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Supplementary Materials

Tailoring the FeO/SiO_2 Ratio in Electric Arc Furnace Slags to Minimize the Leaching of Vanadium and Chromium

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1. FactSage™ Calculations

Table S1. Input data and selected base phases with end members for the performed FactSage™ calculations.

			Input			
	FeO	SiO_2	CaO	Al_2O_3	MgO	Cr_2O_3
Sample A	44.89	12.27	24.92	8.57	7.30	2.04
Sample B	42.04	12.29	29.31	10.50	3.82	2.04
Sample C	28.98	27.84	26.30	10.15	4.36	2.37
			Phase selection*			
Liquid phase	SLAGA					
Oxides	SPINA	MeO_A				
Silicates	cPyrA	WOLLA	bC2SA	aC2SA	Mel_A	OlivA

*from FactSage™ database FToxid (version 7.3):

"SLAGA: Oxides of: Al, As, B, Ba, Ca, Co, Cr(II), Cr(III), Cu(I), Fe(II), Fe(III), Ge, K, Mg, Mn(II), Mn(III), Na, Ni, P, Pb, Si, Sn, Ti(III), Ti(IV), Zn, Zr + (S in dilute solution (<10%))

SPINA: AB_2O_4-type cubic spinel solution containing Al-Co-Cr-Fe-Mg-Ni-Zn-O (2+ and 3+ oxidation states only)

MeO_A: Fe(II)O,CaO,MgO,Mn(II)O,NiO,CoO at all compositions + (Al,Fe(III),Cr(III),Ti(IV),Zn,Zr in dilute amounts)

cPyrA: $MSiO_3$ – MAl_2SiO_6 – MFe_2SiO_6 solution (where: M = Fe(II), Ca, Mg)

WOLLA: $CaSiO_3$ with $MgSiO_3$, $FeSiO_3$, $MnSiO_3$ and $BaSiO_3$ in solution

bC2SA: Ca_2SiO_4 – Ba_2SiO_4, solution + (Mg_2SiO_4, Fe_2SiO_4, Mn_2SiO_4, Pb_2SiO_4, Zn_2SiO_4, $Ca_3B_2O_6$ in dilute amounts)

aC2SA: Ca_2SiO_4 + (Mg_2SiO_4, Fe_2SiO_4, Mn_2SiO_4, Ba_2SiO_4, $Ca_3B_2O_6$ in dilute amounts)

Mel_A: $(Ca,Pb)_2[Mg,Fe(II),Fe(III),Al,Zn]\{Al,Fe(III),Si\}_2O_7$

OlivA: Mg_2SiO_4-Ca_2SiO_4-Fe_2SiO_4-Mn_2SiO_4-Co_2SiO_4-Ni_2SiO_4-Zn_2SiO_4 solution"

2. Electron Microprobe Analyses

The results of the chemical mineral EMP analyses performed on individual grains are presented in this chapter. Concentrations of Fe and Mn are shown as FeO and MnO, respectively. However, for some samples, e.g., sample BC3, where the total values of spinel were less than 100 %, additional calculations were performed, distinguishing between Fe^{2+} and Fe^{3+} and adjusting the sum of cations in spinel to a value of 3 (Table S22). The results revealed that spinels also contain considerable

amounts of Fe^{3+}. The presented F concentrations were measured on a TAP crystal; however, recent analyses on slag samples measuring F on a LDE1 crystal showed no F signal throughout the measured grains. Therefore it is assumed, that the detected F signals may be artifacts.

Table S2. Results of chemical mineral EMP analyses performed on the original sample A (oxides).

SAMPLE A	Wuestite phases										Spinel phases					Detection limit
	Oxide [mass-%]										Oxide [mass-%]					
	an1	an2	an3	an4	an5	an6	an7	an8	an9	an10	an11	an12	an13	an14	an15	
SiO_2	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Al_2O_3	0.235	0.298	0.229	0.328	0.256	0.208	0.267	0.252	0.156	0.245	21.093	19.852	27.253	22.843	23.649	
Cr_2O_3	1.207	1.126	1.396	1.069	0.814	1.013	1.105	1.057	0.449	0.554	38.827	42.862	34.566	37.783	38.337	
V_2O_3	bdl	bdl	0.056	0.086	0.056	0.067	0.146	bdl	0.049	0.076	0.191	0.170	0.289	0.111	0.130	
FeO*	85.895	87.117	85.919	85.873	85.068	86.127	85.462	87.174	87.771	87.232	25.177	22.585	21.469	24.957	24.180	
MnO	9.047	8.221	8.737	9.309	8.883	8.552	8.866	8.882	8.913	8.888	3.998	3.893	4.317	3.924	3.816	
MgO	5.587	5.579	6.758	5.768	5.944	5.311	5.916	5.399	4.947	4.651	10.834	10.624	11.819	10.820	11.568	
CaO	0.171	0.276	0.302	0.283	0.384	0.308	0.330	0.324	0.782	0.596	0.443	0.398	0.747	0.445	0.377	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.804	0.792	0.843	0.555	0.762	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.072	0.086	bdl	bdl	bdl	bdl	bdl	
Total	102.181	102.755	103.490	102.732	101.486	101.734	102.132	103.198	103.139	102.366	101.045	100.893	101.005	101.212	102.570	
	Element [mass-%]										Element [mass-%]					mass-%
Si	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.026
Al	0.124	0.158	0.121	0.174	0.135	0.110	0.141	0.133	0.083	0.130	11.163	10.507	14.424	12.090	12.516	0.012
Cr	0.826	0.770	0.955	0.731	0.557	0.693	0.756	0.723	0.307	0.379	26.565	29.326	23.650	25.851	26.230	0.036
V	bdl	bdl	0.038	0.058	0.038	0.046	0.099	bdl	0.033	0.052	0.130	0.116	0.196	0.075	0.088	0.030
Fe	66.767	67.716	66.785	66.749	66.124	66.947	66.430	67.761	68.225	67.806	19.570	17.555	16.688	19.399	18.795	0.046
Mn	7.007	6.367	6.766	7.209	6.879	6.623	6.866	6.879	6.903	6.883	3.096	3.015	3.343	3.039	2.955	0.020
Mg	3.369	3.364	4.075	3.478	3.584	3.203	3.568	3.256	2.983	2.805	6.533	6.407	7.127	6.525	6.976	0.016
Ca	0.122	0.197	0.216	0.202	0.274	0.220	0.236	0.232	0.559	0.426	0.317	0.284	0.534	0.318	0.269	0.018
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.804	0.792	0.843	0.555	0.762	0.167
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.048	0.057	bdl	bdl	bdl	bdl	bdl	0.038
O (calculated)	23.940	24.100	24.489	24.104	23.850	23.730	23.983	24.145	23.998	23.811	32.858	32.868	34.167	33.356	33.944	
Total	102.181	102.755	103.490	102.732	101.486	101.734	102.132	103.198	103.139	102.366	101.045	100.893	101.005	101.212	102.570	
	Cations based on 1 O										Cations based on 4 O					
Si	0.000	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.001	0.002	0.001	0.000	0.002	
Al	0.003	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.806	0.758	1.001	0.860	0.875	
Cr	0.011	0.003	0.004	0.003	0.002	0.003	0.003	0.003	0.001	0.002	0.995	1.098	0.852	0.954	0.951	
V	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.004	0.007	0.003	0.003	
Fe	0.799	0.806	0.781	0.792	0.795	0.803	0.792	0.804	0.815	0.817	0.683	0.612	0.560	0.666	0.635	
Mn	0.085	0.077	0.080	0.087	0.084	0.081	0.083	0.083	0.084	0.084	0.110	0.107	0.114	0.106	0.101	
Mg	0.093	0.092	0.110	0.095	0.099	0.088	0.098	0.089	0.082	0.078	0.524	0.513	0.549	0.515	0.541	
Ca	0.002	0.003	0.004	0.003	0.005	0.004	0.004	0.004	0.009	0.007	0.015	0.014	0.025	0.015	0.013	
Mo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Sum cations	0.993	0.983	0.981	0.982	0.987	0.980	0.981	0.984	0.993	0.990	3.138	3.108	3.110	3.120	3.121	

Table S3. Results of chemical mineral EMP analyses performed on the original sample A (silicates).

SAMPLE A	Melilite phases					Olivine phases					Detection limit
	Oxide [mass-%]					Oxide [mass-%]					
	an1	an2	an3	an4	an5	an6	an7	an8	an9	an10	
SiO_2	27.670	28.308	27.795	26.824	28.747	33.745	33.302	32.990	32.177	33.413	
Al_2O_3	23.854	24.715	24.477	25.799	22.978	0.063	0.069	0.085	0.132	0.088	
Cr_2O_3	0.079	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.046	bdl	0.049	
FeO*	5.651	5.265	5.512	5.025	5.604	20.047	19.959	19.963	19.286	20.569	
MnO	0.755	0.713	0.729	0.572	0.674	5.865	5.904	5.905	5.919	5.901	
MgO	2.563	2.478	2.431	1.940	3.153	5.561	5.325	5.089	4.887	5.607	
CaO	39.095	39.255	39.080	39.479	39.157	36.322	36.606	37.312	36.224	36.736	
F	bdl	bdl	bdl	bdl	bdl	0.269	bdl	bdl	0.188	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	99.667	100.734	100.102	99.659	100.341	101.882	101.199	101.533	98.763	102.382	
	Element [mass-%]					Element [mass-%]					mass-%
Si	12.934	13.232	12.992	12.538	13.437	15.773	15.566	15.420	15.040	15.618	0.026
Al	12.625	13.080	12.954	13.654	12.161	0.033	0.037	0.045	0.070	0.047	0.012
Cr	0.054	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.036
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.031	bdl	0.033	0.030
Fe	4.393	4.093	4.284	3.906	4.356	15.583	15.514	15.517	14.991	15.988	0.046
Mn	0.585	0.552	0.565	0.443	0.522	4.542	4.572	4.573	4.584	4.570	0.020
Mg	1.546	1.494	1.466	1.170	1.901	3.353	3.211	3.069	2.947	3.381	0.016
Ca	27.941	28.055	27.930	28.215	27.985	25.959	26.162	26.666	25.889	26.255	0.018
F	bdl	bdl	bdl	bdl	bdl	0.269	bdl	bdl	0.188	bdl	0.167
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.038
O (calculated)	39.591	40.227	39.857	39.719	39.959	36.286	36.114	36.063	35.034	36.476	
Total	99.667	100.734	100.102	99.659	100.341	101.882	101.199	101.533	98.763	102.382	
	Cations based on 7 O					Cations based on 4 O					
Si	1.303	1.312	1.300	1.259	1.341	0.991	0.982	0.974	0.978	0.976	
Al	1.324	1.350	1.349	1.427	1.263	0.002	0.002	0.003	0.005	0.003	
Cr	0.003	0.000	0.001	0.001	0.000	0.001	0.000	0.001	0.000	0.000	
V	0.000	0.000	0.002	0.000	0.001	0.001	0.000	0.001	0.000	0.001	
Fe	0.223	0.204	0.216	0.197	0.219	0.492	0.492	0.493	0.490	0.502	
Mn	0.030	0.028	0.029	0.023	0.027	0.146	0.147	0.148	0.152	0.146	
Mg	0.180	0.171	0.169	0.136	0.219	0.243	0.234	0.224	0.221	0.244	
Ca	1.972	1.949	1.958	1.985	1.957	1.142	1.157	1.181	1.180	1.149	
Mo	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	
Sum cations	5.034	5.013	5.024	5.027	5.027	3.019	3.016	3.026	3.028	3.022	

Table S4. Results of chemical mineral EMP analyses performed on the original sample B (oxides and silicates).

SAMPLE B	Spinel phases				Brownmillerite phase					Detection limit
	Oxide [mass-%]				Oxide [mass-%]					
	an13	an14	an15	an16	an4	an5	an6	an7	an8	
SiO_2	bdl	0.078	bdl	bdl	0.066	0.106	0.111	0.088	0.100	
Al_2O_3	12.760	12.182	12.023	11.168	48.031	48.131	48.398	48.094	48.265	
Cr_2O_3	57.104	58.033	59.581	60.560	0.075	0.046	bdl	0.317	0.102	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.665	bdl	
TiO_2	0.195	0.213	0.173	0.233	0.079	0.026	0.035	0.031	0.049	
FeO*	17.500	16.633	15.241	15.629	3.003	2.700	2.979	2.636	3.032	
MnO	6.037	5.448	6.075	5.572	0.357	0.314	0.289	0.370	0.352	
MgO	13.922	14.858	14.268	14.691	0.088	0.078	0.069	0.095	0.082	
CaO	0.921	1.051	1.024	0.825	46.916	46.765	46.867	46.549	46.877	
F	1.196	1.203	1.225	1.246	1.637	0.939	0.976	0.942	0.774	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	109.240	109.302	109.440	109.780	99.719	99.181	99.485	99.650	99.498	
	Element [mass-%]				Element [mass-%]					mass-%
Si	bdl	0.036	bdl	bdl	0.031	0.050	0.052	0.041	0.047	0.019
Al	6.753	6.447	6.363	5.911	25.420	25.473	25.615	25.454	25.544	0.015
Cr	39.071	39.706	40.765	41.435	0.051	0.031	bdl	0.217	0.070	0.029
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.452	bdl	0.349
Fe	13.603	12.929	11.847	12.148	2.334	2.099	2.316	2.049	2.357	0.060
Mn	4.675	4.219	4.705	4.315	0.276	0.243	0.224	0.287	0.273	0.034
Mg	8.395	8.960	8.604	8.859	0.053	0.047	0.042	0.057	0.049	0.013
Ca	0.658	0.751	0.732	0.590	33.530	33.422	33.495	33.268	33.502	0.017
F	1.196	1.203	1.225	1.246	1.637	0.939	0.976	0.942	0.774	0.165
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.127
O (calculated)	34.822	34.975	34.972	35.023	36.365	36.659	36.766	36.883	36.841	
Total	109.240	109.302	109.440	109.780	99.719	99.181	99.485	99.650	99.498	
	Cations based on 4 O				Cations based on 5 O					
Si	0.001	0.002	0.001	0.001	0.002	0.004	0.004	0.003	0.004	
Al	0.460	0.437	0.432	0.400	2.073	2.060	2.066	2.046	2.056	
Cr	1.381	1.397	1.435	1.456	0.002	0.001	0.000	0.009	0.003	
V	0.000	0.003	0.007	0.009	0.000	0.009	0.000	0.019	0.000	
Fe	0.448	0.424	0.388	0.398	0.092	0.082	0.090	0.080	0.092	
Mn	0.156	0.141	0.157	0.144	0.011	0.010	0.009	0.011	0.011	
Mg	0.635	0.675	0.648	0.666	0.005	0.004	0.004	0.005	0.004	
Ca	0.030	0.034	0.033	0.027	1.840	1.820	1.818	1.800	1.815	
Mo	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	
Sum cations	3.112	3.113	3.101	3.100	4.026	3.990	3.991	3.974	3.985	

Table S5. Results of chemical mineral EMP analyses performed on the original sample C (oxides).

SAMPLE C	Spinel phases														Detection limit
	Oxide [mass-%]														
	C1_an1	C1_an2	C1_an3	C1_an4	C1_an5	C1_an6	C1_an7	C2_an1	C2_an2	C2_an3	C2_an4	C2_an5	C2_an6	C2_an7	
SiO_2	bdl	bdl	bdl	bdl	0.604	bdl	bdl	2.583	bdl	0.216	bdl	0.358	0.361	0.114	
Al_2O_3	21.366	15.601	18.454	16.724	22.897	25.218	16.112	21.983	14.975	14.610	23.549	28.678	16.806	22.527	
Cr_2O_3	40.153	46.383	43.230	48.041	39.508	36.725	49.687	37.105	49.457	45.686	38.253	29.888	38.362	40.476	
V_2O_3	0.194	0.094	0.141	0.131	0.161	0.258	0.177	0.281	0.103	0.213	0.217	0.200	0.168	0.161	
FeO*	17.637	19.493	18.052	16.387	17.353	17.610	13.953	16.874	17.937	14.341	16.602	19.399	16.874	17.123	
MnO	5.521	5.573	5.913	5.934	5.482	5.465	5.859	5.635	5.590	5.840	6.776	5.410	5.256	5.133	
MgO	7.216	6.253	7.410	6.957	7.154	7.169	7.535	7.642	6.430	7.869	7.172	7.166	8.132	7.160	
CaO	0.469	0.629	0.698	0.461	0.831	0.498	0.553	1.879	0.420	0.264	0.357	0.517	0.618	0.518	
F	1.193	1.074	0.523	0.874	1.358	0.980	1.234	1.162	1.201	0.882	0.978	0.750	1.027	0.930	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	0.057	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	93.323	94.718	94.264	95.174	94.786	93.544	94.684	94.655	95.607	89.550	93.581	92.050	87.199	93.750	
	Element [mass-%]														mass-%
Si	bdl	bdl	bdl	bdl	0.282	bdl	bdl	1.207	bdl	0.101	bdl	0.167	0.169	0.053	0.030
Al	11.308	8.257	9.767	8.851	12.118	13.347	8.527	11.634	7.926	7.732	12.463	15.178	8.895	11.922	0.012
Cr	27.473	31.735	29.578	32.870	27.031	25.127	33.996	25.387	33.839	31.258	26.173	20.449	26.247	27.694	0.030
V	0.132	0.064	0.096	0.089	0.109	0.175	0.120	0.191	0.070	0.145	0.148	0.136	0.114	0.109	0.023
Fe	13.709	15.152	14.032	12.738	13.489	13.688	10.846	13.116	13.942	11.147	12.905	15.079	13.116	13.310	0.036
Mn	4.276	4.316	4.579	4.596	4.246	4.232	4.538	4.364	4.329	4.523	5.248	4.190	4.071	3.975	0.018
Mg	4.351	3.771	4.468	4.195	4.314	4.323	4.544	4.608	3.878	4.745	4.325	4.321	4.904	4.318	0.055
Ca	0.335	0.450	0.499	0.329	0.594	0.356	0.395	1.343	0.300	0.189	0.255	0.369	0.442	0.370	0.018
F	1.193	1.074	0.523	0.874	1.358	0.980	1.234	1.162	1.201	0.882	0.978	0.750	1.027	0.930	0.164
Mo	bdl	bdl	bdl	bdl	bdl	bdl	0.038	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.036
O (calculated)	30.510	29.863	30.692	30.617	31.238	31.299	30.429	31.641	30.123	28.827	31.038	31.410	28.197	31.068	
Total	93.323	94.718	94.264	95.174	94.786	93.544	94.684	94.655	95.607	89.550	93.581	92.050	87.199	93.750	
	Cations based on 4 O														
Si	0.003	0.002	0.002	0.001	0.021	0.001	0.001	0.087	0.000	0.008	0.002	0.012	0.014	0.004	
Al	0.879	0.656	0.755	0.686	0.920	1.011	0.665	0.872	0.624	0.636	0.952	1.146	0.748	0.910	
Cr	1.108	1.308	1.186	1.321	1.065	0.988	1.375	0.988	1.383	1.335	1.038	0.801	1.146	1.097	
V	0.005	0.003	0.004	0.004	0.004	0.007	0.005	0.008	0.003	0.006	0.006	0.005	0.005	0.004	
Fe	0.515	0.581	0.524	0.477	0.495	0.501	0.408	0.475	0.530	0.443	0.476	0.550	0.533	0.491	
Mn	0.163	0.168	0.174	0.175	0.158	0.158	0.174	0.161	0.167	0.183	0.197	0.155	0.168	0.149	
Mg	0.376	0.332	0.383	0.361	0.364	0.364	0.393	0.384	0.339	0.433	0.367	0.362	0.458	0.366	
Ca	0.018	0.024	0.026	0.017	0.030	0.018	0.021	0.068	0.016	0.010	0.013	0.019	0.025	0.019	
Mo	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Sum cations	3.067	3.075	3.054	3.042	3.058	3.048	3.043	3.041	3.062	3.055	3.052	3.052	3.097	3.041	

Table S6. Results of chemical mineral EMP analyses performed on the original sample C (silicates).

SAMPLE C	Melilite phases prior to leaching										Olivine phases prior to leaching										Detection limit
	Oxide [mass-%]										Oxide [mass-%]										
	C1_an1	C1_an2	C1_an3	C1_an4	C1_an5	C2_an1	C2_an2	C2_an3	C2_an4	C2_an5	C1_an6	C1_an7	C1_an8	C1_an9	C1_an10	C2_an6	C2_an7	C2_an8	C2_an9	C2_an10	
SiO_2	32.145	31.269	30.237	31.186	32.380	31.982	31.952	31.739	30.721	32.210	33.179	33.815	33.236	32.890	33.232	32.933	32.925	32.275	33.233	32.197	
Al_2O_3	19.196	20.299	21.197	20.021	18.108	18.573	18.670	21.020	20.949	18.129	0.094	0.089	0.055	0.084	0.160	0.158	0.233	0.135	0.258	0.098	
Cr_2O_3	0.082	bdl	bdl	0.044	0.099	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.102	bdl	0.087	bdl	0.221	bdl	0.183	
V_2O_3	bdl	bdl	bdl	0.048	bdl	0.044	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.036	bdl	bdl	bdl	bdl	
FeO*	3.909	3.742	3.770	4.489	4.432	3.924	3.917	3.657	3.525	4.020	24.935	24.246	27.334	27.027	22.293	24.739	24.311	24.192	22.471	28.242	
MnO	0.968	1.064	0.965	1.047	1.146	1.006	0.977	0.919	0.910	1.016	9.948	10.135	10.257	9.750	9.026	11.729	10.772	9.845	9.416	10.273	
MgO	4.242	4.217	3.796	3.975	4.700	4.979	4.787	3.905	3.934	4.614	5.619	5.719	3.547	4.366	7.430	5.340	6.012	5.259	6.262	3.176	
CaO	36.596	37.207	37.562	37.489	37.032	36.835	37.147	37.564	37.516	37.235	27.560	27.917	26.937	27.058	27.993	25.866	26.682	27.879	27.966	26.411	
F	bdl	bdl	bdl	bdl	0.192	bdl	0.433	0.169	bdl	bdl	bdl	bdl	bdl	bdl	0.263	bdl	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	97.238	97.916	97.595	98.299	98.022	97.343	97.758	98.945	97.616	97.303	101.347	101.931	101.448	101.286	100.323	100.977	101.093	99.865	99.615	100.689	
	Element [mass-%]										Element [mass-%]										mass-%
Si	15.026	14.616	14.134	14.577	15.135	14.949	14.935	14.836	14.360	15.056	15.509	15.806	15.535	15.374	15.534	15.394	15.390	15.086	15.534	15.050	0.030
Al	10.159	10.743	11.218	10.596	9.584	9.830	9.881	11.125	11.087	9.595	0.050	0.047	0.029	0.044	0.085	0.084	0.123	0.071	0.137	0.052	0.012
Cr	0.056	bdl	bdl	0.030	0.068	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.070	bdl	0.060	bdl	0.151	bdl	0.125	0.030
V	bdl	bdl	bdl	0.033	bdl	0.030	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.024	bdl	bdl	bdl	bdl	0.023
Fe	3.038	2.909	2.930	3.489	3.445	3.050	3.045	2.843	2.740	3.125	19.382	18.847	21.247	21.008	17.328	19.230	18.897	18.805	17.467	21.953	0.036
Mn	0.750	0.824	0.747	0.811	0.888	0.779	0.757	0.712	0.705	0.787	7.704	7.849	7.944	7.551	6.990	9.084	8.342	7.625	7.292	7.956	0.018
Mg	2.558	2.543	2.289	2.397	2.834	3.003	2.887	2.355	2.372	2.782	3.388	3.449	2.139	2.633	4.481	3.220	3.625	3.171	3.776	1.915	0.055
Ca	26.155	26.591	26.845	26.793	26.466	26.326	26.549	26.847	26.812	26.611	19.697	19.952	19.252	19.338	20.006	18.486	19.069	19.925	19.987	18.876	0.018
F	bdl	bdl	bdl	bdl	0.192	bdl	0.433	0.169	bdl	bdl	bdl	bdl	bdl	bdl	0.263	bdl	bdl	bdl	bdl	bdl	0.164
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.036
O (calculated)	39.355	39.521	39.385	39.573	39.401	39.377	39.233	40.031	39.498	39.250	35.609	35.975	35.169	35.262	35.611	35.243	35.459	34.938	35.416	34.598	
Total	97.238	97.916	97.595	98.299	98.022	97.343	97.758	98.945	97.616	97.303	101.347	101.931	101.448	101.286	100.323	100.977	101.093	99.865	99.615	100.689	
	Cations based on 7 O										Cations based on 4 O										
Si	1.523	1.475	1.431	1.469	1.532	1.514	1.518	1.478	1.450	1.530	0.992	1.001	1.007	0.993	0.994	0.995	0.989	0.984	0.999	0.991	
Al	1.072	1.128	1.182	1.111	1.010	1.036	1.045	1.154	1.165	1.015	0.003	0.003	0.002	0.003	0.006	0.006	0.008	0.005	0.009	0.004	
Cr	0.003	0.001	0.001	0.002	0.004	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.002	0.000	0.002	0.001	0.005	0.000	0.004	
V	0.001	0.000	0.000	0.002	0.000	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	
Fe	0.155	0.148	0.149	0.177	0.175	0.155	0.156	0.142	0.139	0.160	0.624	0.600	0.692	0.683	0.558	0.625	0.611	0.617	0.565	0.727	
Mn	0.039	0.043	0.039	0.042	0.046	0.040	0.039	0.036	0.036	0.041	0.252	0.254	0.263	0.249	0.229	0.300	0.274	0.254	0.240	0.268	
Mg	0.300	0.296	0.268	0.279	0.331	0.351	0.339	0.271	0.277	0.327	0.251	0.252	0.160	0.197	0.331	0.241	0.269	0.239	0.281	0.146	
Ca	1.857	1.880	1.905	1.892	1.877	1.868	1.891	1.874	1.897	1.895	0.883	0.886	0.874	0.876	0.897	0.838	0.859	0.911	0.901	0.871	
Mo	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	
Sum cations	4.949	4.971	4.976	4.974	4.975	4.967	4.991	4.957	4.966	4.968	3.006	2.997	2.998	3.004	3.015	3.008	3.012	3.015	2.996	3.011	

16 **Table S7.** Results of chemical mineral EMP analyses performed on the remelted sample AR1.

SAMPLE AR1	Spinel phases										Detection limit
	Oxide [mass-%]										
	an3	an5	an6	an7	an8	an107	an108	an109	an110	an111	
SiO_2	0.094	bdl	0.101	0.069	0.082	bdl	0.075	0.079	bdl	0.106	
Al_2O_3	16.519	19.576	19.233	20.541	21.075	17.457	17.166	17.895	18.299	21.946	
Cr_2O_3	23.063	31.261	5.459	8.060	7.799	19.475	19.115	36.496	1.113	3.192	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.077	bdl	bdl	
TiO_2	0.253	0.333	0.490	0.436	0.340	0.303	0.333	0.195	0.519	0.390	
FeO*	41.474	31.008	57.555	51.726	53.944	43.775	43.809	27.515	64.573	57.168	
MnO	3.667	3.717	3.813	3.740	4.024	3.760	3.768	3.843	4.564	4.240	
MgO	8.493	12.874	12.311	12.737	11.775	12.969	13.101	12.866	9.414	10.809	
CaO	0.472	0.416	0.522	0.458	0.438	0.569	0.555	0.468	0.559	0.518	
F	0.455	0.599	bdl	0.177	bdl	0.233	bdl	0.891	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.081	bdl	bdl	
Total	94.323	99.639	99.528	97.944	99.585	98.568	98.002	100.092	99.126	98.433	
	Element [mass-%]										mass-%
Si	0.044	bdl	0.047	0.032	0.038	bdl	0.035	0.037	bdl	0.050	0.022
Al	8.743	10.361	10.179	10.871	11.154	9.239	9.085	9.471	9.685	11.615	0.014
Cr	15.780	21.389	3.735	5.515	5.336	13.325	13.079	24.971	0.762	2.184	0.025
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.052	bdl	bdl	0.049
Fe	32.238	24.103	44.738	40.207	41.931	34.026	34.053	21.388	50.193	44.437	0.041
Mn	2.840	2.879	2.953	2.896	3.116	2.912	2.918	2.976	3.535	3.284	0.027
Mg	5.122	7.763	7.424	7.681	7.101	7.821	7.900	7.759	5.677	6.518	0.012
Ca	0.337	0.297	0.373	0.327	0.313	0.407	0.397	0.334	0.400	0.370	0.012
F	0.455	0.599	bdl	0.177	bdl	0.233	bdl	0.891	bdl	bdl	0.166
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.054	bdl	bdl	0.053
O (calculated)	28.765	32.182	30.065	30.187	30.440	30.571	30.396	32.159	28.858	29.887	
Total	94.323	99.639	99.528	97.944	99.585	98.568	98.002	100.092	99.126	98.433	
	Cations based on 4 O										
Si	0.003	0.001	0.004	0.002	0.003	0.001	0.003	0.003	0.001	0.004	
Al	0.721	0.764	0.803	0.854	0.869	0.717	0.709	0.699	0.796	0.922	
Cr	0.675	0.818	0.153	0.225	0.216	0.536	0.530	0.956	0.032	0.090	
V	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.002	0.000	0.000	
Fe	1.284	0.858	1.705	1.526	1.579	1.276	1.284	0.762	1.993	1.704	
Mn	0.115	0.104	0.114	0.112	0.119	0.111	0.112	0.108	0.143	0.128	
Mg	0.469	0.635	0.650	0.670	0.614	0.674	0.684	0.635	0.518	0.574	
Ca	0.019	0.015	0.020	0.017	0.016	0.021	0.021	0.017	0.022	0.020	
Mo	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.000	
Sum cations	3.287	3.196	3.450	3.408	3.417	3.336	3.342	3.182	3.506	3.441	

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Table S8. Results of chemical mineral EMP analyses performed on the remelted sample AR2.

SAMPLE AR2	Wuestite phases										Spinel phases										Detection limit
	Oxide [mass-%]										Oxide [mass-%]										
	an35	an36	an37	an38	an39	an40	an41	an42	an43	an44	an25	an26	an27	an28	an29	an30	an31	an32	an33	an34	
SiO_2	0.079	0.074	0.088	0.112	0.055	0.057	bdl	0.070	0.105	0.074	bdl	0.057	bdl	bdl	0.080	bdl	bdl	0.047	bdl	bdl	
Al_2O_3	0.487	2.242	0.680	0.508	2.579	2.138	0.759	0.777	2.728	3.134	19.430	19.582	19.288	23.193	20.570	21.182	18.668	21.820	20.893	22.139	
Cr_2O_3	1.310	1.558	1.497	1.004	1.535	1.456	1.142	1.137	2.187	2.617	32.567	32.061	28.911	25.793	30.685	30.152	35.629	28.759	29.273	25.859	
V_2O_3	bdl	0.113	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.112	bdl	bdl	bdl	bdl	bdl	0.081	
TiO_2	0.104	0.197	0.093	0.103	0.186	0.173	0.090	0.139	0.168	0.274	0.267	0.211	0.248	0.298	0.249	0.240	0.206	0.260	0.219	0.274	
FeO*	82.542	79.301	79.616	78.015	79.081	79.439	78.576	77.626	78.124	76.785	29.240	29.611	32.933	32.729	29.722	29.749	27.908	31.397	31.214	33.023	
MnO	7.933	7.902	7.674	7.952	7.581	7.727	7.715	7.969	7.432	7.488	3.348	3.354	3.398	3.424	3.336	3.248	3.400	3.217	3.350	3.381	
MgO	12.377	11.504	12.035	13.336	11.321	11.578	13.730	13.862	10.789	10.983	14.433	14.373	12.552	14.144	14.286	14.325	14.045	14.610	14.285	14.445	
CaO	0.321	0.497	0.491	0.502	0.408	0.446	0.594	0.539	0.364	0.394	0.153	0.171	0.144	0.165	0.187	0.169	0.173	0.148	0.226	0.348	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.857	0.906	0.474	0.771	0.433	0.467	0.935	0.877	0.882	0.787	
MoO_3	bdl	bdl	bdl	bdl	0.168	bdl	bdl	bdl	bdl	bdl	bdl	0.170	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	105.229	103.458	102.176	101.567	102.928	103.056	102.682	102.219	101.951	101.843	99.953	100.115	97.809	100.417	99.404	99.458	100.643	100.787	100.020	100.118	
	Element [mass-%]										Element [mass-%]										mass-%
Si	0.037	0.035	0.041	0.052	0.026	0.027	bdl	0.033	0.049	0.035	bdl	0.027	bdl	bdl	0.037	bdl	bdl	0.022	bdl	bdl	0.022
Al	0.258	1.187	0.360	0.269	1.365	1.132	0.402	0.411	1.444	1.659	10.283	10.364	10.208	12.275	10.887	11.211	9.880	11.548	11.058	11.717	0.014
Cr	0.896	1.066	1.024	0.687	1.050	0.996	0.781	0.778	1.496	1.791	22.282	21.936	19.781	17.648	20.995	20.630	24.377	19.677	20.029	17.693	0.025
V	bdl	0.077	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.076	bdl	bdl	bdl	bdl	bdl	0.055	0.048
Fe	64.160	61.641	61.886	60.641	61.470	61.748	61.077	60.339	60.726	59.685	22.728	23.017	25.599	25.440	23.103	23.124	21.693	24.405	24.263	25.669	0.045
Mn	6.144	6.120	5.943	6.158	5.871	5.984	5.975	6.172	5.756	5.799	2.593	2.598	2.632	2.652	2.584	2.515	2.633	2.491	2.594	2.618	0.030
Mg	7.464	6.937	7.258	8.042	6.827	6.982	8.280	8.359	6.506	6.623	8.704	8.667	7.569	8.529	8.615	8.638	8.470	8.810	8.614	8.711	0.012
Ca	0.229	0.355	0.351	0.359	0.292	0.319	0.425	0.385	0.260	0.282	0.109	0.122	0.103	0.118	0.134	0.121	0.124	0.106	0.162	0.249	0.016
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.857	0.906	0.474	0.771	0.433	0.467	0.935	0.877	0.882	0.787	0.178
Mo	bdl	bdl	bdl	bdl	0.112	bdl	bdl	bdl	bdl	bdl	bdl	0.113	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.053
O (calculated)	25.998	25.994	25.313	25.334	25.915	25.856	25.684	25.690	25.677	25.894	32.387	32.365	31.407	32.842	32.608	32.683	32.500	32.836	32.393	32.565	
Total	105.229	103.458	102.176	101.567	102.928	103.056	102.682	102.219	101.951	101.843	99.953	100.115	97.809	100.417	99.404	99.458	100.643	100.787	100.020	100.118	
	Cations based on 1 O										Cations based on 4 O										
Si	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.003	0.001	0.000	0.002	0.001	0.000	
Al	0.006	0.027	0.008	0.006	0.032	0.026	0.009	0.009	0.033	0.038	0.753	0.760	0.771	0.887	0.792	0.814	0.721	0.834	0.810	0.853	
Cr	0.011	0.013	0.012	0.008	0.013	0.012	0.009	0.009	0.018	0.021	0.847	0.834	0.775	0.661	0.792	0.777	0.923	0.738	0.761	0.669	
V	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.000	0.000	0.000	0.001	0.000	0.002	
Fe	0.707	0.679	0.700	0.686	0.695	0.684	0.681	0.673	0.678	0.660	0.804	0.815	0.934	0.888	0.812	0.811	0.765	0.852	0.858	0.903	
Mn	0.069	0.069	0.068	0.071	0.067	0.067	0.068	0.070	0.065	0.065	0.093	0.093	0.098	0.094	0.092	0.090	0.094	0.088	0.093	0.094	
Mg	0.189	0.176	0.189	0.209	0.177	0.178	0.212	0.214	0.167	0.168	0.708	0.705	0.635	0.684	0.696	0.696	0.686	0.706	0.700	0.704	
Ca	0.004	0.005	0.006	0.006	0.005	0.005	0.007	0.006	0.004	0.004	0.005	0.006	0.005	0.006	0.007	0.006	0.006	0.005	0.008	0.012	
Mo	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.001	
Sum cations	0.986	0.971	0.985	0.987	0.991	0.973	0.987	0.983	0.966	0.959	3.211	3.218	3.219	3.225	3.194	3.195	3.197	3.226	3.232	3.239	

Table S9. Results of chemical mineral EMP analyses performed on the remelted sample AR3 (oxides 1).

SAMPLE AR3	Wuestite phases										Spinel phases										Detection limit
	Oxide [mass-%]										Oxide [mass-%]										
	an61	an62	an63	an64	an65	an66	an67	an68	an69	an70	an52	an53	an54	an55	an56	an57	an58	an59	an60	an61	
SiO_2	0.066	0.085	0.122	bdl	0.075	0.077	0.055	0.086	0.074	0.090	0.084	0.062	bdl	0.075	bdl	bdl	0.056	bdl	bdl	bdl	
Al_2O_3	0.857	0.902	0.571	1.381	1.371	1.117	0.441	0.496	0.473	0.606	27.506	30.065	29.903	23.775	26.755	27.947	27.651	30.795	29.214	27.517	
Cr_2O_3	0.834	1.155	0.956	1.171	1.144	0.880	0.688	0.751	0.845	0.799	8.073	2.044	1.834	0.614	0.321	0.444	1.100	2.303	4.362	4.281	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.094	bdl	bdl	bdl	bdl	bdl	0.097	bdl	bdl	0.102	bdl	
TiO_2	0.246	0.094	0.085	0.245	0.267	0.745	0.079	0.129	0.100	0.089	0.267	0.267	0.328	0.462	0.675	0.536	0.380	0.308	0.282	0.291	
FeO*	84.280	78.494	80.962	81.247	79.670	86.027	80.795	83.693	78.291	78.906	45.884	50.292	48.870	56.799	56.053	55.516	54.606	49.052	48.679	47.963	
MnO	8.960	7.645	8.444	8.190	8.279	9.524	8.214	8.260	8.388	8.688	3.545	3.982	3.945	4.481	4.366	4.321	4.290	3.908	3.815	3.904	
MgO	6.176	12.274	13.238	10.024	9.759	4.680	9.604	10.198	14.944	15.097	13.842	13.256	13.279	10.816	11.343	11.745	11.827	13.181	13.585	13.424	
CaO	0.315	0.431	0.425	0.475	0.406	0.290	0.436	0.470	0.471	0.557	0.218	0.208	0.168	0.311	0.340	0.382	0.235	0.151	0.184	0.139	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.280	0.196	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	101.780	101.201	104.885	102.935	101.090	103.374	100.331	104.098	103.661	104.980	99.593	100.294	98.448	97.335	99.968	101.098	100.212	99.744	100.288	97.566	
	Element [mass-%]										Element [mass-%]										mass-%
Si	0.031	0.040	0.057	bdl	0.035	0.036	0.026	0.040	0.035	0.042	0.039	0.029	bdl	0.035	bdl	bdl	0.026	bdl	bdl	bdl	0.025
Al	0.454	0.477	0.302	0.731	0.726	0.591	0.233	0.263	0.250	0.321	14.558	15.912	15.826	12.583	14.160	14.791	14.634	16.298	15.461	14.563	0.015
Cr	0.571	0.790	0.654	0.801	0.783	0.602	0.471	0.514	0.578	0.547	5.524	1.399	1.255	0.420	0.220	0.304	0.753	1.576	2.984	2.929	0.028
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.064	bdl	bdl	bdl	bdl	bdl	0.066	bdl	bdl	0.069	bdl	0.057
Fe	65.511	61.014	62.932	63.154	61.928	66.869	62.802	65.055	60.856	61.334	35.666	39.092	37.987	44.150	43.570	43.153	42.445	38.128	37.838	37.282	0.045
Mn	6.939	5.921	6.540	6.343	6.412	7.376	6.361	6.397	6.496	6.728	2.745	3.084	3.055	3.470	3.381	3.346	3.322	3.027	2.955	3.023	0.030
Mg	3.724	7.402	7.983	6.045	5.885	2.822	5.792	6.150	9.012	9.104	8.347	7.994	8.008	6.522	6.840	7.083	7.132	7.949	8.192	8.095	0.012
Ca	0.225	0.308	0.304	0.339	0.290	0.207	0.312	0.336	0.337	0.398	0.156	0.149	0.120	0.222	0.243	0.273	0.168	0.108	0.132	0.099	0.017
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.280	0.196	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.166
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.056
O (calculated)	24.308	25.207	26.058	25.317	24.987	24.847	24.334	25.327	26.047	26.373	32.278	32.440	32.131	29.932	31.479	31.994	31.685	32.635	32.613	31.503	
Total	101.780	101.201	104.885	102.935	101.090	103.374	100.331	104.098	103.661	104.980	99.593	100.294	98.448	97.335	99.968	101.098	100.212	99.744	100.288	97.566	
	Cations based on 1 O										Cations based on 4 O										
Si	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.001	0.003	0.000	0.002	0.002	0.001	0.001	0.000	
Al	0.011	0.011	0.007	0.017	0.017	0.014	0.006	0.006	0.006	0.007	1.070	1.163	1.168	0.997	1.067	1.097	1.095	1.185	1.125	1.096	
Cr	0.007	0.010	0.008	0.010	0.010	0.007	0.006	0.006	0.007	0.006	0.211	0.053	0.048	0.017	0.009	0.012	0.029	0.059	0.113	0.114	
V	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.000	0.002	0.003	0.002	0.001	0.003	0.000	
Fe	0.772	0.693	0.692	0.715	0.701	0.771	0.739	0.736	0.669	0.666	1.266	1.381	1.355	1.690	1.586	1.546	1.535	1.339	1.330	1.356	
Mn	0.083	0.068	0.073	0.073	0.074	0.086	0.076	0.074	0.073	0.074	0.099	0.111	0.111	0.135	0.125	0.122	0.122	0.108	0.106	0.112	
Mg	0.101	0.193	0.202	0.157	0.153	0.075	0.157	0.160	0.228	0.227	0.681	0.649	0.656	0.574	0.572	0.583	0.593	0.641	0.661	0.677	
Ca	0.004	0.005	0.005	0.005	0.005	0.003	0.005	0.005	0.005	0.006	0.008	0.007	0.006	0.012	0.012	0.014	0.008	0.005	0.006	0.005	
Mo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Sum cations	0.979	0.982	0.988	0.978	0.960	0.958	0.990	0.988	0.989	0.989	3.337	3.366	3.347	3.428	3.374	3.377	3.387	3.339	3.344	3.361	

Table S10. Results of chemical mineral EMP analyses performed on the remelted sample AR3 (oxides 2).

SAMPLE AR3	Bredigite phases					Detection limit
	Oxide [mass-%]					
	an71	an72	an73	an74	an75	
SiO_2	35.680	36.360	34.970	36.477	37.474	
Al_2O_3	0.060	0.115	0.084	0.109	0.098	
Cr_2O_3	0.044	bdl	bdl	bdl	bdl	
V_2O_3	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.000	0.038	0.000	0.062	0.040	
FeO*	2.470	3.471	2.310	4.291	4.144	
MnO	1.066	1.058	0.985	1.307	1.294	
MgO	4.641	9.889	4.624	9.359	9.364	
CaO	55.330	49.084	55.213	48.627	48.816	
F	bdl	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	
Total	99.388	100.161	98.219	100.232	101.343	
	Element [mass-%]					mass-%
Si	16.678	16.996	16.346	17.050	17.516	0.025
Al	0.032	0.061	0.044	0.058	0.052	0.015
Cr	0.030	bdl	bdl	bdl	bdl	0.028
V	bdl	bdl	bdl	bdl	bdl	0.057
Fe	1.920	2.698	1.796	3.335	3.221	0.045
Mn	0.826	0.819	0.763	1.012	1.002	0.030
Mg	2.799	5.963	2.788	5.644	5.647	0.012
Ca	39.544	35.080	39.460	34.753	34.888	0.017
F	bdl	bdl	bdl	bdl	bdl	0.166
Mo	bdl	bdl	bdl	bdl	bdl	0.056
O (calculated)	37.426	38.416	37.022	38.379	38.913	
Total	99.388	100.161	98.219	100.232	101.343	
	Cations based on 16 O					
Si	4.062	4.033	4.024	4.049	4.103	
Al	0.008	0.015	0.011	0.014	0.013	
Cr	0.004	0.000	0.000	0.000	0.000	
V	0.000	0.000	0.000	0.000	0.005	
Fe	0.235	0.322	0.222	0.398	0.379	
Mn	0.103	0.099	0.096	0.123	0.120	
Mg	0.788	1.635	0.793	1.549	1.528	
Ca	6.749	5.833	6.808	5.784	5.727	
Mo	0.001	0.003	0.000	0.000	0.001	
Sum cations	11.950	11.939	11.956	11.918	11.877	

Table S11. Results of chemical mineral EMP analyses performed on the conditioned sample AC1.

SAMPLE AC1	Spinel phases										Olivine phases 1						Olivine phases 2			Pyroxene phases				Detection limit
	Oxide [mass-%]										Oxide [mass-%]						Oxide [mass-%]			Oxide [mass-%]				
	an9	an85	an86	an87	an88	an89	an90	an91	an92	an93	an96	an97	an98	an100	an101	an103	an104	an105	an106	an94	an95	an99	an102	
SiO_2	0.214	0.842	0.902	0.335	0.408	20.896	0.158	0.149	0.255	0.118	36.513	37.633	36.120	37.521	37.382	35.989	40.638	40.617	38.590	36.407	36.705	36.846	38.612	
Al_2O_3	10.249	22.805	23.512	22.368	23.875	13.261	13.226	12.495	16.243	15.165	0.039	0.142	0.144	0.102	0.156	0.055	0.302	0.327	0.462	14.052	10.742	12.902	11.934	
Cr_2O_3	35.688	4.648	4.379	6.851	2.541	2.470	31.929	33.653	17.142	41.469	0.177	0.361	0.125	bdl	0.111	bdl	0.051	0.048	0.070	bdl	bdl	0.123	bdl	
V_2O_3	bdl	bdl	bdl	0.088	bdl	bdl	bdl	bdl	bdl	0.081	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.231	0.814	0.755	0.659	0.816	0.488	0.332	0.250	0.518	0.268	0.042	0.014	0.000	0.000	0.017	0.011	0.050	0.026	0.035	0.571	0.469	0.557	0.455	
FeO*	33.571	56.941	56.639	52.243	56.405	34.021	34.829	32.940	45.112	27.342	22.422	18.408	24.505	18.353	22.726	25.351	16.763	16.778	20.516	22.621	25.329	23.708	24.020	
MnO	2.141	2.129	2.096	1.957	2.022	3.205	1.840	1.652	1.807	2.374	4.748	4.217	4.739	4.111	4.399	4.606	3.444	3.322	3.382	2.400	2.694	2.587	2.652	
MgO	14.309	8.920	9.301	14.049	13.673	13.834	17.094	17.116	17.152	13.443	14.129	18.597	13.542	17.019	14.110	12.143	38.713	38.963	38.489	0.933	1.512	1.314	1.250	
CaO	0.160	0.533	0.549	0.330	0.372	9.868	0.219	0.210	0.296	0.260	25.978	24.119	24.192	26.531	25.652	25.219	4.780	4.545	4.699	19.570	19.573	19.676	19.647	
F	0.778	bdl	bdl	bdl	bdl	bdl	0.764	0.832	0.473	0.678	bdl	bdl	bdl	bdl	0.164	bdl	0.198	bdl	bdl	0.480	0.490	0.301	0.495	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.077	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.144	bdl	bdl	bdl	bdl	
Total	97.041	97.688	98.233	98.880	100.226	98.143	100.069	99.024	98.857	100.913	104.103	103.533	103.367	103.778	104.709	103.454	104.867	104.626	106.398	97.319	97.748	98.265	99.207	
	Element [mass-%]										Element [mass-%]						Element [mass-%]			Element [mass-%]				mass-%
Si	0.100	0.394	0.422	0.157	0.191	9.767	0.074	0.070	0.119	0.055	17.067	17.591	16.884	17.538	17.473	16.822	18.995	18.986	18.038	17.018	17.157	17.223	18.048	0.015
Al	5.424	12.070	12.444	11.838	12.636	7.018	7.000	6.613	8.597	8.026	0.021	0.075	0.076	0.054	0.083	0.029	0.160	0.173	0.245	7.437	5.685	6.828	6.316	0.016
Cr	24.418	3.180	2.996	4.687	1.739	1.690	21.846	23.025	11.729	28.373	0.121	0.247	0.086	bdl	0.076	bdl	0.035	0.033	0.048	bdl	bdl	0.084	bdl	0.023
V	bdl	bdl	bdl	0.060	bdl	bdl	bdl	bdl	bdl	0.055	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.048
Fe	26.095	44.260	44.026	40.609	43.844	26.445	27.073	25.604	35.066	21.253	17.429	14.309	19.048	14.266	17.665	19.705	13.030	13.042	15.947	17.583	19.688	18.428	18.671	0.034
Mn	1.658	1.649	1.623	1.516	1.566	2.482	1.425	1.279	1.399	1.839	3.677	3.266	3.670	3.184	3.407	3.567	2.667	2.573	2.619	1.859	2.086	2.004	2.054	0.025
Mg	8.629	5.379	5.609	8.472	8.245	8.342	10.308	10.322	10.343	8.107	8.520	11.215	8.166	10.263	8.509	7.323	23.345	23.496	23.210	0.563	0.912	0.792	0.754	0.016
Ca	0.114	0.381	0.392	0.236	0.266	7.053	0.157	0.150	0.212	0.186	18.566	17.238	17.290	18.961	18.333	18.024	3.416	3.248	3.358	13.986	13.989	14.062	14.042	0.015
F	0.778	bdl	bdl	bdl	bdl	bdl	0.764	0.832	0.473	0.678	bdl	bdl	bdl	bdl	0.164	bdl	0.198	bdl	bdl	0.480	0.490	0.301	0.495	0.117
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.051	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.096	bdl	bdl	bdl	bdl	0.047
O (calculated)	29.806	30.299	30.675	31.306	31.665	35.291	31.423	31.077	30.889	32.342	38.678	39.567	38.148	39.387	38.970	37.941	43.015	43.076	42.829	38.381	37.735	38.542	38.809	
Total	97.041	97.688	98.233	98.880	100.226	98.143	100.069	99.024	98.857	100.913	104.103	103.533	103.367	103.778	104.709	103.454	104.867	104.626	106.398	97.319	97.748	98.265	99.207	
	Cations based on 4 O										Cations based on 4 O						Cations based on 4 O			Cations based on 6 O				
Si	0.008	0.030	0.031	0.011	0.014	0.631	0.005	0.005	0.009	0.004	1.006	1.013	1.009	1.015	1.022	1.010	1.006	1.004	0.960	1.516	1.554	1.527	1.590	
Al	0.432	0.945	0.962	0.897	0.947	0.472	0.528	0.505	0.660	0.589	0.001	0.005	0.005	0.003	0.005	0.002	0.009	0.010	0.014	0.689	0.536	0.630	0.579	
Cr	1.008	0.129	0.120	0.184	0.068	0.059	0.856	0.912	0.467	1.080	0.004	0.008	0.003	0.001	0.002	0.000	0.001	0.001	0.001	0.000	0.000	0.004	0.001	
V	0.001	0.001	0.001	0.002	0.001	0.001	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Fe	1.003	1.674	1.645	1.487	1.587	0.859	0.987	0.944	1.301	0.753	0.516	0.414	0.572	0.415	0.519	0.595	0.347	0.347	0.427	0.788	0.897	0.822	0.827	
Mn	0.065	0.063	0.062	0.056	0.058	0.082	0.053	0.048	0.053	0.066	0.111	0.096	0.112	0.094	0.102	0.110	0.072	0.070	0.071	0.085	0.097	0.091	0.092	
Mg	0.762	0.467	0.481	0.713	0.686	0.622	0.864	0.875	0.882	0.660	0.580	0.746	0.564	0.686	0.575	0.508	1.429	1.436	1.427	0.058	0.095	0.081	0.077	
Ca	0.006	0.020	0.020	0.012	0.013	0.319	0.008	0.008	0.011	0.009	0.767	0.696	0.724	0.769	0.751	0.759	0.127	0.120	0.125	0.873	0.888	0.874	0.867	
Mo	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	
Sum cations	3.285	3.329	3.324	3.363	3.373	3.045	3.301	3.297	3.383	3.163	2.985	2.978	2.988	2.983	2.977	2.985	2.991	2.988	3.026	4.008	4.067	4.030	4.032	

Table S12. Results of chemical mineral EMP analyses performed on the conditioned sample AC2 (oxides).

SAMPLE AC2	Spinel phases										Detection limit
	Oxide [mass-%]										
	an4	an8	an9	an10	an11	an12	an13	an14	an15	an16	
SiO_2	0.104	0.181	0.171	0.179	0.190	0.136	0.188	1.468	0.169	0.220	
Al_2O_3	15.874	16.732	14.924	14.447	14.983	13.760	15.871	15.561	13.688	16.536	
Cr_2O_3	12.681	5.728	0.222	0.178	0.325	19.770	0.469	7.431	0.232	4.818	
V_2O_3	bdl	bdl	0.126	bdl	bdl	0.122	0.158	0.125	bdl	bdl	
TiO_2	0.482	0.626	0.761	0.771	0.760	0.429	0.776	0.556	0.898	0.620	
FeO*	51.081	57.143	67.107	67.495	67.924	46.749	66.620	55.734	69.895	58.895	
MnO	2.073	2.064	2.541	2.401	2.565	2.030	2.450	2.249	2.580	2.143	
MgO	13.283	13.168	8.729	8.783	9.095	13.748	9.728	12.226	7.433	12.695	
CaO	0.125	0.130	0.201	0.173	0.140	0.123	0.125	1.029	0.146	0.117	
F	0.188	bdl	bdl	bdl	bdl	0.279	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.077	bdl	bdl	
Total	95.865	95.877	94.831	94.604	96.010	97.078	96.385	96.486	95.157	96.142	
	Element [mass-%]										mass-%
Si	0.049	0.085	0.080	0.084	0.089	0.064	0.088	0.686	0.079	0.103	0.020
Al	8.401	8.855	7.899	7.646	7.930	7.282	8.400	8.236	7.244	8.752	0.014
Cr	8.676	3.919	0.152	0.122	0.222	13.527	0.321	5.084	0.159	3.296	0.026
V	bdl	bdl	0.086	bdl	bdl	0.083	0.107	0.085	bdl	bdl	0.080
Fe	39.705	44.417	52.163	52.464	52.798	36.338	51.784	43.322	54.330	45.779	0.036
Mn	1.605	1.598	1.968	1.859	1.986	1.572	1.897	1.742	1.998	1.660	0.028
Mg	8.010	7.941	5.264	5.296	5.485	8.291	5.866	7.373	4.482	7.656	0.012
Ca	0.089	0.093	0.144	0.124	0.100	0.088	0.089	0.735	0.104	0.084	0.016
F	0.188	bdl	bdl	bdl	bdl	0.279	bdl	bdl	bdl	bdl	0.164
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.051	bdl	bdl	0.051
O (calculated)	29.105	28.853	27.044	26.893	27.382	29.541	27.832	29.120	26.609	28.717	
Total	95.865	95.877	94.831	94.604	96.010	97.078	96.385	96.486	95.157	96.142	
	Cations based on 4 O										
Si	0.004	0.007	0.007	0.007	0.007	0.005	0.007	0.054	0.007	0.008	
Al	0.685	0.728	0.693	0.674	0.687	0.585	0.716	0.671	0.646	0.723	
Cr	0.367	0.167	0.007	0.006	0.010	0.564	0.014	0.215	0.007	0.141	
V	0.000	0.002	0.004	0.003	0.000	0.004	0.005	0.004	0.002	0.002	
Fe	1.563	1.764	2.210	2.236	2.210	1.410	2.132	1.705	2.340	1.827	
Mn	0.064	0.065	0.085	0.081	0.085	0.062	0.079	0.070	0.087	0.067	
Mg	0.725	0.725	0.513	0.519	0.527	0.739	0.555	0.667	0.444	0.702	
Ca	0.005	0.005	0.008	0.007	0.006	0.005	0.005	0.040	0.006	0.005	
Mo	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.000	0.000	
Sum cations	3.413	3.462	3.527	3.534	3.532	3.372	3.514	3.426	3.539	3.475	

Table S13. Results of chemical mineral EMP analyses performed on the conditioned sample AC2 (silicates).

SAMPLE AC2	Olivine phases 1										Olivine phases 2											Detection limit
	Oxide [mass-%]										Oxide [mass-%]											
	an7	an26	an27	an28	an29	an30	an31	an32	an33	an34	an5	an6	an17	an18	an19	an20	an21	an22	an23	an24	an25	an30	
SiO_2	35.669	37.660	37.705	36.819	37.449	36.362	37.140	36.385	36.560	36.940	40.650	40.779	32.653	33.251	33.813	41.065	41.562	41.692	42.001	41.368	41.744	39.675	
Al_2O_3	0.049	0.034	0.438	0.070	0.050	0.069	bdl	0.050	0.074	0.032	0.239	0.246	0.238	0.381	0.268	0.150	0.304	0.196	0.201	0.233	0.183	0.392	
Cr_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.060	bdl	bdl	bdl	0.060	bdl	bdl	bdl	bdl	0.064	bdl	0.081	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.169	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.012	0.003	0.059	0.033	0.021	0.046	0.047	0.009	0.035	0.026	0.015	0.000	0.000	0.024	0.000	0.012	0.002	0.000	0.000	0.011	0.030	0.016	
FeO*	21.817	17.690	19.406	20.011	19.302	22.986	21.845	23.777	21.850	20.762	13.305	14.809	16.008	14.178	14.908	15.063	13.723	13.957	15.958	15.653	14.686	13.668	
MnO	4.954	4.584	4.603	4.835	4.770	4.891	5.163	4.979	5.083	4.532	3.034	3.171	3.582	3.104	3.197	3.422	2.969	3.123	3.630	3.428	3.326	3.434	
MgO	13.101	16.959	14.161	13.628	14.465	11.725	13.853	11.522	13.879	12.644	42.235	40.814	39.632	41.712	41.665	40.933	41.719	41.875	39.184	40.129	40.480	41.367	
CaO	25.080	25.114	25.592	26.430	26.116	25.875	24.682	25.432	25.181	27.487	2.241	2.470	3.032	2.574	2.539	2.511	2.475	2.176	2.729	2.700	2.517	2.764	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.163	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.089	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.086	bdl	0.086	
Total	100.755	102.203	102.082	101.841	102.305	102.061	102.905	102.154	102.895	102.544	101.779	102.495	95.162	95.243	96.457	103.171	102.821	103.065	103.735	103.750	102.991	101.522	
	Element [mass-%]										Element [mass-%]											mass-%
Si	16.673	17.603	17.624	17.210	17.505	16.997	17.360	17.007	17.089	17.267	19.001	19.061	15.263	15.542	15.805	19.195	19.427	19.488	19.632	19.337	19.512	18.545	0.020
Al	0.026	0.018	0.232	0.037	0.026	0.037	bdl	0.026	0.039	0.017	0.126	0.130	0.126	0.202	0.142	0.079	0.161	0.104	0.106	0.123	0.097	0.207	0.014
Cr	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.041	bdl	bdl	bdl	0.041	bdl	bdl	bdl	bdl	0.044	bdl	0.043	0.026
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.115	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.080
Fe	16.958	13.751	15.084	15.555	15.004	17.867	16.980	18.482	16.984	16.138	10.342	11.511	12.443	11.021	11.588	11.709	10.667	10.849	12.404	12.167	11.415	10.624	0.036
Mn	3.837	3.550	3.565	3.744	3.694	3.788	3.999	3.856	3.937	3.510	2.350	2.456	2.774	2.404	2.476	2.650	2.299	2.419	2.811	2.655	2.576	2.659	0.028
Mg	7.900	10.227	8.540	8.218	8.723	7.071	8.354	6.948	8.370	7.625	25.469	24.612	23.899	25.154	25.125	24.684	25.158	25.252	23.629	24.199	24.411	24.946	0.012
Ca	17.924	17.949	18.290	18.889	18.665	18.493	17.640	18.176	17.997	19.645	1.602	1.765	2.167	1.840	1.815	1.795	1.769	1.555	1.950	1.930	1.799	1.975	0.016
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.163	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.164
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.059	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.057	bdl	0.057	0.051
O (calculated)	37.387	39.027	38.615	38.177	38.535	37.756	38.424	37.658	38.317	38.161	42.848	42.819	38.478	39.049	39.465	43.049	43.255	43.369	43.179	43.142	43.178	42.428	
Total	100.755	102.203	102.082	101.841	102.305	102.061	102.905	102.154	102.895	102.544	101.779	102.495	95.162	95.243	96.457	103.171	102.821	103.065	103.735	103.750	102.991	101.522	
	Cations based on 4 O										Cations based on 4 O											
Si	1.016	1.028	1.040	1.027	1.035	1.026	1.030	1.029	1.016	1.031	1.011	1.014	0.904	0.907	0.913	1.016	1.023	1.024	1.036	1.021	1.030	0.996	
Al	0.002	0.001	0.014	0.002	0.002	0.002	0.001	0.002	0.002	0.001	0.007	0.007	0.008	0.012	0.009	0.004	0.009	0.006	0.006	0.007	0.005	0.012	
Cr	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.001	0.001	0.000	0.001	
V	0.000	0.001	0.000	0.000	0.000	0.002	0.001	0.000	0.002	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	
Fe	0.520	0.404	0.448	0.467	0.446	0.542	0.506	0.562	0.508	0.485	0.277	0.308	0.371	0.323	0.336	0.312	0.283	0.287	0.329	0.323	0.303	0.287	
Mn	0.120	0.106	0.108	0.114	0.112	0.117	0.121	0.119	0.120	0.107	0.064	0.067	0.084	0.072	0.073	0.072	0.062	0.065	0.076	0.072	0.069	0.073	
Mg	0.556	0.690	0.582	0.567	0.596	0.493	0.572	0.486	0.575	0.526	1.565	1.514	1.635	1.696	1.676	1.510	1.531	1.533	1.441	1.477	1.489	1.548	
Ca	0.766	0.734	0.756	0.790	0.773	0.782	0.733	0.771	0.750	0.822	0.060	0.066	0.090	0.075	0.073	0.067	0.065	0.057	0.072	0.071	0.067	0.074	
Mo	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	
Sum cations	2.980	2.965	2.949	2.968	2.965	2.964	2.966	2.969	2.975	2.973	2.984	2.980	3.092	3.086	3.082	2.980	2.974	2.973	2.961	2.974	2.963	2.993	

Table S14. Results of chemical mineral EMP analyses performed on the conditioned sample AC3 (oxides and silicates 1).

SAMPLE AC3	Spinel phases										Olivine phases 1										Detection limit
	Oxide [mass-%]										Oxide [mass-%]										
	an22	an23	an24	an45	an46	an47	an48	an49	an4	an5	an32	an33	an3	an14	an15	an16	an17	an18	an20	an21	
SiO_2	0.317	0.189	0.176	0.137	0.222	0.205	0.302	0.229	0.226	0.284	34.978	36.154	36.407	35.516	36.598	36.652	36.166	36.234	35.558	36.414	
Al_2O_3	18.608	14.486	14.626	12.637	15.893	14.308	18.854	14.722	18.580	18.508	0.028	0.007	0.037	0.028	0.028	0.033	0.041	0.012	0.017	0.037	
Cr_2O_3	5.239	0.201	bdl	34.450	0.505	0.199	4.137	0.298	6.944	2.434	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
V_2O_3	bdl	0.225	0.401	bdl	bdl	0.173	0.205	0.162	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.687	0.905	1.353	0.287	0.773	0.979	0.665	0.857	0.685	0.764	0.000	0.029	0.032	0.060	0.040	0.000	0.044	0.001	0.000	0.002	
FeO*	56.483	67.664	70.483	34.010	62.636	65.769	56.206	67.370	53.037	57.307	22.988	23.834	19.786	23.413	22.175	20.919	22.397	21.584	24.457	19.957	
MnO	1.905	2.588	2.657	2.156	2.208	2.367	1.886	2.384	1.966	2.031	4.593	4.845	4.441	4.860	4.533	4.369	4.575	4.386	4.789	4.311	
MgO	12.395	7.289	4.934	12.927	9.486	7.344	12.123	8.213	12.462	11.666	10.809	11.498	14.431	10.103	13.303	14.218	12.142	10.735	10.775	12.888	
CaO	0.057	0.093	0.139	0.064	0.077	0.087	0.047	0.049	0.070	0.030	25.896	25.878	26.217	26.539	25.601	25.577	27.020	28.502	26.059	28.229	
F	bdl	bdl	0.175	0.367	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.303	bdl	bdl	bdl	bdl	0.201	
MoO_3	bdl	bdl	bdl	bdl	bdl	0.111	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	95.740	93.673	94.914	96.942	91.916	91.622	94.469	94.419	93.991	93.072	99.387	102.313	101.396	100.587	102.470	101.789	102.385	101.463	101.686	101.959	
	Element [mass-%]										Element [mass-%]										mass-%
Si	0.148	0.088	0.082	0.064	0.104	0.096	0.141	0.107	0.106	0.133	16.350	16.899	17.018	16.601	17.107	17.132	16.905	16.937	16.621	17.021	0.020
Al	9.848	7.667	7.741	6.688	8.411	7.572	9.978	7.792	9.833	9.795	0.015	0.004	0.020	0.015	0.015	0.017	0.022	0.006	0.009	0.020	0.013
Cr	3.585	0.138	bdl	23.571	0.346	0.136	2.831	0.204	4.751	1.665	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.025
V	bdl	0.153	0.273	bdl	bdl	0.118	0.139	0.110	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.085
Fe	43.904	52.595	54.787	26.436	48.687	51.122	43.689	52.367	41.226	44.545	17.869	18.526	15.380	18.199	17.237	16.260	17.409	16.777	19.011	15.513	0.036
Mn	1.475	2.004	2.058	1.670	1.710	1.833	1.461	1.846	1.523	1.573	3.557	3.752	3.439	3.764	3.511	3.384	3.543	3.397	3.709	3.339	0.027
Mg	7.475	4.396	2.975	7.795	5.720	4.429	7.311	4.953	7.515	7.035	6.518	6.934	8.702	6.092	8.022	8.574	7.322	6.474	6.498	7.772	0.012
Ca	0.041	0.066	0.099	0.046	0.055	0.062	0.034	0.035	0.050	0.021	18.508	18.495	18.737	18.967	18.297	18.280	19.311	20.370	18.624	20.175	0.016
F	bdl	bdl	0.175	0.367	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.303	bdl	bdl	bdl	bdl	0.201	0.152
Mo	bdl	bdl	bdl	bdl	bdl	0.074	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.050
O (calculated)	29.239	26.550	26.708	30.263	26.804	26.102	28.838	26.927	28.959	28.277	36.533	37.690	38.048	36.852	37.979	38.127	37.873	37.496	37.191	37.916	
Total	95.740	93.673	94.914	96.942	91.916	91.622	94.469	94.419	93.991	93.072	99.387	102.313	101.396	100.587	102.470	101.789	102.385	101.463	101.686	101.959	
	Cations based on 4 O										Cations based on 4 O										
Si	0.012	0.008	0.007	0.005	0.009	0.008	0.011	0.009	0.008	0.011	1.020	1.022	1.019	1.027	1.026	1.024	1.017	1.029	1.018	1.023	
Al	0.799	0.685	0.687	0.524	0.744	0.688	0.821	0.686	0.805	0.822	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	
Cr	0.151	0.006	0.001	0.959	0.016	0.006	0.121	0.009	0.202	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
V	0.000	0.007	0.013	0.002	0.003	0.006	0.006	0.005	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Fe	1.721	2.270	2.351	1.001	2.082	2.244	1.736	2.229	1.631	1.805	0.561	0.563	0.463	0.566	0.520	0.489	0.527	0.513	0.586	0.469	
Mn	0.059	0.088	0.090	0.064	0.074	0.082	0.059	0.080	0.061	0.065	0.113	0.116	0.105	0.119	0.108	0.103	0.109	0.106	0.116	0.103	
Mg	0.673	0.436	0.293	0.678	0.562	0.447	0.668	0.484	0.683	0.655	0.470	0.484	0.602	0.435	0.556	0.592	0.509	0.455	0.460	0.540	
Ca	0.002	0.004	0.006	0.002	0.003	0.004	0.002	0.002	0.003	0.001	0.809	0.784	0.786	0.822	0.769	0.766	0.814	0.867	0.800	0.850	
Mo	0.000	0.000	0.000	0.000	0.000	0.002	0.000	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Sum cations	3.416	3.505	3.448	3.235	3.494	3.487	3.423	3.506	3.395	3.432	2.974	2.970	2.978	2.970	2.981	2.975	2.978	2.970	2.981	2.985	

Table S15. Results of chemical mineral EMP analyses performed on the conditioned sample AC3 (silicates 2).

SAMPLE AC3	Olivine phases 2						Pyroxene phases										Detection limit
	Oxide [mass-%]						Oxide [mass-%]										
	an28	an29	an30	an51	an2	an10	an25	an26	an27	an50	an52	an53	an54	an9	an11	an12	
SiO_2	41.173	41.370	40.936	40.466	40.288	37.129	43.385	42.653	43.592	42.839	41.873	43.009	41.862	39.834	40.376	40.908	
Al_2O_3	0.214	0.332	0.208	0.123	0.173	0.159	11.585	11.872	10.031	10.914	11.093	12.516	12.051	12.374	12.800	11.839	
Cr_2O_3	bdl	0.078	bdl	bdl	bdl	0.053	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
V_2O_3	bdl	bdl	bdl	0.150	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.047	0.000	0.000	0.021	0.023	0.000	0.529	0.713	0.467	0.587	0.550	0.751	0.655	0.673	0.644	0.707	
FeO*	14.310	14.196	18.236	18.845	16.570	20.328	14.050	13.619	14.481	15.647	15.301	14.363	14.723	14.267	13.773	16.099	
MnO	2.923	2.715	3.614	3.555	3.423	4.020	1.321	1.209	1.396	1.462	1.314	1.425	1.176	1.101	1.263	1.147	
MgO	42.349	42.920	38.147	38.084	39.051	35.331	6.404	6.681	7.368	6.446	6.937	5.661	6.396	6.671	6.607	6.243	
CaO	1.771	1.679	2.440	2.408	2.204	2.797	23.274	23.560	23.209	22.955	22.865	23.608	23.313	21.960	21.984	23.104	
F	bdl	bdl	bdl	bdl	bdl	bdl	0.295	bdl	bdl	0.183	0.200	bdl	bdl	0.292	0.293	bdl	
MoO_3	bdl	bdl	0.097	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.101	
Total	102.846	103.290	103.739	103.652	101.844	99.918	100.776	100.536	100.635	100.989	100.105	101.359	100.288	97.136	97.704	100.198	
	Element [mass-%]						Element [mass-%]										mass-%
Si	19.245	19.338	19.135	18.915	18.832	17.355	20.279	19.937	20.376	20.024	19.573	20.104	19.568	18.620	18.873	19.122	0.020
Al	0.113	0.176	0.110	0.065	0.092	0.084	6.131	6.283	5.309	5.776	5.871	6.624	6.378	6.549	6.774	6.266	0.013
Cr	bdl	0.053	bdl	bdl	bdl	0.036	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.025
V	bdl	bdl	bdl	0.102	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.085
Fe	11.123	11.035	14.175	14.648	12.880	15.801	10.921	10.586	11.256	12.162	11.894	11.164	11.444	11.090	10.706	12.514	0.036
Mn	2.264	2.103	2.799	2.753	2.651	3.113	1.023	0.936	1.081	1.132	1.018	1.104	0.911	0.853	0.978	0.888	0.027
Mg	25.538	25.882	23.004	22.966	23.549	21.306	3.862	4.029	4.443	3.887	4.183	3.414	3.857	4.023	3.984	3.765	0.012
Ca	1.266	1.200	1.744	1.721	1.575	1.999	16.634	16.838	16.587	16.406	16.341	16.872	16.662	15.695	15.712	16.512	0.016
F	bdl	bdl	bdl	bdl	bdl	bdl	0.295	bdl	bdl	0.183	0.200	bdl	bdl	0.292	0.293	bdl	0.152
Mo	bdl	bdl	0.065	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.067	0.050
O (calculated)	43.275	43.504	42.637	42.482	42.189	40.129	41.592	41.743	41.536	41.405	40.988	42.061	41.401	39.978	40.325	41.037	
Total	102.846	103.290	103.739	103.652	101.844	99.918	100.776	100.536	100.635	100.989	100.105	101.359	100.288	97.136	97.704	100.198	
	Cations based on 4 O						Cations based on 6 O										
Si	1.013	1.013	1.023	1.015	1.017	0.986	1.667	1.633	1.677	1.653	1.632	1.634	1.616	1.592	1.600	1.593	
Al	0.006	0.010	0.006	0.004	0.005	0.005	0.524	0.536	0.455	0.496	0.510	0.560	0.548	0.583	0.598	0.543	
Cr	0.001	0.002	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
V	0.000	0.000	0.000	0.003	0.002	0.000	0.002	0.003	0.001	0.001	0.002	0.001	0.003	0.002	0.003	0.001	
Fe	0.295	0.291	0.381	0.395	0.350	0.451	0.451	0.436	0.466	0.505	0.499	0.456	0.475	0.477	0.456	0.524	
Mn	0.061	0.056	0.076	0.075	0.073	0.090	0.043	0.039	0.045	0.048	0.043	0.046	0.038	0.037	0.042	0.038	
Mg	1.554	1.567	1.421	1.423	1.470	1.398	0.367	0.381	0.423	0.371	0.403	0.321	0.368	0.397	0.390	0.362	
Ca	0.047	0.044	0.065	0.065	0.060	0.080	0.958	0.966	0.957	0.949	0.955	0.961	0.964	0.940	0.933	0.964	
Mo	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	
Sum cations	2.976	2.982	2.974	2.980	2.977	3.011	4.012	3.994	4.024	4.023	4.044	3.978	4.012	4.029	4.022	4.027	

Table S16. Results of chemical mineral EMP analyses performed on the remelted sample BR1.

SAMPLE BR1	Wuestite phases										Spinel phases												Detection limit
	Oxide [mass-%]										Oxide [mass-%]												
	an11	an12	an13	an14	an15	an16	an17	an18	an19	an20	an10	an21	an22	an23	an29	an30	an31	an32	an33	an34	an35	an36	
SiO_2	0.063	0.034	bdl	0.023	bdl	0.036	0.031	0.050	bdl	0.054	0.033	bdl	0.057	bdl	0.033	bdl	0.041	0.047	bdl	0.032	0.033	bdl	
Al_2O_3	1.053	1.101	1.127	1.447	1.198	1.067	0.767	1.272	1.355	1.464	13.375	13.409	14.473	13.582	14.554	15.316	17.863	18.587	16.670	18.747	13.360	13.401	
Cr_2O_3	0.095	0.073	bdl	0.077	0.117	0.150	0.206	0.082	0.211	0.049	31.109	20.874	22.072	30.982	25.899	18.868	0.737	4.160	0.112	4.527	29.282	31.924	
V_2O_3	bdl	bdl	0.694	bdl	0.482	bdl	bdl	0.791	bdl	bdl	bdl	bdl	bdl	0.382	bdl	bdl	bdl	bdl	0.403	bdl	bdl	0.450	
TiO_2	0.115	0.117	0.074	0.126	0.108	0.163	0.044	0.112	0.088	0.177	0.151	0.191	0.167	0.087	0.198	0.243	0.407	0.343	0.366	0.347	0.153	0.116	
FeO*	78.270	79.516	79.123	81.963	76.065	79.248	78.197	80.238	77.427	78.389	34.232	46.625	41.688	38.194	41.986	47.114	64.070	60.903	67.267	61.002	39.316	38.592	
MnO	11.634	11.397	11.546	11.671	11.615	11.770	11.995	11.668	11.757	11.716	5.454	5.622	5.587	5.405	5.382	5.713	5.536	5.496	5.662	5.477	5.023	5.494	
MgO	5.313	6.063	5.242	4.409	4.796	5.169	5.595	4.860	5.475	4.805	10.877	9.879	10.264	10.941	10.621	10.832	9.465	10.215	8.194	10.441	11.018	11.081	
CaO	2.554	2.192	2.851	2.957	2.964	2.787	2.367	3.042	2.660	2.940	0.719	0.850	0.647	0.564	0.610	0.602	0.618	0.540	0.781	0.568	0.802	0.633	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.489	0.349	0.252	0.594	0.599	0.256	bdl	bdl	bdl	bdl	0.319	0.585	
MoO_3	bdl	bdl	bdl	bdl	bdl	0.142	bdl	bdl	bdl	0.164	bdl	0.197	0.137	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	99.152	100.495	100.699	102.673	97.379	100.564	99.601	102.229	99.038	99.896	96.233	97.899	95.449	100.495	99.699	98.851	98.838	100.484	99.534	101.392	99.172	102.087	
	Element [mass-%]										Element [mass-%]												mass-%
Si	0.029	0.016	bdl	0.011	bdl	0.017	0.014	0.023	bdl	0.025	0.015	bdl	0.027	bdl	0.015	bdl	0.019	0.022	bdl	0.015	0.015	bdl	0.010
Al	0.557	0.583	0.596	0.766	0.634	0.565	0.406	0.673	0.717	0.775	7.079	7.097	7.660	7.188	7.703	8.106	9.454	9.837	8.823	9.922	7.071	7.092	0.008
Cr	0.065	0.050	bdl	0.053	0.080	0.103	0.141	0.056	0.144	0.034	21.285	14.282	15.102	21.198	17.720	12.910	0.504	2.846	0.077	3.097	20.035	21.842	0.020
V	bdl	bdl	0.472	bdl	0.328	bdl	bdl	0.538	bdl	bdl	bdl	bdl	bdl	0.260	bdl	bdl	bdl	bdl	0.274	bdl	bdl	0.306	0.249
Fe	60.840	61.808	61.503	63.710	59.126	61.600	60.783	62.369	60.184	60.932	26.609	36.242	32.404	29.688	32.636	36.622	49.802	47.340	52.287	47.417	30.560	29.998	0.046
Mn	9.010	8.826	8.942	9.039	8.995	9.115	9.290	9.036	9.105	9.074	4.224	4.354	4.327	4.186	4.168	4.424	4.287	4.256	4.385	4.242	3.890	4.255	0.026
Mg	3.204	3.656	3.161	2.659	2.892	3.117	3.374	2.931	3.302	2.898	6.559	5.957	6.190	6.598	6.405	6.532	5.708	6.160	4.941	6.296	6.644	6.682	0.007
Ca	1.825	1.567	2.038	2.113	2.118	1.992	1.692	2.174	1.901	2.101	0.514	0.607	0.462	0.403	0.436	0.430	0.442	0.386	0.558	0.406	0.573	0.452	0.012
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.489	0.349	0.252	0.594	0.599	0.256	bdl	bdl	bdl	bdl	0.319	0.585	0.164
Mo	bdl	bdl	bdl	bdl	bdl	0.095	bdl	bdl	bdl	0.109	bdl	0.131	0.091	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.084
O (calculated)	23.621	23.989	23.965	24.323	23.198	23.961	23.653	24.302	23.645	23.812	29.459	28.870	28.791	30.373	29.988	29.564	28.555	29.464	28.103	29.803	30.064	30.838	
Total	99.152	100.495	100.699	102.673	97.379	100.564	99.601	102.229	99.038	99.896	96.233	97.899	95.449	100.495	99.699	98.851	98.838	100.484	99.534	101.392	99.172	102.087	
	Cations based on 1 O										Cations based on 4 O												
Si	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.002	0.000	0.001	0.001	0.002	0.002	0.000	0.001	0.001	0.000	
Al	0.014	0.014	0.015	0.019	0.015	0.014	0.010	0.016	0.018	0.019	0.570	0.583	0.631	0.561	0.609	0.650	0.785	0.792	0.745	0.790	0.558	0.546	
Cr	0.001	0.001	0.000	0.001	0.001	0.001	0.002	0.001	0.002	0.000	0.889	0.609	0.646	0.859	0.727	0.537	0.022	0.119	0.003	0.128	0.820	0.872	
V	0.000	0.000	0.006	0.000	0.004	0.000	0.003	0.007	0.000	0.000	0.000	0.000	0.006	0.011	0.001	0.000	0.000	0.001	0.012	0.006	0.000	0.012	
Fe	0.738	0.738	0.735	0.750	0.696	0.761	0.736	0.735	0.729	0.733	1.035	1.439	1.290	1.120	1.247	1.420	1.999	1.841	2.132	1.823	1.165	1.115	
Mn	0.111	0.107	0.109	0.108	0.108	0.114	0.114	0.108	0.112	0.111	0.167	0.176	0.175	0.161	0.162	0.174	0.175	0.168	0.182	0.166	0.151	0.161	
Mg	0.089	0.100	0.087	0.072	0.078	0.088	0.094	0.079	0.092	0.080	0.586	0.543	0.566	0.572	0.562	0.582	0.526	0.550	0.463	0.556	0.582	0.571	
Ca	0.031	0.026	0.034	0.035	0.035	0.034	0.029	0.036	0.032	0.035	0.028	0.034	0.026	0.021	0.023	0.023	0.025	0.021	0.032	0.022	0.030	0.023	
Mo	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.003	0.002	0.000	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.001	
Sum cations	0.985	0.987	0.986	0.985	0.938	1.015	0.989	0.984	0.986	0.981	3.277	3.387	3.344	3.305	3.334	3.387	3.535	3.496	3.569	3.492	3.307	3.300	

Table S17. Results of chemical mineral EMP analyses performed on the remelted sample BR2.

SAMPLE BR2	Wuestite phases									Spinel phases						Melilite phases					Detection limit
	Oxide [mass-%]									Oxide [mass-%]						Oxide [mass-%]					
	an 11	an 12	an 13	an 14	an 15	an 17	an 18	an 19	an 20	an21	an22	an25	an27	an28	an29	an 30	an 31	an 32	an 33	an 34	
SiO_2	0.038	0.038	0.080	0.063	0.087	0.029	0.047	0.080	0.040	0.081	bdl	bdl	bdl	0.080	0.085	22.874	23.094	23.524	25.400	22.962	
Al_2O_3	0.936	0.568	0.677	0.747	0.696	0.801	2.467	0.703	0.586	12.669	12.638	12.675	12.639	18.848	16.749	34.158	34.263	32.942	28.663	34.437	
Cr_2O_3	0.536	0.567	0.609	0.542	0.556	0.339	0.591	0.495	0.679	51.918	50.718	51.303	51.350	33.479	35.270	bdl	bdl	bdl	0.054	bdl	
V_2O_3	bdl	bdl	bdl	bdl	bdl	0.676	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.609	bdl	0.684	bdl	
TiO_2	0.082	0.000	0.000	0.046	0.015	0.086	0.015	0.012	0.047	0.083	0.135	0.092	0.079	0.308	0.314	0.248	0.328	0.280	0.271	0.316	
FeO*	83.180	81.540	84.492	81.036	80.202	81.161	77.542	82.778	81.552	28.195	27.000	28.731	28.236	34.246	35.285	5.509	5.092	6.268	4.291	5.488	
MnO	9.394	9.612	9.497	9.607	9.894	9.816	9.468	9.745	9.989	4.687	4.430	4.459	4.519	4.355	4.507	0.222	0.236	0.378	0.294	0.275	
MgO	7.017	7.611	6.616	7.179	7.000	7.076	6.471	6.545	6.804	10.455	10.491	10.317	10.484	10.930	10.766	0.169	0.106	0.220	0.179	0.151	
CaO	1.773	1.471	1.645	1.747	1.623	1.846	4.791	1.609	1.619	0.797	0.654	0.823	0.818	0.635	0.710	39.208	39.518	39.222	43.364	39.173	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.877	0.997	1.224	0.775	0.684	0.635	bdl	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	0.173	bdl	0.210	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.187	0.195	bdl	bdl	
Total	103.015	101.644	103.798	101.068	100.283	101.864	101.441	101.997	101.318	109.572	106.915	109.166	108.683	103.526	104.149	102.601	103.525	103.054	103.239	103.178	
	Element [mass-%]									Element [mass-%]						Element [mass-%]					mass-%
Si	bdl	bdl	0.037	0.029	0.041	bdl	0.022	0.037	bdl	0.038	bdl	bdl	bdl	0.037	0.040	10.692	10.795	10.996	11.873	10.733	0.020
Al	0.495	0.301	0.358	0.395	0.368	0.424	1.306	0.372	0.310	6.705	6.689	6.708	6.689	9.975	8.864	18.078	18.134	17.435	15.170	18.226	0.014
Cr	0.367	0.388	0.417	0.371	0.380	0.232	0.404	0.339	0.465	35.522	34.701	35.102	35.134	22.906	24.132	bdl	bdl	bdl	0.037	bdl	0.031
V	bdl	bdl	bdl	bdl	bdl	0.460	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.414	bdl	0.465	bdl	0.358
Fe	64.656	63.381	65.676	62.990	62.341	63.087	60.274	64.344	63.391	21.916	20.987	22.333	21.948	26.620	27.427	4.282	3.958	4.872	3.335	4.266	0.060
Mn	7.275	7.444	7.355	7.440	7.662	7.602	7.333	7.547	7.736	3.630	3.431	3.453	3.500	3.373	3.490	0.172	0.183	0.293	0.228	0.213	0.035
Mg	4.231	4.590	3.990	4.329	4.221	4.267	3.902	3.947	4.103	6.305	6.326	6.222	6.322	6.591	6.492	0.102	0.064	0.133	0.108	0.091	0.012
Ca	1.267	1.051	1.176	1.249	1.160	1.319	3.424	1.150	1.157	0.570	0.467	0.588	0.585	0.454	0.507	28.022	28.243	28.032	30.992	27.997	0.017
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.877	0.997	1.224	0.775	0.684	0.635	bdl	bdl	bdl	bdl	bdl	0.169
Mo	bdl	bdl	bdl	bdl	0.140	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.125	0.130	bdl	bdl	0.124
O (calculated)	24.685	24.314	24.674	24.210	23.969	24.404	24.776	24.228	24.138	33.890	33.142	33.517	33.671	32.740	32.515	41.030	41.466	41.136	41.006	41.337	
Total	103.015	101.644	103.798	101.068	100.283	101.864	101.441	101.997	101.318	109.572	106.915	109.166	108.683	103.526	104.149	102.601	103.525	103.054	103.239	103.178	
	Cations based on 1 O									Cations based on 7 O						Cations based on 7 O					
Si	0.000	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.000	0.003	0.001	0.001	0.000	0.003	0.003	1.039	1.038	1.066	1.155	1.035	
Al	0.012	0.007	0.009	0.010	0.009	0.010	0.031	0.009	0.008	0.469	0.479	0.475	0.471	0.723	0.647	1.829	1.815	1.759	1.536	1.830	
Cr	0.005	0.005	0.005	0.005	0.005	0.003	0.005	0.004	0.006	1.290	1.289	1.289	1.284	0.861	0.913	0.000	0.000	0.000	0.002	0.000	
V	0.000	0.001	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.006	0.000	0.000	0.022	0.000	0.025	0.011	
Fe	0.750	0.747	0.763	0.745	0.738	0.741	0.697	0.761	0.752	0.741	0.726	0.764	0.747	0.932	0.967	0.209	0.191	0.238	0.163	0.207	
Mn	0.086	0.089	0.087	0.090	0.092	0.091	0.086	0.091	0.093	0.125	0.121	0.120	0.121	0.120	0.125	0.009	0.009	0.015	0.011	0.011	
Mg	0.113	0.124	0.106	0.118	0.115	0.115	0.104	0.107	0.112	0.490	0.503	0.489	0.494	0.530	0.526	0.011	0.007	0.015	0.012	0.010	
Ca	0.020	0.017	0.019	0.021	0.019	0.022	0.055	0.019	0.019	0.027	0.023	0.028	0.028	0.022	0.025	1.908	1.903	1.904	2.112	1.893	
Mo	0.000	0.000	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.002	0.002	0.000	0.001	0.000	0.001	0.002	0.004	0.004	0.001	0.000	
Sum cations	0.987	0.992	0.990	0.989	0.980	0.987	0.979	0.992	0.991	3.147	3.144	3.165	3.147	3.196	3.206	5.008	4.990	5.001	5.016	4.997	

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Table S18. Results of chemical mineral EMP analyses performed on the remelted sample BR3.

SAMPLE BR3	Wuestite phases											Spinel phases				Detection limit
	Oxide [mass-%]											Oxide [mass-%]				
	an25	an26	an27	an28	an37	an38	an39	an40	an41	an42	an43	an24	an44	an45	an28	
SiO_2	0.092	0.045	0.072	0.049	0.042	0.047	bdl	0.045	0.100	0.047	0.058	0.050	0.041	0.049	0.047	
Al_2O_3	1.371	0.644	0.782	0.603	0.747	0.878	0.875	1.211	1.987	0.918	1.003	12.551	19.893	12.920	13.853	
Cr_2O_3	0.153	0.098	0.092	0.082	0.092	0.153	0.218	0.111	0.089	0.166	0.413	39.883	18.452	39.953	36.959	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.659	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.079	0.008	0.048	0.095	0.053	0.088	0.066	0.105	0.116	0.025	0.061	0.121	0.257	0.113	0.092	
FeO*	77.547	81.555	79.011	81.230	87.306	78.857	80.659	77.321	82.275	75.734	79.141	30.554	43.812	40.625	42.148	
MnO	10.914	11.507	10.950	10.726	11.092	10.764	11.015	10.945	10.834	11.312	11.422	5.107	5.103	5.318	5.152	
MgO	5.741	5.705	5.387	5.449	5.587	6.990	6.753	5.697	5.166	6.883	7.024	10.923	11.216	11.089	11.165	
CaO	2.005	2.170	1.639	1.823	1.993	1.884	1.666	2.151	2.610	1.562	1.528	0.680	0.532	0.614	0.567	
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.206	bdl	0.761	0.759	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	97.920	101.732	97.981	100.134	106.947	99.763	101.686	98.259	103.229	96.809	100.932	100.020	99.353	111.152	110.593	
	Element [mass-%]											Element [mass-%]				mass-%
Si	0.043	0.021	0.034	0.023	0.020	0.022	bdl	0.021	0.047	0.022	0.027	0.023	0.019	0.023	0.022	0.018
Al	0.726	0.341	0.414	0.319	0.395	0.465	0.463	0.641	1.052	0.486	0.531	6.643	10.528	6.838	7.332	0.014
Cr	0.105	0.067	0.063	0.056	0.063	0.105	0.149	0.076	0.061	0.114	0.283	27.288	12.625	27.336	25.287	0.027
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.448	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.339
Fe	60.278	63.393	61.416	63.140	67.863	61.296	62.697	60.102	63.953	58.868	61.517	23.750	34.055	31.578	32.762	0.052
Mn	8.452	8.912	8.480	8.307	8.590	8.336	8.531	8.476	8.390	8.761	8.846	3.955	3.952	4.119	3.990	0.030
Mg	3.462	3.440	3.249	3.286	3.369	4.215	4.072	3.435	3.115	4.151	4.236	6.587	6.764	6.687	6.733	0.012
Ca	1.433	1.551	1.171	1.303	1.424	1.346	1.191	1.537	1.865	1.116	1.092	0.486	0.380	0.439	0.405	0.016
F	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.206	bdl	0.761	0.759	0.174
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.114
O (calculated)	23.422	24.007	23.155	23.567	25.222	23.912	24.274	23.522	24.656	23.213	24.198	31.062	30.968	33.352	33.217	
Total	97.920	101.732	97.981	100.134	106.947	99.763	101.686	98.259	103.229	96.809	100.932	100.020	99.353	111.152	110.593	
	Cations based on 1 O											Cations based on 4 O				
Si	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	
Al	0.018	0.008	0.011	0.008	0.010	0.011	0.011	0.016	0.025	0.012	0.013	0.507	0.806	0.486	0.524	
Cr	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.004	1.081	0.502	1.009	0.937	
V	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.006	0.000	0.001	0.002	0.000	0.000	0.000	0.000	
Fe	0.737	0.757	0.760	0.768	0.825	0.696	0.740	0.732	0.743	0.727	0.728	0.876	1.260	1.085	1.130	
Mn	0.105	0.108	0.107	0.103	0.106	0.096	0.102	0.105	0.099	0.110	0.106	0.148	0.149	0.144	0.140	
Mg	0.097	0.094	0.092	0.092	0.094	0.110	0.110	0.096	0.083	0.118	0.115	0.558	0.575	0.528	0.534	
Ca	0.024	0.026	0.020	0.022	0.024	0.021	0.020	0.026	0.030	0.019	0.018	0.025	0.020	0.021	0.019	
Mo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	
Sum cations	0.985	0.995	0.991	0.993	1.061	0.937	0.988	0.983	0.983	0.989	0.987	3.199	3.313	3.275	3.287	

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Table S19. Results of chemical mineral EMP analyses performed on the remelted sample BC1.

SAMPLE BC1	Pyroxene phase								Detection limit
	Oxide [mass-%]								
	an22	an33	an34	an35	an36	an39	an40	an41	
SiO_2	45.483	40.177	40.857	41.647	44.662	45.168	44.377	45.757	
Al_2O_3	8.334	7.786	7.838	7.924	8.015	8.478	8.220	7.721	
Cr_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.366	0.396	0.381	0.394	0.362	0.377	0.462	0.360	
FeO*	21.015	23.977	23.572	23.521	23.959	22.926	24.077	23.316	
MnO	1.745	1.841	2.058	1.782	1.878	1.825	1.836	1.899	
MgO	9.890	8.953	9.714	9.469	8.876	9.654	8.866	9.658	
CaO	22.364	22.045	21.506	21.947	22.161	22.035	22.247	21.787	
F	bdl	0.172	bdl	bdl	bdl	0.191	bdl	bdl	
MoO_3	bdl	0.224	bdl	0.184	bdl	bdl	bdl	bdl	
Total	109.284	105.529	106.069	107.413	109.968	110.656	110.535	110.929	
	Element [mass-%]								mass-%
Si	21.260	18.780	19.098	19.467	20.876	21.113	20.743	21.388	0.021
Al	4.411	4.121	4.148	4.194	4.242	4.487	4.350	4.086	0.014
Cr	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.029
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.344
Fe	16.335	18.637	18.323	18.283	18.623	17.820	18.715	18.124	0.059
Mn	1.351	1.426	1.594	1.380	1.454	1.413	1.422	1.471	0.032
Mg	5.964	5.399	5.858	5.710	5.353	5.822	5.347	5.824	0.012
Ca	15.983	15.755	15.370	15.685	15.838	15.748	15.900	15.571	0.016
F	bdl	0.172	bdl	bdl	bdl	0.191	bdl	bdl	0.159
Mo	bdl	0.149	bdl	0.123	bdl	bdl	bdl	bdl	0.120
O (calculated)	43.944	41.090	41.581	42.154	43.546	44.013	43.756	44.079	
Total	109.284	105.529	106.069	107.413	109.968	110.656	110.535	110.929	
	Cations based on 6 O								
Si	1.654	1.562	1.570	1.578	1.639	1.640	1.620	1.659	
Al	0.357	0.357	0.355	0.354	0.347	0.363	0.354	0.330	
Cr	0.001	0.000	0.000	0.001	0.000	0.000	0.000	0.001	
V	0.000	0.000	0.004	0.014	0.000	0.000	0.013	0.006	
Fe	0.639	0.780	0.757	0.746	0.735	0.696	0.735	0.707	
Mn	0.054	0.061	0.067	0.057	0.058	0.056	0.057	0.058	
Mg	0.536	0.519	0.556	0.535	0.485	0.522	0.483	0.522	
Ca	0.871	0.918	0.885	0.891	0.871	0.857	0.870	0.846	
Mo	0.000	0.004	0.000	0.003	0.000	0.001	0.000	0.002	
Sum cations	4.112	4.200	4.195	4.179	4.135	4.135	4.132	4.130	

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Table S20. Results of chemical mineral EMP analyses performed on the remelted sample BC2.

SAMPLE BC2	Spinel phases										Pyroxene phases								Detection limit
	Oxide [mass-%]										Oxide [mass-%]								
	an35	an38	an39	an40	an41	an42	an43	an44	an45	an46	an36	an47	an48	an49	an53	an54	an55	an56	
SiO_2	0.062	0.093	0.109	0.111	0.126	0.088	0.212	0.074	0.187	0.140	51.171	51.203	50.975	48.505	49.625	51.836	51.231	50.108	
Al_2O_3	6.691	7.755	7.565	7.308	7.545	6.673	7.330	6.808	7.432	6.837	8.098	7.901	9.185	9.827	8.534	7.479	9.219	9.021	
Cr_2O_3	46.166	29.187	12.715	32.625	24.696	45.815	3.621	46.838	3.636	44.880	bdl	bdl	0.049	bdl	0.055	bdl	bdl	bdl	
V_2O_3	bdl	0.564	bdl	bdl	bdl	bdl	bdl	bdl	0.948	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.106	0.186	0.241	0.107	0.174	0.097	0.433	0.045	0.423	0.072	0.366	0.376	0.520	0.521	0.423	0.246	0.477	0.430	
FeO*	38.379	54.368	68.755	51.736	57.551	42.750	81.588	42.666	80.155	41.659	12.805	13.469	14.667	16.446	21.928	18.701	20.039	19.385	
MnO	3.184	2.923	2.907	3.191	3.093	3.145	2.926	3.014	2.694	3.084	1.616	1.535	1.818	1.526	1.680	1.708	1.589	1.705	
MgO	9.972	9.432	8.367	9.547	9.085	10.288	7.331	10.002	7.395	10.099	9.906	10.188	7.804	6.875	8.241	10.511	8.147	8.809	
CaO	0.134	0.112	0.107	0.170	0.239	0.146	0.129	0.128	0.173	0.161	22.831	22.778	23.094	23.116	22.781	22.839	23.190	23.021	
F	0.585	0.379	bdl	0.441	0.563	0.885	bdl	0.695	bdl	0.640	bdl	bdl	bdl	0.163	bdl	bdl	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	105.459	104.921	100.977	105.448	103.291	109.514	103.595	110.081	103.063	107.433	106.886	107.457	108.358	107.141	113.416	113.424	113.984	112.739	
	Element [mass-%]										Element [mass-%]								mass-%
Si	0.029	0.043	0.051	0.052	0.059	0.041	0.099	0.035	0.087	0.065	23.919	23.934	23.827	22.673	23.196	24.230	23.947	23.422	0.021
Al	3.541	4.104	4.004	3.868	3.993	3.532	3.879	3.603	3.933	3.618	4.286	4.182	4.861	5.201	4.517	3.958	4.879	4.774	0.014
Cr	31.587	19.970	8.700	22.322	16.897	31.347	2.477	32.047	2.488	30.707	bdl	bdl	0.034	bdl	0.038	bdl	bdl	bdl	0.030
V	bdl	0.383	bdl	bdl	bdl	bdl	bdl	bdl	0.644	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.329
Fe	29.832	42.260	53.444	40.215	44.735	33.230	63.419	33.164	62.305	32.382	9.953	10.470	11.401	12.784	17.045	14.536	15.576	15.068	0.057
Mn	2.466	2.264	2.251	2.471	2.395	2.436	2.266	2.334	2.086	2.388	1.252	1.189	1.408	1.182	1.301	1.323	1.231	1.320	0.032
Mg	6.013	5.688	5.046	5.757	5.479	6.204	4.421	6.032	4.459	6.090	5.974	6.144	4.706	4.146	4.970	6.338	4.913	5.312	0.012
Ca	0.096	0.080	0.076	0.121	0.171	0.104	0.092	0.091	0.124	0.115	16.317	16.279	16.505	16.521	16.281	16.323	16.574	16.453	0.016
F	0.585	0.379	bdl	0.441	0.563	0.885	bdl	0.695	bdl	0.640	bdl	bdl	bdl	0.163	bdl	bdl	bdl	bdl	0.155
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.119
O (calculated)	31.020	29.694	27.283	29.930	28.690	31.736	26.898	32.011	26.936	31.355	45.033	45.256	45.450	44.317	45.952	46.580	46.759	46.214	
Total	105.459	104.921	100.977	105.448	103.291	109.514	103.595	110.081	103.063	107.433	106.886	107.457	108.358	107.141	113.416	113.424	113.984	112.739	
	Cations based on 4 O										Cations based on 6 O								
Si	0.002	0.003	0.004	0.004	0.005	0.003	0.008	0.002	0.007	0.005	1.815	1.808	1.792	1.749	1.725	1.778	1.751	1.732	
Al	0.271	0.328	0.348	0.307	0.330	0.264	0.342	0.267	0.346	0.274	0.339	0.329	0.381	0.418	0.350	0.302	0.371	0.368	
Cr	1.253	0.828	0.392	0.918	0.725	1.216	0.113	1.232	0.114	1.205	0.000	0.000	0.001	0.000	0.002	0.001	0.001	0.000	
V	0.012	0.016	0.004	0.011	0.014	0.000	0.000	0.000	0.030	0.003	0.000	0.000	0.005	0.003	0.000	0.000	0.001	0.007	
Fe	1.102	1.631	2.245	1.540	1.787	1.200	2.702	1.187	2.651	1.184	0.380	0.398	0.431	0.496	0.638	0.536	0.573	0.560	
Mn	0.093	0.089	0.096	0.096	0.097	0.089	0.098	0.085	0.090	0.089	0.049	0.046	0.054	0.047	0.049	0.050	0.046	0.050	
Mg	0.510	0.504	0.487	0.506	0.503	0.515	0.433	0.496	0.436	0.511	0.524	0.536	0.409	0.369	0.427	0.537	0.415	0.454	
Ca	0.005	0.004	0.004	0.006	0.010	0.005	0.005	0.005	0.007	0.006	0.868	0.862	0.870	0.893	0.849	0.839	0.849	0.853	
Mo	0.000	0.001	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.002	0.001	0.000	0.000	0.000	
Sum cations	3.248	3.405	3.582	3.389	3.470	3.292	3.702	3.276	3.682	3.276	3.975	3.978	3.944	3.976	4.041	4.044	4.006	4.024	

Table S21. Results of chemical mineral EMP analyses performed on the remelted sample BC3.

SAMPLE BC3	Spinel phases											Pyroxene phases											Detection limit
	Oxide [mass-%]											Oxide [mass-%]											
	an1	an15	an16	an17	an18	an19	an20	an21	an22	an23	an24	an2	an5	an6	an7	an8	an9	an10	an11	an12	an13	an14	
SiO_2	0.065	bdl	0.045	bdl	0.122	0.074	0.068	0.062	0.063	0.081	0.054	46.720	47.055	46.975	46.200	46.198	46.693	46.046	46.041	46.450	46.572	47.747	
Al_2O_3	7.371	7.365	6.878	6.742	7.134	7.364	7.203	7.424	7.623	7.832	6.848	7.913	7.890	7.889	7.735	7.732	7.442	7.853	7.884	7.741	8.117	8.073	
Cr_2O_3	31.752	24.138	37.995	39.103	37.047	34.503	34.335	25.066	23.684	32.129	38.485	bdl	bdl	0.015	0.073	bdl	bdl	bdl	bdl	bdl	bdl	0.047	
V_2O_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.690	bdl	bdl	bdl	bdl	bdl	bdl	0.912	bdl	bdl	bdl	bdl	bdl	bdl	
TiO_2	0.111	0.175	0.115	0.114	0.102	0.111	0.148	0.160	0.203	0.118	0.114	0.338	0.342	0.356	0.341	0.324	0.362	0.464	0.383	0.338	0.500	0.358	
FeO*	46.380	51.058	39.082	37.941	39.269	41.707	40.882	50.836	53.425	45.288	40.862	12.112	11.462	10.599	11.639	11.299	10.996	12.217	11.685	11.432	10.488	10.435	
MnO	3.177	3.200	3.307	3.286	3.163	3.288	3.207	3.247	3.137	3.310	3.168	1.543	1.493	1.832	1.629	1.504	1.759	1.639	1.501	1.525	1.569	1.555	
MgO	9.005	8.190	9.174	9.112	9.403	9.302	8.880	8.374	8.468	9.195	9.260	10.254	10.309	10.933	10.462	10.127	10.580	9.967	10.217	9.962	10.364	11.055	
CaO	0.125	0.098	0.081	0.126	0.089	0.103	0.084	0.163	0.168	0.096	0.113	22.846	22.587	22.286	22.121	22.874	22.597	22.588	22.768	22.766	22.787	22.433	
F	0.340	0.387	0.977	1.060	0.781	0.591	0.862	0.658	0.471	0.862	0.660	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.243	bdl	bdl	
MoO_3	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.218	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	
Total	98.220	94.655	97.377	97.105	97.077	97.150	95.544	95.743	97.802	98.937	99.515	102.370	101.167	101.140	100.464	100.995	100.439	100.791	100.551	100.564	100.488	101.857	
	Element [mass-%]											Element [mass-%]											mass-%
Si	0.030	bdl	0.021	bdl	0.057	0.035	0.032	0.029	0.029	0.038	0.025	21.838	21.995	21.957	21.595	21.594	21.826	21.523	21.521	21.712	21.769	22.318	0.020
Al	3.901	3.898	3.640	3.568	3.776	3.897	3.812	3.929	4.034	4.145	3.624	4.188	4.176	4.175	4.094	4.092	3.939	4.156	4.173	4.097	4.296	4.273	0.014
Cr	21.725	16.515	25.996	26.754	25.348	23.607	23.492	17.150	16.205	21.983	26.331	bdl	bdl	bdl	0.050	bdl	bdl	bdl	bdl	bdl	bdl	0.032	0.029
V	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.469	bdl	bdl	bdl	bdl	bdl	bdl	0.620	bdl	bdl	bdl	bdl	bdl	bdl	0.347
Fe	36.051	39.688	30.379	29.492	30.524	32.419	31.778	39.515	41.527	35.203	31.762	9.415	8.909	8.239	9.047	8.783	8.547	9.496	9.083	8.886	8.152	8.111	0.055
Mn	2.460	2.478	2.561	2.545	2.450	2.546	2.484	2.515	2.429	2.563	2.453	1.195	1.156	1.419	1.262	1.165	1.362	1.269	1.162	1.181	1.215	1.204	0.031
Mg	5.430	4.939	5.532	5.495	5.670	5.609	5.355	5.050	5.106	5.545	5.584	6.184	6.217	6.593	6.309	6.107	6.380	6.010	6.161	6.007	6.250	6.667	0.012
Ca	0.089	0.070	0.058	0.090	0.064	0.074	0.060	0.116	0.120	0.069	0.081	16.328	16.143	15.928	15.810	16.348	16.150	16.143	16.272	16.271	16.286	16.033	0.016
F	0.340	0.387	0.977	1.060	0.781	0.591	0.862	0.658	0.471	0.862	0.660	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.243	bdl	bdl	0.143
Mo	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.145	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	bdl	0.115
O (calculated)	28.192	26.547	28.137	28.084	28.217	28.131	27.509	26.765	27.365	28.270	28.848	42.816	42.555	42.656	42.129	42.269	42.230	42.185	42.099	42.026	42.378	43.117	
Total	98.220	94.655	97.377	97.105	97.077	97.150	95.544	95.743	97.802	98.937	99.515	102.370	101.167	101.140	100.464	100.995	100.439	100.791	100.551	100.564	100.488	101.857	
	Cations based on 4 O											Cations based on 6 O											
Si	0.002	0.001	0.002	0.001	0.005	0.003	0.003	0.002	0.002	0.003	0.002	1.743	1.767	1.759	1.752	1.746	1.767	1.744	1.747	1.766	1.756	1.769	
Al	0.328	0.348	0.307	0.301	0.317	0.329	0.329	0.348	0.350	0.348	0.298	0.348	0.349	0.348	0.346	0.344	0.332	0.351	0.353	0.347	0.361	0.353	
Cr	0.948	0.766	1.137	1.173	1.106	1.033	1.051	0.789	0.729	0.957	1.123	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.001	0.000	0.000	0.001	
V	0.000	0.002	0.000	0.000	0.006	0.006	0.005	0.000	0.022	0.012	0.000	0.013	0.000	0.007	0.006	0.028	0.000	0.000	0.000	0.004	0.000	0.000	
Fe	1.465	1.713	1.237	1.203	1.240	1.321	1.324	1.692	1.739	1.427	1.262	0.378	0.360	0.332	0.369	0.357	0.348	0.387	0.371	0.363	0.331	0.323	
Mn	0.102	0.109	0.106	0.106	0.101	0.105	0.105	0.109	0.103	0.106	0.099	0.049	0.047	0.058	0.052	0.048	0.056	0.053	0.048	0.049	0.050	0.049	
Mg	0.507	0.490	0.518	0.515	0.529	0.525	0.513	0.497	0.491	0.516	0.510	0.570	0.577	0.610	0.591	0.571	0.597	0.563	0.578	0.565	0.582	0.611	
Ca	0.005	0.004	0.003	0.005	0.004	0.004	0.003	0.007	0.007	0.004	0.004	0.913	0.909	0.894	0.899	0.926	0.916	0.917	0.926	0.927	0.920	0.891	
Mo	0.000	0.002	0.002	0.000	0.001	0.002	0.001	0.000	0.001	0.000	0.003	0.003	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.000	0.002	
Sum cations	3.358	3.435	3.312	3.305	3.309	3.328	3.334	3.445	3.445	3.372	3.302	4.018	4.009	4.010	4.019	4.021	4.016	4.014	4.024	4.023	4.001	3.999	

61 **Table S22.** Calculation of Fe^{2+} and Fe^{3+} considering main elements only of sample BC3 in spinel.

SAMPLE BC3											
Oxide	**an1**	**an15**	**an16**	**an17**	**an18**	**an19**	**an20**	**an21**	**an22**	**an23**	**an24**
Al_2O_3	7.371	7.365	6.878	6.742	7.134	7.364	7.203	7.424	7.623	7.832	6.848
Cr_2O_3	31.752	24.138	37.995	39.103	37.047	34.503	34.335	25.066	23.684	32.129	38.485
Fe_2O_3	33.671	38.748	26.656	25.396	27.187	29.725	28.638	38.506	40.846	32.840	27.828
FeO	16.082	16.192	15.097	15.090	14.806	14.960	15.113	16.188	16.672	15.738	15.822
MnO	3.177	3.200	3.307	3.286	3.163	3.288	3.207	3.247	3.137	3.310	3.168
MgO	9.005	8.190	9.174	9.112	9.403	9.302	8.880	8.374	8.468	9.195	9.260
Total	101.058	97.833	99.107	98.728	98.740	99.142	97.376	98.805	100.429	101.044	101.411
Cations	**an1**	**an15**	**an16**	**an17**	**an18**	**an19**	**an20**	**an21**	**an22**	**an23**	**an24**
Al^{3+}	0.294	0.305	0.279	0.274	0.289	0.298	0.297	0.304	0.307	0.311	0.272
Cr^{3+}	0.849	0.671	1.032	1.067	1.007	0.935	0.949	0.689	0.641	0.856	1.024
Fe^{3+}	0.857	1.024	0.689	0.659	0.704	0.767	0.754	1.007	1.052	0.833	0.705
Fe^{2+}	0.455	0.476	0.434	0.435	0.426	0.429	0.442	0.471	0.477	0.444	0.445
Mn^{2+}	0.091	0.095	0.096	0.096	0.092	0.095	0.095	0.096	0.091	0.094	0.090
Mg^{2+}	0.454	0.429	0.470	0.469	0.482	0.476	0.463	0.434	0.432	0.462	0.464
Cations (tot)	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Oxygen (tot)	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000

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3. Chemical Analyses

Table S23. Chemical composition of original sample A, B and C. Oxides below <0.1 mass-% are not presented.

Oxide*in mass-%	Sample A	Sample B	Sample C
FeO	42.3	38.3	26.1
CaO	21.2	26.7	23.6
SiO_2	10.4	11.2	25.0
Al_2O_3	7.28	9.58	9.13
MgO	6.20	3.48	3.92
MnO	4.65	5.19	5.38
Cr_2O_3	1.73	1.86	2.13
TiO_2	0.37	0.55	0.47
V_2O_3	0.11	0.11	0.16

*oxides calculated to the most common oxidation state in EAF slags

4. Mineralogical Characterization

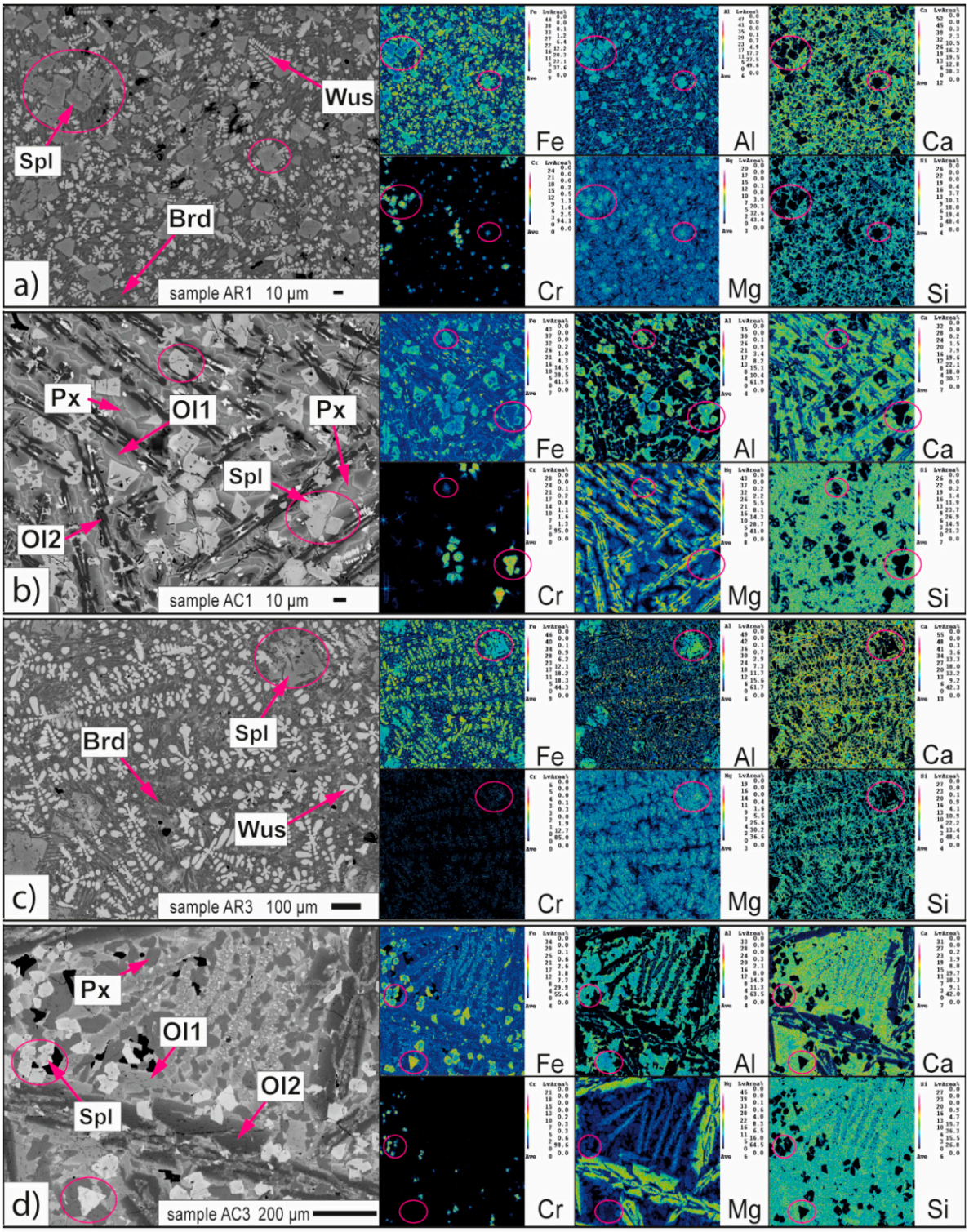

Figure S1. Back scattered electron (BSE) images and element mappings (Fe, Al, Ca, Cr, Mg, Si) of samples derived from the laboratory experiments: (**a**) remelted sample AR1 (fast cooling), (**b**) remelted sample AR3 (slow cooling), (**c**) remelted and modified sample AC1 (fast cooling) and (**d**) remelted and modified sample AC3 (slow cooling). Abbreviations according to Whitney and Evans (2010): wuestite solid solution (Wus), spinel solid solution (Spl), olivine group phase (Ol), melilite group phase (Mll), bredigite (Brd), Ca-rich olivine (Ol1), Mg-rich olivine (Ol2), and pyroxene (Px). Phases determined via x-ray diffraction (XRD) and, if possible, via quantitative electron microprobe (EMP) analyses.

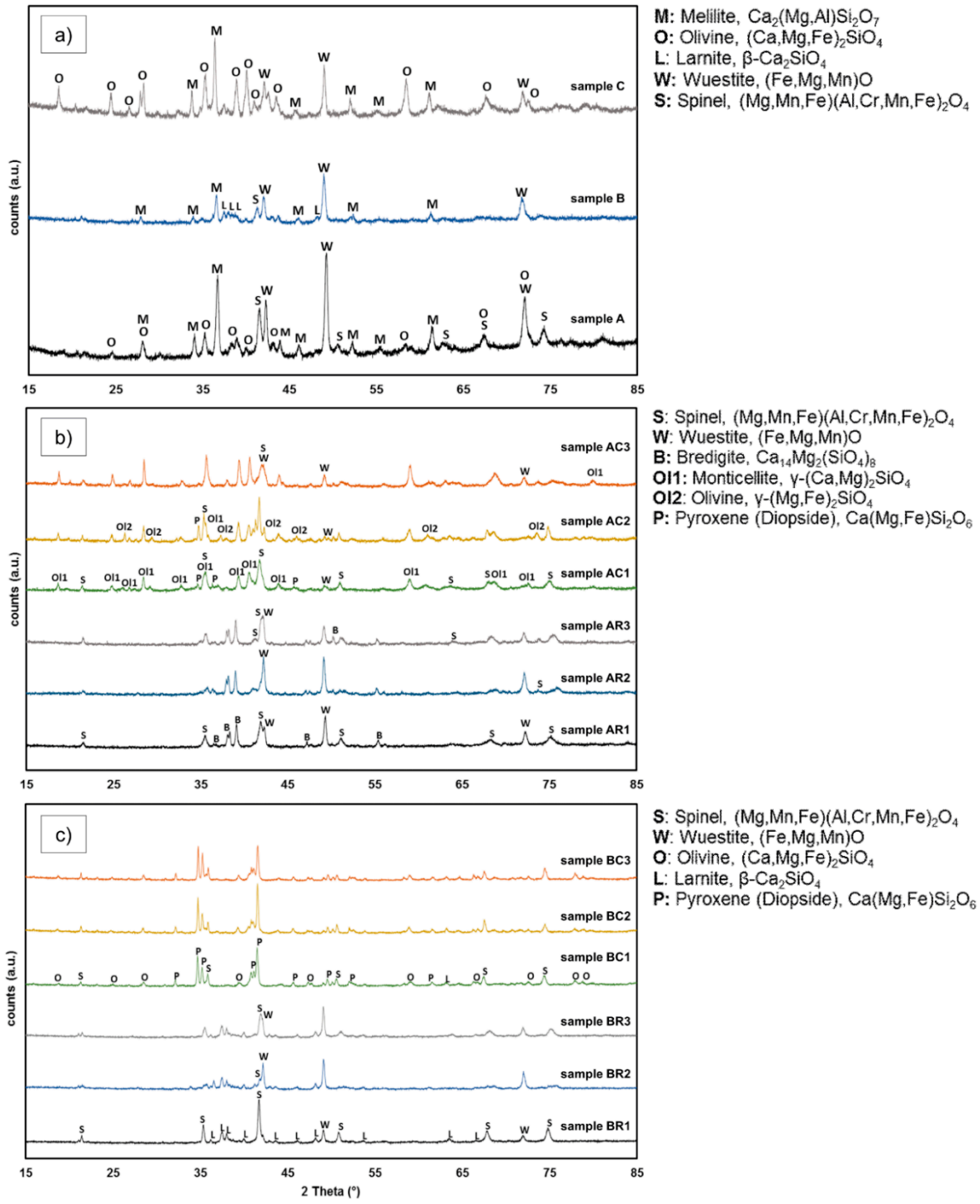

Figure S2. X-ray diffraction (XRD) pattern of (**a**) original samples A-C, (**b**) remelted and conditioned samples derived from the laboratory experiments (samples AR1-3 and AC1-3) and (**c**) remelted and conditioned samples derived from the experiments in a pilot plant scale EAF (samples BR1-3 and BC1-3).

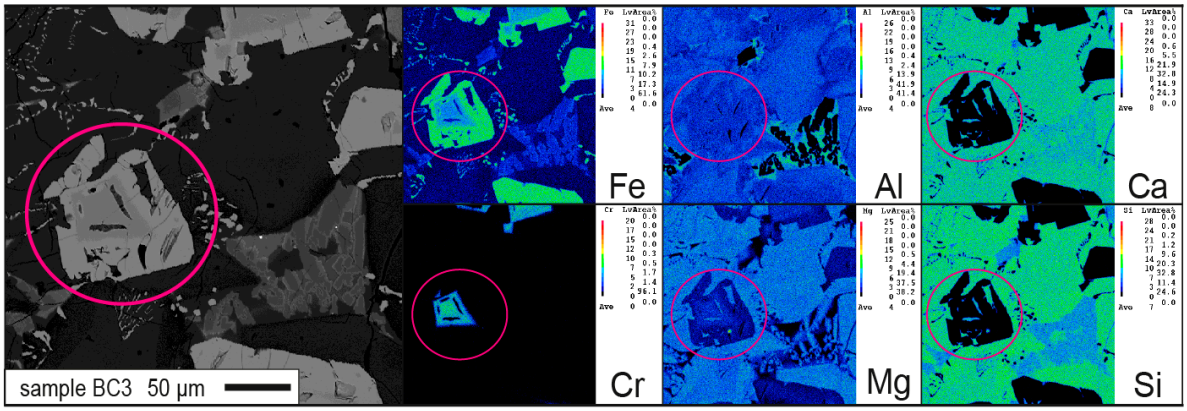

Figure S3. Back scattered electron (BSE) image and element mapping of sample BC3 (slow cooling). Circles mark the observed zoning in the spinel phase.

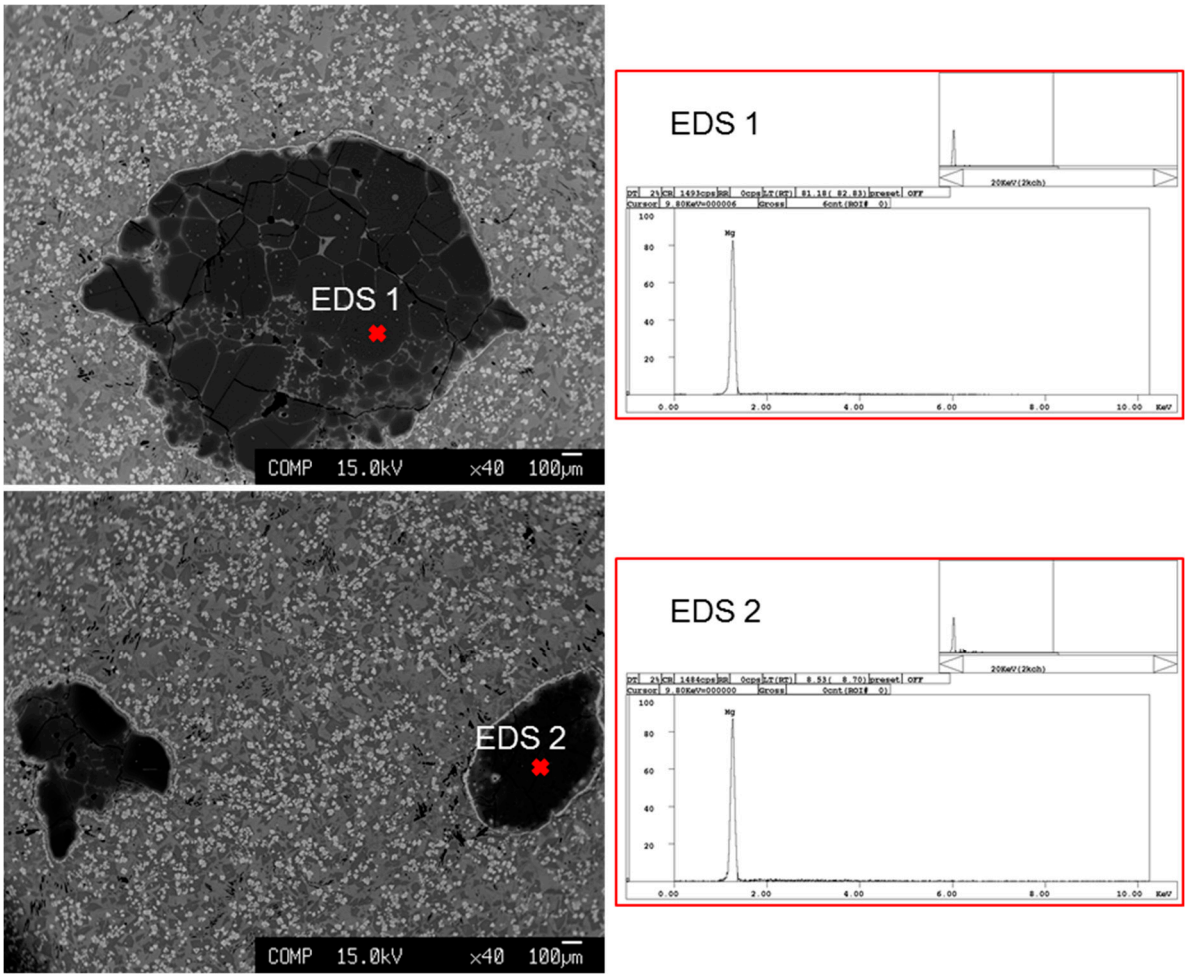

Figure S4. Back scattered electron (BSE) images of MgO inclusions and energy dispersive spectrometer (EDS) analyses for sample BC1 (fast cooling).