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Supplement of

Natrolitised nepheline-bearing Teschenite Association rocks from the Podbeskydí area (Czech Republic): a testimony from selected accessory minerals

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Supplementary Material

Figure S1

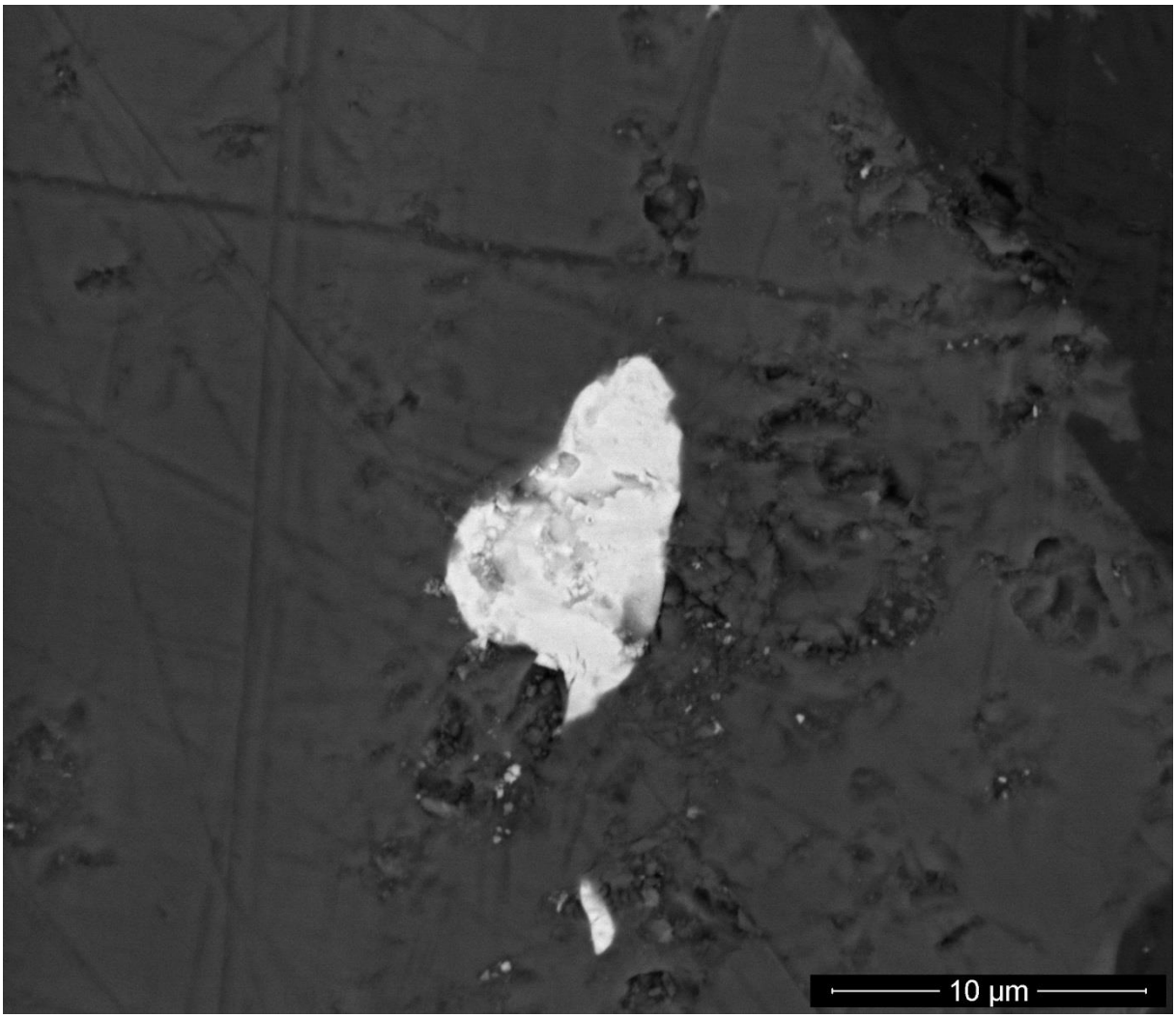

Fig. S1. BSE image of strontiofluorite (SrF_2) in K-feldspar from Brušperk-Borošín site No. 3.

Figure S2

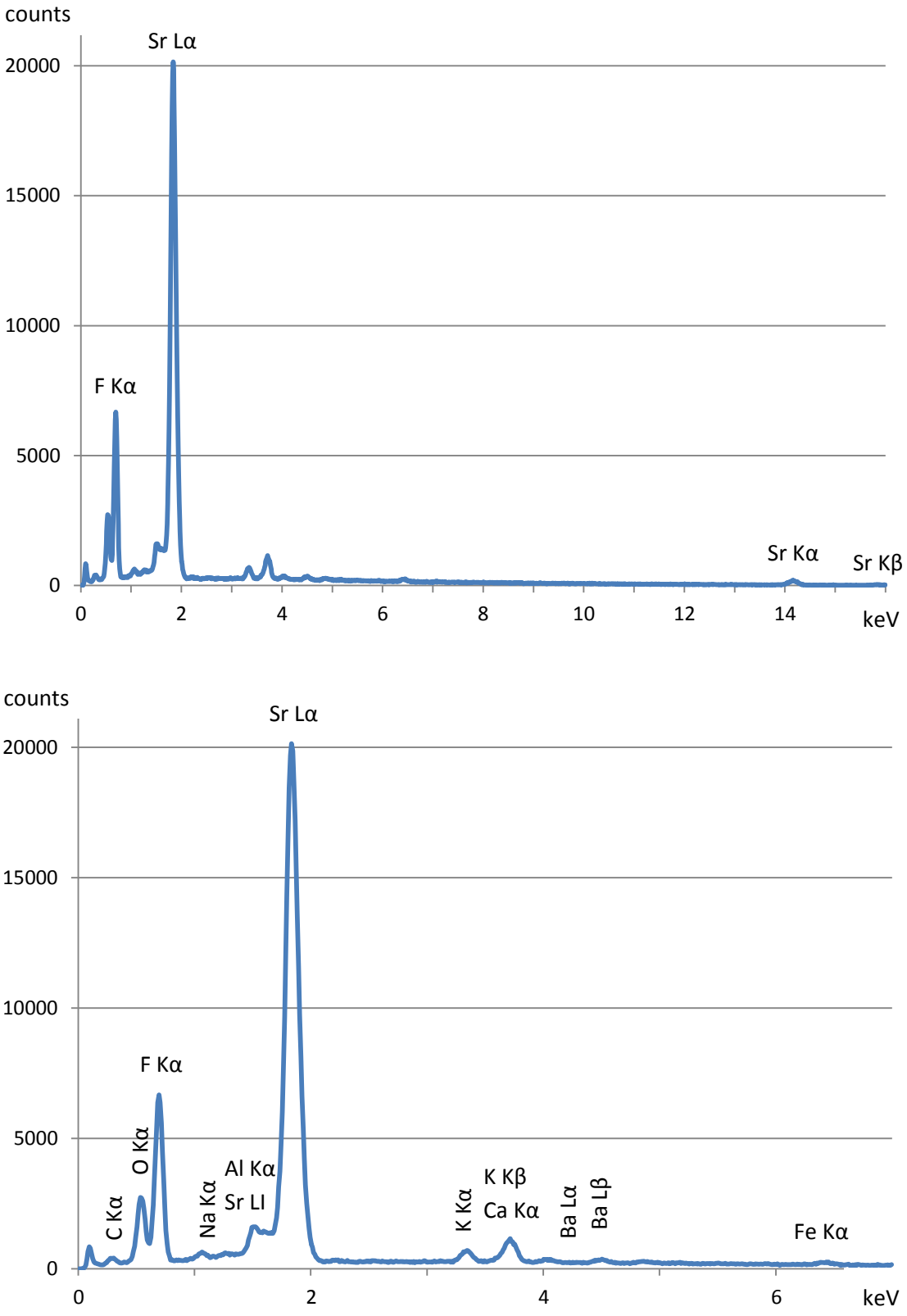

Fig. S2. EDS spectrum of strontiofluorite (SrF_2) – overall (upper) and detail (lower).

Table S1

sample	source	system, group	a (Å)	b (Å)	c (Å)
Zálezly, Czech Rep.	Pechar et al. (1983)	ort., *Fdd*2	18.326(5)	18.652(5)	6.601(3)
Zálezly, Czech Rep.	Stuckenschmidt et al. (1993)	ort., *Fdd*2	18.2929(7)	18.6407(9)	6.5871(6)
India	Dudka et al. (2020)	ort., *Fdd*2	18.24822(6)	18.59561(8)	6.57868(4)
Hodslavice - Čerťák	this work	ort., *Fdd*2	18.3031(2)	18.6410(2)	6.5894(1)
Hodslavice - Čerťák	this work	ort., *Fdd*2	18.2875(5)	18.6226(5)	6.5820(2)
Hodslavice - Čerťák	this work	ort., *Fdd*2	18.2853(6)	18.6201(6)	6.5824(3)
Brušperk - Borošín site 1 mesocratic rock	this work	ort., *Fdd*2	18.3025(5)	18.6370(6)	6.5884(3)
Brušperk - Borošín site 1 white spots*	this work	ort., *Fdd*2	18.2965(3)	18.6349(3)	6.5866(2)
Brušperk - Borošín site 1 leucocratic rock	this work	ort., *Fdd*2	18.2997(4)	18.6391(4)	6.5877(3)
Bruzovice - Pazderůvka	this work	ort., *Fdd*2	18.3036(9)	18.6409(9)	6.5893(5)
Bruzovice - Pazderůvka	this work	ort., *Fdd*2	18.2927(9)	18.6354(9)	6.5862(4)

Tab. S1. Unit-cell parameters of selected natrolite and their comparison with the published ones. * white spots corresponds to *hydronephelite* sensu Pacák (1926).

Table S2

sample	**source**	**system, group**	**a (Å)**	**c (Å)**
Egan Chute, Canada	Antao and Hassan (2010)	hex., *P*6	9.99567(1)	8.37777(1)
Nephton, Canada			10.00215(1)	8.38742(1)
Davis Hill, Canada			9.99567(1)	8.37873(1)
Hodslavice-Čerťák	this work	hex., $P6_3$	10.0007(7)	8.376(1)
Brušperk-Borošín	this work	hex., $P6_3$	10.0002(9)	8.386(1)

Tab. S2. Unit-cell parameters of nepheline and their comparison with the published ones.

Table S3

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*average*
Na_2O	15.97	15.37	15.75	15.56	15.63	15.48	15.86	16.14	15.72
K_2O	6.42	6.61	6.50	6.73	6.84	6.85	6.77	6.25	6.62
CaO	0.63	0.68	0.76	0.68	0.61	0.56	0.52	0.55	0.62
SrO	b.d.l.	0.12	b.d.l.	0.13	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.03
MgO	0.08	0.09	0.09	0.08	0.14	0.05	0.06	0.09	0.08
MnO	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.06	b.d.l.	b.d.l.	0.01
FeO	0.97	1.03	0.91	0.90	1.05	1.15	1.03	0.93	0.99
Al_2O_3	34.32	33.37	33.52	33.84	34.28	33.55	34.18	33.32	33.80
SiO_2	43.43	43.46	43.11	43.48	42.53	42.47	43.40	43.62	43.19
F	0.06	0.06	0.08	0.06	0.09	0.08	0.07	0.07	0.07
total	101.87	100.79	100.70	101.45	101.16	100.25	101.89	100.96	101.13
structural formula (apfu)									
Na^+	2.938	2.860	2.934	2.877	2.908	2.907	2.923	2.996	2.918
K^+	0.777	0.809	0.796	0.819	0.837	0.847	0.821	0.763	0.809
Ca^{2+}	0.064	0.070	0.078	0.070	0.062	0.058	0.053	0.056	0.064
Sr^{2+}	0.000	0.007	0.000	0.007	0.000	0.000	0.000	0.000	0.002
Mg^{2+}	0.011	0.013	0.013	0.011	0.020	0.008	0.009	0.012	0.012
Mn^{2+}	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.001
Fe^{2+}	0.077	0.082	0.073	0.071	0.084	0.093	0.082	0.074	0.080
Σ	3.790	3.759	3.822	3.784	3.827	3.825	3.805	3.827	3.805
Al^{3+}	3.838	3.774	3.797	3.805	3.876	3.829	3.829	3.759	3.813
Si^{4+}	4.121	4.171	4.143	4.148	4.080	4.113	4.126	4.175	4.135
F^-	0.018	0.018	0.023	0.019	0.026	0.024	0.021	0.022	0.021

Tab. S3. Chemical composition of nepheline from Brušperk-Borošín No. 3 site (wt.%) based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the 16 oxygen atoms. Note: b.d.l. – below detection limit.

Table S4

	BRU 1	*BRU 2*	*BRU 3*	*BRU 4*	*BRU 5*	*BRU 6*	*BRU 7*	*BRU 8*	*HOD*
Na_2O	15.06	15.02	14.93	15.24	14.57	14.29	14.54	15.64	15.68
K_2O	0.05	0.07	b.d.l.	b.d.l.	0.06	0.09	b.d.l.	0.07	b.d.l.
CaO	0.32	0.31	0.57	0.35	0.41	0.38	0.25	0.09	b.d.l.
FeO	0.09	b.d.l.	b.d.l.	b.d.l.	0.10	b.d.l.	0.10	b.d.l.	b.d.l.
Al_2O_3	25.89	25.87	25.91	26.22	25.69	25.81	25.59	25.49	26.03
SiO_2	46.99	46.72	46.65	46.57	46.97	47.26	47.05	47.69	47.52
Total	88.40	87.99	88.07	88.37	87.80	87.83	87.52	88.97	89.23
H2O*	16.76	16.70	16.69	16.73	16.72	16.81	16.71	16.85	16.92
total & H_2O	105.16	104.69	104.76	105.11	104.52	104.65	104.24	105.81	106.15
structural formula (apfu)									
Na^+	1.886	1.889	1.877	1.910	1.834	1.793	1.834	1.947	1.946
K^+	0.004	0.006	0.000	0.000	0.005	0.008	0.000	0.005	0.000
Ca^{2+}	0.022	0.021	0.040	0.024	0.028	0.026	0.017	0.006	0.000
Fe^{2+}	0.005	0.000	0.000	0.000	0.005	0.000	0.005	0.000	0.000
Σ	1.918	1.916	1.917	1.934	1.873	1.827	1.856	1.959	1.946
Al^{3+}	1.971	1.979	1.980	1.999	1.966	1.970	1.961	1.929	1.963
Si^{4+}	3.035	3.032	3.025	3.011	3.049	3.060	3.060	3.062	3.041
Σ	5.007	5.010	5.006	5.010	5.015	5.029	5.021	4.991	5.004
H_2O*	1.997	1.996	1.998	1.996	1.994	1.988	1.992	2.004	1.998
T_{si}	0.61	0.61	0.60	0.60	0.61	0.61	0.61	0.61	0.61

Tab. S4. Chemical composition of natrolite from Brušperk-Borošín No. 1 (BRU) and Hodslavice-Čerťák (HOD) sites based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the 10 oxygen atoms. Notes: b.d.l. – below detection limit, * Water content is calculated based on the (Si+Al)/H_2O ratio in the theoretical formula.

Table S5 (*1st part*)

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
Na_2O	8.12	9.53	9.77	8.99	8.46	7.76	8.64	8.36	9.71	9.04	8.27	8.19	9.42	9.67	9.82
K_2O	0.06	0.12	0.13	0.14	0.12	0.16	0.10	0.10	0.10	0.12	0.11	0.13	0.12	0.11	0.11
CaO	6.29	4.28	4.08	3.99	4.59	4.09	4.27	4.26	4.24	4.33	5.06	4.19	4.29	3.67	3.70
SrO	11.54	10.06	9.22	12.05	12.91	13.19	10.02	11.15	8.90	10.21	12.05	11.20	8.12	10.20	9.75
BaO	b.d.l.	0.20	0.10	0.10	0.07	b.d.l.	b.d.l.	0.14	0.10	0.12	0.09	0.10	b.d.l.	b.d.l.	0.08
FeO	1.05	0.83	0.89	0.84	0.70	0.64	0.88	0.90	0.89	0.82	0.57	0.72	0.86	0.70	0.69
ThO_2	0.39	0.63	0.70	0.35	0.37	0.41	0.40	0.36	0.77	0.38	0.42	0.42	0.38	0.41	0.44
UO_2	b.d.l.	b.d.l.	0.07	0.06	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.11	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.26
La_2O_3	6.18	6.26	6.28	6.36	6.39	6.80	6.48	6.19	5.71	5.86	5.75	6.60	6.56	6.33	6.10
Ce_2O_3	8.83	9.61	9.72	8.88	9.03	9.46	9.24	8.38	9.10	8.38	8.26	9.26	9.02	9.23	8.89
Pr_2O_3	0.52	0.64	0.53	0.62	0.51	0.56	0.44	0.48	0.63	0.51	0.58	0.58	0.47	0.58	0.54
Nd_2O_3	1.14	1.42	1.41	0.95	1.03	1.31	1.26	1.15	1.34	1.12	1.22	1.28	1.08	1.26	1.17
Sm_2O_3	b.d.l.	b.d.l.	0.20	b.d.l.	0.08	b.d.l.	0.09	0.15	0.13	0.14	0.15	0.18	0.11	0.17	0.20
Eu_2O_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.14	0.10	0.15	0.15	0.08	0.14	0.10	0.13	0.13
Gd_2O_3	b.d.l.	b.d.l.	b.d.l.	0.17	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.15	0.15	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.
Dy_2O_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.26	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.
Al_2O_3	0.06	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.
Bi_2O_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.22	0.23	0.24	b.d.l.	0.18	0.16	0.05	0.25	b.d.l.
TiO_2	34.16	31.92	30.99	30.17	32.22	33.44	30.95	30.33	30.26	29.94	31.93	31.86	29.47	29.56	29.32
SiO_2	0.32	0.92	0.95	0.66	0.53	0.52	0.42	0.31	1.07	0.75	0.90	0.78	0.99	0.84	0.78
ZrO_2	0.29	0.08	0.12	0.20	b.d.l.	0.22	0.08	0.11	0.09	0.10	0.07	0.11	b.d.l.	b.d.l.	b.d.l.
Nb_2O_5	20.20	23.41	23.70	24.65	21.76	19.89	22.85	22.90	25.06	24.49	21.35	20.82	24.85	26.26	25.89
Ta_2O_5	0.62	0.99	0.94	0.97	0.79	0.56	b.d.l.	b.d.l.	0.29	0.10	b.d.l.	b.d.l.	0.35	0.34	0.41
WO_3	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.29	b.d.l.	0.19	b.d.l.
F	0.59	0.55	0.50	0.47	0.46	0.47	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	100.36	101.44	100.29	100.62	100.02	99.47	96.81	95.83	96.90	97.22	96.86	96.99	96.32	99.91	98.46
structural formula (apfu)															
Na^+	0.441	0.518	0.537	0.497	0.468	0.432	0.485	0.477	0.530	0.505	0.461	0.461	0.526	0.528	0.543
K^+	0.002	0.004	0.005	0.005	0.004	0.006	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.004	0.004
Ca^{2+}	0.189	0.128	0.124	0.122	0.140	0.126	0.133	0.134	0.128	0.134	0.156	0.13	0.132	0.111	0.113
Sr^{2+}	0.188	0.163	0.152	0.199	0.214	0.22	0.168	0.190	0.145	0.171	0.201	0.189	0.136	0.167	0.161
Ba^{2+}	0	0.002	0.001	0.001	0.001	0	0.002	0.002	0.001	0.001	0.001	0.001		0.001	0.001
Fe^{2+}	0.025	0.019	0.021	0.02	0.017	0.015									
Fe^{3+}							0.021	0.022	0.021	0.020	0.014	0.017	0.021	0.017	0.016
Th^{4+}	0.003	0.004	0.004	0.002	0.002	0.003	0.003	0.002	0.005	0.003	0.003	0.003	0.002	0.003	0.003
U^{4+}									0.001						
La^{3+}	0.064	0.065	0.066	0.067	0.067	0.072	0.069	0.067	0.059	0.062	0.061	0.071	0.07	0.066	0.064
Ce^{3+}	0.091	0.099	0.101	0.093	0.094	0.099	0.098	0.090	0.094	0.088	0.087	0.098	0.095	0.095	0.093
Pr^{3+}	0.005	0.007	0.006	0.006	0.005	0.006	0.005	0.005	0.006	0.005	0.006	0.006	0.005	0.006	0.006
Nd^{3+}	0.011	0.014	0.014	0.010	0.011	0.013	0.013	0.012	0.013	0.012	0.013	0.013	0.011	0.013	0.012
Sm^{3+}			0.002		0.001		0.001	0.002	0.001	0.001	0.002	0.002	0.001	0.002	0.002
Eu^{3+}							0.001					0.001	0.001	0.001	0.001
Gd^{3+}				0.002											
Dy^{3+}							0.002								
Al^{3+}	0.002		0.001	0.001	0.001	0.001									
Bi^{3+}							0.002	0.002	0.002		0.001	0.001		0.002	
Ti^{4+}	0.721	0.673	0.661	0.647	0.692	0.722	0.675	0.671	0.641	0.649	0.690	0.696	0.639	0.627	0.630
Si^{4+}	0.009	0.026	0.027	0.019	0.015	0.015	0.012	0.009	0.030	0.022	0.026	0.023	0.029	0.024	0.022
Zr^{4+}	0.004	0.001	0.002	0.003	0.001	0.003	0.001	0.002	0.001	0.001	0.690	0.002	0.001		0.001
Nb^{5+}	0.256	0.297	0.304	0.318	0.281	0.258	0.299	0.305	0.319	0.319	0.277	0.273	0.323	0.335	0.334
Ta^{5+}	0.006	0.009	0.009	0.009	0.007	0.005			0.002				0.003	0.003	0.003
Σ A site	0.995	1.004	1.011	1.004	1.008	0.977	0.985	0.987	0.990	0.989	0.994	0.980	0.985	0.997	1.004
Σ B site	0.993	0.996	0.994	0.989	0.991	1.000	1.009	1.009	1.014	1.013	1.008	1.011	1.015	1.005	1.007
unassigned cat. (%)	2.6	4.5	4.9	3.7	3.4	1.8	2.2	2.0	4.6	3.1	3.3	2.5	3.6	3.7	3.9
normalized end-member (mol.%)															
lueshite	26	31	31	33	29	26	31	31	34	33	28	28	34	35	35
loparite	35	38	39	37	37	37	39	36	37	35	35	39	38	38	37
tausonite	19	17	16	21	22	23	17	20	15	18	21	19	14	17	17
perovskite	19	13	13	10	12	13	13	13	13	14	16	13	14	10	11
$ThTi_2O_6$	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0

Table S5 (*2nd part*)

	16	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*	*26*	*27*	*28*	*29*
Na_2O	9.05	9.15	9.33	9.72	9.44	9.47	10.04	9.81	10.06	8.41	8.36	8.87	9.43	8.38
K_2O	0.12	0.12	0.11	0.11	0.11	0.14	0.09	0.10	0.12	0.08	0.11	0.14	0.14	0.10
CaO	4.69	4.58	4.18	3.74	4.41	3.82	4.52	3.96	3.86	6.77	4.28	3.73	3.74	5.64
SrO	10.55	10.79	10.00	9.02	10.85	9.88	9.16	10.02	9.11	9.51	11.18	10.01	11.12	12.48
BaO	b.d.l.	0.11	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.18	b.d.l.	b.d.l.	0.19	b.d.l.	0.10	b.d.l.	b.d.l.
FeO	0.78	0.87	0.41	1.52	0.98	0.86	0.98	0.47	0.48	1.27	0.63	0.75	1.00	0.83
ThO_2	0.59	0.53	0.63	0.69	b.d.l.	0.38	0.69	0.56	0.37	0.52	0.56	0.45	0.44	1.16
UO_2	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.11
La_2O_3	6.16	6.20	5.99	6.01	5.73	6.31	5.81	6.06	6.87	5.30	5.17	6.49	5.70	4.71
Ce_2O_3	9.42	9.27	8.66	9.71	8.83	8.95	9.02	8.98	9.57	8.17	7.65	9.20	8.13	7.51
Pr_2O_3	0.59	0.51	0.77	0.75	0.53	0.48	0.67	0.55	0.46	0.71	0.73	0.63	0.54	0.72
Nd_2O_3	1.17	1.17	1.20	1.38	1.31	1.18	1.30	1.30	1.17	1.15	1.35	1.23	1.12	1.49
Sm_2O_3	0.17	0.17	0.16	0.13	0.14	0.16	0.15	0.15	0.09	0.08	0.12	0.19	0.16	0.32
Eu_2O_3	0.13	0.14	0.16	0.17	0.16	0.11	0.09	0.07	0.12	0.13	0.14	0.12	0.17	0.13
Gd_2O_3	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.13	b.d.l.	b.d.l.	b.d.l.
Dy_2O_3	b.d.l.	0.14	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.16	0.09	b.d.l.	0.12
Al_2O_3	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.51	b.d.l.	b.d.l.	b.d.l.	0.11
Bi_2O_3	0.12	0.16	b.d.l.	b.d.l.	0.18	b.d.l.	0.39	0.30	b.d.l.	0.13	0.15	b.d.l.	0.33	0.18
TiO_2	32.59	32.24	29.92	30.56	31.00	29.45	30.60	29.90	30.01	30.12	31.44	29.98	28.36	32.92
SiO_2	1.03	1.16	0.83	0.70	0.77	0.67	0.81	0.86	1.32	3.94	1.27	0.66	1.01	1.05
ZrO_2	b.d.l.	b.d.l.	0.10	0.12	b.d.l.	0.09	b.d.l.	b.d.l.	0.11	0.10	0.10	b.d.l.	0.10	b.d.l.
Nb_2O_5	20.87	22.46	25.81	24.07	23.61	25.36	25.20	25.31	26.35	25.58	22.63	24.52	28.24	20.64
Ta_2O_5	b.d.l.	b.d.l.	0.15	b.d.l.	b.d.l.	0.23	0.20	0.24	0.35	0.15	b.d.l.	b.d.l.	0.13	b.d.l.
WO_3	0.20	b.d.l.	b.d.l.	0.14	0.20	0.20	b.d.l.	b.d.l.	0.13	0.22	b.d.l.	b.d.l.	0.11	0.09
F	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	99.00	100.39	98.46	98.98	99.31	97.74	100.39	99.05	100.92	103.29	96.56	97.14	99.95	98.65
structural formula (apfu)														
Na^+	0.496	0.494	0.513	0.535	0.517	0.526	0.543	0.540	0.540	0.426	0.466	0.497	0.513	0.457
K^+	0.004	0.004	0.004	0.004	0.004	0.005	0.003	0.004	0.004	0.003	0.004	0.005	0.005	0.003
Ca^{2+}	0.142	0.137	0.127	0.114	0.134	0.117	0.135	0.120	0.115	0.190	0.132	0.116	0.112	0.17
Sr^{2+}	0.173	0.174	0.164	0.148	0.178	0.164	0.148	0.165	0.145	0.144	0.186	0.168	0.181	0.204
Ba^{2+}		0.001	0.001				0.002			0.002		0.001		
Fe^{2+}														
Fe^{3+}	0.018	0.020	0.01	0.036	0.023	0.021	0.023	0.011	0.011	0.028	0.015	0.018	0.024	0.020
Th^{4+}	0.004	0.003	0.004	0.005	0.004	0.003	0.004	0.004	0.002	0.003	0.004	0.003	0.003	0.007
U^{4+}														0.001
La^{3+}	0.064	0.064	0.063	0.063	0.060	0.067	0.060	0.063	0.070	0.051	0.055	0.069	0.059	0.049
Ce^{3+}	0.098	0.095	0.090	0.101	0.091	0.094	0.092	0.093	0.097	0.078	0.080	0.097	0.083	0.077
Pr^{3+}	0.006	0.005	0.008	0.009	0.006	0.005	0.007	0.006	0.005	0.007	0.008	0.007	0.005	0.007
Nd^{3+}	0.015	0.012	0.012	0.014	0.013	0.012	0.013	0.013	0.012	0.011	0.014	0.013	0.011	0.015
Sm^{3+}	0.002	0.002	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0.001	0.001	0.002	0.002	0.003
Eu^{3+}	0.001	0.001	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001
Gd^{3+}														
Dy^{3+}												0.001		0.001
Al^{3+}			0.001							0.016				0.004
Bi^{3+}	0.001	0.001			0.004		0.003	0.002		0.001	0.001		0.002	0.001
Ti^{4+}	0.693	0.676	0.638	0.652	0.659	0.636	0.642	0.639	0.626	0.592	0.680	0.652	0.599	0.697
Si^{4+}	0.029	0.032	0.024	0.020	0.022	0.019	0.023	0.024	0.037	0.103	0.037	0.019	0.028	0.029
Zr^{4+}			0.001			0.001			0.002	0.001	0.001		0.001	0.001
Nb^{5+}	0.267	0.283	0.331	0.309	0.302	0.329	0.318	0.325	0.330	0.302	0.294	0.321	0.358	0.262
Ta^{5+}			0.001			0.002	0.002	0.002	0.003	0.001			0.001	
Σ A site	1.007	0.995	0.990	0.995	1.008	0.997	1.012	1.011	0.996	0.918	0.955	0.980	0.977	0.996
Σ B site	1.009	1.012	1.005	1.019	1.007	1.008	1.008	1.002	1.008	1.043	1.026	1.010	1.012	1.013
unassigned cat. (%)	4.8	4.6	2.7	5.0	4.8	3.5	5.0	4.2	4.3	6.3	4.8	1.5	3.3	4.9
normalized end-member (mol.%)														
lueshite	28	30	34	32	31	34	33	34	35	33	31	33	37	27
loparite	39	38	36	39	36	38	37	37	39	27	34	37	33	32
tausonite	18	18	17	16	19	17	15	17	15	16	20	17	19	21
perovskite	14	14	12	12	14	11	14	12	11	20	14	12	10	17
$ThTi_2O_6$	1	0	0	1	0	0	1	0	0	1	1	1	0	2

Tab. S5. Chemical composition of loparite and lueshite from Brušperk-Borošín No. 1 based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the 3 oxygen atoms (according to Locock and Mitchell 2018). Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S6

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*average*
Na_2O	0.04	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.07	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.05
CaO	11.51	12.41	12.17	11.32	11.09	12.62	11.08	12.14	10.85	11.02	11.73	11.63
SrO	b.d.l.	0.93	b.d.l.	n.a.	n.a.	n.a.	n.a.	n.a.	b.d.l.	0.23	0.48	0.55
BaO	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	b.d.l.	b.d.l.	0.28	0.28
La_2O_3	6.48	6.47	6.87	7.29	6.99	4.96	5.94	6.13	7.96	7.26	7.22	6.69
Ce_2O_3	9.66	9.00	9.63	10.30	10.19	7.83	9.19	8.35	11.10	10.54	10.21	9.64
Pr_2O_3	b.d.l.	0.60	0.62	0.64	0.57	0.42	0.51	0.47	0.72	0.61	0.58	0.57
Nd_2O_3	1.30	1.21	1.38	1.39	1.15	1.14	1.26	1.07	1.19	1.36	1.31	1.25
Sm_2O_3	n.a.	n.a.	n.a.	0.12	b.d.l.	0.13	0.21	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.16
Eu_2O_3	n.a.	n.a.	n.a.	0.15	0.10	0.12	0.14	0.10	n.a.	n.a.	n.a.	0.12
Y_2O_3	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.11	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.11
Nb_2O_5	34.88	26.59	29.76	31.43	31.36	40.70	33.09	33.44	27.07	27.49	25.03	30.99
Ta_2O_5	1.04	1.26	1.36	1.20	1.15	1.86	1.30	1.36	1.32	1.01	1.12	1.27
P_2O_5	n.a.	n.a.	n.a.	0.04	b.d.l.	b.d.l.	b.d.l.	b.d.l.	n.a.	n.a.	n.a.	0.04
Al_2O_3	b.d.l.	b.d.l.	0.06	b.d.l.	b.d.l.	0.06	0.23	0.09	0.06	0.04	0.04	0.08
Fe_2O_3	1.70	0.49	0.61	0.92	0.84	0.92	1.01	0.72	0.86	1.00	0.47	0.87
Bi_2O_3	n.a.	n.a.	n.a.	0.41	b.d.l.	b.d.l.	b.d.l.	b.d.l.	n.a.	n.a.	n.a.	0.41
TiO_2	25.91	31.08	32.33	31.36	31.16	23.65	28.99	30.52	32.77	32.23	35.00	30.45
SiO_2	1.42	0.53	0.94	0.83	1.45	1.28	2.14	1.33	1.21	1.04	1.00	1.20
ThO_2	0.54	0.43	0.46	0.42	0.50	0.58	1.90	0.37	0.29	0.52	0.48	0.59
UO_2	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.10	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.10
ZrO_2	0.34	b.d.l.	b.d.l.	0.10	0.08	b.d.l.	b.d.l.	0.10	b.d.l.	0.13	0.21	0.16
F	b.d.l.	b.d.l.	b.d.l.	n.a.	n.a.	n.a.	n.a.	n.a.	0.51	0.52	0.47	0.50
Total	94.82	91.00	96.19	97.93	96.61	96.36	97.16	96.18	95.90	94.98	95.62	95.70
structural formula (apfu)												
Na^+	0.008	0.000	0.000	0.000	0.000	0.000	0.015	0.000	0.000	0.000	0.000	0.002
Ca^{2+}	1.391	1.499	1.471	1.368	1.341	1.525	1.339	1.467	1.311	1.332	1.417	1.406
Sr^{2+}	0.000	0.061	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.015	0.032	0.010
Ba^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.012	0.001
La^{3+}	0.270	0.269	0.286	0.303	0.291	0.206	0.247	0.255	0.331	0.302	0.300	0.278
Ce^{3+}	0.399	0.372	0.398	0.425	0.421	0.323	0.379	0.345	0.458	0.435	0.422	0.398
Pr^{3+}	0.000	0.024	0.025	0.026	0.023	0.017	0.021	0.019	0.030	0.025	0.024	0.021
Nd^{3+}	0.053	0.049	0.055	0.056	0.046	0.046	0.051	0.043	0.048	0.055	0.053	0.050
Sm^{3+}	0.000	0.000	0.000	0.005	0.000	0.005	0.008	0.000	0.000	0.000	0.000	0.002
Eu^{3+}	0.000	0.000	0.000	0.006	0.004	0.004	0.005	0.004	0.000	0.000	0.000	0.002
Y^{3+}	0.000	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.001
ΣREE+Y	0.721	0.714	0.765	0.822	0.785	0.608	0.712	0.666	0.867	0.817	0.798	0.752
Nb^{5+}	1.779	1.356	1.517	1.603	1.599	2.075	1.688	1.705	1.380	1.402	1.276	1.580
Ta^{5+}	0.032	0.039	0.042	0.037	0.035	0.057	0.040	0.042	0.040	0.031	0.034	0.039
P^{5+}	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Al^{3+}	0.000	0.000	0.008	0.000	0.000	0.007	0.031	0.012	0.008	0.006	0.005	0.007
Fe^{3+}	0.145	0.042	0.052	0.078	0.071	0.078	0.086	0.061	0.073	0.085	0.040	0.074
Bi^{3+}	0.000	0.000	0.000	0.012	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Ti^{4+}	2.198	2.637	2.742	2.660	2.643	2.006	2.459	2.588	2.779	2.733	2.968	2.583
Si^{4+}	0.160	0.060	0.106	0.094	0.163	0.144	0.242	0.149	0.136	0.117	0.113	0.135
Th^{4+}	0.014	0.011	0.012	0.011	0.013	0.015	0.049	0.009	0.007	0.013	0.012	0.015
U^{4+}	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
Zr^{4+}	0.019	0.000	0.000	0.005	0.004	0.000	0.000	0.005	0.000	0.007	0.011	0.005
F^-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.182	0.184	0.168	0.049

Tab. S6. Chemical composition of Ca-LREE-titanoniobate from Brušperk-Borošín No. 1 based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the 12 oxygen atoms. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S7 (*1st part*)

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
WO_3	0.00	0.00	0.00	0.00	0.47	0.38	0.35	0.36	0.00	0.00	0.73	0.68
Nb_2O_5	44.66	50.65	42.88	52.75	49.10	51.38	56.03	51.85	53.98	53.83	52.80	55.50
Ta_2O_5	1.29	0.88	1.90	1.96	1.92	1.70	1.17	1.98	0.80	0.50	1.41	1.05
SiO_2	0.31	0.54	2.37	0.53	0.67	0.23	0.64	1.54	0.14	0.17	0.65	0.35
TiO_2	9.40	10.85	12.04	8.29	10.29	7.43	4.71	6.57	10.44	11.11	3.69	4.20
ZrO_2	7.22	1.32	3.61	1.64	1.89	3.95	1.55	2.47	1.68	1.26	5.17	3.46
ThO_2	0.96	0.17	1.51	0.20	0.27	0.35	0.09	0.37	0.00	0.00	0.00	0.00
UO_2	1.06	1.24	1.33	1.83	1.55	0.33	0.84	2.08	0.10	0.00	0.36	0.00
Al_2O_3	0.00	0.07	0.00	0.07	0.07	0.00	0.10	0.33	0.04	0.05	0.11	0.10
Ce_2O_3	3.36	2.03	4.18	1.45	1.93	1.60	1.20	1.46	0.55	0.81	1.15	0.00
Y_2O_3	0.41	0.18	0.29	0.21	0.22	0.35	0.20	0.00	0.18	0.16	0.00	0.00
La_2O_3	1.52	0.88	1.42	0.70	0.90	0.86	0.61	0.76	0.37	0.49	0.72	0.21
Fe_2O_3	1.00	1.10	1.49	1.23	1.02	0.79	1.83	2.62	0.76	0.51	1.33	2.07
MnO	0.05	0.00	0.18	0.07	0.06	0.00	0.00	0.09	0.00	0.00	0.00	0.00
CaO	19.92	22.90	19.11	20.74	21.37	21.78	19.88	17.13	23.23	22.89	19.41	20.85
Na_2O	2.20	3.35	1.69	3.76	3.78	3.42	4.35	2.65	3.57	3.43	5.04	4.84
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PbO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.00	0.00	0.00	0.00
Pr_2O_3	0.28	0.24	0.27	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nd_2O_3	0.67	0.28	0.88	0.00	0.23	0.24	0.27	0.24	0.00	0.00	0.00	0.00
Sm_2O_3	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eu_2O_3	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.03	0.03	0.00	0.00	0.04	0.00	0.00	0.00	0.00
K_2O	0.05	0.00	0.06	0.10	0.04	0.00	0.07	0.08	0.04	0.08	0.27	0.09
Cs_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	4.12	3.95	4.45	3.85	3.37	4.23	4.42	4.22	3.99	3.84	4.25	4.08
-O=F2	-1.73	-1.66	-1.87	-1.62	-1.42	-1.78	-1.86	-1.78	-1.68	-1.62	-1.79	-1.72
Total	98.47	100.61	99.86	99.50	99.43	99.02	98.28	97.62	99.86	99.13	97.09	97.48
structural formula (apfu)												
A site												
Th^{4+}	0.014	0.002	0.020	0.003	0.004	0.005	0.001	0.005	0.000	0.000	0.000	0.000
U^{4+}	0.015	0.017	0.017	0.025	0.021	0.005	0.012	0.027	0.001	0.000	0.005	0.000
Ce^{3+}	0.076	0.044	0.090	0.032	0.043	0.037	0.027	0.031	0.012	0.017	0.027	0.000
Mn^{2+}	0.003	0.000	0.009	0.004	0.003	0.000	0.000	0.004	0.000	0.000	0.000	0.000
Ca^{2+}	1.326	1.470	1.197	1.347	1.386	1.453	1.324	1.075	1.462	1.440	1.319	1.378
Na^{+}	0.265	0.389	0.191	0.442	0.444	0.412	0.524	0.301	0.406	0.390	0.620	0.578
Sr^{+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Y^{3+}	0.014	0.006	0.009	0.007	0.007	0.011	0.007	0.000	0.005	0.005	0.000	0.000
La^{3+}	0.035	0.019	0.031	0.016	0.020	0.020	0.014	0.016	0.008	0.011	0.017	0.005
Zn^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pb^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.000
Pr^{3+}	0.006	0.005	0.006	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Nd^{3+}	0.015	0.006	0.018	0.000	0.005	0.005	0.006	0.005	0.000	0.000	0.000	0.000
Sm^{3+}	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Eu^{3+}	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total A	1.768	1.959	1.592	1.877	1.938	1.948	1.915	1.477	1.895	1.863	1.988	1.961
B site												
W^{6+}	0.000	0.000	0.000	0.000	0.007	0.006	0.006	0.005	0.000	0.000	0.012	0.011
Nb^{5+}	1.254	1.372	1.133	1.446	1.344	1.446	1.575	1.373	1.433	1.429	1.515	1.548
Ta^{5+}	0.022	0.014	0.030	0.032	0.032	0.029	0.020	0.032	0.013	0.008	0.024	0.018
Si^{4+}	0.019	0.032	0.138	0.032	0.040	0.014	0.040	0.090	0.008	0.010	0.041	0.022
Ti^{4+}	0.439	0.489	0.530	0.378	0.468	0.348	0.220	0.289	0.461	0.491	0.176	0.195
Zr^{4+}	0.219	0.039	0.103	0.048	0.056	0.120	0.047	0.070	0.048	0.036	0.160	0.104
Al^{3+}	0.000	0.005	0.000	0.005	0.005	0.000	0.007	0.023	0.003	0.004	0.008	0.007
Mg^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Fe^{3+}	0.047	0.050	0.066	0.056	0.046	0.037	0.085	0.116	0.033	0.022	0.064	0.096
P^{5+}	0.000	0.000	0.000	0.002	0.001	0.000	0.000	0.002	0.000	0.000	0.000	0.000
Total B	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Nb#	73.1	73.2	66.9	77.9	72.9	79.3	86.8	81.1	75.1	74.1	88.3	87.9
Ta#	1.3	0.8	1.8	1.7	1.7	1.6	1.1	1.9	0.7	0.4	1.4	1.0
Ti#	25.6	26.1	31.3	20.4	25.4	19.1	12.1	17.1	24.2	25.5	10.3	11.1
X+Y sites												
F^{-}	0.808	0.748	0.823	0.738	0.645	0.832	0.868	0.781	0.741	0.713	0.853	0.796
O^{2-}	5.947	6.116	5.750	6.052	6.129	6.096	6.015	5.634	6.040	6.034	6.024	6.018
K^{+}	0.004	0.000	0.004	0.007	0.003	0.000	0.005	0.006	0.003	0.006	0.022	0.007
Cs^{+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Total X+Y	6.759	6.864	6.577	6.798	6.777	6.928	6.889	6.421	6.784	6.753	6.899	6.822
Tot. (O+OH)	5.947	6.116	5.750	6.052	6.129	6.096	6.015	5.634	6.040	6.034	6.024	6.018

Tab. S7 (1st part). Chemical composition of pyrochlore group mineral from Nový Jičín-Čerťák based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the B site = 2.000 normalization. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S7 (*2nd part*)

	13	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*	*25*
WO_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.00	0.00	0.00	0.77
Nb_2O_5	50.12	49.85	51.53	42.02	47.95	45.61	40.22	51.75	51.00	53.83	49.94	52.02	48.22
Ta_2O_5	1.88	3.16	1.32	1.96	0.87	1.60	1.60	0.99	1.95	1.25	1.99	0.73	0.47
SiO_2	0.46	0.43	0.20	1.85	0.28	1.95	1.41	0.84	0.59	0.50	0.33	2.29	1.84
TiO_2	7.05	5.28	9.18	11.00	10.89	10.38	9.64	3.58	2.73	5.51	7.03	1.58	7.15
ZrO_2	3.07	5.15	2.45	5.36	1.84	3.35	8.96	8.15	5.09	2.31	2.66	6.12	1.32
ThO_2	0.20	0.18	0.31	1.54	0.17	0.12	1.02	0.16	0.18	0.00	0.17	0.18	0.42
UO_2	1.77	2.22	1.19	1.18	1.34	0.15	1.50	0.00	1.42	1.14	1.75	0.49	0.58
Al_2O_3	0.09	0.18	0.06	0.38	0.10	1.07	0.44	0.08	0.10	0.06	0.08	0.09	0.11
Ce_2O_3	1.48	1.27	1.51	4.22	2.16	0.67	3.63	0.78	1.25	1.51	1.53	0.88	2.12
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
La_2O_3	0.67	0.95	0.74	1.46	0.89	0.41	1.52	0.70	0.72	0.78	0.76	0.78	1.26
Fe_2O_3	1.52	1.25	0.93	1.33	1.01	3.30	1.39	1.26	2.17	1.85	1.29	1.96	1.72
MnO	0.00	0.00	0.00	0.14	0.00	0.00	0.10	0.09	0.00	0.00	0.00	0.00	0.00
CaO	20.57	18.98	21.19	18.02	22.65	22.34	18.02	20.95	20.43	20.76	20.52	19.62	19.67
Na_2O	4.11	4.00	3.91	1.96	3.48	3.37	2.34	3.91	4.27	3.79	4.22	4.89	4.09
SrO	0.00	0.00	0.00	0.27	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PbO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pr_2O_3	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00
Nd_2O_3	0.00	0.00	0.33	0.72	0.38	0.00	0.56	0.00	0.00	0.00	0.35	0.00	0.35
Sm_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eu_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	0.11	0.14	0.10	0.09	0.00	0.07	0.10	0.12	0.10	0.13	0.00	0.11	0.00
Cs_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	3.63	3.35	3.54	2.04	3.96	4.16	2.48	3.08	3.49	3.30	3.74	3.40	3.19
-O=F2	-1.53	-1.41	-1.49	-0.86	-1.67	-1.75	-1.05	-1.30	-1.47	-1.39	-1.58	-1.43	-1.34
Total	96.73	96.38	98.49	95.96	97.97	98.63	95.14	96.43	96.26	96.71	96.68	95.13	93.27
structural formula (apfu)													
A site													
Th^{4+}	0.003	0.003	0.004	0.021	0.002	0.001	0.014	0.002	0.003	0.000	0.003	0.003	0.006
U^{4+}	0.025	0.031	0.016	0.016	0.019	0.002	0.020	0.000	0.021	0.016	0.025	0.007	0.008
Ce^{3+}	0.034	0.029	0.034	0.092	0.049	0.014	0.080	0.018	0.030	0.035	0.036	0.020	0.049
Mn^{2+}	0.000	0.000	0.000	0.007	0.000	0.000	0.005	0.005	0.000	0.000	0.000	0.000	0.000
Ca^{2+}	1.391	1.293	1.388	1.145	1.508	1.319	1.161	1.394	1.428	1.394	1.414	1.325	1.342
Na^{+}	0.503	0.493	0.464	0.226	0.420	0.360	0.273	0.470	0.539	0.461	0.526	0.597	0.505
Sr^{+}	0.000	0.000	0.000	0.009	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.000	0.000
Y^{3+}	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
La^{3+}	0.016	0.022	0.017	0.032	0.020	0.008	0.034	0.016	0.017	0.018	0.018	0.018	0.029
Zn^{2+}	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
Pb^{2+}	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
Pr^{3+}	0.000	0.000	0.000	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000
Nd^{3+}	0.000	0.000	0.007	0.015	0.008	0.000	0.012	0.000	0.000	0.000	0.008	0.000	0.008
Sm^{3+}	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
Eu^{3+}	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
Total A	1.972	1.871	1.930	1.571	2.027	1.704	1.605	1.905	2.038	1.923	2.038	1.969	1.948
B site													
W^{6+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.000	0.000	0.000	0.013
Nb^{5+}	1.430	1.433	1.424	1.127	1.348	1.136	1.094	1.453	1.504	1.525	1.452	1.481	1.388
Ta^{5+}	0.032	0.055	0.022	0.032	0.015	0.024	0.026	0.017	0.035	0.021	0.035	0.012	0.008
Si^{4+}	0.029	0.027	0.012	0.110	0.018	0.107	0.085	0.052	0.038	0.031	0.021	0.144	0.117
Ti^{4+}	0.335	0.253	0.422	0.491	0.509	0.430	0.436	0.167	0.134	0.260	0.340	0.075	0.343
Zr^{4+}	0.095	0.160	0.073	0.155	0.056	0.090	0.263	0.247	0.162	0.070	0.083	0.188	0.041
Al^{3+}	0.007	0.013	0.004	0.026	0.007	0.069	0.031	0.006	0.008	0.005	0.006	0.006	0.008
Mg^{2+}	0.000	0.000	0.000	0.000	0.000	0.007	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Fe^{3+}	0.072	0.060	0.043	0.059	0.047	0.137	0.063	0.059	0.106	0.087	0.062	0.093	0.082
P^{5+}	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
Total B	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Nb#	79.6	82.3	76.2	68.3	72.0	71.4	70.3	88.8	89.9	84.4	79.5	94.4	79.8
Ta#	1.8	3.1	1.2	1.9	0.8	1.5	1.7	1.0	2.1	1.2	1.9	0.8	0.5
Ti#	18.6	14.5	22.6	29.8	27.2	27.1	28.0	10.2	8.0	14.4	18.6	4.8	19.7
X+Y sites													
F^{-}	0.724	0.673	0.685	0.382	0.778	0.725	0.472	0.604	0.720	0.655	0.761	0.678	0.643
O^{2-}	6.103	6.055	6.104	5.914	6.142	5.646	5.840	6.089	6.180	6.136	6.166	6.058	6.098
K^{+}	0.009	0.011	0.008	0.007	0.000	0.005	0.008	0.010	0.008	0.010	0.000	0.009	0.000
Cs^{+}	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
Total X+Y	6.836	6.739	6.797	6.303	6.920	6.376	6.320	6.703	6.908	6.800	6.927	6.744	6.741

Tot. (O+OH)	6.103	6.055	6.104	5.914	6.142	5.646	5.840	6.089	6.180	6.136	6.166	6.058	6.098

Tab. S7 (2nd part). Chemical composition of pyrochlore group mineral from Nový Jičín-Čerťák based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the B site = 2.000 normalization. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S7 (*3rd part*)

	26	*27*	*28*	*29*	*30*	*31*	*32*	*33*	*34*	*35*	*36*	*37*	*38*
WO_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nb_2O_5	46.98	51.80	45.50	47.13	47.02	46.75	47.24	46.99	48.91	47.52	49.38	49.60	51.32
Ta_2O_5	1.25	0.51	1.91	0.67	3.02	2.73	2.10	0.52	1.87	0.61	0.58	0.69	1.56
SiO_2	0.10	0.17	0.18	0.25	0.73	0.48	0.58	0.19	0.52	0.29	0.06	0.09	0.87
TiO_2	11.17	6.64	8.72	8.86	8.44	5.82	7.26	13.08	6.78	11.64	10.74	10.92	4.10
ZrO_2	3.17	3.33	4.83	3.37	2.79	5.22	3.09	2.91	3.45	1.36	2.91	2.08	3.63
ThO_2	0.33	0.00	0.54	0.29	1.45	0.21	0.33	0.00	0.32	0.00	0.00	0.00	0.00
UO_2	0.26	0.00	0.98	0.50	2.92	1.84	1.82	0.00	1.91	0.00	0.00	0.14	1.31
Al_2O_3	0.08	0.04	0.05	0.07	0.15	0.10	0.35	0.09	0.12	0.20	0.08	0.00	0.10
Ce_2O_3	2.00	0.84	1.93	1.82	1.82	1.22	1.44	1.14	1.48	1.47	0.99	0.59	1.22
Y_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
La_2O_3	0.89	0.64	0.80	0.93	0.78	0.71	0.71	0.60	0.80	0.67	0.51	0.46	0.57
Fe_2O_3	0.65	1.16	0.78	0.81	0.78	1.23	1.49	0.69	2.16	0.73	0.75	0.83	2.18
MnO	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.12	0.00	0.10	0.00
CaO	22.79	22.68	21.45	19.98	20.23	21.15	20.02	23.51	20.43	21.89	22.99	23.52	20.44
Na_2O	3.42	4.59	3.68	4.20	2.71	4.06	3.59	3.43	3.63	3.55	3.60	3.49	4.37
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PbO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pr_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nd_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.49	0.00	0.00
Sm_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Eu_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	0.00	0.11	0.00	0.00	0.09	0.00	0.00	0.00	0.08	0.10	0.09	0.00	0.08
Cs_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	3.85	3.91	3.78	4.40	2.53	4.06	3.74	3.69	3.51	5.33	4.01	4.09	3.61
-O=F2	-1.62	-1.65	-1.59	-1.85	-1.06	-1.71	-1.58	-1.55	-1.48	-2.24	-1.69	-1.72	-1.52
Total	96.95	96.41	95.12	93.27	95.55	95.58	93.76	96.82	96.32	95.46	97.16	96.59	95.36
structural formula (apfu)													
A site													
Th^{4+}	0.005	0.000	0.008	0.004	0.021	0.003	0.005	0.000	0.005	0.000	0.000	0.000	0.000
U^{4+}	0.004	0.000	0.014	0.007	0.042	0.027	0.026	0.000	0.027	0.000	0.000	0.002	0.019
Ce^{3+}	0.045	0.020	0.046	0.043	0.042	0.029	0.034	0.025	0.034	0.033	0.022	0.013	0.029
Mn^{2+}	0.000	0.000	0.000	0.000	0.006	0.000	0.000	0.000	0.000	0.006	0.000	0.005	0.000
Ca^{2+}	1.516	1.554	1.491	1.393	1.386	1.495	1.384	1.506	1.381	1.459	1.507	1.548	1.408
Na^{+}	0.412	0.570	0.463	0.530	0.336	0.519	0.449	0.398	0.445	0.429	0.427	0.415	0.545
Sr^{+}	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
Y^{3+}	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
La^{3+}	0.020	0.015	0.019	0.022	0.018	0.017	0.017	0.013	0.019	0.015	0.012	0.010	0.013
Zn^{2+}	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
Pb^{2+}	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
Pr^{3+}	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
Nd^{3+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.011	0.000	0.000
Sm^{3+}	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
Eu^{3+}	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
Total A	2.002	2.159	2.041	2.001	1.852	2.090	1.915	1.942	1.918	1.943	1.979	1.994	2.013
B site													
W^{6+}	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
Nb^{5+}	1.318	1.498	1.334	1.387	1.359	1.394	1.378	1.270	1.396	1.337	1.366	1.378	1.491
Ta^{5+}	0.021	0.009	0.034	0.012	0.052	0.049	0.037	0.008	0.032	0.010	0.010	0.011	0.027
Si^{4+}	0.006	0.011	0.012	0.016	0.047	0.031	0.037	0.011	0.033	0.018	0.004	0.006	0.056
Ti^{4+}	0.522	0.319	0.425	0.434	0.406	0.289	0.352	0.588	0.322	0.545	0.494	0.505	0.198
Zr^{4+}	0.096	0.104	0.153	0.107	0.087	0.168	0.097	0.085	0.106	0.041	0.087	0.062	0.114
Al^{3+}	0.006	0.003	0.004	0.005	0.011	0.008	0.026	0.006	0.009	0.015	0.005	0.000	0.008
Mg^{2+}	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
Fe^{3+}	0.030	0.056	0.038	0.040	0.037	0.061	0.072	0.031	0.102	0.034	0.034	0.038	0.105
P^{5+}	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
Total B	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Nb#	70.8	82.0	74.4	75.7	74.8	80.5	78.0	68.0	79.8	70.7	73.1	72.7	86.9
Ta#	1.1	0.5	1.9	0.6	2.9	2.8	2.1	0.5	1.8	0.5	0.5	0.6	1.6
Ti#	28.0	17.5	23.7	23.7	22.3	16.7	19.9	31.5	18.4	28.8	26.4	26.6	11.5
X+Y sites													
F^{-}	0.756	0.792	0.774	0.905	0.511	0.847	0.764	0.697	0.700	1.048	0.776	0.794	0.734
O^{2-}	6.111	6.219	6.140	6.004	6.202	6.148	6.023	6.035	6.065	5.878	6.067	6.079	6.117
K^{+}	0.000	0.009	0.000	0.000	0.007	0.000	0.000	0.000	0.007	0.008	0.007	0.000	0.007
Cs^{+}	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
Total X+Y	6.867	7.020	6.914	6.909	6.721	6.995	6.787	6.732	6.772	6.934	6.850	6.873	6.858

Tot. (O+OH)	6.111	6.219	6.140	6.004	6.202	6.148	6.023	6.035	6.065	5.878	6.067	6.079	6.117

Tab. S7 (3rd part). Chemical composition of pyrochlore group mineral from Nový Jičín-Čerťák based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the B site = 2.000 normalization. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S8 (*1st part*)

locality	**Bruzovice**												
source	this study												
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
WO_3	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.00
Nb_2O_5	55.89	44.53	52.73	53.30	44.56	47.81	45.86	53.31	52.61	53.69	51.39	43.48	43.64
Ta_2O_5	0.62	3.19	0.56	0.74	2.34	2.02	2.39	0.77	0.21	0.62	1.68	2.24	2.26
SiO_2	0.29	0.73	0.23	0.25	0.72	0.61	0.74	0.21	0.18	0.25	0.27	0.47	0.36
TiO_2	8.40	11.65	8.92	9.16	12.49	10.71	11.25	9.45	11.20	8.90	8.02	15.16	15.79
ZrO_2	1.58	2.26	1.92	2.08	1.77	1.42	0.77	3.49	1.28	2.38	4.61	1.82	1.77
ThO_2	0.00	0.30	0.00	0.09	0.53	0.19	0.11	0.00	0.00	0.00	0.00	0.26	0.29
UO_2	0.08	3.57	0.00	0.09	2.79	1.88	2.78	0.19	0.00	0.00	0.18	2.96	2.93
Al_2O_3	0.00	0.00	0.09	0.00	0.07	0.03	0.09	0.00	0.07	0.05	0.10	0.00	0.00
Ce_2O_3	0.24	2.08	0.43	0.27	2.62	1.63	1.77	0.46	0.55	0.35	1.24	2.01	1.98
Y_2O_3	0.18	0.12	0.21	0.20	0.29	0.18	0.17	0.00	0.00	0.00	0.00	0.00	0.00
La_2O_3	0.17	0.81	0.42	0.23	1.04	0.66	0.78	0.28	0.44	0.28	0.55	0.70	0.62
Fe_2O_3	0.49	1.82	0.74	0.37	1.93	0.65	1.50	0.70	0.19	0.34	0.41	0.64	0.70
MnO	0.00	0.37	0.00	0.00	0.09	0.06	0.14	0.00	0.00	0.00	0.00	0.00	0.00
CaO	21.86	21.12	21.96	22.06	19.73	19.95	19.83	22.04	22.81	22.27	21.06	21.11	20.86
Na_2O	5.12	1.10	4.52	4.90	2.62	4.11	2.82	5.20	5.18	5.30	4.87	3.11	2.39
SrO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MgO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00
PbO	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00
Pr_2O_3	0.00	0.00	0.00	0.00	0.30	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00
Nd_2O_3	0.00	0.37	0.00	0.00	0.50	0.28	0.39	0.00	0.00	0.00	0.00	0.51	0.32
Sm_2O_3	0.00	0.14	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
Eu_2O_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K_2O	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.05	0.06	0.00
Cs_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	4.55	4.57	4.11	4.01	4.02	4.25	4.09	4.90	5.24	4.86	4.83	3.22	2.42
-O=F2	-1.92	-1.93	-1.73	-1.69	-1.69	-1.79	-1.72	-2.07	-2.21	-2.04	-2.03	-1.35	-1.02
Total	99.83	98.71	96.82	97.75	98.41	96.47	96.24	101.05	100.65	99.28	99.24	97.75	96.33
structural formula (apfu)													
A site													
Th^{4+}	0.000	0.004	0.000	0.001	0.007	0.003	0.002	0.000	0.000	0.000	0.000	0.004	0.004
U^{4+}	0.001	0.048	0.000	0.001	0.037	0.026	0.038	0.002	0.000	0.000	0.002	0.039	0.038
Ce^{3+}	0.005	0.046	0.010	0.006	0.058	0.037	0.040	0.010	0.012	0.008	0.028	0.044	0.043
Mn^{2+}	0.000	0.019	0.000	0.000	0.005	0.003	0.007	0.000	0.000	0.000	0.000	0.000	0.000
Ca^{2+}	1.408	1.373	1.447	1.445	1.270	1.334	1.320	1.392	1.460	1.452	1.382	1.350	1.316
Na^{+}	0.597	0.129	0.539	0.581	0.305	0.497	0.339	0.595	0.600	0.626	0.578	0.360	0.273
Sr^{+}	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
Y^{3+}	0.006	0.004	0.007	0.007	0.009	0.006	0.006	0.000	0.000	0.000	0.000	0.000	0.000
La^{3+}	0.004	0.018	0.009	0.005	0.023	0.015	0.018	0.006	0.010	0.006	0.012	0.015	0.014
Zn^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.000	0.000	0.000	0.000	0.000	0.000
Pb^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Pr^{3+}	0.000	0.000	0.000	0.000	0.007	0.000	0.005	0.000	0.000	0.000	0.000	0.000	0.000
Nd^{3+}	0.000	0.008	0.000	0.000	0.011	0.006	0.009	0.000	0.000	0.000	0.000	0.011	0.007
Sm^{3+}	0.000	0.003	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000
Eu^{3+}	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
Total A	2.021	1.652	2.011	2.046	1.731	1.927	1.798	2.005	2.081	2.092	2.002	1.823	1.694
B site													
W^{6+}	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.000	0.000	0.000	0.000
Nb^{5+}	1.519	1.222	1.466	1.473	1.210	1.349	1.288	1.421	1.421	1.477	1.423	1.173	1.161
Ta^{5+}	0.010	0.053	0.009	0.012	0.038	0.034	0.040	0.012	0.003	0.010	0.028	0.036	0.036
Si^{4+}	0.017	0.044	0.014	0.015	0.043	0.038	0.046	0.012	0.011	0.015	0.016	0.028	0.021
Ti^{4+}	0.380	0.532	0.413	0.421	0.564	0.503	0.526	0.419	0.504	0.407	0.369	0.681	0.699
Zr^{4+}	0.046	0.067	0.058	0.062	0.052	0.043	0.023	0.100	0.037	0.071	0.138	0.053	0.051
Al^{3+}	0.000	0.000	0.006	0.000	0.005	0.002	0.007	0.000	0.005	0.004	0.007	0.000	0.000
Mg^{2+}	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.000
Fe^{3+}	0.022	0.083	0.034	0.017	0.087	0.030	0.070	0.031	0.009	0.016	0.019	0.029	0.031
P^{5+}	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
Total B	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Nb#	79.6	67.6	77.7	77.3	66.8	71.5	69.5	76.7	73.7	78.0	78.2	62.1	61.2
Ta#	0.5	2.9	0.5	0.6	2.1	1.8	2.2	0.7	0.2	0.5	1.5	1.9	1.9
Ti#	19.9	29.4	21.9	22.1	31.1	26.7	28.4	22.6	26.1	21.5	20.3	36.0	36.9
X+Y sites													
F^{-}	0.865	0.878	0.800	0.776	0.763	0.838	0.804	0.914	0.991	0.935	0.935	0.607	0.451
O^{2-}	6.058	5.836	6.073	6.113	5.873	5.996	5.932	5.959	6.013	6.053	5.981	6.007	5.989
K^{+}	0.000	0.000	0.000	0.000	0.000	0.004	0.000	0.000	0.000	0.000	0.004	0.005	0.000

Cs^+	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
Total X+Y	6.923	6.714	6.872	6.888	6.636	6.839	6.736	6.873	7.004	6.988	6.920	6.619	6.439
Tot. (O+OH)	6.058	5.836	6.073	6.113	5.873	5.996	5.932	5.959	6.013	6.053	5.981	6.007	5.989

Tab. S8 (1st part). Chemical composition of pyrochlore group mineral from Bruzovice, Brušperk, and previously published data from the TAR based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the B site = 2.000 normalization. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S8 (*2nd part*)

locality	**Bruzovice**				**Brušperk**		**Puńców (PL)**				**NJ-Čerťák**	**Řepiště**
source	this study						Włodyka (2010)				Kropáč et al. (2020)	
	14	*15*	*16*	*17*	*1*	*2*	*1*	*2*	*3*	*4*	*1*	*2*
WO_3	0.00	0.72	0,00	0,00	0,00	0.00	n.a.	n.a.	n.a.	n.a.	55.17	44.53
Nb_2O_5	47.66	43.08	52.50	51.53	47.38	45.05	50.43	49.88	52.38	47.84	0.89	1.51
Ta_2O_5	1.57	2.05	0.48	0.84	1.66	0.65	1.41	1.08	1.00	0.79	0.21	6.76
SiO_2	0.47	0.86	0.26	0.17	1.76	1.52	2.27	1.05	1.10	1.16	6.25	8.67
TiO_2	11.73	12.54	10.23	9.43	17.27	20.22	10.26	12.23	7.03	8.38	1.82	3.36
ZrO_2	2.65	2.98	1.66	2.86	0.20	0.30	2.75	2.02	4.41	3.14	55.17	44.53
HfO_2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.10	0.06	0.43	1.25	0.00	0.00
ThO_2	0.30	0.55	0.00	0.00	0.00	1.72	0.03	0.15	0.35	0.51	0.15	0.12
UO_2	0.43	3.10	0.00	0.00	0.00	0.09	1.57	2.01	0.92	4.42	0.46	0.79
Al_2O_3	0.08	0.05	0.00	0.05	0.14	0.08	0.03	0.53	0.03	0.69	0.07	0.09
V_2O_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.16	0.12	0.06	0.06	0.00	0.00
Ce_2O_3	1.93	2.75	0.41	0.41	5.77	6.37	1.09	0.74	1.96	2.92	0.00	0.00
Y_2O_3	0.00	0.00	0.00	0.00	0.10	0.16	0.00	0.01	0.15	0.16	0.12	0.00
La_2O_3	0.66	1.09	0.32	0.23	3.47	3.48	0.63	0.62	0.91	1.42	0.00	0.00
Fe_2O_3	0.99	2.39	0.90	0.28	1.78	1.83	1.29	0.96	1.15	4.03	1.93	0.79
MnO	0.00	0.14	0.00	0.00	0.00	0.00	0.05	0.12	0.12	0.14	0.00	0.10
CaO	21.35	19.55	22.89	21.83	13.68	12.87	19.52	21.47	19.81	16.45	16.09	13.78
Na_2O	4.72	2.04	4.85	5.35	0.00	0.00	4.41	3.90	4.18	4.93	4.23	4.85
SrO	0.00	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
MgO	0.00	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
ZnO	0.00	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
PbO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Pr_2O_3	0.00	0.00	0.00	0.00	0.43	0.65	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Nd_2O_3	0.00	0.51	0.00	0.00	1.02	1.75	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sm_2O_3	0.00	0.00	0.00	0.00	0.00	0.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Eu_2O_3	0.00	0.00	0.00	0.00	0.12	0.11	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
P_2O_5	0.00	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
K_2O	0.06	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Cs_2O	0.00	0.00	0.00	0.00	0.00	0.00	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
F	4.69	2.34	5.16	5.10	4.91	3.99	1.82	0.81	1.95	0.65	4.40	3.42
-O=F2	-1.98	-0.99	-2.17	-2.15	-2.07	-1.68	-0.77	-0.34	-0.82	-0.27	-1.85	-1.44
Total	99.30	96.74	99.65	98.09	99.69	101.09	97.82	97.76	97.94	98.94	91.79	88.86
structural formula (apfu)												
A site												
Th^{4+}	0.004	0.007	0.000	0.000	0.000	0.020						
U^{4+}	0.006	0.041	0.000	0.000	0.000	0.001						
Ce^{3+}	0.042	0.060	0.009	0.009	0.111	0.120						
Mn^{2+}	0.000	0.007	0.000	0.000	0.000	0.000						
Ca^{2+}	1.370	1.239	1.472	1.441	0.767	0.709						
Na^{+}	0.548	0.234	0.564	0.639	0.000	0.000						
Sr^{+}	0.000	0.000	0.000	0.000	0.000	0.000						
Y^{3+}	0.000	0.000	0.000	0.000	0.003	0.004						
La^{3+}	0.014	0.024	0.007	0.005	0.067	0.066						
Zn^{2+}	0.000	0.000	0.000	0.000	0.000	0.000						
Pb^{2+}	0.000	0.000	0.000	0.000	0.000	0.000						
Pr^{3+}	0.000	0.000	0.000	0.000	0.008	0.012						
Nd^{3+}	0.000	0.011	0.000	0.000	0.019	0.032						
Sm^{3+}	0.000	0.000	0.000	0.000	0.000	0.005						
Eu^{3+}	0.000	0.000	0.000	0.000	0.002	0.002						
Total A	1.984	1.622	2.053	2.095	0.977	0.971						
B site												
W^{6+}	0.000	0.011	0.000	0.000	0.000	0.000						
Nb^{5+}	1.290	1.152	1.425	1.435	1.121	1.047						
Ta^{5+}	0.026	0.033	0.008	0.014	0.024	0.009						
Si^{4+}	0.028	0.051	0.016	0.011	0.092	0.078						
Ti^{4+}	0.528	0.558	0.462	0.437	0.680	0.782						
Zr^{4+}	0.077	0.086	0.049	0.086	0.005	0.007						
Hf^{4+}												
Al^{3+}	0.006	0.003	0.000	0.004	0.008	0.005						
Mg^{2+}	0.000	0.000	0.000	0.000	0.000	0.000						
Fe^{3+}	0.045	0.106	0.041	0.013	0.070	0.071						
P^{5+}	0.000	0.000	0.000	0.000	0.000	0.000						
Total B	2.000	2.000	2.000	2.000	2.000	2.000						

Nb#	70.0	66.1	75.2	76.1	61.4	57.0						
Ta#	1.4	1.9	0.4	0.7	1.3	0.5						
Ti#	28.7	32.0	24.4	23.2	37.3	42.5						
X+Y sites												
F^-	0.888	0.438	0.979	0.995	0.813	0.649						
O^{2-}	5.937	5.929	5.985	6.002	5.208	5.282						
K^+	0.004	0.000	0.000	0.000	0.000	0.000						
Cs^+	0.000	0.000	0.000	0.000	0.000	0.000						
Total X+Y	6.830	6.367	6.964	6.997	6.022	5.931						
Tot. (O+OH)	5.937	5.929	5.985	6.002	5.208	5.282						

Tab. S8 (2nd part). Chemical composition of pyrochlore group mineral from Bruzovice, Brušperk, and previously published data from the TAR based on the WDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the B site = 2.000 normalization. Notes: b.d.l. – below detection limit, n.a. – not available (was not measured).

Table S9

	WDS	*WDS*	*WDS*	*WDS*	*WDS*	*EDS*	*EDS*	*EDS*	*EDS*	*EDS*	*average*
Na_2O	9.97	10.21	9.95	10.20	10.32	10.25	10.15	9.88	10.33	9.85	10.11
K_2O	0.21	0.36	0.20	0.26	0.26	0.18	0.10	0.17	0.33	b.d.l.	0.21
CaO	0.05	0.27	0.12	0.07	0.10	0.25	b.d.l.	b.d.l.	0.07	b.d.l.	0.09
SrO	13.38	12.64	12.90	12.35	11.73	12.60	13.68	11.64	11.63	12.22	12.48
BaO	3.41	2.04	3.65	3.47	3.13	3.21	2.87	4.89	3.45	6.04	3.62
FeO	b.d.l.	b.d.l.	b.d.l.	b.d.l.	b.d.l.	0.35	b.d.l.	0.45	0.33	b.d.l.	0.11
Al_2O_3	32.67	32.82	32.72	32.40	32.46	33.20	33.86	32.62	32.51	33.60	32.89
SiO_2	40.87	41.78	41.22	41.19	42.13	40.34	39.91	39.50	40.94	38.38	40.63
Total	100.56	100.11	100.76	99.95	100.12	100.38	100.57	99.15	99.59	100.09	100.13
structural formula (apfu)											
Na^+	1.951	1.979	1.940	1.999	2.001	2.006	1.985	1.972	2.028	1.969	1.983
K^+	0.027	0.046	0.026	0.033	0.033	0.023	0.013	0.022	0.043	0.000	0.027
Σ	1.979	2.025	1.966	2.033	2.033	2.029	1.998	1.995	2.071	1.969	2.010
Ca^{2+}	0.006	0.028	0.013	0.008	0.011	0.027	0.000	0.000	0.008	0.000	0.010
Sr^{2+}	0.783	0.732	0.752	0.724	0.681	0.737	0.800	0.695	0.683	0.731	0.732
Ba^{2+}	0.135	0.080	0.144	0.137	0.123	0.127	0.113	0.197	0.137	0.244	0.144
Fe^{2+}	0.000	0.000	0.000	0.000	0.000	0.030	0.000	0.039	0.028	0.000	0.010
Σ	0.924	0.841	0.909	0.869	0.814	0.921	0.913	0.931	0.855	0.975	0.895
Al^{3+}	3.888	3.865	3.878	3.859	3.827	3.949	4.025	3.958	3.879	4.084	3.921
Si^{4+}	4.127	4.175	4.146	4.163	4.214	4.071	4.025	4.067	4.145	3.958	4.109

Tab. S9. Chemical composition of stronalsite from Hodslavice-Čerťák based on the WDS & EDS microanalyses (wt.%) and calculation of its empirical formula coefficients based on the 16 oxygen atoms. Note: b.d.l. – below detection limit.

Table S10

	1	*2*	*3*	*average*
Na_2O	b.d.l.	0.90	b.d.l.	0.30
CaO	4.15	2.75	1.83	2.91
SrO	7.51	8.53	13.60	9.88
FeO	0.71	1.89	1.63	1.41
Y_2O_3	b.d.l.	0.37	b.d.l.	0.12
La_2O_3	18.19	16.90	16.19	17.09
Ce_2O_3	24.80	24.11	23.08	24.00
Pr_2O_3	2.22	2.14	1.37	1.91
Nd_2O_3	4.44	3.64	4.65	4.24
P_2O_5	8.08	4.92	2.34	5.11
ThO_2	4.04	4.59	4.65	4.43
UO_2	b.d.l.	0.49	b.d.l.	0.16
SiO_2	1.41	2.29	1.11	1.60
SO_3	0.44	b.d.l.	b.d.l.	0.15
F	1.08	0.62	0.80	0.83
Total	78.52	75.30	71.98	75.27

Tab. S10. Chemical composition of unidentified REE-fluocarbonate from Bruzovice site (wt.%). Note: b.d.l. – below detection limit.

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