

Supplemental Table S1. FE-EPMA-WDS analyses of columbite-(Mn) from fluid-melt interaction experiments

Experiment name and grain analyzed	SiO ₂ * (Mass%)	P ₂ O ₅ * (Mass%)	MnO (Mass%)	Nb ₂ O ₅ (Mass%)	Total (Mass%)	Total MnO+Nb ₂ O ₅	Chemical Formula
SMn1Nb5000-675_COL_1	4.19	0.51	19.23	72.59	96.52	91.82	Mn _{0.99} Nb _{2.00} O ₆
SMn1Nb5000-675_COL_1b	3.37	0.11	19.08	74.28	96.84	93.36	Mn _{0.97} Nb _{2.01} O ₆
SMn1Nb5000-675_COL_1c	3.19	0.11	19.37	74.52	97.19	93.89	Mn _{0.98} Nb _{2.01} O ₆
SMn1Nb5000-675_COL_1d	2.75	0.11	19.50	75.54	97.89	95.04	Mn _{0.97} Nb _{2.01} O ₆
SMn1Nb5000-675_COL_1e	2.81	0.11	19.23	75.52	97.68	94.75	Mn _{0.96} Nb _{2.02} O ₆
SMn1Nb5000-675_COL_1f	4.88	0.12	18.80	71.65	95.45	90.45	Mn _{0.98} Nb _{2.01} O ₆
SMn1Nb5000-675_COL_2	5.09	0.13	19.44	73.41	98.07	92.85	Mn _{0.99} Nb _{2.00} O ₆
SMn1Nb5000-675_COL_3	3.18	1.22	19.71	73.09	97.19	92.80	Mn _{1.01} Nb _{2.00} O ₆
SMn1Nb5000-675_COL_4	7.03	0.16	18.91	70.66	96.75	89.57	Mn _{1.00} Nb _{2.00} O ₆
SMn1Nb5000-675_COL_5	3.37	1.98	20.29	71.87	97.52	92.17	Mn _{1.05} Nb _{1.98} O ₆
SMn1Nb5000-675_COL_6	6.56	0.18	19.08	71.31	97.13	90.39	Mn _{1.00} Nb _{2.00} O ₆
SMn1Nb5000-675_COL_7	4.24	0.39	19.37	75.62	99.63	94.99	Mn _{0.97} Nb _{2.01} O ₆
SMn1Nb5000-650_COL_1	4.48	3.46	20.00	68.36	96.30	88.36	Mn _{1.07} Nb _{1.97} O ₆
SMn1Nb5000-650_COL_2	2.60	1.30	19.63	70.90	94.44	90.53	Mn _{1.03} Nb _{1.99} O ₆
SMn1Nb5000-650_COL_3	9.12	0.21	18.72	69.19	97.24	87.91	Mn _{1.01} Nb _{2.00} O ₆
SMn1Nb5000-650_COL_4	1.14	0.22	19.65	77.25	98.26	96.90	Mn _{0.96} Nb _{2.02} O ₆
SMn1Nb5000-650_COL_5	6.71	3.21	19.53	64.97	94.41	84.50	Mn _{1.10} Nb _{1.96} O ₆
SMn1Nb5000-700_COL_1	4.71	0.11	19.17	73.28	97.28	92.46	Mn _{0.98} Nb _{2.01} O ₆
SMn1Nb5000-700_COL_1b	4.03	0.11	19.64	75.26	99.04	94.90	Mn _{0.98} Nb _{2.01} O ₆
SMn1Nb5000-700_COL_1c	13.55	0.26	17.15	62.46	93.41	79.61	Mn _{1.02} Nb _{1.99} O ₆
SMn1Nb5000-700_COL_2	11.72	0.25	17.58	64.21	93.76	81.79	Mn _{1.02} Nb _{1.99} O ₆
SMn1Nb5000-700_COL_3	0.62	1.05	20.11	75.49	97.27	95.60	Mn _{1.00} Nb _{2.00} O ₆
SMn1Nb5000-700_COL_4	2.71	0.07	19.87	75.69	98.34	95.56	Mn _{0.99} Nb _{2.00} O ₆
SMn1Nb5000-700_COL_5	6.96	0.18	18.92	71.22	97.28	90.14	Mn _{1.00} Nb _{2.00} O ₆
SMn1Nb5000-700_COL_6	4.61	2.44	20.29	70.24	97.58	90.52	Mn _{1.07} Nb _{1.97} O ₆
SMn1Nb5000-700_COL_7	2.51	0.06	19.72	76.72	99.00	96.44	Mn _{0.97} Nb _{2.01} O ₆
SMn1Nb5000-700_COL_8	3.07	0.23	19.78	75.65	98.73	95.43	Mn _{0.98} Nb _{2.01} O ₆
SMn1Nb5000-700_COL_9	2.99	0.08	19.86	76.27	99.19	96.12	Mn _{0.98} Nb _{2.01} O ₆
Average concentrations	4.72	0.66	19.34	72.40	97.12	91.74	Mn_{1.00}Nb_{2.00}O₆

* SiO₂ and P₂O₅ were analyzed to determine approximate glass contribution to analysis as grains were typically <1 μm wide. High SiO₂ and P₂O₅ values represent background analysis of either the glass or lithiophilite grains where the columbite-(Mn) grain was smaller than the beam size (approx. 1 μm).