

Tables S1-S2

Table S1. Secondary ion intensity ratios and cross check of water contents as unknown samples using the calibration curves of apatite and glass standards.

Sample	Session*	Date	D/H ^a	2SD ^b (%)	¹ H/ ¹⁸ O ^a	2SD ^b (%)	H ₂ O ^c (ppm)	2SD ^d (ppm)	Error ^e (%)	
MORB	1	20110406	1.73E-04	6	0.220	10	2798	280	9	
	1	20110407	1.64E-04	3	0.212	7	2697	189	5	
	1	20110408	1.74E-04	1	0.229	9	2913	262	13	
	1	20110409	1.73E-04	2	0.221	11	2811	309	9	
	1	20110410	1.67E-04	3	0.207	2	2633	53	2	
	1	20110411	1.77E-04	10	0.229	11	2913	320	13	
	1	20110412	1.60E-04	8	0.236	7	3002	210	16	
	1	20110413	1.76E-04	11	0.208	12	2646	317	3	
			<i>Average</i>	<i>1.71E-04</i>	<i>7</i>	<i>0.220</i>	<i>10</i>	<i>2802</i>	<i>271</i>	<i>9</i>
	2	20111024	1.45E-04	3	0.250	6	3164	190	23	
	2	20111025	1.48E-04	5	0.208	8	2800	224	9	
	2	20111026	1.47E-04	2	0.214	7	2829	198	10	
	2	20111029	1.43E-04	1	0.227	7	2917	204	13	
	2	20111030	1.47E-04	7	0.204	5	2558	128	1	
	2	20111031	1.42E-04	2	0.206	2	2614	52	1	
	2	20111101	1.43E-04	2	0.217	4	2625	105	2	
	2	20111102	1.46E-04	7	0.211	4	2604	104	1	
			<i>Average</i>	<i>1.45E-04</i>	<i>3</i>	<i>0.217</i>	<i>13</i>	<i>2764</i>	<i>413</i>	<i>7</i>
	3	20120419	1.71E-04	3	0.180	12	2444	293	5	
	3	20120420	1.78E-04	6	0.172	13	2486	323	4	
	3	20120423	1.74E-04	5	0.207	9	2928	264	14	
	3	20120424	1.64E-04	4	0.197	0	2918	9	13	
	3	20120425	1.64E-04	4	0.210	1	3067	31	19	
	3	20120426	1.72E-04	4	0.176	8	2584	207	0	
	3	20120427	1.68E-04	3	0.232	1	3147	31	22	
	3	20120428	1.76E-04	2	0.201	15	2832	425	10	
			<i>Average</i>	<i>1.71E-04</i>	<i>6</i>	<i>0.197</i>	<i>20</i>	<i>2801</i>	<i>532</i>	<i>9</i>
4	20121214	1.61E-04	4	0.225	15	3198	480	24		
4	20121215	1.55E-04	4	0.170	16	2280	365	12		
4	20121217	1.58E-04	4	0.150	14	2105	295	18		

4	20121218	1.57E-04	4	0.189	11	2696	297	5	
4	20121219	1.57E-04	4	0.244	17	3327	566	29	
4	20121220	1.57E-04	3	0.240	15	3198	480	24	
	<i>Average</i>	<i>1.58E-04</i>	<i>3</i>	<i>0.203</i>	<i>38</i>	<i>2801</i>	<i>1043</i>	<i>9</i>	
5	20130827	1.53E-04	5	0.180	21	2503	531	3	
5	20130828	1.58E-04	4	0.144	16	2010	312	22	
5	20130829	1.55E-04	3	0.240	16	3337	521	29	
5	20130830	1.52E-04	4	0.230	14	3198	459	24	
5	20130831	1.55E-04	5	0.152	14	2116	296	18	
5	20130901	1.54E-04	7	0.206	18	2872	517	11	
5	20130903	1.53E-04	5	0.158	19	2204	419	15	
5	20130904	1.51E-04	5	0.151	17	2110	359	18	
5	20130905	1.49E-04	6	0.232	21	3226	662	25	
5	20130906	1.53E-04	4	0.227	19	3163	594	23	
5	20130907	1.51E-04	4	0.236	20	3291	668	28	
5	20130908	1.51E-04	3	0.211	13	2940	375	14	
5	20130909	1.51E-04	5	0.228	17	3182	534	23	
5	20130910	1.51E-04	5	0.225	16	3135	509	22	
5	20130912	1.51E-04	2	0.185	14	2580	365	0	
5	20130913	1.54E-04	5	0.221	13	3083	395	20	
5	20130914	1.55E-04	4	0.221	14	3082	431	20	
5	20130915	1.54E-04	4	0.223	9	3111	274	21	
5	20130916	1.57E-04	2	0.223	18	3108	562	21	
5	20130920	1.52E-04	2	0.211	14	2937	397	14	
5	20130923	1.55E-04	3	0.193	14	2692	364	4	
	<i>Average</i>	<i>1.53E-04</i>	<i>3</i>	<i>0.205</i>	<i>30</i>	<i>2851</i>	<i>857</i>	<i>11</i>	
6	20140425	1.67E-04	5	0.192	14	2693	413	4	
6	20140426	1.67E-04	6	0.183	17	2602	478	1	
6	20140427	1.69E-04	2	0.178	19	2565	504	1	
	<i>Average</i>	<i>1.68E-04</i>	<i>1</i>	<i>0.184</i>	<i>8</i>	<i>2620</i>	<i>131</i>	<i>5</i>	
DAP	1	20110408	1.82E-04	4	0.033	12	420	50	12
	1	20110410	1.78E-04	8	0.042	12	534	64	12
	1	20110412	1.92E-04	4	0.023	9	293	26	39
		<i>Average</i>	<i>1.84E-04</i>	<i>8</i>	<i>0.033</i>	<i>58</i>	<i>416</i>	<i>241</i>	<i>13</i>

2	20111024	1.36E-04	4	0.057	11	721	79	51
2	20111025	1.37E-04	2	0.063	14	848	119	77
2	20111026	1.35E-04	4	0.056	13	740	96	55
2	20111029	1.30E-04	1	0.036	5	463	23	3
2	20111030	1.33E-04	6	0.037	8	464	37	3
2	20111031	1.33E-04	7	0.041	4	520	21	9
2	20111101	1.29E-04	3	0.045	14	544	76	14
2	20111102	1.29E-04	9	0.046	1	568	6	19
	<i>Average</i>	<i>1.33E-04</i>	<i>5</i>	<i>0.048</i>	<i>43</i>	<i>609</i>	<i>286</i>	<i>27</i>
3	20120419	1.85E-04	13	0.028	4	380	15	21
3	20120420	1.74E-04	5	0.032	3	462	14	3
3	20120423	1.78E-04	2	0.034	2	481	10	1
3	20120424	1.69E-04	10	0.035	0	518	2	8
3	20120425	1.85E-04	7	0.026	1	380	4	21
3	20120426	1.85E-04	1	0.028	1	411	4	14
3	20120427	1.95E-04	3	0.024	4	326	13	32
3	20120428	1.65E-04	2	0.031	1	437	4	9
	<i>Average</i>	<i>1.80E-04</i>	<i>11</i>	<i>0.030</i>	<i>26</i>	<i>424</i>	<i>125</i>	<i>11</i>
4	20121214	1.69E-04	11	0.036	10	512	51	7
4	20121215	1.60E-04	4	0.037	5	496	25	4
4	20121217	1.71E-04	17	0.032	7	449	31	6
4	20121218	1.68E-04	10	0.036	6	514	31	7
4	20121219	1.65E-04	9	0.036	7	491	34	3
4	20121220	1.66E-04	10	0.036	6	480	29	0
	<i>Average</i>	<i>1.67E-04</i>	<i>5</i>	<i>0.036</i>	<i>10</i>	<i>490</i>	<i>48</i>	<i>3</i>
5	20130827	1.70E-04	9	0.022	15	313	47	35
5	20130828	1.66E-04	7	0.041	5	572	31	20
5	20130829	1.74E-04	11	0.039	8	548	44	15
5	20130830	1.72E-04	11	0.039	5	544	24	14
5	20130831	1.73E-04	8	0.025	0	344	1	28
5	20130903	1.58E-04	7	0.031	4	429	19	10
5	20130904	1.60E-04	16	0.023	18	321	58	33
5	20130905	1.67E-04	10	0.029	7	404	29	16
5	20130906	1.70E-04	11	0.029	8	397	30	17
5	20130907	1.71E-04	13	0.027	4	376	14	21
5	20130908	1.71E-04	16	0.026	5	356	19	26

5	20130909	1.65E-04	13	0.030	18	411	74	14	
5	20130910	1.77E-04	8	0.029	20	404	82	16	
5	20130912	1.67E-04	9	0.030	13	423	53	12	
5	20130913	1.67E-04	10	0.029	8	403	32	16	
5	20130913	1.65E-04	11	0.030	9	412	37	14	
5	20130914	1.75E-04	7	0.029	12	404	47	15	
5	20130915	1.76E-04	11	0.029	16	400	65	16	
5	20130916	1.81E-04	5	0.029	5	399	20	17	
5	20130920	1.50E-04	14	0.028	2	386	9	19	
5	20130921	1.67E-04	7	0.029	15	408	61	15	
5	20130923	1.71E-04	8	0.025	2	347	7	27	
	<i>Average</i>	<i>1.69E-04</i>	<i>8</i>	<i>0.029</i>	<i>33</i>	<i>409</i>	<i>134</i>	<i>14</i>	
6	20140425	1.86E-04	6	0.032	4	449	20	6	
6	20140426	1.71E-04	6	0.032	3	452	21	6	
6	20140427	1.80E-04	17	0.029	18	414	77	14	
	<i>Average</i>	<i>1.79E-04</i>	<i>9</i>	<i>0.031</i>	<i>12</i>	<i>438</i>	<i>42</i>	<i>10</i>	
KOV	2	20111024	1.52E-04	4	0.764	7	9669	677	1
	2	20111025	1.51E-04	4	0.717	3	9652	290	2
	2	20111026	1.49E-04	3	0.736	5	9730	486	1
	2	20111029	1.50E-04	2	0.756	2	9714	194	1
	2	20111030	1.46E-04	9	0.781	2	9793	196	0
	2	20111031	1.47E-04	2	0.784	5	9948	497	2
	2	20111101	1.50E-04	4	0.808	1	9776	98	0
	2	20111102	1.50E-04	1	0.793	3	9788	294	0
		<i>Average</i>	<i>1.49E-04</i>	<i>3</i>	<i>0.767</i>	<i>8</i>	<i>9759</i>	<i>186</i>	<i>0</i>
	3	20120419	1.69E-04	2	0.720	3	9777	293	0
	3	20120420	1.74E-04	1	0.679	4	9813	393	0
	3	20120423	1.78E-04	6	0.680	0	9620	38	2
	3	20120424	1.76E-04	8	0.660	3	9775	293	0
	3	20120425	1.73E-04	2	0.669	2	9770	195	0
	3	20120426	1.73E-04	2	0.667	1	9794	98	0
	3	20120427	1.71E-04	3	0.715	1	9698	97	1
	3	20120428	1.74E-04	1	0.678	1	9551	96	3
		<i>Average</i>	<i>1.74E-04</i>	<i>3</i>	<i>0.684</i>	<i>7</i>	<i>9725</i>	<i>188</i>	<i>1</i>

4	20121214	1.62E-04	3	0.679	3	9651	290	2	
4	20121215	1.58E-04	3	0.726	4	9736	389	1	
4	20121217	1.61E-04	3	0.717	2	10062	201	3	
4	20121218	1.60E-04	2	0.688	6	9815	589	0	
4	20121219	1.61E-04	2	0.694	7	9463	662	3	
4	20121221	1.61E-04	2	0.686	4	9141	366	7	
	<i>Average</i>	<i>1.61E-04</i>	<i>2</i>	<i>0.698</i>	<i>5</i>	<i>9645</i>	<i>631</i>	<i>2</i>	
5	20130827	1.57E-04	2	0.688	3	9582	279	2	
5	20130828	1.61E-04	3	0.677	6	9439	566	4	
5	20130829	1.61E-04	0	0.689	4	9604	341	2	
5	20130829	1.60E-04	2	0.656	3	9140	236	7	
5	20130830	1.59E-04	2	0.693	3	9661	290	1	
5	20130831	1.57E-04	4	0.710	3	9899	293	1	
5	20130905	1.61E-04	3	0.675	6	9414	600	4	
5	20130906	1.57E-04	3	0.681	4	9493	365	3	
5	20130907	1.59E-04	2	0.691	3	9627	267	2	
5	20130908	1.59E-04	3	0.679	4	9467	356	3	
5	20130909	1.56E-04	4	0.693	3	9660	249	1	
5	20130910	1.61E-04	3	0.681	7	9485	692	3	
5	20130911	1.59E-04	0	0.689	0	9606	39	2	
5	20130912	1.59E-04	4	0.668	5	9306	499	5	
5	20130913	1.62E-04	2	0.696	3	9705	247	1	
5	20130914	1.60E-04	0	0.699	1	9747	81	1	
5	20130915	1.61E-04	4	0.699	2	9744	145	1	
5	20130916	1.60E-04	3	0.690	1	9619	59	2	
5	20130921	1.61E-04	1	0.679	3	9457	318	4	
5	20130923	1.60E-04	2	0.680	3	9473	297	3	
	<i>Average</i>	<i>1.60E-04</i>	<i>2</i>	<i>0.686</i>	<i>4</i>	<i>9556</i>	<i>341</i>	<i>3</i>	
6	20140425	1.64E-04	4	0.695	5	9768	552	0	
6	20140426	1.64E-04	3	0.688	2	9772	360	0	
6	20140427	1.65E-04	1	0.680	3	9806	395	0	
	<i>Average</i>	<i>1.64E-04</i>	<i>1</i>	<i>0.687</i>	<i>2</i>	<i>9782</i>	<i>42</i>	<i>0</i>	
1833-1	5	20130827	1.56E-04	1	1.488	2	20737	377	15
	5	20130829	1.57E-04	5	1.576	8	21967	1811	10
	5	20130830	1.55E-04	4	1.601	3	22310	765	8

	5	20130901	1.53E-04	2	1.594	6	22217	1228	9
	5	20130906	1.51E-04	2	1.543	8	21506	1634	12
	5	20130907	1.52E-04	2	1.507	2	20998	499	14
	5	20130908	1.55E-04	2	1.479	1	20606	243	15
	5	20130913	1.58E-04	3	1.452	6	20240	1203	17
	5	20130914	1.57E-04	3	1.517	2	21147	425	13
	5	20130915	1.54E-04	2	1.620	3	22581	745	7
		<i>Average</i>	<i>1.54E-04</i>	<i>3</i>	<i>1.539</i>	<i>8</i>	<i>21451</i>	<i>1704</i>	<i>12</i>
1833-11	5	20130828	1.56E-04	2	0.834	11	11617	1248	3
	5	20130829	1.60E-04	2	0.874	1	12176	128	2
	5	20130830	1.57E-04	3	0.911	4	12699	530	6
	5	20130901	1.53E-04	5	0.923	6	12862	815	7
	5	20130906	1.56E-04	3	0.836	7	11647	770	3
	5	20130907	1.62E-04	6	0.883	8	12307	938	3
	5	20130908	1.59E-04	3	0.910	1	12683	139	6
		<i>Average</i>	<i>1.58E-04</i>	<i>4</i>	<i>0.881</i>	<i>8</i>	<i>12284</i>	<i>1009</i>	<i>2</i>
519-4-1	5	20130828	1.44E-04	11	0.132	2	1833	92	8
	5	20130829	1.62E-04	12	0.126	8	1760	136	4
	5	20130830	1.63E-04	5	0.116	5	1622	134	5
	5	20130906	1.40E-04	10	0.122	7	1704	114	0
	5	20130907	1.49E-04	6	0.138	4	1919	141	13
	5	20130908	1.51E-04	8	0.148	2	2063	104	21
	5	20130913	1.40E-04	9	0.121	7	1682	109	1
	5	20130923	1.58E-04	7	0.126	6	1758	100	3
		<i>Average</i>	<i>1.51E-04</i>	<i>12</i>	<i>0.129</i>	<i>16</i>	<i>1793</i>	<i>16</i>	<i>5</i>
ND 70-01	5	20130829	1.60E-04	2	0.721	3	10046	264	1
	5	20130830	1.59E-04	4	0.713	2	9930	178	1
	5	20130901	1.61E-04	4	0.722	2	10058	224	1
	5	20130907	1.53E-04	4	0.725	5	10105	521	1
	5	20130913	1.62E-04	7	0.669	6	9319	562	7
	5	20130914	1.61E-04	8	0.660	3	9204	287	8
	5	20130915	1.61E-04	2	0.689	7	9600	681	4
		<i>Average</i>	<i>1.60E-04</i>	<i>4</i>	<i>0.700</i>	<i>8</i>	<i>9752</i>	<i>751</i>	<i>3</i>

*Analytical sessions 1 and 2 were carried out in the combined mode, and the sessions 3, 4, 5 and 6 in the multi-collection mode;

^aAverage of the analyses carried out within single days;

^bStandard deviation of the analyses carried out within single days;

^cWater content corrected by calibration curves;

^dAnalytical error: including the counting errors of the samples and the analytical errors of the water content calibration curves;

^eThe difference between the measurements and the recommended values: $([\text{H}_2\text{O}]_m - [\text{H}_2\text{O}]_r) / [\text{H}_2\text{O}]_r \times 100\%$, where $[\text{H}_2\text{O}]_m$ is the measured value and $[\text{H}_2\text{O}]_r$ is the recommended value.

Italic Average: averages and standard deviations of all day analyses within the same analytical sessions.

Table S2. Secondary ion intensity ratios and cross check of water contents as unknown samples using the calibration curves of apatite and glass standards in element mode.

Date	Sample	$^1\text{H}/^{18}\text{O}^{\text{a}}$	2SD ^b (%)	H ₂ O ^c (ppm)	2SD ^d (ppm)	Error ^e (%)
20140504	DAP	1.62E-01	1.8	440	11	8.0
20140504	KOV	3.62E+00	2.4	9802	300	0.0
20140505	DAP	1.52E-01	7.0	408	31	14.7
20140505	KOV	3.65E+00	3.3	9805	383	0.1
20140506	519-4-1	1.84E-01	4.2	2162	118	27.2
20140506	1833-1	2.05E+00	3.9	24170	1230	0.5
20140506	1833-11	1.02E+00	2.4	12020	434	0.2
20140506	MORB	1.90E-01	32.4	2235	753	13.4
20140506	ND 70-01	8.86E-01	2.2	10437	360	4.4
20140507	KOV	3.62E+00	2.2	9800	272	0.0
20140531	519-4-1	1.86E-01	3.8	2174	126	27.9
20140531	1833-1	2.05E+00	2.1	23943	992	1.5
20140531	1833-11	9.89E-01	6.2	11571	944	3.6
20140531	KOV	3.59E+00	1.5	9720	197	0.8
20140531	MORB	1.94E-01	8.6	2275	241	11.8
20140531	ND7001	9.21E-01	3.2	10781	557	7.8
20140615	519-4-1	1.85E-01	0.5	2061	61	21.3
20140615	1833-1	2.13E+00	1.4	23738	900	2.3
20140615	1833-11	1.09E+00	0.9	12168	403	1.4
20140615	ND 70-01	9.97E-01	3.2	11103	621	11.0
20140616	DAP	1.62E-01	5.0	426	26	10.9
20140616	KOV	3.68E+00	2.6	9659	373	1.4
20140616	MORB	1.49E-01	23.9	1680	441	34.9
20140616	ND 70-01	9.57E-01	2.5	10759	531	7.6

^aAverage of the analyses carried out within single days;

^bStandard deviation of the analyses carried out within single days;

^cWater content corrected by calibration curves;

^dAnalytical error: including the counting errors of the samples and the analytical errors of the water content calibration curves;

^eThe difference between the measurements and the recommended values: $([\text{H}_2\text{O}]_m - [\text{H}_2\text{O}]_r) / [\text{H}_2\text{O}]_r \times 100\%$, where $[\text{H}_2\text{O}]_m$ is the measured value and $[\text{H}_2\text{O}]_r$ is the recommended value.