

**Electronic Supplementary Information (ESI)**

**“Displacive disorder and spin frustration hosted multiferroic orders in pyrochlore - spinel composites”**

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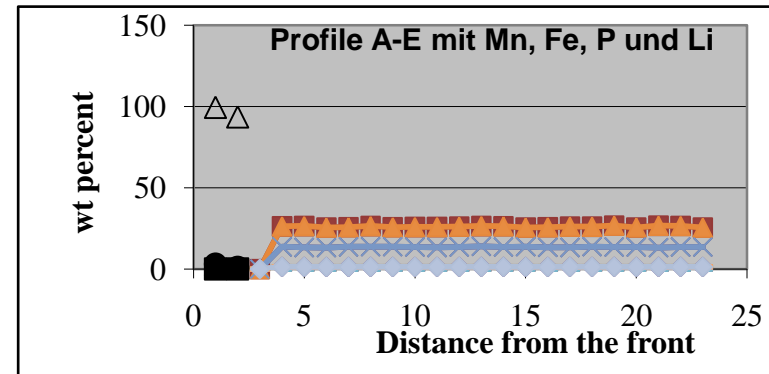
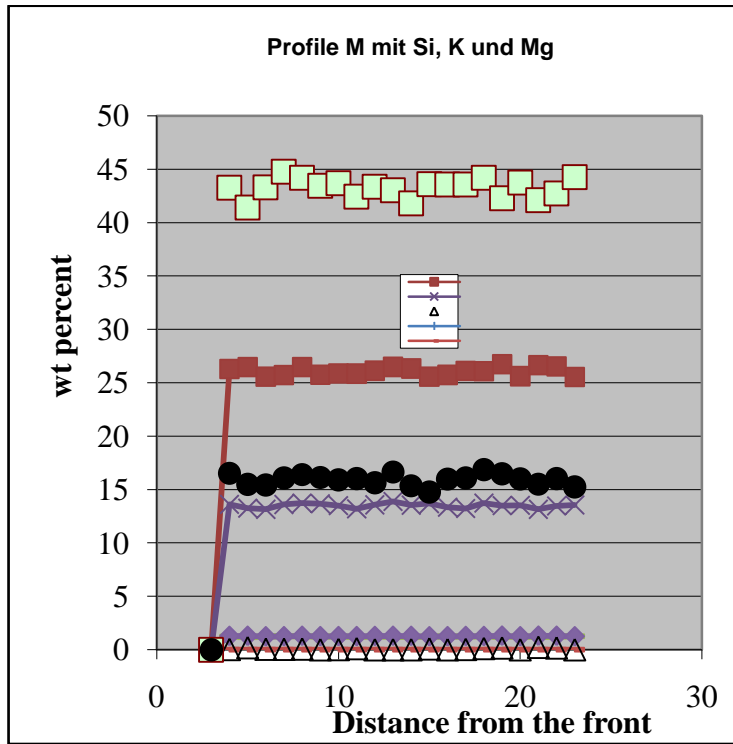
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**1. Electron probe microanalysis data from the BNMO sample.**

<i>Pyrochlore</i>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	Faktor
BNMO-Py-1	0.089	48.503	0.002	20.087	13.557	16.652	98.89	0.003	1.393	0.000	1.297	1.481	6.245		6.000
BNMO-Py-2	0	49.957	0	21.008	12.505	17.907	101.377	0.000	1.434	0.000	1.357	1.366	6.716		6.000
BNMO-Py-3	0	49.523	0.021	21.216	12.537	16.728	100.025	0.000	1.422	0.001	1.370	1.369	6.273		6.000
BNMO-Py-4	0.033	49.604	0	20.801	12.487	17.663	100.588	0.001	1.424	0.000	1.343	1.364	6.624		6.000
BNMO-Py-5	0	49.972	0.03	20.827	12.673	17.452	100.954	0.000	1.435	0.001	1.345	1.384	6.545		6.000
BNMO-Py-6	0.142	49.033	0.042	21.037	12.153	16.375	98.782	0.005	1.408	0.002	1.359	1.327	6.141		6.000
BNMO-Py-7	0.07	48.908	0.001	21.029	12.199	17.131	99.338	0.002	1.404	0.000	1.358	1.332	6.425		6.000
BNMO-Py-8	0.03	48.909	0.004	20.743	12.224	15.62	97.53	0.001	1.404	0.000	1.340	1.335	5.858		6.000
BNMO-Py-9	0.048	50.194	0.026	21.058	12.352	17.46	101.138	0.002	1.441	0.001	1.360	1.349	6.548		6.000
BNMO-Py-10	0	48.869	0.017	20.614	12.363	16.546	98.409	0.000	1.403	0.001	1.331	1.350	6.205		6.000
BNMO-Py-11	0.027	48.893	0	20.72	12.526	16.981	99.147	0.001	1.404	0.000	1.338	1.368	6.368		6.000
BNMO-Py-12	0	49.038	0.061	20.578	12.315	17.734	99.726	0.000	1.408	0.003	1.329	1.345	6.651		6.000
BNMO-Py-13	0.064	48.933	0.014	20.879	12.47	17.554	99.914	0.002	1.405	0.001	1.348	1.362	6.583		6.000
BNMO-Py-14	0	49.263	0.038	20.593	12.587	17.177	99.658	0.000	1.414	0.002	1.330	1.375	6.442		6.000
BNMO-Py-15	0.008	49.502	0.042	20.927	12.228	16.781	99.488	0.000	1.421	0.002	1.351	1.335	6.293		6.000
BNMO-Py-16	0	49.035	0.006	20.878	12.259	16.361	98.539	0.000	1.408	0.000	1.348	1.339	6.136		6.000



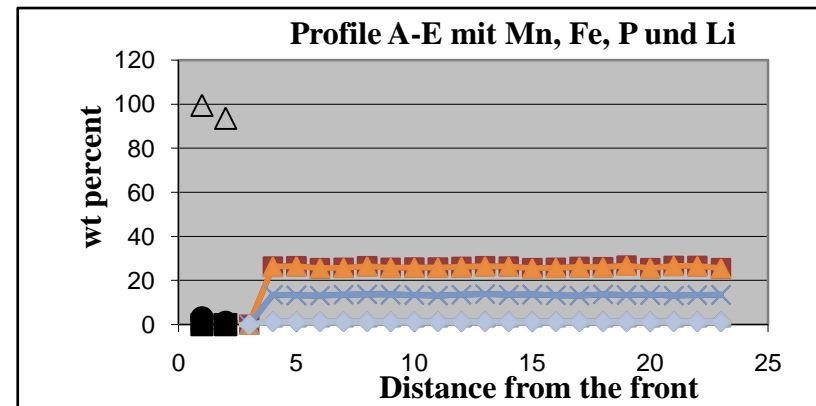
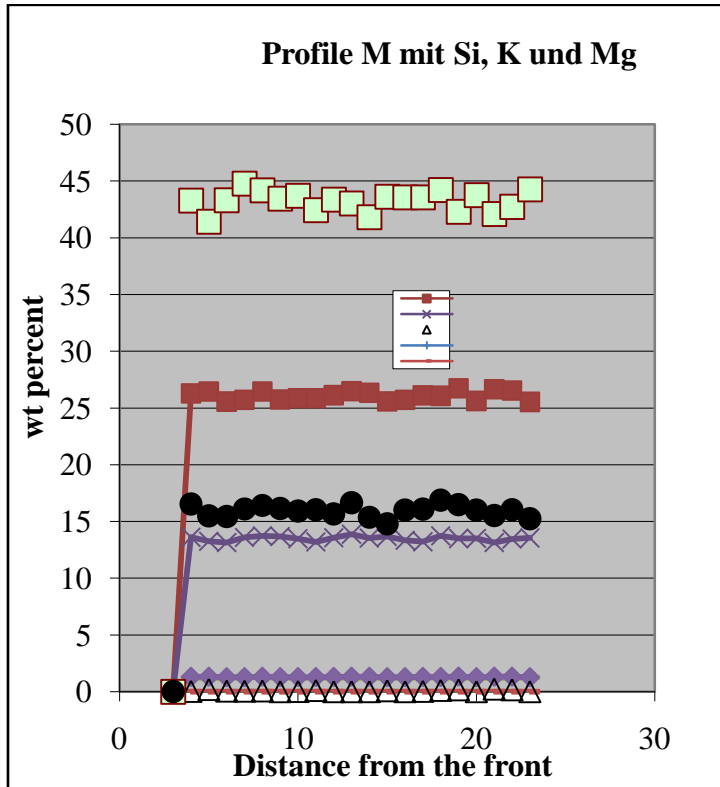


## 2. Electron probe microanalysis data from the BTMO sample.

<i>Pyrochlore</i>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	Faktor
BTMO-Py-1	31.434	40.181	0	0	10.781	12.343	94.739	1.042	1.154	0.000	0.000	1.177	4.629		6.000
BTMO-Py-2	30.927	40.552	0	0.053	10.31	12.425	94.267	1.025	1.164	0.000	0.003	1.126	4.660		6.000
BTMO-Py-3	31.357	40.839	0.008	0.001	10.449	12.785	95.439	1.040	1.173	0.000	0.000	1.141	4.795		6.000
BTMO-Py-4	32.055	41.601	0	0.027	10.59	13.305	97.578	1.063	1.194	0.000	0.002	1.157	4.990		6.000
BTMO-Py-5	31.427	42.158	0.072	0.043	10.684	13.102	97.486	1.042	1.210	0.004	0.003	1.167	4.914		6.000
BTMO-Py-6	31.124	41.246	0	0	10.572	13.002	95.944	1.032	1.184	0.000	0.000	1.155	4.876		6.000
BTMO-Py-7	31.041	41.237	0	0.049	10.717	13.02	96.064	1.029	1.184	0.000	0.003	1.170	4.883		6.000
BTMO-Py-8	31.404	40.926	0.009	0.082	10.292	11.902	94.615	1.041	1.175	0.000	0.005	1.124	4.464		6.000
BTMO-Py-9	32.279	41.712	0.045	0.034	10.249	12.616	96.935	1.070	1.198	0.002	0.002	1.119	4.731		6.000
BTMO-Py-10	31.995	41.534	0.044	0	10.394	13.22	97.187	1.061	1.192	0.002	0.000	1.135	4.958		6.000
BTMO-Py-11	30.854	41.555	0.008	0.087	10.336	12.926	95.766	1.023	1.193	0.000	0.006	1.129	4.848		6.000
BTMO-Py-12	30.47	41.685	0	0	10.368	12.153	94.676	1.010	1.197	0.000	0.000	1.132	4.558		6.000
BTMO-Py-13	32.131	40.932	0.063	0.014	10.492	12.536	96.168	1.065	1.175	0.003	0.001	1.146	4.701		6.000
BTMO-Py-14	31.433	40.863	0.019	0.017	10.56	12.654	95.546	1.042	1.173	0.001	0.001	1.153	4.746		6.000
BTMO-Py-15	31.689	41.616	0.001	0	10.492	13.614	97.412	1.051	1.195	0.000	0.000	1.146	5.106		6.000
BTMO-Py-16	31.887	41.258	0.015	0	10.221	12.753	96.134	1.057	1.185	0.001	0.000	1.116	4.783		6.000
BTMO-Py-17	31.505	41.633	0.032	0.066	10.489	12.795	96.52	1.045	1.195	0.002	0.004	1.146	4.798		6.000
BTMO-Py-18	31.827	42.082	0.022	0.055	10.469	13.346	97.801	1.055	1.208	0.001	0.004	1.143	5.005		6.000
BTMO-Py-19	31.023	40.752	0.045	0.007	10.573	14.448	96.848	1.029	1.170	0.002	0.000	1.155	5.418		6.000
BTMO-Py-20	30.573	41.998	0	0	10.218	12.471	95.26	1.014	1.206	0.000	0.000	1.116	4.677		6.000
	31.422	41.318	0.019	0.027	10.463	12.871	96.119	1.042	1.186	0.001	0.002	1.143	4.827	#DIV/0!	
	0.514	0.531	0.023	0.030	0.164	0.563	1.085	0.017	0.015	0.001	0.002	0.018	0.211	#DIV/0!	

	A- Position		B- Position		
<b>Formula</b>	<b>Bi</b>	<b>Mn</b>	<b>Ta</b>	<b>Mn</b>	<b>O</b>
	<b>1.186</b>	<b>0.571</b>	<b>1.042</b>	<b>0.571</b>	<b>4.827</b>
<b>Valences</b>	<b>A =</b>	<b>1.758</b>	<b>B =</b>	<b>1.61</b>	
<b>Summe</b>	<b>11.05</b>	<b>1.14</b>	<b>5.21</b>	<b>1.14</b>	<b>-9.65</b>
<b>Formula</b>	<b>Mn</b>	<b>Bi</b>	<b>Ta</b>	<b>O</b>	<b>Faktor</b>
	<b>1.039</b>	<b>1.078</b>	<b>0.947</b>	<b>4.39</b>	<b>0.909090909</b>

<i>Hausmannite</i>	Ta	Bi	Sb	Nb	Mn	O	Total	ok	Ta	Bi	Sb	Nb	Mn	O	Total	
BTMO-Ha-1	0	0.501	0.002	0.119	72.504	28.497	101.623		0.000	0.005	0.000	0.003	2.952	3.985		2.237
BTMO-Ha-2	0.067	0.077	0	0.071	72.447	28.546	101.208		0.001	0.001	0.000	0.002	2.950	3.992		2.237
BTMO-Ha-3	0	0	0	0.094	72.429	27.756	100.279		0.000	0.000	0.000	0.002	2.949	3.881		2.237
	0.02	0.19	0.00	0.09	72.46	28.27	101.04		0.00	0.00	0.00	0.00	2.95	3.95	#DIV/0!	
	0.04	0.27	0.00	0.02	0.04	0.44	0.69		0.00	0.00	0.00	0.00	0.00	0.06	#DIV/0!	



### 3. Electron probe microanalysis data from the BSMO sample.

<i>Pyrochlore</i>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	Faktor
BSMO-Py-1	0	43.289	26.28	0.028	13.621	16.534	99.752	0.000	1.243	1.295	0.002	1.488	6.201		6.000
BSMO-Py-2	0.164	41.417	26.461	0.194	13.266	15.492	96.994	0.005	1.189	1.304	0.013	1.449	5.810		6.000
BSMO-Py-3	0	43.31	25.565	0.053	13.159	15.428	97.515	0.000	1.243	1.260	0.003	1.437	5.786		6.000
BSMO-Py-4	0.07	44.773	25.716	0.047	13.602	16.103	100.311	0.002	1.285	1.267	0.003	1.486	6.039		6.000
BSMO-Py-5	0.09	44.194	26.461	0.066	13.739	16.414	100.964	0.003	1.269	1.304	0.004	1.500	6.156		6.000
BSMO-Py-6	0.136	43.44	25.752	0	13.687	16.139	99.154	0.005	1.247	1.269	0.000	1.495	6.053		6.000
BSMO-Py-7	0.01	43.697	25.865	0.02	13.496	15.91	98.998	0.000	1.255	1.275	0.001	1.474	5.967		6.000
BSMO-Py-8	0.121	42.431	25.857	0.108	13.204	16.026	97.747	0.004	1.218	1.274	0.007	1.442	6.010		6.000
BSMO-Py-9	0.028	43.352	26.127	0	13.58	15.653	98.74	0.001	1.245	1.288	0.000	1.483	5.870		6.000
BSMO-Py-10	0.024	43.03	26.485	0	13.883	16.653	100.075	0.001	1.235	1.305	0.000	1.516	6.245		6.000
BSMO-Py-11	0	41.811	26.336	0.003	13.55	15.361	97.061	0.000	1.200	1.298	0.000	1.480	5.761		6.000
BSMO-Py-12	0.023	43.611	25.578	0.082	13.693	14.784	97.771	0.001	1.252	1.261	0.005	1.495	5.544		6.000
BSMO-Py-13	0.03	43.573	25.729	0	13.355	15.995	98.682	0.001	1.251	1.268	0.000	1.459	5.998		6.000
BSMO-Py-14	0.201	43.565	26.11	0.032	13.223	16.094	99.225	0.007	1.251	1.287	0.002	1.444	6.036		6.000
BSMO-Py-15	0	44.213	26.072	0.116	13.747	16.88	101.028	0.000	1.269	1.285	0.007	1.501	6.330		6.000
BSMO-Py-16	0.091	42.296	26.732	0.166	13.507	16.485	99.277	0.003	1.214	1.317	0.011	1.475	6.182		6.000
BSMO-Py-17	0.052	43.765	25.619	0	13.529	16.005	98.97	0.002	1.257	1.263	0.000	1.478	6.002		6.000
BSMO-Py-18	0.191	42.105	26.657	0.229	13.157	15.512	97.851	0.006	1.209	1.314	0.015	1.437	5.817		6.000
BSMO-Py-19	0.072	42.729	26.535	0.169	13.471	16.036	99.012	0.002	1.227	1.308	0.011	1.471	6.014		6.000
BSMO-Py-20	0.182	44.275	25.541	0	13.565	15.247	98.81	0.006	1.271	1.259	0.000	1.481	5.718		6.000
	0.074	43.244	26.074	0.066	13.502	15.938	98.897	0.002	1.242	1.285	0.004	1.475	5.977	#DIV/0!	
	0.070	0.879	0.398	0.074	0.212	0.526	1.169	0.002	0.025	0.020	0.005	0.023	0.197	#DIV/0!	

	A-Position		B-Position		
Formula	Bi	Mn	Sb	Mn	O
	1.242	0.737	1.285	0.737	5.977
Valences	A = 3.72	1.979	B = 1.47	6.42	1.47
Summe	13.10				11.95
Formula	Mn	Bi	Sb	O	Faktor
	1.170	0.985	1.020	4.74	0.793650794

<b>Bi2O3</b>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	
BSMO-Bi-1	0	58.653	15.773	0.123	10.078	14.806	99.433	0.000	0.842	0.389	0.004	0.550	2.776		3.000
BSMO-Bi-2	0	81.582	0.737	0.016	0.686	10.564	93.585	0.000	0.390	0.006	0.000	0.012	0.660		1.000
	0.00	70.12	8.26	0.07	5.38	12.69	96.51	0.00	0.62	0.20	0.00	0.28	1.72	#DIV/0!	
	0.00	16.21	10.63	0.08	6.64	3.00	4.14	0.00	0.32	0.27	0.00	0.38	1.50	#DIV/0!	
<b>Bi-Mn-Oxide</b>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	
BSMO-BiMn-1	0	27.209	7.143	0.066	40.261	25.16	99.839	0.000	0.130	0.059	0.001	0.733	1.573		1.000
BSMO-BiMn-2	0	23.856	3.187	0.11	44.385	26.292	97.83	0.000	0.114	0.026	0.001	0.808	1.643		1.000
BSMO-BiMn-3	0	27.92	7.91	0.078	38.789	24.88	99.577	0.000	0.134	0.065	0.001	0.706	1.555		1.000
	0.00	26.33	6.08	0.08	41.15	25.44	99.08	0.00	0.12	0.05	0.00	0.76	1.60	#DIV/0!	
	0.00	2.17	2.53	0.02	2.90	0.75	1.09	0.00	0.01	0.03	0.00	0.07	0.06	#DIV/0!	
<b>Hausmannite</b>	Ta	Bi	Sb	Nb	Mn	O	Total	Ta	Bi	Sb	Nb	Mn	O	Total	
BSMO-Ha-1	0	0.232	0.52	0.083	71.209	28.61	100.654	0.000	0.002	0.010	0.002	2.900	4.001		2.237
BSMO-Ha-2	0	0.166	0.602	0.074	71.61	28.57	101.022	0.000	0.002	0.011	0.002	2.916	3.995		2.237
	0.00	0.20	0.56	0.08	71.41	28.59	100.84	0.00	0.00	0.01	0.00	2.91	4.00	#DIV/0!	
	0.00	0.05	0.06	0.01	0.28	0.03	0.26	0.00	0.00	0.00	0.00	0.01	0.00	#DIV/0!	



