{-1} to 661 ± 37 μg.g^{-1} water, plotting in the region between the analyses of apatite and the negative trend of the melt inclusions (Fig. 2). Three analyses of apatite plot overlapping with the D-enriched melt inclusions. The negative correlation of the melt inclusions supply with convincing evidence for degassing of H_2 in the basaltic magma and D-enrichment during this process[2, 7]. The water-richest melt inclusions have δD values of ~-300 ‰, within the range of the hydrogen isotopic compositions of the lunar mantle (~0 ± 300 ‰) constrained by numerous measurements of Apollo melt inclusions[2], anorthosite[9], and apatite from KREEP basalts[10, 11], high-Al basalts[6, 12], and highlands samples[13-15]. The most D-depleted melt inclusions likely captured the primordial magma of CE5 basalts before significant degassing of H_2, and its water abundance of 367 μg.g^{-1} can be referred to as the maximum water-content of the parent magma, because a part of pyroxene and olivine could have deposited from the magma before capturing of the melt inclusions by ilmenite. According to the petrogenesis of CE5 basalts, the parent magma was derived from the depleted mantle source by low-degrees of partial melting (~2-3%) followed by a moderate to high degree of fractional crystallization (43-78%)[1], the maximum water abundance of the mantle source of the CE5 basalts can be estimated ~2-6 μg.g^{-1}.

5.2. Apatite

Apatite is the major OH-, F-, and Cl-bearing phase in lunar and other extraterrestrial samples. It was once widely used to estimate water-contents of the mantle reservoirs of Mars[16] and the Moon[17, 18]. Recent numerical models revealed that it is possible to crystallize water-rich apatite from an highly water-depleted magma, because of the fractional crystallisation and exchange behavior of H, F, and Cl in apatite[19]. Based on the afterwards synthetic experiments, regardless large variation in the partition coefficients (D) between apatite and the coexisting melts, the exchange coefficients for volatile pairs, OH-F, Cl-F, and OH-Cl, display much less variability[20]. In order to calculate the water content of a silicate melt using the composition of coexisting apatite, many parameters are required, including the apatite-based melt hygrometry, the water content of the apatite, the apatite-melt exchange coefficient, the abundance of F or Cl in the apatite, and that of F or Cl in the melt[20]. However, it is difficult to determine all of these parameters precisely in the case of CE5 apatite. Instead, we estimated the water abundance of the bulk CE5 basalts from the modal abundance of apatite and its average water content, because apatite is the dominant water-bearing phase in mare basalts. The modal abundance of apatite in CE5 basalts is determined to be ~0.4 vol%, using the surface areas of apatite in all basaltic clasts analyzed (Table S1). The average water content and δD value of the CE5 apatite measured by NanoSIMS 50L are 1921 ± 910 μg.g^{-1} and 578 ± 208‰ (N=40) respectively, except for the three low water abundance analyses (Extended Data Table 2). Hence, the water abundance of the bulk CE5 basalt is ~8 μg.g^{-1}. As discussed above, the parent magma of CE5 basalts has the original δD value of ~-300 ‰ indicated by the water-richest melt inclusions, and the D-enrichment of apatite was attributed to degassing of water in the form of H_2, the water

abundance of the parent magma was calibrated to be ~370-760 μg.g^{-1}, with 98-99% water degassing loss required to enhance the δD value from ~-300 ‰ to ~600 ‰ based on the H_2 degassing modeling[21]. This estimate is consistent with the water abundance of the most D-depleted melt inclusions in ilmenite (Extended Data Table 3).

5.3. Clinopyroxene

Eighteen analyses on clinopyroxene from 13 individual CE5 basalt clasts have an average $^{1}H/^{16}O$ value of 8.85×10^{-7}, ~2.6 times lower than that of San Carlos olivine (2.30×10^{-6}) (Extended Data Table 4). The water content calibration slope of clinopyroxene has been investigated to be ~2 times higher than that of olivine by SIMS[22], indicating that the true value of water content in the CE5 clinopyroxene could be ~1/5 of San Carlos olivine[23]. Therefore, it is reliable to conclude that the CE5 clinopyroxene has a water abundance lower than that on San Carlos olivine, which was referred to determine the instrument background of H (5 ± 2 μg.g^{-1}). The water abundance of the parent magma equilibrated with the CE5 clinopyroxene could be less than ~170 μg.g^{-1} using the water partition coefficient of 0.03[24].

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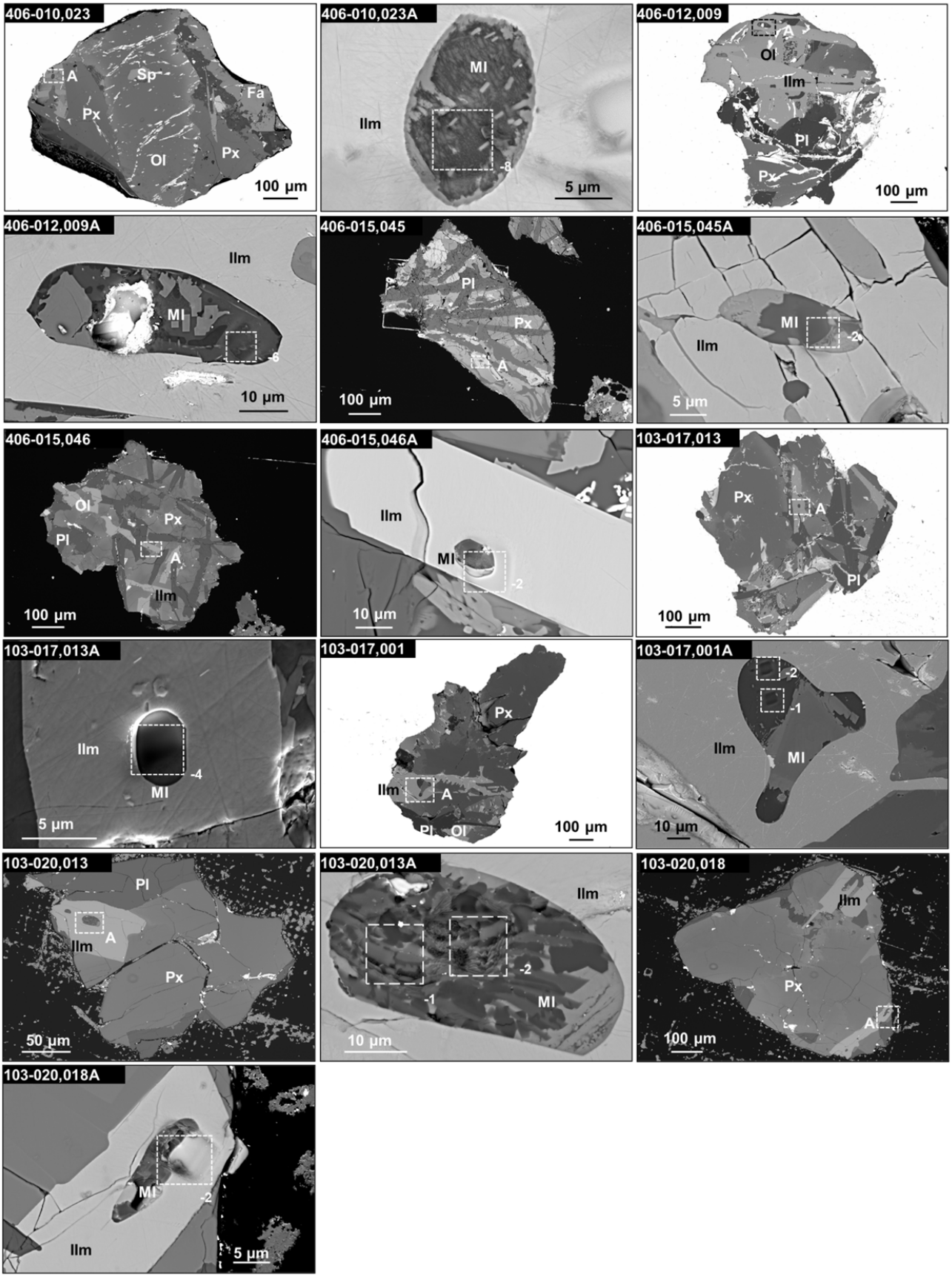


Fig. S1 | Occurrences of the ilmenite-hosted melt inclusions from CE5 basalt clasts.

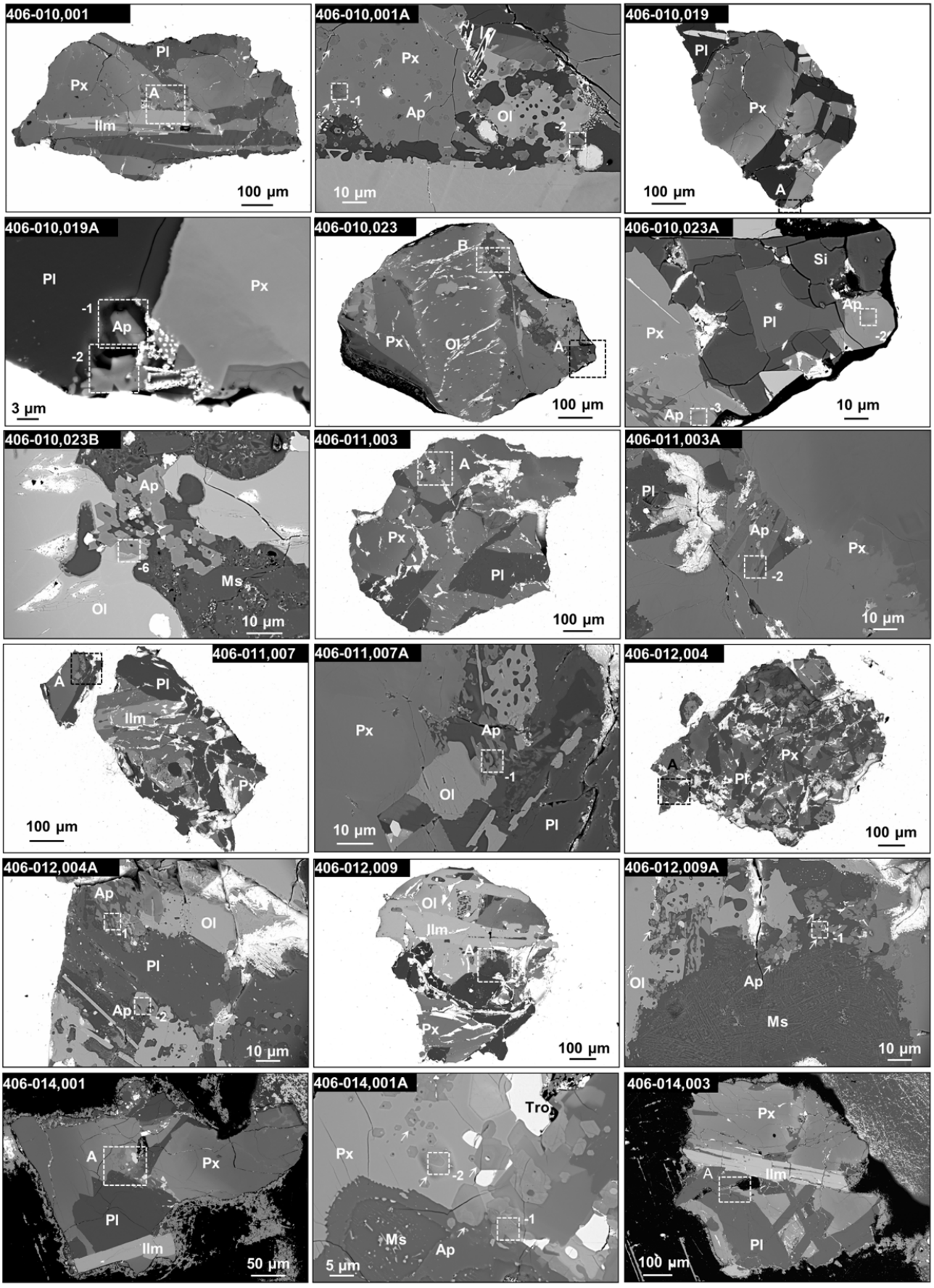
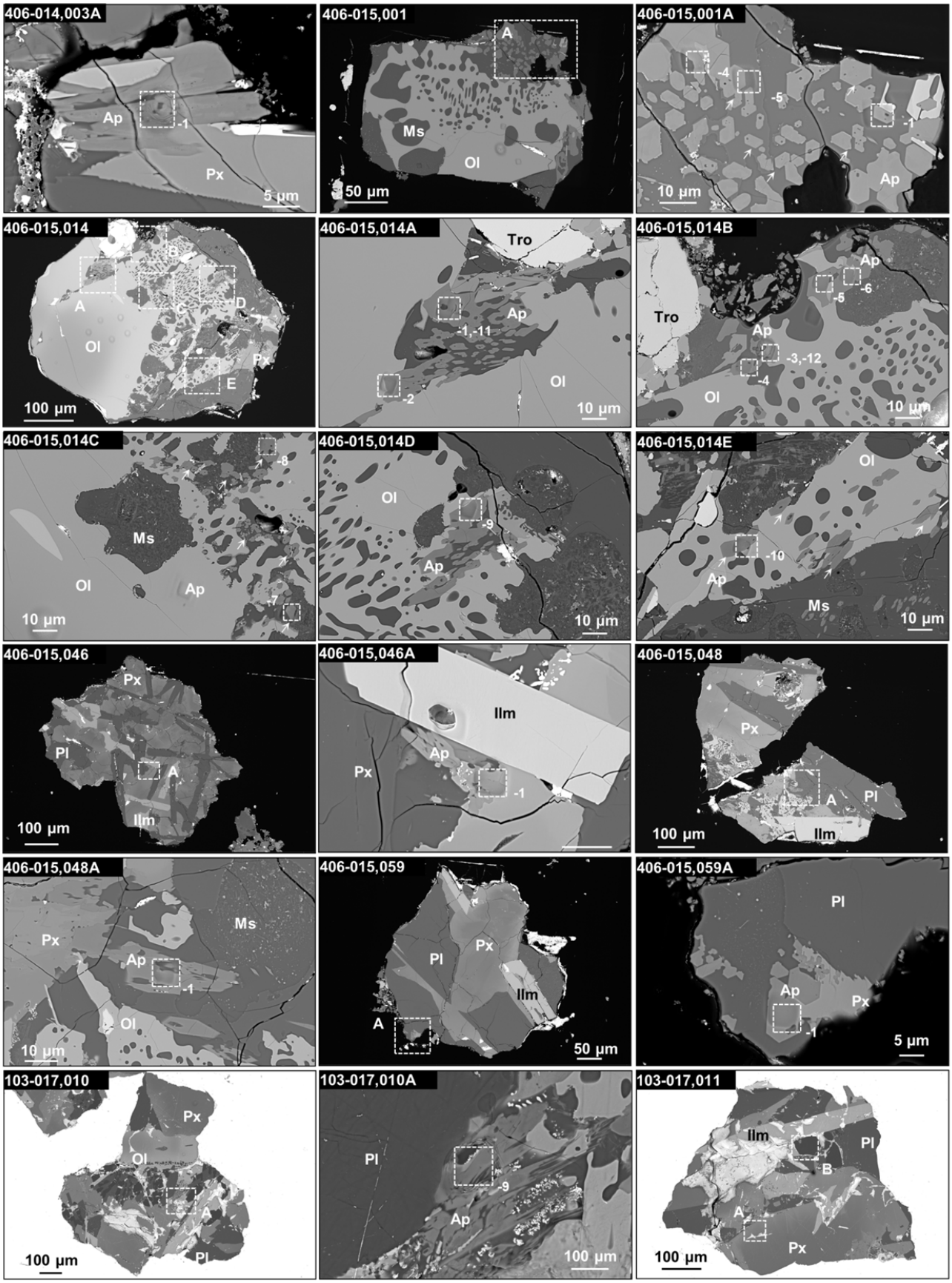


Fig. S2 | Occurrences of apatite from CE5 basalt clasts.



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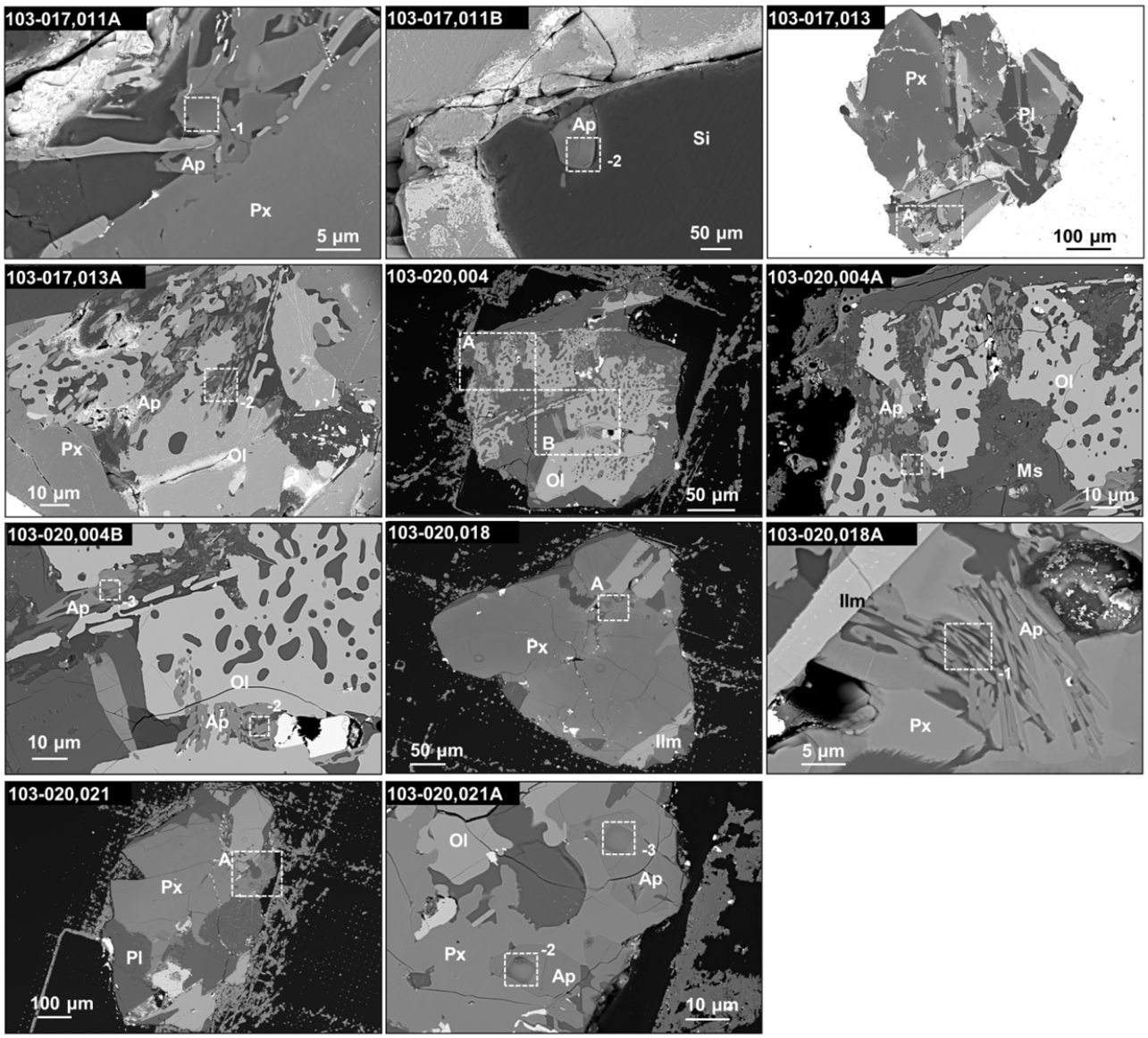

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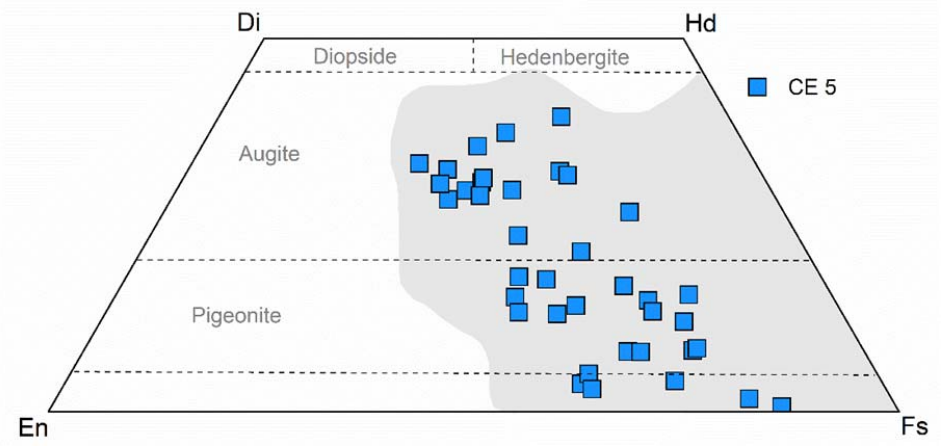

Fig. S3 | Pyroxene quadrilateral diagram of the CE5 basalt clasts compared with those of other ones reported by ref. [1] (grey hatched region).

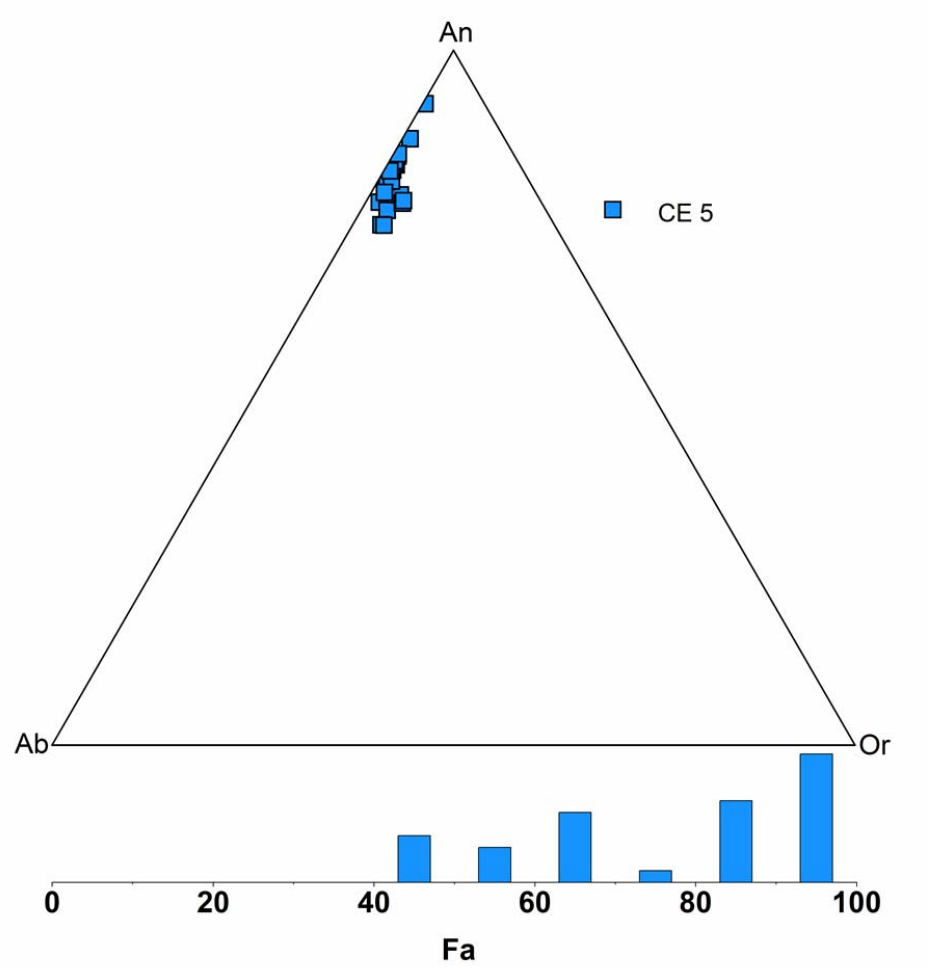

Fig. S4 | Ternary diagram of plagioclase and the variation of the Fa-contents of olivine from CE5 basalt clasts.

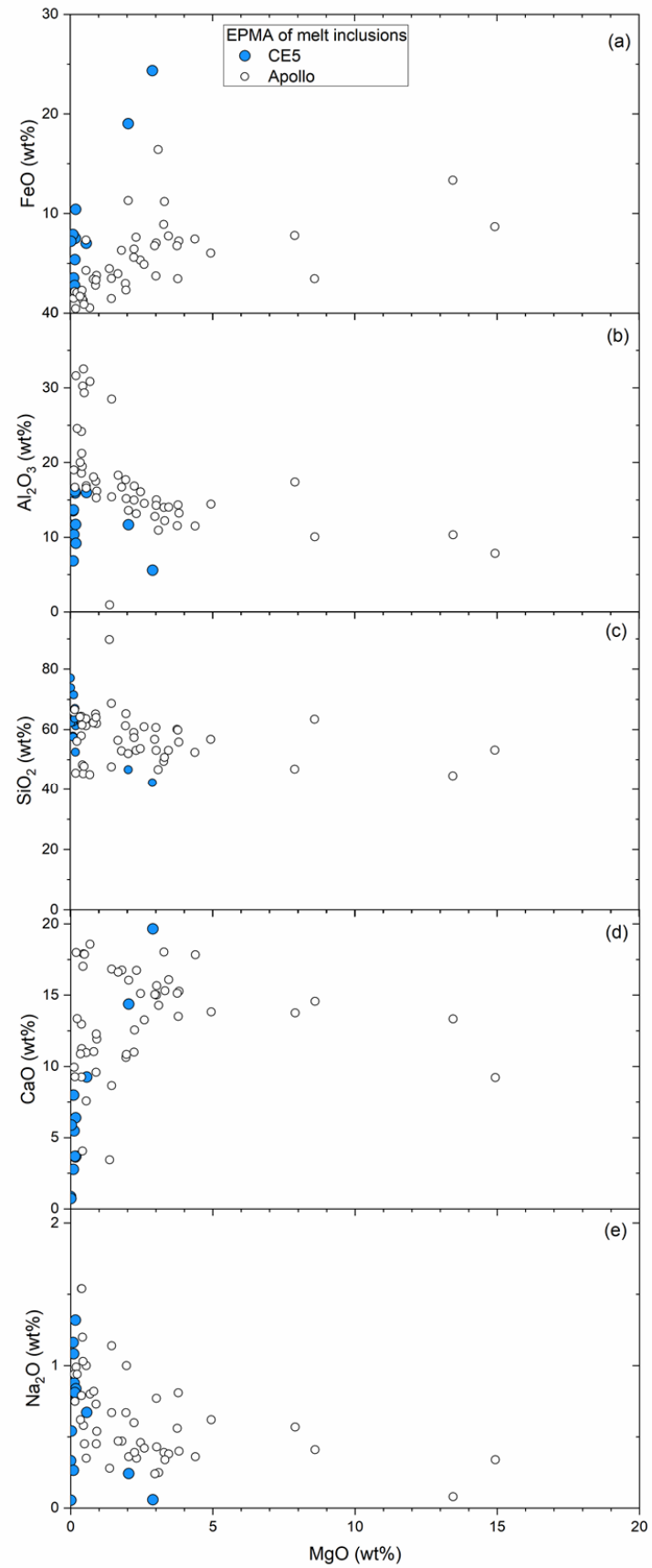

Fig. S5 | Major-element compositions of the melt inclusions in ilmenite from the CE5 basalt clasts, comparing with those enclosed in olivine and pyroxene from Apollo mare basalts [2, 25, 26].

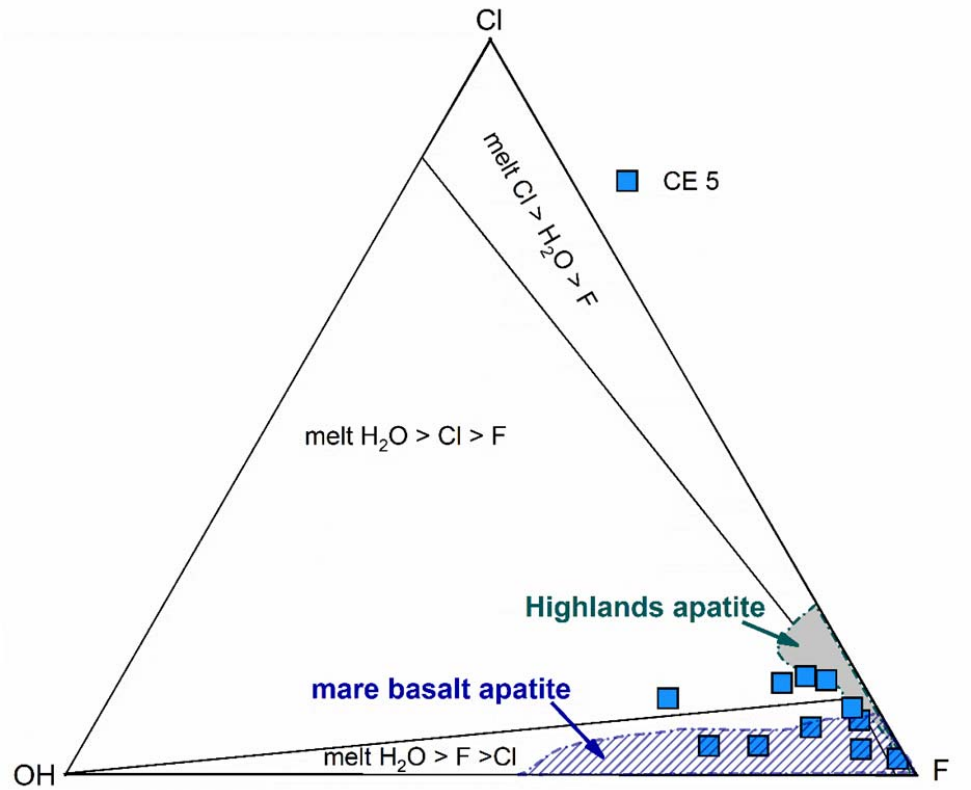

Fig. S6 | The ternary atomic plot of apatite from CE5 basalt clasts (Table S2). Cl and F were measured with EPMA, and OH was calculated based on the stoichiometry of apatite. Those apatite grains from Apollo mare basalts and highlands are modifed from literatures[4, 5, 7, 10, 13, 18].

Table S1 | Modal abundances of apatite in CE5 basalt clasts.

Clast ID	Petro_Type	Size (mm)	Total area (mm^2)	Apatite area (mm^2)
CE5C0400YJFM00406				
406-009,001	Basalt	1.03	0.35813	0.00000
406-009,004	Basalt	1.47	1.09373	0.00015
406-009,007	Basalt	0.90	0.49190	0.00034
406-009,007a	Basalt	0.19	0.01813	0.00011
406-009,010	Basalt	0.83	0.57616	0.00080
406-010,001	Basalt	0.87	0.34882	0.00165
406-010,009	Basalt	0.62	0.23291	0.00000
406-010,013	Basalt	0.52	0.14495	0.00000
406-010,015	Basalt	0.31	0.03222	0.00012
406-010,016	Basalt	0.68	0.19713	0.00013
406-010,017	Basalt	0.68	0.22417	0.00012
406-010,018	Basalt	0.53	0.13329	0.00012
406-010,019	Basalt	0.58	0.19292	0.00015
406-010,022	Basalt	0.50	0.13588	0.00045
406-010,023	Basalt	0.79	0.34418	0.00197
406-010,024	Basalt	0.53	0.19664	0.00357
406-011,002	Basalt	0.42	0.12134	0.00000
406-011,003	Basalt	0.89	0.37434	0.00058
406-011,004	Basalt	0.82	0.35079	0.00294
406-011,007	Basalt	0.70	0.18691	0.00114
406-012,001	Basalt	0.39	0.07568	0.00015
406-012,002	Basalt	0.37	0.05394	0.00033
406-012,003	Basalt	0.54	0.17687	0.00059
406-012,004	Basalt	0.89	0.39661	0.00081
406-012,006	Basalt	0.65	0.23438	0.00028
406-012,007	Basalt	0.69	0.18240	0.00047
406-012,008	Basalt	0.75	0.33972	0.00028
406-012,009	Basalt	0.69	0.35521	0.00130
406-013,001	Basalt	0.67	0.35179	0.00116
406-013,002	Basalt	0.86	0.36364	0.00037
406-013,003	Basalt	0.66	0.31632	0.00353
406-014,001	Basalt	0.39	0.06234	0.00058
406-014,003	Basalt	0.81	0.37680	0.00176
406-015,001	Basalt	0.26	0.03990	0.00311
406-015,014	Basalt	0.52	0.16425	0.00358
406-015,030	Basalt	0.49	0.17191	0.00045
406-015,031	Basalt	0.53	0.13963	0.00080
406-015,040	Basalt	0.61	0.18348	0.00104
406-015,042	Basalt	0.66	0.15741	0.00174
406-015,045	Basalt	0.68	0.17659	0.00185
406-015,046	Basalt	0.59	0.18231	0.00108
406-015,048	Basalt	0.69	0.15467	0.00293
406-015,059	Basalt	0.42	0.09038	0.00027
406-016,001	Basalt	0.35	0.07826	0.00092
406-016,002	Basalt	0.38	0.08852	0.00000
406-016,005	Basalt	0.18	0.01792	0.00004
406-016,007	Basalt	0.42	0.03798	0.00000
406-016,008	Basalt	0.44	0.12016	0.00000
406-016,009	Basalt	0.41	0.08050	0.00000
406-016,013	Basalt	0.26	0.02787	0.00000
406-016,016	Basalt	0.27	0.02349	0.00000

Clast ID	Petro_Type	Size (mm)	Total area (mm^2)	Apatite area (mm^2)
406-016,018	Basalt	0.11	0.00838	0.00000
406-016,019	Basalt	0.38	0.07971	0.00037
406-016,020	Basalt	0.13	0.00929	0.00000
406-016,021	Basalt	0.30	0.04906	0.00006
406-016,026	Basalt	0.14	0.00772	0.00000
406-016,027	Basalt	0.28	0.04831	0.00000
406-016,028	Basalt	0.44	0.06178	0.00025
406-016,029	Basalt	0.61	0.09825	0.00017
406-016,030	Basalt	0.49	0.11878	0.00000
406-016,033	Basalt	0.24	0.02117	0.00000
CE5C0100YJFM00103				
103-017,001	Basalt	1.05	0.15798	0.00014
103-017,002	Basalt	0.69	0.28300	0.00028
103-017,003	Basalt	0.70	0.28468	0.00051
103-017,006	Basalt	0.82	0.32724	0.00116
103-017,007	Basalt	0.71	0.36103	0.00000
103-017,008	Basalt	0.82	0.46286	0.00068
103-017,010	Basalt	0.45	0.25739	0.00118
103-017,011	Basalt	0.65	0.22026	0.00093
103-017,013	Basalt	0.54	0.18673	0.00174
103-018,001	Basalt	0.50	0.11896	0.00031
103-018,002	Basalt	0.69	0.22163	0.00000
103-018,003	Basalt	0.76	0.24505	0.00053
103-018,004	Basalt	0.78	0.21978	0.00080
103-018,005	Basalt	0.57	0.16684	0.00000
103-018,006	Basalt	0.66	0.25358	0.00018
103-019,001	Basalt	0.78	0.27206	0.00032
103-019,003	Basalt	0.63	0.20971	0.00020
103-019,004	Basalt	0.40	0.15901	0.00171
103-019,005	Basalt	0.48	0.10835	0.00075
103-019,006	Basalt	0.78	0.28893	0.00029
103-019,007	Basalt	0.54	0.12661	0.00050
103-019,008	Basalt	0.55	0.15796	0.00042
103-020,001	Basalt	0.36	0.05665	0.00062
103-020,002	Basalt	0.44	0.10729	0.00000
103-020,004	Basalt	0.26	0.04663	0.00226
103-020,010	Basalt	0.25	0.01519	0.00000
103-020,011	Basalt	0.25	0.02070	0.00000
103-020,012	Basalt	0.44	0.11479	0.00000
103-020,013	Basalt	0.37	0.05898	0.00000
103-020,014	Basalt	0.42	0.07304	0.00046
103-020,015	Basalt	0.29	0.05255	0.00000
103-020,016	Basalt	0.38	0.07244	0.00023
103-020,017	Basalt	0.36	0.08059	0.00042
103-020,018	Basalt	0.42	0.08343	0.00063
103-020,021	Basalt	0.39	0.06179	0.00096
103-021,001	Basalt	0.21	0.00873	0.00000
103-021,002	Basalt	0.38	0.05791	0.00005
sum			17.47828	0.06283
modal abundance %				0.36

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189 **Table S2 | EPMA analytical results of CE5 basalt clasts.**

Clast No.	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	NiO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	F	Cl	BaO	SO_3	Total
Olivine																	
406-010,023	32.5	0.10	b.d.	b.d.	53.0	b.d.	0.57	13.0	0.36	b.d.	b.d.	b.d.	0.23	b.d.	b.d.	b.d.	99.7
406-010,023	35.6	0.07	b.d.	0.07	36.6	0.03	0.38	27.2	0.35	b.d.	b.d.	b.d.	0.11	b.d.	b.d.	b.d.	100.4
406-010,024	32.9	0.16	b.d.	b.d.	50.8	b.d.	0.61	14.4	0.44	b.d.	b.d.	0.13	0.09	b.d.	b.d.	0.03	99.5
406-010,024	31.4	0.13	b.d.	b.d.	59.9	b.d.	0.76	6.5	0.54	b.d.	b.d.	0.10	0.09	b.d.	b.d.	0.02	99.6
406-012,009	30.6	0.32	b.d.	b.d.	62.8	b.d.	0.81	4.8	0.58	b.d.	b.d.	b.d.	0.15	0.02	b.d.	b.d.	100.1
406-012,009	30.7	0.16	b.d.	b.d.	64.7	b.d.	0.77	2.8	0.72	b.d.	b.d.	0.22	0.14	b.d.	b.d.	0.03	100.2
406-013,001	31.7	0.18	0.10	0.03	65.1	b.d.	0.78	1.1	1.01	b.d.	0.06	0.43	0.13	b.d.	b.d.	0.03	100.5
406-013,001	34.7	0.06	0.05	0.09	42.0	b.d.	0.50	21.8	0.44	b.d.	0.03	b.d.	0.04	b.d.	b.d.	b.d.	99.7
406-015,001	30.4	0.05	b.d.	0.03	66.1	b.d.	0.88	1.6	0.81	b.d.	b.d.	0.20	0.11	b.d.	b.d.	0.04	100.2
406-015,001	30.7	0.10	0.03	0.03	66.0	b.d.	0.84	1.7	0.67	b.d.	b.d.	0.10	0.13	0.02	b.d.	0.02	100.3
406-015,001	30.6	0.12	0.04	b.d.	65.9	b.d.	0.81	1.6	0.73	b.d.	b.d.	0.11	0.13	b.d.	0.05	0.03	100.1
406-015,001	30.8	0.14	b.d.	0.04	65.8	b.d.	0.87	1.6	0.72	b.d.	b.d.	0.33	0.17	b.d.	b.d.	b.d.	100.4
406-015,014	35.9	0.09	0.05	0.07	38.3	b.d.	0.46	25.0	0.32	0.03	b.d.	b.d.	0.11	b.d.	b.d.	0.02	100.4
406-015,014	35.3	0.10	0.04	0.09	37.8	0.03	0.39	26.0	0.35	b.d.	b.d.	0.05	0.09	0.02	0.06	0.03	100.3
406-015,014	34.8	0.09	b.d.	0.03	41.5	0.03	0.46	23.3	0.42	b.d.	b.d.	0.07	0.11	b.d.	b.d.	b.d.	100.8
406-015,014	33.4	0.14	b.d.	0.03	49.4	b.d.	0.50	16.4	0.36	b.d.	b.d.	0.11	0.12	b.d.	b.d.	0.02	100.5
406-015,014	31.8	0.01	b.d.	b.d.	59.3	b.d.	0.68	7.9	0.40	b.d.	b.d.	0.00	0.16	0.03	b.d.	0.07	100.4
406-015,014	30.6	0.09	b.d.	0.03	62.7	b.d.	0.79	4.2	0.57	0.03	b.d.	0.16	0.19	b.d.	b.d.	0.06	99.4
406-015,014	30.0	0.15	0.19	0.07	63.7	b.d.	0.75	2.3	0.45	0.03	0.10	0.40	0.04	0.02	b.d.	0.03	98.2
406-015,030	31.5	0.09	b.d.	0.06	59.7	b.d.	0.68	7.7	0.49	0.03	b.d.	0.07	0.15	b.d.	b.d.	b.d.	100.4
406-015,030	33.6	0.09	b.d.	b.d.	50.0	b.d.	0.58	15.9	0.41	0.04	b.d.	0.05	0.12	b.d.	0.04	0.04	100.9
406-015,030	32.7	0.13	b.d.	0.04	51.6	b.d.	0.59	14.7	0.40	b.d.	b.d.	b.d.	0.12	b.d.	b.d.	0.02	100.3
406-015,030	32.7	0.23	b.d.	0.09	52.1	b.d.	0.61	13.7	0.36	0.05	b.d.	b.d.	0.07	b.d.	b.d.	0.02	99.9
406-015,030	34.4	0.12	0.04	0.09	45.0	b.d.	0.47	20.2	0.44	b.d.	b.d.	0.05	b.d.	b.d.	b.d.	0.00	100.9
406-015,030	34.8	0.20	0.09	0.34	42.2	b.d.	0.43	21.7	0.82	b.d.	b.d.	b.d.	0.16	b.d.	b.d.	0.04	100.8
406-015,030	31.8	0.14	b.d.	0.08	58.8	b.d.	0.74	8.0	0.43	0.08	b.d.	0.07	0.10	b.d.	b.d.	0.03	100.1
406-016,021	36.2	0.06	b.d.	0.10	34.8	0.05	0.36	28.4	0.36	b.d.	b.d.	b.d.	b.d.	0.03	b.d.	0.03	100.6
103-017,010	31.4	0.15	0.03	b.d.	57.6	0.04	0.69	8.3	0.47	b.d.	b.d.	0.06	0.18	b.d.	0.08	0.03	99.0
103-017,013	30.5	0.24	0.09	b.d.	65.7	b.d.	0.83	2.1	0.33	b.d.	b.d.	0.50	0.15	b.d.	0.09	0.02	100.5
103-020,021	29.9	0.11	0.16	b.d.	66.6	b.d.	0.92	0.5	0.60	b.d.	b.d.	0.47	0.13	b.d.	b.d.	0.03	99.4
103-020,004	30.2	0.15	0.05	b.d.	65.6	b.d.	0.88	1.2	0.97	0.05	0.03	0.27	0.15	b.d.	b.d.	0.03	99.5
103-020,004	29.9	0.14	0.10	b.d.	66.0	b.d.	0.93	1.0	0.83	0.04	0.05	0.32	0.13	b.d.	b.d.	0.09	99.5
103-021,015	31.0	0.14	b.d.	0.03	62.0	b.d.	0.75	4.9	0.57	b.d.	b.d.	0.17	0.08	0.02	b.d.	0.03	99.7
Pyroxene																	
406-010,001	48.7	1.75	2.35	0.16	20.7	b.d.	0.34	10.4	15.1	0.04	b.d.	0.13	b.d.	b.d.	b.d.	b.d.	99.7
406-010,001	46.5	0.97	0.90	b.d.	34.6	b.d.	0.44	0.94	15.0	b.d.	b.d.	0.11	b.d.	b.d.	b.d.	b.d.	99.4
406-010,001	46.9	1.01	1.01	b.d.	33.4	b.d.	0.54	1.57	14.5	0.05	b.d.	0.08	0.05	b.d.	b.d.	b.d.	99.1
406-010,001	47.9	1.36	1.43	0.08	26.4	b.d.	0.36	5.86	15.9	0.07	b.d.	0.05	b.d.	b.d.	0.09	b.d.	99.4

Clast No.	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	NiO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	F	Cl	BaO	SO_3	Total
406-010,001	46.3	0.91	1.05	b.d.	39.2	b.d.	0.58	2.54	8.6	0.13	b.d.	b.d.	0.12	b.d.	b.d.	b.d.	99.4
406-010,016	49.4	1.02	1.21	0.18	25.7	b.d.	0.42	10.7	10.8	0.03	b.d.	b.d.	0.06	b.d.	0.07	b.d.	99.5
406-010,016	47.3	0.65	1.25	b.d.	35.1	b.d.	0.46	2.42	11.0	b.d.	0.29	0.06	b.d.	b.d.	b.d.	1.77	100.3
406-010,017	47.5	0.85	0.95	b.d.	39.0	b.d.	0.60	2.60	8.2	b.d.	b.d.	0.00	0.10	0.03	b.d.	b.d.	99.9
406-010,019	47.5	2.84	3.53	0.25	17.7	b.d.	0.29	10.0	17.4	0.08	b.d.	b.d.	b.d.	0.03	0.11	b.d.	99.8
406-010,019	46.9	1.13	1.20	0.11	35.5	b.d.	0.50	4.21	9.6	b.d.	b.d.	b.d.	b.d.	b.d.	0.05	b.d.	99.2
406-010,019	46.3	0.89	1.19	b.d.	38.8	b.d.	0.58	1.26	10.3	b.d.	b.d.	b.d.	0.12	b.d.	0.05	b.d.	99.4
406-010,023	49.1	1.56	1.83	0.22	26.5	b.d.	0.48	10.6	10.5	0.03	b.d.	b.d.	b.d.	0.02	b.d.	b.d.	100.8
406-010,024	47.9	1.70	1.80	0.12	26.7	b.d.	0.34	4.94	16.5	b.d.	b.d.	0.12	b.d.	b.d.	0.05	b.d.	100.3
406-010,024	47.6	1.30	2.30	0.05	30.5	0.05	0.52	4.48	13.3	b.d.	b.d.	0.07	b.d.	b.d.	b.d.	0.06	100.3
406-010,024	47.8	1.39	2.35	0.04	27.1	b.d.	0.34	4.23	16.6	0.10	b.d.	0.52	b.d.	b.d.	b.d.	b.d.	100.5
406-012,009	46.9	1.26	1.61	0.09	30.0	b.d.	0.47	4.19	14.8	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	0.32	99.7
406-013,001	49.2	1.69	2.11	0.09	24.4	b.d.	0.37	7.56	14.5	b.d.	b.d.	0.07	b.d.	b.d.	b.d.	b.d.	100.0
406-013,001	47.7	0.85	0.93	0.04	35.0	b.d.	0.52	2.49	11.8	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	0.15	99.5
406-013,018	46.2	1.38	1.73	b.d.	30.1	b.d.	0.39	1.61	17.5	b.d.	0.18	0.22	0.09	b.d.	b.d.	b.d.	99.4
406-015,045	47.0	1.48	1.37	b.d.	32.8	b.d.	0.47	5.31	10.3	b.d.	b.d.	0.09	b.d.	0.02	0.04	b.d.	98.9
406-015,045	44.7	2.85	1.61	b.d.	44.0	b.d.	0.56	0.19	5.4	0.04	0.05	0.05	b.d.	b.d.	b.d.	b.d.	99.4
406-015,045	47.2	1.05	1.10	0.05	37.5	b.d.	0.63	3.73	8.2	b.d.	b.d.	b.d.	0.17	b.d.	b.d.	b.d.	99.6
406-015,045	49.0	2.55	3.17	0.28	19.7	b.d.	0.33	9.70	16.1	0.05	b.d.	b.d.	b.d.	b.d.	0.08	b.d.	100.9
406-015,046	47.8	0.62	0.82	0.09	37.5	b.d.	0.60	4.95	7.3	b.d.	b.d.	0.07	b.d.	b.d.	b.d.	0.03	99.8
103-017,001	49.7	1.68	2.08	0.13	20.3	b.d.	0.42	12.4	12.4	0.06	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	99.3
103-017,001	48.2	1.29	1.56	0.14	27.7	b.d.	0.43	5.6	14.2	0.06	b.d.	0.08	b.d.	b.d.	b.d.	b.d.	99.3
103-017,001	50.0	1.80	2.35	0.20	19.4	b.d.	0.34	12.1	14.7	0.06	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.9
103-017,013	47.8	3.62	4.15	0.33	15.3	b.d.	0.28	10.8	17.6	0.13	b.d.	b.d.	0.05	b.d.	b.d.	b.d.	100.0
103-017,013	48.9	1.12	1.50	0.12	29.6	b.d.	0.42	6.95	11.8	0.09	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.5
103-017,013	48.0	1.01	1.02	0.06	35.4	b.d.	0.51	4.76	9.7	b.d.	0.03	b.d.	b.d.	b.d.	b.d.	b.d.	100.5
103-017,013	48.5	2.27	2.98	0.15	17.8	b.d.	0.32	10.7	16.7	0.07	b.d.	b.d.	0.04	b.d.	b.d.	b.d.	99.5
103-020,013	49.2	1.76	1.86	0.16	22.6	b.d.	0.39	9.64	13.6	0.05	b.d.	b.d.	b.d.	b.d.	0.04	b.d.	99.3
103-020,013	50.6	1.18	1.15	0.09	24.3	b.d.	0.42	13.5	9.2	0.04	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.5
103-020,014	46.1	0.91	1.23	b.d.	43.6	b.d.	0.58	0.51	7.0	b.d.	b.d.	b.d.	0.08	0.02	b.d.	0.03	100.0
103-020,014	49.0	2.22	2.89	0.14	20.4	b.d.	0.35	10.1	15.1	0.08	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.3
103-020,018	49.4	1.95	2.50	0.14	18.7	b.d.	0.32	9.26	17.3	0.12	b.d.	0.05	0.05	b.d.	0.07	b.d.	99.8
103-020,018	47.9	1.40	1.22	0.06	31.3	b.d.	0.44	8.67	8.09	b.d.	b.d.	0.06	0.04	0.02	b.d.	b.d.	99.2
103-020,018	48.6	2.15	2.53	0.19	21.2	b.d.	0.35	9.64	15.8	0.09	b.d.	b.d.	b.d.	b.d.	b.d.	b.d.	100.6
103-020,021	47.1	0.79	0.81	b.d.	33.3	b.d.	0.53	1.15	15.2	b.d.	b.d.	b.d.	0.05	b.d.	b.d.	b.d.	99.0
Plagioclase																	
406-010,001	50.9	0.14	29.7	b.d.	1.92	b.d.	b.d.	b.d.	14.2	1.75	0.71	b.d.	b.d.	b.d.	0.20	0.03	99.6
406-010,001	49.1	0.13	31.9	0.03	1.07	b.d.	b.d.	b.d.	16.2	1.62	0.11	b.d.	b.d.	b.d.	0.05	0.03	100.4
406-010,001	49.7	0.08	29.6	b.d.	2.28	0.06	b.d.	b.d.	15.3	1.84	0.75	0.65	b.d.	0.03	0.45	0.12	100.9
406-010,016	48.9	0.05	32.5	b.d.	0.60	b.d.	b.d.	b.d.	15.9	1.92	0.19	b.d.	b.d.	b.d.	0.06	0.02	100.4

Clast No.	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	NiO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	F	Cl	BaO	SO_3	Total
406-010,017	45.4	b.d.	35.0	b.d.	0.45	b.d.	b.d.	b.d.	17.9	0.79	0.05	0.06	b.d.	b.d.	b.d.	0.04	99.9
406-010,019	50.0	0.06	30.0	b.d.	1.17	b.d.	0.03	b.d.	15.5	1.80	0.27	b.d.	b.d.	0.02	b.d.	0.02	99.0
406-010,024	49.0	0.09	31.6	0.03	0.70	b.d.	b.d.	b.d.	15.5	1.72	0.12	b.d.	b.d.	b.d.	b.d.	0.04	99.2
406-012,009	51.3	0.10	30.5	b.d.	0.90	b.d.	0.03	b.d.	14.8	2.11	0.27	0.06	b.d.	b.d.	b.d.	0.04	100.2
406-015,045	48.7	0.47	32.3	b.d.	1.41	b.d.	0.03	b.d.	15.6	1.59	0.18	b.d.	b.d.	0.02	b.d.	0.03	100.6
406-015,045	48.5	0.11	32.6	b.d.	1.23	b.d.	b.d.	b.d.	15.9	1.51	0.11	b.d.	b.d.	b.d.	b.d.	b.d.	100.4
406-015,046	47.0	0.14	34.2	b.d.	0.84	b.d.	b.d.	b.d.	17.0	1.27	0.16	b.d.	b.d.	b.d.	b.d.	0.03	100.8
103-017,001	49.1	0.09	32.9	b.d.	0.64	b.d.	b.d.	b.d.	16.2	1.65	0.10	b.d.	b.d.	b.d.	b.d.	0.02	100.8
103-017,013	50.4	0.40	30.2	b.d.	2.39	b.d.	b.d.	b.d.	14.6	2.07	0.52	0.07	b.d.	b.d.	0.10	b.d.	100.9
103-017,013	49.8	0.05	32.1	0.05	0.96	b.d.	b.d.	b.d.	15.7	1.70	0.17	b.d.	b.d.	b.d.	b.d.	0.02	100.7
103-020,013	48.0	0.45	32.5	b.d.	1.03	b.d.	b.d.	b.d.	15.8	1.61	0.12	b.d.	b.d.	b.d.	b.d.	b.d.	99.7
103-020,014	52.4	0.12	30.0	0.02	2.07	b.d.	b.d.	b.d.	13.5	2.15	0.54	0.10	b.d.	b.d.	b.d.	0.02	100.9
103-020,014	49.8	0.05	31.9	b.d.	0.94	0.04	b.d.	b.d.	15.6	1.87	0.17	b.d.	b.d.	b.d.	b.d.	b.d.	100.6
103-020,018	49.4	0.18	32.3	b.d.	0.89	b.d.	b.d.	b.d.	15.9	1.87	0.13	b.d.	b.d.	0.02	b.d.	b.d.	100.9
103-020,021	51.5	0.07	30.6	b.d.	1.07	b.d.	b.d.	b.d.	14.2	2.23	0.63	b.d.	b.d.	0.03	0.23	b.d.	100.6
103-020,021	49.4	0.10	31.7	b.d.	0.72	b.d.	b.d.	b.d.	15.8	1.92	0.18	b.d.	b.d.	b.d.	b.d.	0.06	100.0
103-020,004	51.5	0.06	29.9	b.d.	2.38	b.d.	b.d.	b.d.	14.5	1.72	0.58	0.07	b.d.	0.02	0.20	b.d.	100.9
103-021,011	48.7	0.09	32.6	b.d.	0.52	b.d.	b.d.	b.d.	16.4	1.53	0.09	b.d.	b.d.	b.d.	b.d.	0.05	100.2
103-021,011	49.8	0.01	29.8	0.05	1.04	b.d.	b.d.	b.d.	15.1	1.97	0.26	b.d.	b.d.	b.d.	b.d.	0.02	98.1
Apatite																	
406-010,023	2.88	0.06	0.21	b.d.	3.04	b.d.	0.06	b.d.	50.1	0.03	0.12	40.94	3.23	0.22	0.07	0.09	99.7
406-010,023	2.78	0.09	0.30	b.d.	2.20	b.d.	0.03	b.d.	50.6	0.04	0.19	40.85	3.71	0.40	b.d.	0.08	99.7
406-011,003	2.91	0.03	0.11	0.04	2.71	b.d.	0.09	b.d.	52.0	b.d.	0.03	40.18	3.49	0.24	b.d.	0.04	100.4
406-011,003	2.65	1.60	0.19	b.d.	10.1	b.d.	0.09	b.d.	43.2	b.d.	0.08	35.16	2.78	0.25	0.09	4.90	99.9
406-015,001	2.22	0.07	0.24	0.03	1.07	b.d.	0.03	b.d.	52.7	b.d.	0.17	41.82	2.63	0.26	b.d.	0.04	100.1
406-015,001	3.44	b.d.	0.30	b.d.	1.71	b.d.	b.d.	b.d.	50.5	b.d.	0.29	40.14	2.95	0.41	0.05	0.06	98.5
406-015,001	2.58	0.18	0.22	0.03	0.79	b.d.	0.03	b.d.	51.1	b.d.	0.34	41.17	3.91	0.11	b.d.	0.04	98.9
406-015,001	2.07	0.04	0.47	0.05	0.97	b.d.	0.05	b.d.	51.5	b.d.	0.13	41.97	3.86	0.21	b.d.	0.06	99.8
406-015,001	2.02	b.d.	0.15	b.d.	1.07	b.d.	0.05	b.d.	50.8	b.d.	0.13	41.74	3.88	0.14	b.d.	0.02	98.4
406-015,001	3.75	b.d.	0.36	b.d.	1.70	b.d.	0.05	b.d.	50.0	b.d.	0.34	40.55	3.66	0.13	0.09	0.02	99.1
406-015,014	2.75	0.15	0.14	b.d.	4.81	b.d.	0.05	b.d.	48.9	b.d.	0.09	39.87	3.10	0.47	0.05	0.16	99.2
406-015,014	2.51	0.24	0.17	0.02	3.41	b.d.	0.07	b.d.	50.2	b.d.	0.15	40.51	2.73	0.81	b.d.	0.24	99.7
406-015,014	2.13	0.24	0.24	0.03	1.92	b.d.	0.10	b.d.	51.3	b.d.	0.18	42.79	3.68	0.32	b.d.	0.10	101.4
406-015,014	2.81	0.15	0.30	b.d.	2.87	b.d.	b.d.	b.d.	50.1	b.d.	0.16	41.58	2.35	0.69	0.06	0.18	100.1
406-015,014	1.97	0.05	0.17	0.02	1.94	b.d.	0.07	b.d.	51.9	b.d.	0.15	41.66	3.44	0.34	b.d.	0.03	100.3
406-015,046	2.86	0.08	0.27	b.d.	1.58	b.d.	0.07	b.d.	50.8	0.07	0.20	40.88	3.38	0.14	b.d.	0.02	98.8
406-015,046	2.15	0.14	0.18	b.d.	1.77	b.d.	0.07	b.d.	50.5	0.07	0.16	42.02	3.61	0.12	b.d.	0.04	99.2
406-015,048	3.46	0.25	0.26	0.02	2.50	b.d.	0.07	b.d.	49.2	b.d.	0.15	41.01	3.61	0.14	0.06	0.04	99.2
406-015,015	3.03	b.d.	0.44	b.d.	2.01	b.d.	0.09	b.d.	50.9	b.d.	0.16	40.49	3.08	0.59	b.d.	0.08	99.4
103-020,021	1.81	0.06	0.08	b.d.	1.76	b.d.	0.07	b.d.	51.8	b.d.	0.05	41.66	2.91	0.84	0.10	0.12	99.8

Clast No.	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	FeO	NiO	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	F	Cl	BaO	SO_3	Total
103-020,021	1.77	b.d.	0.05	b.d.	1.93	b.d.	0.08	b.d.	51.4	b.d.	0.05	41.53	2.81	0.87	b.d.	0.14	99.3
Melt inclusions in ilmenite																	
406-010,023	63.7	2.65	16.17	b.d.	2.79	b.d.	b.d.	0.15	3.70	0.81	5.99	0.77	b.d.	b.d.	2.23	0.05	99.0
406-012,009	46.7	2.28	11.69	0.09	19.0	b.d.	0.28	2.04	14.4	0.24	0.61	1.40	b.d.	b.d.	0.05	0.43	99.2
406-012,009	42.3	3.32	5.59	0.11	24.4	b.d.	0.30	2.89	19.7	0.06	0.04	1.00	b.d.	0.03	b.d.	b.d.	99.6
406-013,001	62.3	1.45	16.07	b.d.	7.22	0.05	0.14	b.d.	5.89	0.54	4.26	0.79	b.d.	0.04	0.57	0.24	99.6
406-015,045	37.9	3.41	8.00	0.03	9.90	0.06	0.09	0.11	15.6	0.25	2.82	16.7	b.d.	0.02	0.61	b.d.	95.5
406-015,045	77.1	2.43	11.62	b.d.	3.49	b.d.	0.04	b.d.	0.87	0.33	5.57	0.18	b.d.	b.d.	0.54	0.00	102.2
406-015,046	57.8	7.25	13.53	0.06	7.41	b.d.	0.07	0.09	7.99	1.16	0.39	1.28	b.d.	0.03	0.12	0.26	97.5
406-015,046	57.5	7.50	13.67	0.06	7.88	b.d.	0.07	0.10	7.99	1.08	0.37	1.40	b.d.	b.d.	b.d.	0.43	98.1
103-017,001	67.0	1.04	15.92	b.d.	5.39	b.d.	0.05	0.16	3.64	1.32	5.01	0.33	b.d.	0.04	0.79	0.02	100.7
103-017,013	73.8	3.11	11.27	0.02	3.11	0.05	0.09	b.d.	0.72	0.06	2.39	0.07	b.d.	b.d.	0.16	b.d.	94.9
103-020,013	62.7	1.88	16.00	b.d.	7.03	b.d.	0.08	0.56	9.26	0.67	0.04	0.50	b.d.	b.d.	b.d.	b.d.	98.8
103-020,013	71.5	3.09	10.38	0.07	3.53	b.d.	b.d.	0.12	5.48	0.88	0.13	0.80	b.d.	0.03	0.11	0.02	96.1
103-020,018	52.5	12.0	11.70	0.07	7.52	b.d.	0.06	0.18	6.39	0.80	0.75	0.83	b.d.	0.03	0.15	b.d.	93.0
103-020,018	61.2	13.1	9.21	0.03	10.4	b.d.	0.08	0.18	3.69	0.84	0.34	0.62	b.d.	0.02	0.07	b.d.	99.8
103-020,018	62.5	7.09	6.84	b.d.	7.90	b.d.	0.05	0.09	2.78	0.27	2.90	1.59	b.d.	0.02	1.39	1.28	94.7
Ilmenite																	
406-010,001	0.1	####	0.08	0.13	45.8	0.05	0.43	0.2	0.04	b.d.	0.02	b.d.	0.06	b.d.	0.20	0.00	100.8
406-010,023	0.1	####	0.07	0.27	41.8	0.04	0.35	1.5	0.34	b.d.	0.00	b.d.	b.d.	b.d.	0.14	0.00	96.4
406-010,023	0.1	####	0.06	0.29	43.4	0.04	0.40	1.4	0.08	0.03	0.00	b.d.	0.05	b.d.	0.09	0.00	98.9
406-010,023	0.9	####	0.28	0.19	44.1	b.d.	0.47	1.2	0.36	b.d.	0.06	0.19	b.d.	b.d.	0.10	0.00	98.5
406-012,009	0.0	####	0.05	0.15	44.4	b.d.	0.45	0.6	0.08	0.04	0.02	0.09	0.04	0.02	0.15	0.00	99.6
406-013,001	0.1	####	0.16	0.13	45.4	b.d.	0.37	0.4	0.08	b.d.	0.02	b.d.	b.d.	b.d.	0.09	0.00	100.2
406-013,001	0.3	####	0.21	0.12	45.4	b.d.	0.39	0.2	0.37	b.d.	0.01	b.d.	b.d.	0.03	0.17	0.00	99.5
406-013,001	0.5	####	0.10	0.14	45.1	b.d.	0.47	0.7	0.04	b.d.	0.00	b.d.	b.d.	b.d.	0.09	0.00	100.5
406-015,045	0.4	####	0.21	0.09	45.9	b.d.	0.41	0.1	0.21	0.04	0.01	0.05	b.d.	b.d.	0.28	0.00	99.7
406-015,046	0.4	####	0.13	0.19	45.0	b.d.	0.34	0.4	0.27	0.04	0.04	0.05	b.d.	b.d.	0.19	0.00	99.5
103-017,001	0.2	####	0.17	0.12	44.8	0.05	0.46	0.6	0.11	b.d.	0.00	b.d.	b.d.	b.d.	b.d.	0.00	99.4
103-017,010	0.0	####	0.11	0.20	45.6	b.d.	0.46	0.3	0.16	b.d.	0.00	b.d.	b.d.	b.d.	0.20	0.00	100.2
103-017,013	0.2	####	0.21	0.03	45.3	b.d.	0.39	0.3	0.11	b.d.	0.02	b.d.	b.d.	b.d.	0.16	0.00	100.0
103-020,013	0.0	####	0.11	0.32	44.4	b.d.	0.47	0.8	b.d.	b.d.	0.00	b.d.	b.d.	b.d.	0.26	0.00	100.2
103-020,014	0.1	####	0.16	0.06	45.5	b.d.	0.38	0.1	0.14	b.d.	0.00	b.d.	b.d.	0.02	0.08	0.00	99.8
103-020,018	0.2	####	0.09	0.24	45.2	b.d.	0.44	0.7	0.16	b.d.	0.00	b.d.	0.08	b.d.	0.14	0.00	100.7
103-020,021	0.0	####	0.11	0.06	45.6	b.d.	0.41	0.2	0.06	0.05	0.00	b.d.	b.d.	b.d.	0.09	0.00	100.3

b.d., below detection limit.

192 **Table S3 | NanoSIMS analytical results of the standards.**

Sample*	Mineral	$^{2}H/^{1}H$	Err Mean	Poisson	$^{1}H/^{16}O$	Err Mean	Poisson	Ratio	Err Mean	Poisson
KOV	Ap	1.56E-04	2.560E+000	2.63E+00	1.34E-03	5.400E-002	3.28E-02	5.78E-05	1.69E-01	1.58E-01
KOV	Ap	1.60E-04	2.460E+000	2.62E+00	1.28E-03	6.860E-002	3.32E-02	6.33E-05	1.66E-01	1.49E-01
KOV	Ap	1.62E-04	2.500E+000	2.54E+00	1.30E-03	6.330E-002	3.23E-02	6.27E-05	1.85E-01	1.47E-01
KOV	Ap	1.60E-04	2.710E+000	2.64E+00	1.25E-03	7.160E-002	3.34E-02	6.48E-05	2.21E-01	1.47E-01
KOV	Ap	1.72E-04	2.710E+000	2.67E+00	1.14E-03	8.260E-002	3.51E-02	6.41E-05	1.63E-01	1.48E-01
KOV	Ap	1.63E-04	1.810E+000	1.90E+00	1.21E-03	2.670E-002	2.44E-02	5.62E-05	1.27E-01	1.13E-01
KOV	Ap	1.70E-04	1.910E+000	1.86E+00	1.19E-03	2.770E-002	2.43E-02	6.23E-05	1.39E-01	1.06E-01
KOV	Ap	1.61E-04	1.920E+000	1.89E+00	1.18E-03	2.980E-002	2.40E-02	6.78E-05	1.10E-01	1.00E-01
KOV	Ap	1.61E-04	1.910E+000	2.01E+00	1.22E-03	3.660E-002	2.55E-02	7.18E-05	1.56E-01	1.05E-01
KOV	Ap	1.58E-04	1.830E+000	1.96E+00	1.27E-03	4.700E-002	2.47E-02	6.29E-05	1.10E-01	1.11E-01
KOV	Ap	1.61E-04	2.070E+000	1.97E+00	1.20E-03	4.170E-002	2.50E-02	9.69E-05	1.39E-01	8.80E-02
KOV	Ap	1.63E-04	1.410E+000	1.33E+00	1.22E-03	6.340E-002	1.70E-02	9.59E-05	1.87E-01	6.06E-02
KOV	Ap	1.64E-04	1.360E+000	1.35E+00	1.23E-03	3.800E-002	1.73E-02	7.59E-05	1.56E-01	6.95E-02
KOV	Ap	1.57E-04	1.450E+000	1.44E+00	1.26E-03	6.280E-002	1.81E-02	6.56E-05	4.57E-01	7.90E-02
KOV	Ap	1.59E-04	1.510E+000	1.43E+00	1.23E-03	5.980E-002	1.81E-02	7.63E-05	1.59E-01	7.27E-02
KOV	Ap	1.61E-04	1.380E+000	1.40E+00	1.23E-03	5.960E-002	1.78E-02	6.68E-05	1.59E-01	7.66E-02
KOV	Ap	1.63E-04	1.400E+000	1.40E+00	1.21E-03	5.000E-002	1.79E-02	7.43E-05	3.55E-01	7.21E-02
KOV	Ap	1.64E-04	1.400E+000	1.43E+00	1.21E-03	5.950E-002	1.83E-02	6.52E-05	2.81E-01	7.88E-02
KOV	Ap	1.60E-04	1.390E+000	1.37E+00	1.25E-03	1.630E-001	1.73E-02	7.95E-05	9.45E-02	6.86E-02
KOV	Ap	1.63E-04	1.370E+000	1.36E+00	1.24E-03	9.340E-002	1.74E-02	8.09E-05	9.69E-02	6.84E-02
KOV	Ap	1.60E-04	1.430E+000	1.35E+00	1.29E-03	1.830E-001	1.71E-02	6.70E-05	2.11E-01	7.50E-02
KOV	Ap	1.64E-04	1.610E+000	1.55E+00	1.14E-03	6.890E-002	1.98E-02	7.14E-05	2.42E-01	7.92E-02
KOV	Ap	1.64E-04	1.590E+000	1.52E+00	1.16E-03	9.560E-002	1.95E-02	7.15E-05	1.75E-01	7.85E-02
KOV	Ap	1.64E-04	1.530E+000	1.48E+00	1.23E-03	1.390E-001	1.90E-02	8.07E-05	1.60E-01	7.41E-02
KOV	Ap	1.62E-04	1.390E+000	1.44E+00	1.26E-03	3.300E-002	1.83E-02	7.07E-05	1.26E-01	7.72E-02
KOV	Ap	1.59E-04	1.420E+000	1.44E+00	1.27E-03	3.490E-002	1.81E-02	6.89E-05	9.51E-02	7.77E-02
KOV	Ap	1.58E-04	1.580E+000	1.47E+00	1.24E-03	3.110E-002	1.84E-02	7.88E-05	9.50E-02	7.31E-02
KOV	Ap	1.67E-04	1.530E+000	1.55E+00	1.15E-03	1.470E-001	2.01E-02	6.19E-05	2.81E-01	8.67E-02
KOV	Ap	1.62E-04	1.570E+000	1.58E+00	1.19E-03	6.010E-002	2.02E-02	7.10E-05	3.83E-01	8.26E-02
KOV	Ap	1.64E-04	1.550E+000	1.51E+00	1.20E-03	4.880E-002	1.93E-02	5.74E-05	1.31E-01	8.81E-02
MORB	Glass	1.64E-04	5.980E+000	5.80E+00	2.95E-04	8.040E-002	7.43E-02	9.69E-06	4.59E-01	4.09E-01
MORB	Glass	1.61E-04	5.760E+000	5.48E+00	3.12E-04	8.710E-002	6.96E-02	1.14E-05	3.97E-01	3.64E-01
MORB	Glass	1.48E-04	6.250E+000	5.62E+00	3.15E-04	8.990E-002	6.84E-02	1.22E-05	3.51E-01	3.48E-01
MORB	Glass	1.56E-04	5.030E+000	5.44E+00	3.09E-04	1.070E-001	6.79E-02	1.11E-05	4.03E-01	3.58E-01
MORB	Glass	1.63E-04	2.820E+000	2.83E+00	3.43E-04	4.270E-002	3.61E-02	1.14E-05	2.05E-01	1.98E-01
MORB	Glass	1.56E-04	3.120E+000	2.97E+00	3.16E-04	4.610E-002	3.70E-02	1.07E-05	2.21E-01	2.01E-01
MORB	Glass	1.60E-04	2.800E+000	2.94E+00	3.02E-04	5.800E-002	3.72E-02	9.27E-06	2.16E-01	2.12E-01
MORB	Glass	1.64E-04	3.080E+000	3.03E+00	2.97E-04	8.120E-002	3.87E-02	9.53E-06	2.48E-01	2.16E-01
MORB	Glass	1.54E-04	3.660E+000	3.40E+00	4.65E-04	4.970E-002	4.21E-02	1.54E-05	2.73E-01	2.31E-01

Sample*	Mineral	$^{2}H/^{1}H$	Err Mean	Poisson	$^{1}H/^{16}O$	Err Mean	Poisson	Ratio	Err Mean	Poisson
MORB	Glass	1.56E-04	3.320E+000	3.35E+00	4.51E-04	4.320E-002	4.18E-02	1.52E-05	2.46E-01	2.28E-01
MORB	Glass	1.53E-04	3.180E+000	3.27E+00	4.45E-04	4.600E-002	4.04E-02	1.54E-05	2.56E-01	2.17E-01
MORB	Glass	1.57E-04	2.500E+000	2.35E+00	4.28E-04	5.170E-002	2.94E-02	1.40E-05	1.94E-01	1.63E-01
MORB	Glass	1.60E-04	2.350E+000	2.36E+00	4.23E-04	4.940E-002	2.99E-02	1.40E-05	1.92E-01	1.64E-01
MORB	Glass	1.56E-04	2.330E+000	2.33E+00	4.28E-04	5.070E-002	2.91E-02	1.45E-05	2.51E-01	1.58E-01
MORB	Glass	1.58E-04	2.370E+000	2.33E+00	4.31E-04	6.790E-002	2.93E-02	1.37E-05	1.80E-01	1.64E-01
MORB	Glass	1.51E-04	2.550E+000	2.56E+00	4.09E-04	4.980E-002	3.15E-02	1.31E-05	2.39E-01	1.76E-01
MORB	Glass	1.50E-04	2.580E+000	2.55E+00	4.13E-04	7.000E-002	3.13E-02	1.28E-05	3.52E-01	1.78E-01
MORB	Glass	1.51E-04	2.480E+000	2.44E+00	4.06E-04	9.640E-002	3.00E-02	1.23E-05	2.00E-01	1.72E-01
MORB	Glass	1.58E-04	2.520E+000	2.59E+00	4.16E-04	4.680E-002	3.26E-02	1.34E-05	2.20E-01	1.82E-01
MORB	Glass	1.59E-04	2.630E+000	2.67E+00	4.14E-04	5.010E-002	3.36E-02	1.33E-05	2.07E-01	1.87E-01
MORB	Glass	1.54E-04	2.790E+000	2.73E+00	4.12E-04	5.210E-002	3.39E-02	1.34E-05	2.45E-01	1.88E-01
DAP	Ap	1.56E-04	7.470E+000	7.14E+00	6.01E-05	9.590E-002	8.94E-02	4.60E-07	1.21E+00	1.02E+00
DAP	Ap	1.56E-04	6.730E+000	6.84E+00	6.63E-05	1.530E-001	8.54E-02	1.49E-06	5.85E-01	5.70E-01
DAP	Ap	1.77E-04	1.250E+001	9.41E+00	5.85E-05	1.230E-001	1.25E-01	3.96E-07	1.64E+00	1.52E+00
DAP	Ap	1.68E-04	6.220E+000	5.98E+00	6.88E-05	8.670E-002	7.75E-02	9.00E-07	7.67E-01	6.78E-01
DAP	Ap	1.79E-04	6.920E+000	6.12E+00	6.72E-05	9.750E-002	8.18E-02	1.20E-06	5.98E-01	6.13E-01
DAP	Ap	1.67E-04	6.680E+000	6.26E+00	6.43E-05	9.470E-002	8.09E-02	4.73E-07	1.27E+00	9.43E-01
DAP	Ap	1.63E-04	6.340E+000	6.09E+00	6.59E-05	1.210E-001	7.77E-02	3.05E-07	1.17E+00	1.14E+00
DAP	Ap	1.65E-04	6.210E+000	5.97E+00	6.70E-05	1.190E-001	7.66E-02	4.25E-07	1.05E+00	9.62E-01
DAP	Ap	1.62E-04	6.560E+000	6.16E+00	6.61E-05	1.100E-001	7.84E-02	5.02E-07	1.07E+00	8.99E-01
DAP	Ap	1.54E-04	5.950E+000	6.16E+00	6.91E-05	9.590E-002	7.63E-02	1.20E-06	8.82E-01	5.78E-01
DAP	Ap	1.80E-04	6.060E+000	5.87E+00	6.75E-05	1.510E-001	7.87E-02	4.28E-07	1.10E+00	9.88E-01
DAP	Ap	1.66E-04	6.610E+000	6.01E+00	7.04E-05	1.570E-001	7.74E-02	4.28E-07	1.05E+00	9.92E-01
DAP	Ap	1.57E-04	6.840E+000	6.03E+00	7.25E-05	1.560E-001	7.54E-02	7.67E-07	8.84E-01	7.33E-01
DAP	Ap	1.70E-04	6.090E+000	5.84E+00	7.21E-05	1.470E-001	7.63E-02	4.32E-07	9.33E-01	9.85E-01
DAP	Ap	1.67E-04	6.730E+000	6.42E+00	6.61E-05	1.060E-001	8.29E-02	5.62E-07	9.29E-01	8.98E-01
DAP	Ap	1.82E-04	6.100E+000	5.91E+00	6.94E-05	1.010E-001	7.98E-02	6.51E-07	8.83E-01	8.24E-01
519	Glass	1.56E-04	3.320E+000	3.23E+00	2.42E-04	4.580E-002	4.04E-02	9.13E-06	2.25E-01	2.08E-01
519	Glass	1.63E-04	3.100E+000	3.09E+00	2.46E-04	5.670E-002	3.94E-02	9.30E-06	2.17E-01	2.03E-01
519	Glass	1.60E-04	3.200E+000	3.30E+00	2.47E-04	5.630E-002	4.17E-02	8.89E-06	2.27E-01	2.20E-01
519	Glass	1.60E-04	3.350E+000	3.29E+00	2.39E-04	7.070E-002	4.17E-02	9.03E-06	2.54E-01	2.14E-01
519	Glass	1.62E-04	3.270E+000	3.20E+00	2.44E-04	8.660E-002	4.06E-02	9.46E-06	2.44E-01	2.06E-01
519	Glass	1.48E-04	3.230E+000	3.04E+00	2.69E-04	6.130E-002	3.70E-02	9.19E-06	2.66E-01	2.00E-01
519	Glass	1.41E-04	3.340E+000	3.13E+00	2.69E-04	4.500E-002	3.71E-02	9.46E-06	3.56E-01	1.98E-01
519	Glass	1.47E-04	3.240E+000	3.21E+00	2.50E-04	1.050E-001	3.90E-02	8.52E-06	2.21E-01	2.11E-01
519	Glass	1.46E-04	3.270E+000	3.32E+00	2.45E-04	5.910E-002	4.02E-02	8.75E-06	2.29E-01	2.12E-01
519	Glass	1.55E-04	3.430E+000	3.27E+00	2.41E-04	4.940E-002	4.07E-02	8.57E-06	2.55E-01	2.16E-01
519	Glass	1.51E-04	3.100E+000	3.18E+00	2.70E-04	4.380E-002	3.91E-02	9.67E-06	2.30E-01	2.07E-01
519	Glass	1.48E-04	3.130E+000	3.15E+00	2.66E-04	4.310E-002	3.83E-02	9.82E-06	2.84E-01	1.99E-01

Sample*	Mineral	$^{2}H/^{1}H$	Err Mean	Poisson	$^{1}H/^{16}O$	Err Mean	Poisson	Ratio	Err Mean	Poisson
519	Glass	1.52E-04	3.210E+000	3.11E+00	2.60E-04	4.550E-002	3.84E-02	9.73E-06	2.28E-01	1.98E-01
1833-11	Glass	1.54E-04	1.820E+000	1.83E+00	1.57E-03	3.870E-002	2.27E-02	5.73E-06	3.93E-01	3.75E-01
1833-11	Glass	1.63E-04	1.710E+000	1.78E+00	1.56E-03	4.400E-002	2.27E-02	9.09E-06	8.05E-01	2.96E-01
1833-11	Glass	1.58E-04	1.220E+000	1.24E+00	1.58E-03	2.910E-002	1.56E-02	5.63E-06	2.92E-01	2.61E-01
1833-11	Glass	1.59E-04	1.280E+000	1.25E+00	1.55E-03	3.310E-002	1.58E-02	5.93E-06	2.76E-01	2.56E-01
1833-11	Glass	1.59E-04	1.210E+000	1.27E+00	1.51E-03	3.780E-002	1.60E-02	6.17E-06	2.86E-01	2.50E-01
1833-11	Glass	1.58E-04	1.240E+000	1.28E+00	1.52E-03	4.750E-002	1.61E-02	5.57E-06	2.87E-01	2.65E-01
1833-11	Glass	1.57E-04	1.180E+000	1.21E+00	1.62E-03	3.660E-002	1.52E-02	5.63E-06	3.54E-01	2.57E-01
1833-11	Glass	1.56E-04	1.250E+000	1.21E+00	1.58E-03	4.390E-002	1.52E-02	5.42E-06	3.33E-01	2.59E-01
1833-11	Glass	1.57E-04	1.260E+000	1.23E+00	1.56E-03	3.340E-002	1.54E-02	5.66E-06	2.74E-01	2.56E-01
1833-11	Glass	1.50E-04	1.270E+000	1.23E+00	1.75E-03	2.250E-002	1.51E-02	6.22E-06	2.51E-01	2.52E-01
1833-11	Glass	1.50E-04	1.310E+000	1.23E+00	1.74E-03	3.260E-002	1.51E-02	6.29E-06	2.63E-01	2.50E-01
SCOL	Ol	3.76E-04	3.180E+001	2.36E+01	2.20E-06	8.590E-001	4.57E-01	2.99E-07	1.45E+00	1.24E+00
SCOL	Ol	3.49E-04	4.060E+001	2.43E+01	4.09E-06	8.100E-001	4.53E-01	3.67E-07	1.59E+00	1.51E+00
SCOL	Ol	3.19E-04	3.020E+001	1.92E+01	3.53E-06	6.710E-001	3.44E-01	3.74E-07	1.21E+00	1.06E+00
SCOL	Ol	3.31E-04	3.390E+001	1.83E+01	3.72E-06	4.360E-001	3.32E-01	3.93E-07	1.05E+00	1.02E+00
SCOL	Ol	2.69E-04	3.610E+001	2.09E+01	3.54E-06	6.130E-001	3.42E-01	3.75E-07	1.27E+00	1.05E+00
SCOL	Ol	3.15E-04	3.310E+001	1.89E+01	3.73E-06	6.230E-001	3.35E-01	3.29E-07	1.30E+00	1.13E+00
SCOL	Ol	3.29E-04	3.130E+001	2.00E+01	3.07E-06	6.830E-001	3.63E-01	3.94E-07	1.25E+00	1.01E+00
SCOL	Ol	4.70E-04	2.480E+001	1.67E+01	3.10E-06	6.910E-001	3.61E-01	3.95E-07	1.23E+00	1.01E+00
SCOL	Ol	2.72E-04	3.400E+001	2.24E+01	3.04E-06	6.750E-001	3.69E-01	3.74E-07	1.31E+00	1.05E+00
SCOL	Ol	3.15E-04	3.410E+001	2.04E+01	3.31E-06	4.950E-001	3.62E-01	3.91E-07	1.31E+00	1.05E+00
SCOL	Ol	3.55E-04	3.180E+001	2.13E+01	2.73E-06	7.190E-001	4.02E-01	3.88E-07	1.22E+00	1.07E+00

***KOV, Kvodor apatite, DAP, Durango apatite, MORB, SWIFT MORB glass, 519, basaltic glass 519-4-1, 1833-11, basaltic glass 1833-11, SCOL, San Carlos Olivine.**

Table S4 | Water abundances and hydrogen isotope compositions of ilmenite-hosted melt inclusions and apatite after correction for spallation effects.

		CRE age =0 Ma				CRE age =10 Ma		CRE age =50 Ma		CRE age =100 Ma		CRE age =200 Ma	
File Name	Clast No.	H_2O μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2 σ ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰
Apatite													
010-001Ap-1	406-010,001	2205	91	382	64	2205	381	2205	380	2204	377	2205	382
010-001Ap-2	406-010,001	1850	79	461	67	1850	460	1849	458	1849	456	1850	461
010-019Ap-1	406-010,019	2418	109	422	65	2418	421	2417	420	2417	418	2418	422
010-019Ap-2	406-010,019	2153	96	363	64	2153	362	2153	361	2153	359	2153	363
010-023Ap-1	406-010,023	176	17	722	169	176	708	176	695	175	668	176	719
010-023Ap-2	406-010,023	236	19	426	159	235	416	235	406	235	385	236	424
010-023Ap-3	406-010,023	110	13	440	210	110	418	110	396	110	352	110	436
011-003Ap-1	406-011,003	2936	119	464	62	2936	463	2936	463	2935	461	2936	464
011-007Ap-1	406-011,007	1626	73	276	69	1626	275	1626	273	1626	270	1626	276
012-004Ap-1	406-012,004	2595	108	382	70	2595	381	2595	380	2594	378	2595	382
012-004Ap-2	406-012,004	2755	110	456	60	2755	455	2754	454	2754	453	2755	456
012-009Ap-1	406-012,009	1936	87	551	67	1936	550	1936	549	1936	547	1936	551
014-001Ap-1	406-014,001	4363	187	329	57	4363	329	4363	328	4362	327	4363	329
014-001Ap-2	406-014,001	1841	82	368	67	1841	367	1841	366	1841	363	1841	368
014-003Ap-1	406-014,003	4856	217	376	66	4856	376	4856	375	4855	374	4856	376
014-006Ap-1	406-014,006	3319	140	579	56	3318	578	3318	578	3318	576	3318	579
014-006Ap-2	406-014,006	2895	119	609	59	2895	609	2895	608	2894	606	2895	609
014-006Ap-3	406-014,006	2283	94	624	61	2283	623	2283	622	2283	620	2283	624
015-001Ap-1	406-015,001	1137	53	368	80	1137	366	1137	364	1137	360	1137	368
015-001Ap-2	406-015,001	1167	56	512	80	1166	510	1166	508	1166	504	1167	512
015-001Ap-3	406-015,001	939	46	566	84	939	563	939	561	938	556	939	565
015-014Ap-1	406-015,014	1717	74	931	63	1717	929	1716	928	1716	925	1717	930
015-014Ap-2	406-015,014	1652	71	814	64	1651	812	1651	811	1651	808	1651	813
015-014Ap-3	406-015,014	791	40	723	83	791	720	790	717	790	711	791	723
015-014Ap-4	406-015,014	1461	64	834	69	1461	832	1461	830	1461	827	1461	833
015-014Ap-5	406-015,014	1983	88	857	61	1983	856	1983	855	1983	853	1983	857
015-014Ap-6	406-015,014	1214	54	878	70	1213	877	1213	875	1213	871	1214	878
015-014Ap-7	406-015,014	1139	52	861	70	1138	859	1138	857	1138	853	1138	861
015-014Ap-8	406-015,014	1312	59	1024	71	1312	1022	1311	1020	1311	1017	1312	1024
015-014Ap-9	406-015,014	1217	54	826	70	1217	824	1217	822	1216	818	1217	826
015-014Ap-10	406-015,014	1516	67	886	65	1516	884	1515	883	1515	880	1516	886
015-014Ap-11	406-015,014	2361	98	930	59	2361	929	2361	928	2360	926	2361	930
015-014Ap-12	406-015,014	952	45	703	78	952	700	952	698	952	693	952	702
015-046Ap-1	406-015,046	1574	69	368	75	1574	367	1574	365	1574	362	1574	368
015-048Ap-1	406-015,048	1127	65	609	77	1127	607	1127	605	1127	601	1127	609

		CRE age =0 Ma				CRE age =10 Ma		CRE age =50 Ma		CRE age =100 Ma		CRE age =200 Ma	
File Name	Clast No.	H_2O μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2 σ ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰	H_2O_{spa}	δD_{spa} ‰
015-059Ap-1	406-015,059	1166	57	754	77	1166	752	1166	750	1165	746	1166	754
017-010Ap-1	103-017,010	1606	75	321	73	1606	320	1606	318	1605	315	1606	321
017-011Ap-1	103-017,011	1714	80	412	68	1714	411	1713	409	1713	407	1714	412
017-011Ap-2	103-017,011	2322	96	479	65	2322	478	2322	477	2321	474	2322	478
017-013Ap-1	103-017,013	1920	87	562	66	1920	561	1920	560	1920	557	1920	562
020-018Ap-1	103-020,018	555	31	564	98	555	560	555	556	554	547	555	564
020-021Ap-1	103-020,021	3681	169	511	55	3681	511	3681	510	3681	509	3681	511
020-021Ap-2	103-020,021	3077	134	563	58	3077	562	3077	561	3077	559	3077	562
020-004Ap-1	103-020,004	1807	82	451	70	1807	450	1807	449	1806	446	1807	451
020-004Ap-2	103-020,004	2164	91	519	64	2164	518	2164	517	2163	515	2164	519
020-004Ap-3	103-020,004	2049	93	509	64	2049	508	2049	507	2048	504	2049	509
Melt inclusions													
010-023MI-1	406-010,023	26	6	411	349	26	177	26	-60	25	-545	26	364
012-009MI-1	406-012,009	89	16	-147	322	89	-216	89	-285	89	-423	89	-161
015-045MI-1	406-015,045	661	37	281	113	661	271	660	262	660	244	661	279
015-046MI-1	406-015,046	174	18	581	161	174	547	173	512	173	443	174	574
017-013MI-1	406-017,013	93	15	933	224	93	869	92	805	92	676	93	920
017-001MI-1	406-017,001	27	6	243	339	27	18	27	-210	26	-676	27	198
017-001MI-2	406-017,001	13	4	669	390	13	202	13	-279	12	-1283	13	577
020-013MI-1	103-020,013	367	29	-313	164	367	-330	367	-347	366	-381	367	-317
020-013MI-2	103-020,013	281	23	-310	182	281	-332	281	-354	280	-398	281	-314
020-018MI-1	103-020,018	114	11	-180	213	114	-234	114	-288	113	-396	114	-191
020-018MI-2	103-020,018	154	13	-94	180	154	-133	154	-173	154	-252	154	-102

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198 **Table S5 | Summary of water abundances and hydrogen isotope compositions of apatite and melt**
199 **inclusions from Apollo samples in the literature.**

Sample	Type*	H_2O/OH μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2σ ‰	Reference
Apatite						
10020	HB	1440	251	595	339	[2]
10044	HB	2221	128	622	48	[3]
10044	HB	877	26	536	57	[5, 27]
10044	HB	1250	200	567	36	[6]
10044	HB	960	160	600	83	[6]
10044	HB	826	25	606	33	[5, 27]
10044	HB	2748	159	623	49	[3]
10044	HB	850	140	622	126	[6]
10044	HB	2604	150	657	63	[3]
10044	HB	3063	177	682	46	[3]
10044	HB	2055	119	1005	46	[3]
10044	HB	2027	117	1013	58	[3]
10044	HB	1030	170	636	38	[6]
10044	HB	2036	118	697	49	[3]
10044	HB	1970	53	631	66	[3]
10044	HB	2193	60	617	64	[3]
10044	HB	2981	81	796	56	[3]
10044	HB	2633	71	710	61	[3]
10044	HB	1155	29	702	28	[5, 27]
10044	HB	3262	89	772	54	[3]
10044	HB	2258	61	697	69	[3]
10044	HB	1220	30	781	23	[5, 27]
10044	HB	2690	70	675	63	[3]
10044	HB	1581	41	533	85	[3]
10044	HB	1944	50	635	77	[3]
10044	HB	1105	29	933	31	[5, 27]
10044	HB	728	27	954	27	[5, 27]
10044	HB	1733	45	818	70	[3]
10044	HB	2275	59	891	63	[3]
10058	HB	2962	17	618	77	[7]
10058	HB	3115	18	648	82	[7]
10058	HB	2619	16	678	84	[7]
10058	HB	3012	17	724	74	[7]
10058	HB	2098	14	735	86	[7]
10058	HB	2431	15	884	85	[7]
10058	HB	2528	15	929	79	[7]
10058	HB	2518	15	949	80	[7]
10058	HB	2128	14	965	84	[7]
10058	HB	2112	14	1098	79	[7]
12002	LB	794	59	568	235	[2]
12002	LB	1286	91	1102	306	[2]
12004	LB	746	56	961	291	[2]
12018	LB	1989		1439	103	[8]
12039	LB	3590	510	391	62	[6]
12039	LB	3040	440	472	63	[6]
12039	LB	960	160	498	83	[6]
12039	LB	3040	440	542	65	[6]
12039	LB	5590	710	655	74	[6]
12039	LB	6050	740	672	35	[6]
12039	LB	2810	420	680	30	[6]
12039	LB	2916	57	698	28	[5, 27]

Sample	Type*	H_2O/OH μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2σ ‰	Reference
12039	LB	1996	43	720	30	[5, 27]
12039	LB	2784	95	729	28	[5, 27]
12039	LB	2570	390	730	31	[6]
12039	LB	5820	720	747	50	[6]
12039	LB	5607	35	767	63	[7]
12039	LB	3764	25	785	68	[7]
12039	LB	5540	700	792	38	[6]
12039	LB	7174	44	812	60	[7]
12039	LB	4492	29	822	65	[7]
12039	LB	2379	47	830	31	[5, 27]
12039	LB	3154	22	860	69	[7]
12039	LB	2773	20	875	72	[7]
12039	LB	1992	15	882	79	[7]
12039	LB	5450	700	875	40	[6]
12039	LB	4189	28	880	66	[7]
12039	LB	3646	24	889	67	[7]
12039	LB	2960	430	892	45	[6]
12039	LB	3932	26	904	67	[7]
12039	LB	5672	36	915	62	[7]
12039	LB	4552	30	967	65	[7]
12039	LB	6006	38	991	61	[7]
12039	LB	2740	410	1010	47	[6]
12040	LB	3	20	14	84	[5, 27]
12040	LB	16	20	-150	26	[5, 27]
12040	LB	105	21	9	163	[5, 27]
12040	LB	38	4	437	377	[2]
12040	LB	51	5	-17	369	[2]
12040	LB	25	2	298	426	[2]
12040	LB	61	6	47	403	[2]
12040	LB	63	6	204	317	[2]
12040	LB	40	4	5	355	[2]
12040	LB	44	4	16	391	[2]
12040	LB	75	7	203	256	[2]
12040	LB	91	9	122	558	[2]
12064	LB	1711	401	880	72	[3]
12064	LB	1479	347	831	74	[3]
12064	LB	2406	564	1009	72	[3]
12064	LB	2443	573	854	72	[3]
12064	LB	2402	563	1008	71	[3]
12064	LB	1979	464	960	73	[3]
12064	LB	2499	586	849	72	[3]
12064	LB	1656	388	940	75	[3]
12064	LB	1241	72	786	62	[3]
12064	LB	2300	133	955	45	[3]
12064	LB	2370	137	947	45	[3]
12064	LB	2406	139	911	45	[3]
12064	LB	4383	253	798	47	[3]
12064	LB	4163	240	811	38	[3]
14053	LB-Al-rich	640	100	-215	96	[6]
14053	LB-Al-rich	670	110	-202	31	[6]
14053	LB-Al-rich	930	150	-202	23	[6]
14053	LB-Al-rich	570	100	-179	40	[6]
14053	LB-Al-rich	870	140	-175	37	[6]
14053	LB-Al-rich	860	140	-172	24	[6]

Sample	Type*	H_2O/OH μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2σ ‰	Reference
14053	LB-Al-rich	2409	10	-86	36	[12]
14053	LB-Al-rich	692	12	-25	47	[12]
14053	LB-Al-rich	679	10	-15	47	[12]
14053	LB-Al-rich	1447	10	-14	36	[12]
14053	LB-Al-rich	721	11	53	49	[12]
14072	LB	323	19	112	230	[2]
14072	LB	68	4	306	341	[2]
14072	LB	93	5	137	323	[2]
14072	LB	81	5	10	410	[2]
14072	LB	265	15	142	345	[2]
14072	LB	74	4	434	308	[2]
15016	LB	377	50	-83	107	[4]
15016	LB	75	12	63	232	[4]
15016	LB	89	13	65	209	[4]
15016	LB	183	25	103	142	[4]
15016	LB	348	46	330	208	[4]
15016	LB	54	9	494	306	[4]
15058	LB	504	86	483	125	[7]
15058	LB	1418	105	510	69	[7]
15058	LB	439	85	556	106	[7]
15058	LB	895	94	565	73	[7]
15058	LB	382	84	611	109	[7]
15058	LB	410	84	637	130	[7]
15058	LB	877	94	637	73	[7]
15058	LB	712	90	647	87	[7]
15065	LB	2728	347	932	36	[4]
15065	LB	2886	367	970	35	[4]
15065	LB	2655	338	991	36	[4]
15065	LB	1815	232	1078	39	[4]
15386	KB	1464	58	89	99	[11]
15386	KB	871	34	140	180	[11]
15386	KB	1102	44	296	127	[11]
15386	KB	226	9	311	234	[11]
15386	KB	560	22	321	149	[11]
15386	KB	411	16	413	170	[11]
15386	KB	651	26	426	135	[11]
15386	KB	858	34	465	118	[11]
15386	KB	500	20	538	151	[11]
15386	KB	500	20	595	144	[11]
15386	KB	216	9	615	217	[11]
15386	KB	571	23	778	123	[11]
15555	LB	2271	107	454	145	[7]
15555	LB	6836	108	520	76	[7]
15555	LB	6022	174	578	56	[7]
15555	LB	3665	132	632	63	[7]
15555	LB	2653	113	682	115	[7]
15555	LB	5945	173	715	102	[7]
72275	KB	649	26	-277	211	[11]
72275	KB	1013	40	-180	172	[11]
72275	KB	1620	64	-157	133	[11]
72275	KB	695	27	-143	162	[11]
72275	KB	303	12	-139	249	[11]
72275	KB	494	20	-129	213	[11]
72275	KB	470	19	-118	386	[11]

Sample	Type*	H_2O/OH μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2σ ‰	Reference
72275	KB	86	3	-105	293	[11]
72275	KB	233	9	-81	460	[11]
72275	KB	151	6	15	228	[11]
72275	KB	94	4	184	316	[11]
72275	KB	328	13	187	254	[11]
75055	HB	604	23	621	35	[5, 27]
75055	HB	1070	180	735	36	[6]
75055	HB	1225	35	794	26	[5, 27]
75055	HB	1430	34	794	26	[5, 27]
75055	HB	1241	30	968	27	[5, 27]
Melt inclusions						
10020	HB	56	15	1942	611	[2]
10020	HB	50	13	1265	501	[2]
10020	HB	29	8	1585	643	[2]
10020	HB	166	44	-234	210	[2]
10020	HB	230	60	-4	229	[2]
10020	HB	222	40	759	397	[2]
10020	HB	124	23	-134	225	[2]
10020	HB	55	11	-421	216	[2]
10020	HB	10	2	-646	578	[2]
10020	HB	366	65	533	338	[2]
10058	HB	115	16	-58	271	[2]
10058	HB	252	27	-169	222	[2]
10058	HB	6	1	-912	553	[2]
10058	HB	130	32	-7	281	[2]
12002	HB	189	113	508	352	[2]
12002	HB	25	9	-412	407	[2]
12002	HB	15	9	-55	717	[2]
12002	HB	63	25	18	328	[2]
12002	HB	46	12	260	425	[2]
12002	HB	16	9	972	850	[2]
12004	LB	63	17	-104	243	[2]
12004	LB	39	10	-496	219	[2]
12004	LB	217	57	-13	318	[2]
12004	LB	38	10	-164	290	[2]
12004	LB	18	5	-332	386	[2]
12004	LB	63	17	73	342	[2]
12004	LB	26	7	-204	348	[2]
12008	LB	15	4	-185	362	[2]
12008	LB	11	3	345	567	[2]
12008	LB	141	26	-165	196	[2]
12008	LB	38	8	142	323	[2]
12008	LB	119	23	87	260	[2]
12008	LB	30	7	283	379	[2]
12008	LB	132	24	46	243	[2]
12018	LB	740		-183	212	[8]
12018	LB	62		-26	162	[8]
12018	LB	631		-123	125	[8]
12018	LB	700		6	185	[8]
12020	LB	90	18	-80	243	[2]
12020	LB	54	11	57	299	[2]
12020	LB	17	4	834	657	[2]
12020	LB	85	16	276	320	[2]
12020	LB	29	6	134	384	[2]

Sample	Type*	H_2O/OH μg.g^{-1}	2σ μg.g^{-1}	δD ‰	2σ ‰	Reference
12020	LB	34	7	-94	304	[2]
12020	LB	38	8	32	321	[2]
12020	LB	30	6	230	402	[2]
12035	LB	28		-209	124	[8]
12035	LB	156		-22	121	[8]
12040	LB	117	31	-393	200	[2]
12040	LB	194	51	-349	187	[2]
12040	LB	50	13	-520	376	[2]
12040	LB	63	17	-534	300	[2]
12040	LB	30	8	-597	570	[2]
12040	LB	118	31	-456	211	[2]
12040	LB	22	6			[2]
12040	LB	90		35	94	[8]
12040	LB	58		138	61	[8]
12040	LB	81		-53	92	[8]
12040	LB	27		-21	75	[8]
12040	LB	67		103	127	[8]
12040	LB	67		126	159	[8]
14072	LB	85	22	-442	235	[2]
14072	LB	125	33	-266	225	[2]
14072	LB	167	44	-108	250	[2]
14072	LB	47	12	-368	278	[2]
14072	LB	54	14	-433	261	[2]
15016	LB	14	4			[2]
15016	LB	3	1			[2]
15016	LB	150	39	-152	287	[2]
15016	LB	112	29	-325	257	[2]
74220	GB	1201		328	32	[25]
74220	GB	1144		189	19	[25]
74220	GB	680		313	37	[25]
74220	GB	752		246	46	[25]
74220	GB	372		285	32	[25]

200 *LB, Low-Ti basalts; HB, High-Ti basalts; KB, KREEP basalts; GB, Glass beads.