Supplement to secondary and rock-forming minerals of the Jáchymov ore district

Dodatek k sekundárním a horninotvorným minerálům jáchymovského rudního revíru

(9 figs, 4 tabs)

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The supplement adds new data to the original description of secondary and rock-forming minerals published in 1997 [475]. Čejkaite, pseudojohannite, švenekite, and vajdakite were defined as new mineral species and approved by CNMMN with Jáchymov as the type locality.

Key words: rock-forming minerals, secondary minerals, microprobe, unit-cell parameters, Jáchymov.

SECONDARY MINERALS OF THE JÁCHYMOV ORE DISTRICT

Following the publication of the volume on Jáchymov secondary minerals in 1997 [475], a continuing work resulted in identification of further mineral species. Descriptions of some new minerals were published and descriptions of some phases were approved by the Commission on New Minerals and Mineral Names, IMA, as new minerals.

This contribution thus completes and updates information on secondary minerals in the Jáchymov ore district.

A complete list of all secondary minerals is included in Appendix.

Azurite $Cu_3(CO_3)_2(OH)_2$

It was identified as coating in adits of the Rovnost I shaft in the course of the non-ferrous metals project [420].

Boltwoodite $HK(UO_2)SiO_4 . 1½ H_2O$

Boltwoodite forms white to light yellow thin needles with *uranophane* and *kasolite* in a fracture in a sample from the No. 7A adit.

Cerussite $PbCO_3$

It forms minute grains or fracture fillings in *bornite*, *chalcopyrite* or newly formed *covellite* in samples carrying *galena* and affected by weathering.

Cobaltkieserite $CoSO_4 . H_2O$

Although the mineral was confirmed in Jáchymov in the course of study of secondary minerals [476] its first detailed description was published on a material from the Bastnäs deposit near Riddarhyttan, Sweden [564].

Cobaltkieserite associated with *gypsum* forms thin, light pink powdery coating on a *quartz* gangue sample from the 12th level of the Svornost shaft, Geschieber vein.

Conichalcite $CaCuAsO_4(OH)$

Conichalcite occurs in thin botryoidal coatings with glassy lustre on black *tennantite*. It is associated with *lavendulan* and *geminite*. The sample comes from the Svornost shaft, Daniel level, intersection of the Geschieber and Trojická veins.

Čejkaite $Na_4(UO_2)(CO_3)_3$

The mineral was characterized [475] as the phase $Na_4(UO_2)(CO_3)_3$. It forms minute earthy aggregates which are deposited on wall-rock or even on continuous coatings of dust. Its colour is yellow. The samples are free of any directly associated secondary minerals. *Čejkaite* occurs in a broader association with uranyl-carbonates of the same origin – *andersonite* and *schröckingerite*. Two polymorphs of the compound have been recognized during the study of this mineral: the low-temperature triclinic phase corresponding to *čejkaite* and a hexagonal polymorph stable at higher temperatures unknown in natural occurrence. Descriptions of *čejkaite* and of the hexagonal polymorph, including their structures, were published [473], [479]. The unit-cell parameters and physical properties of *čejkaite* are as follow: a = 9.280(2), b = 9.295(2), c = 12.864(4) Å, α = 90.293(3), ß = 91.124(2), γ = 119.548(2)°, D_m = 3.67 g/cm^3, D_{calc} = 3.730 g/cm^3.

Greenockite CdS

Secondary *greenockite* forms thin powdery coatings of bright yellow colour in cavities of milky white *quartz* carrying small grains of *chalcopyrite*, *bornite*, *sphalerite*, *greenockite*, and *tennantite*. It probably formed by redeposition of primary *greenockite*. The sample comes from the Giftkies adit.

Illite $K_{0.65}Al_{2.00}\square Al_{0.65}Si_{3.35}O_{10}(OH)_2$

The quite rare mineral forms fine-grained scaly aggregates up to 3 mm long of whitish colour.

It was identified in an old sample probably from the Svornost shaft occurring in a fissure in an assemblage with *calcite*.

Lavendulan $NaCaCu_5(AsO_4)_4Cl\ .\ 5H_2O$

In 1924, W. F. Foshag measured two indices of refraction [ß = 1.715(5), γ = 1.725(3)] of a mineral from Jáchymov kept in the Roebling collection in the Smithsonian Institution, Washington, and considered on the basis of general appearance and blowpipe characteristics as being *lavendulan* described by Breihaupt [200]. Although its crust appeared amorphous, it was seen to consist of minute radiating fibres or plates under the microscope. They were slightly pleochroic, the colours being pale to sky blue. The plates were so small that the optical properties could not be determined with exactness. Z is in the direction of the length of the fibres. The extinction is inclined to the length of the fibres.

In fact, the original *lavendulan* samples from the mine Galiläische Wirtschaft at Frohnauer Schreckenberg near Annaberg, which Breithaupt obtained in 1835 from the foreman Fromberger and studied, represent a completely different mineral. The original samples are kept in the museum of the Technical University in Freiberg, Germany. The material is glassy, finely laminated, with a grey blue colour and conchoidal fracture. XRD analysis shows that the mineral is amorphous, ED analysis gave Zn, As and O as major elements and Cu, Co and S as minor elements. This data show that the type material is different from *lavendulan* as defined at present. It may be close to material described by old-time mineralogists as "*ganomatite*". It is then no surprise that Nickel and Nichols [228] quote Breithaupt as the author of the first description of *lavendulan* and Jáchymov as the type locality. The type locality Jáchymov is due to allocation of the name *lavendulan* to a mineral from Jáchymov (by that time in fact unknown) by W. F. Foshag.

It remains somewhat uncertain which mineral was designated as *lavendulan* from Jáchymov by Vogl in 1853 [125], since the original sample is not preserved. The chemical characteristics – hydrated Cu arsenate containing Ca, Co and SO_4^{2-} suggests that the mineral corresponded with a great probability to *lavendulan* studied by Foshag [565].

Linarite $PbCu(SO_4)(OH)_2$

The mineral occurs in small deep blue grains up to 0.5 mm in a fracture of a rock strongly impregnated by galena. The sample comes from the dump of the No. 14 shaft.

Lindackerite $(Cu,Co,Ni)Cu_4(AsO_4)_2(AsO_3OH)_2 \cdot 9\ H_2O$

The most recent study of *linackerite* [563] presents its crystal structure and the following set of data for two different samples: The microprobe analysis of the first sample yielded (in wt.%): As 29.66, Cu 27.85, Co 1.50, Ni 0.83, O 39.96, sum 99.79,

$(Cu_{0.43}Co_{0.26}Ni_{0.14})_{\Sigma 0.83}Cu_{4.00}[(AsO_4)_{1.66}(AsO_3OH)_{2.34}] \cdot 9.24\ H_2O$,

$P\bar{1}$, a = 6.440(2), b = 8.065(3), c = 10.411(5) Å, α = 85.44(4), ß = 79.38(3), γ = 84.65(3)°, V = 528.1(3) Å^3, Z = 1, D_{calc} = 3.261 g/cm^3. The structure was refined to R_{obs}= 5.03 %. The second crystal was an end member without any Co, Ni yielded (in wt.%): As 30.66, Cu 31.76, Co < 0.01, Ni < 0.01, O 39.30, sum 101.75,

$Cu_{0.89}Cu_{4.00}[(AsO_4)_{1.78}(AsO_3OH)_{2.22}] \cdot 8.01\ H_2O$,

a = 6.415(1), b = 8.048(1), c = 10.332(1) Å, α = 85.41(1), ß = 79.50(1), γ = 84.71(1)°, V = 521.2(1) Å^3, Z = 1, D_{calc} = 3.312 g/cm^3 and the structure was refined to R_{obs}= 5.29 %.

The substituting Co and Ni atoms enter presumably the special position at 0.5, 0, 0, denoted as *M*. Of other two positions, Cu1 is five-coordinated in configuration of square pyramid, whereas Cu2 is octahedrally coordinated. Edge-sharing Cu1 pyramids and Cu2 octahedra form infinite bands parallel to [110]. The adjacent bands are linked together by two kinds of As-tetrahedra. As a result, a layer parallel to (001) is formed. The adjacent layers are connected via *M* atoms. In addition, the *M* position is surrounded by eight half-occupied water molecules (Ow31-Ow34) in four independent positions. This arrangement can be interpreted as two interpenetrating octahedra (with common corners shared with As2 tetrahedra) turned by ~ 45° [563].

Ludjibajite $Cu_5(PO_4)_2(OH)_4$

It forms blue green spheres up to 1 mm in diameter with a finely drusy surface deposited in a fracture coated by limonite and *parsonsite*. The sample comes from the dump of the Rovnost I shaft.

Mallardite $MnSO_4\ .\ 7\ H_2O$

Mallardite was identified in association with *sideronatrite* in brown-yellow-green coloured stallactitic aggregates consisting dominantly of *melanterite* and *hexahydrite*. The sample comes from the Svornost shaft, 12th level, Geschieber vein.

Marecottite $Mg_3(H_2O)_{18}[(UO_2)_4O_3(OH)(SO_4)_2]_2(H_2O)_{10}$

The mineral was described under a provisional name "*pseudo-zippeite(Mg)*" [475]. It occurs in powdery coating or as earthy aggregates, which are strong yellow, ussually in mixture with *zippeite*, *sodium-zippeite*, *uranopilite*, *jáchymovite* and others. *Marecottite* was described as a new mineral from the locality Les Marécottes village, Switzerland. This locality has a similar assemblage of secondary uranium minerals as Jáchymov but the mineral occurs in crystals [532].

Metakirchheimerite $Co(UO_2)_2(AsO_4)_2 \cdot 8H_2O$

It was identified as coatings on thin fissures of a wall-rock and a thin *guartz* veinlet. *Metakirchheimerite* forms small tetragonal tabular crystals up to 0.5 mm. It is orange-beige in colour, its lustre is vitreous. It contains Co, U, and As as major elements and only minor Fe. It is not associted with any other mineral. The sample comes from the Svornost shaft, Adit level, Evangelista vein.

Meta-uranocircite $Ba(UO_2)_2(PO_4)_2 \cdot 8\ H_2O$

The mineral forms cores of dipyramidal crystals up to 2 mm long. The outer rim of crystals consists of *metatorbernite*. It is light straw yellow, with a glassy lustre. The crystals occur in association with tabular *metautunite* crystals of a similar size on samples consisting mainly of a coarse-grained pseudomorph of *phosphouranylite* after *uraninite*.

Picromerite $K_2Mg(SO_4)_2 \cdot 6\ H_2O$

It forms light blue-green spheroidal aggregates or skeletal crystals of glassy appearance, similar to sulphates grown on corroded *arsenic* with *proustite* and *pyrite*. *Arsenolite* and *kaatialaite* occur in the association. The sample comes from the Svornost shaft, 5th level, Geschieber vein.

Pseudojohannite $Cu_5(UO_2)_6(SO_4)_3(OH)_{16} \cdot 14\ H_2O$

A preliminary description was published under the name "*pseudo-johannite*" [475]. The mineral is triclinic and forms brittle and soft aggregates or coatings, which are composed of very fine crystals. The aggregates are deposited directly on strongly weathered *uraninite*. Its colour is grey olive, with a vitreous lustre. Associated minerals are *johannite*, *uranopilite,* and *gypsum*. It was found on a specimen from the Rovnost shaft.

Unit-cell parameters and physical properties: a = 13.754(2), b = 9.866(1), c = 8.595(2) Å, α = 103.84(2), ß = 90.12(2), γ = 106.75(2)°. D_m = 4.31 g/cm^3, D_{calc} = 4.276 g/cm^3. Indices of refraction – 1.725, 1.730, 1.740.

Rooseveltite $BiAsO_4$

Rooseveltite occurs in mixture with *bismuthinite* in a form of fine-grained black mass, in association with *skutterudite*. It was found in a sample from the Svornost shaft, 5th level, Prokop vein.

Sideronatrite $Na_2Fe^{3+}(SO_4)_2(OH) \cdot 3\ H_2O$

It was identified with *mallardite* in variously coloured, brown-yellow-green, stalactitic aggregates consisting dominantly of *melanterite* and *hexahydrite*. The sample comes from the Svornost shaft, 12th level, Geschieber vein.

Švenekite $Ca(H_2AsO_4)_2$

A preliminary description of the mineral and its crystal structure was presented under designation "CAS" [475]. Later on, *švenekite* was approved as a new mineral by CNMMN (IMA 99-007). It occurs as a clear composite coating of indistinct radiating aggregates with a glassy lustre. It also forms hollow botryoidal crusts with mat or lustrous surface. *Švenekite* occurs isolated from other arsenates common in Jáchymov. It was found in the Svornost shaft, 12th level, Geschieber vein.

Unit-cell parameters and physical properties: a = 8.5485(9), b = 7.6973(7), c = 5.7198(52) Å, α = 92.595(7), ß = 109.876(6), γ = 109.920(6)°. D_m = 3.16 g/cm^3, D_{calc} = 3.27 g/cm^3. Indices of refraction – 1.602, 1.658.

Thermonatrite $Na_2CO_3 \cdot H_2O$

Thermonatrite forms white powdery coatings or crusts on hydrothermally altered granite in immediate proximity of the Academician F. Běhounek spring at the 12th level of the Svornost shaft. It was always observed in association with *trona* from which it was derived by dehydration.

Trona $Na_3H(CO_3)_2(H_2O)_2$

Same as *thermonatrite* above.

Vajdakite $[(MoO_2)_2As_2O_5(H_2O)_2] \cdot H_2O$

Detailed description of *vajdakite*, including its crystal structure, was recently published [472]. It forms minute green to grey green acicular crystals or continuous crusts. It was found in the Svornost shaft, 12th level, Geschieber vein. Laterally it gives way to grey green *scorodite* in spherical and botryoidal aggregates.

Unit-cell parameters and physical properties: a = 7.0516(5), b = 12.0908(9), c = 12.2190 (14) Å, ß = 101.268(9)°. D_m = 3.50 g/cm^3, D_{calc} = 3.509 g/cm^3. Indices of refraction – 1.757, 1.778, 2.04.

ROCK-FORMING MINERALS

This section contains information only on newly identified minerals or minerals characterized by new data. A complete list of all rock-forming minerals is included in the Appendix.

Actinolite $Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$

It is a common component in skarns of the district. *Actinolite* was confirmed in samples from the Eliáš and Plavno mines.

Allanite $(Ce,Ca,Y)_2(Al,Fe^{2+},Fe^{3+})_3(SiO_4)_3(OH)$

Allanite was identified in a mineral assemblage with *grossular*, *titanite*, *Ba-orthoclase*, *epidote*, *sphalerite*, and *smithsonite* in skarn at the elevation point Stráž [433].

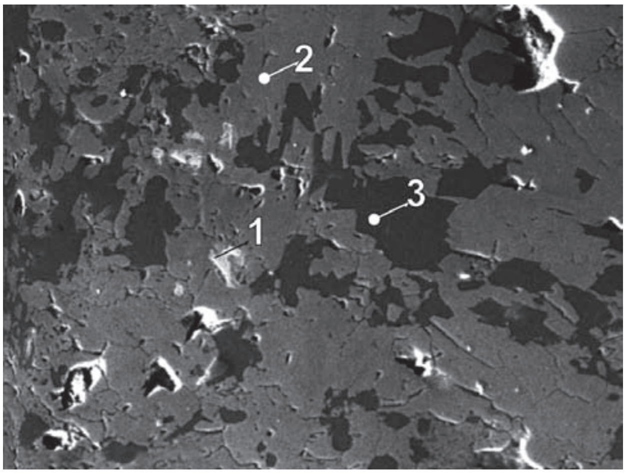

Fig. 1. SR99158/r. Anhedral allanite-(Ce) with quartz in pyroxene skarn. Pyroxene and allanite are partly replaced by quartz. 1 – allanite-(Ce), 2 – pyroxene, 3 – quartz. Skarn. Plavno. BSE image. Magnification 290×.

Almandine $Fe_2^{3+}Al_2(SiO_4)_3$

It occurs as porphyroblasts in mica schist above the skarn body of the Antonín mine.

Andradite $Ca_3Fe_2^{3+}(SiO_4)_3$

It is a common *garnet* in skarns of this district. A strong green stanniferous *andradite* from the 6th level of the Vladimír shaft contains several wt.% Sn [536].

Apophyllite $KCa_4Si_8O_{20}(F,OH) \cdot 8H_2O$

It is identified in a skarn sample from the Vladimír shaft, Plavno. *Apophyllite* forms small relics in *quartz*-carbonate matrix, carrying euhedral *apatite*. *Wollastonite* and *vesuvianite* also occur in the asemblage, see Fig. 5.

Augite $(Ca,Na)(Mg,Fe,Al,Ti)(Si,Al)_2O_6$

Sandberger [468] reported *augite* in porphyritic *nepheline* basaltoid rock from the Bratrství adit.

Chloritoid $(Fe^{2+},Mg,Mn)_2Al_4Si_2O_{10}(OH)_4$

Chloritoid occurs in some mica schist samples as inclusions in rotated *garnet* porphyroblasts and also in intergrowth with *micas* and *chlorite* around *garnet*. *Chloritoid* crystallized during regional metamorphism of schists

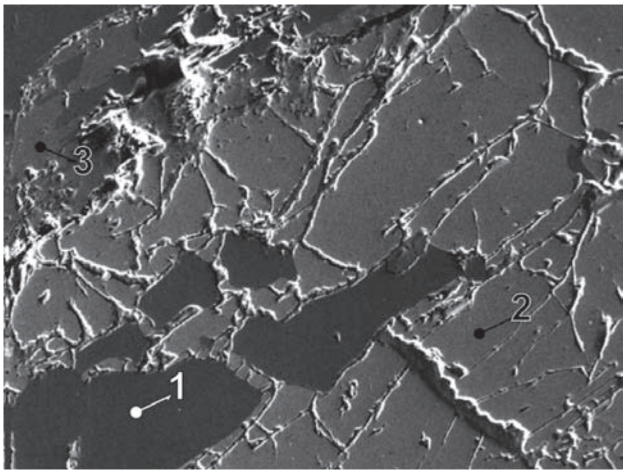

Fig. 2. SR98554/a. Chloritoid crystals enclosed in marginal part of garnet. Chlorite, biotite, muscovite and quartz are associated matrix minerals. 1 – chloritoid, 2 – garnet, 3 – biotite. Skarn. Plavno. BSE image. Magnification 110×.

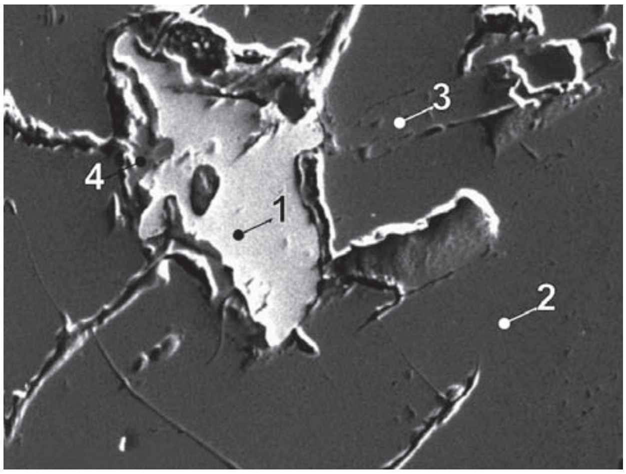

Fig. 3. SR98554/f. Monazite-(Ce) rimmed by limonitic alteration products and flaky crystal of chloritoid are enclosed in a central part of garnet. 1 – monazite-(Ce), 2 – garnet, 3 – chloritoid, 4 – limonite. Skarn. Plavno. BSE image. Magnification 325×.

Table 1. Chemical analyses of chloritoid.

sample	pt.	FeO	MgO	MnO	CaO	K_2O	Na_2O	Al_2O_3	SiO_2	TiO_2	Total
						weight %					
98554	1c	21.67	4.31	0.45	0.11	0.11	0.30	40.70	25.05	0.22	92.92
98554	2c	22.11	4.26	0.24	0.07	0.12	0.23	40.88	24.77	0.14	92.82
98554	3c	21.74	4.38	0.28	0.19	0.32	0.39	40.17	25.20	0.33	93.00
98554	4c	21.41	4.41	0.20	0.14	0.18	0.38	40.84	25.14	0.29	92.99
98554	5c	23.32	3.99	0.08	0.12	0.11	0.26	40.03	24.72	0.15	92.78
98554	6c	22.84	3.78	0.31	0.20	0.14	0.23	40.14	24.82	0.18	92.64
98554	7c	22.79	3.40	0.30	0.11	0.09	0.29	40.97	24.14	0.21	92.30
98554	10c	23.50	2.00	0.45	0.22	0.12	0.36	40.37	24.85	0.23	92.10
98554	11c	26.23	1.44	0.38	0.16	0.08	0.25	40.28	23.92	0.17	92.91
98554	12c	26.10	2.04	0.60	0.21	0.16	0.34	40.45	24.41	0.19	94.50
98554	13c	26.05	1.91	0.33	0.21	0.11	0.22	40.31	24.13	0.33	93.60

Table 1. *(continued)*

sample	pt.	Fe^{2+}	Mg^{2+}	Mn^{2+}	Ca^{2+}	K^{+}	Na^{+}	subtotal	Al^{3+}	Si^{4+}	Ti^{4+}	O^{2-}
						number of atoms						
98554	1c	1.47	0.52	0.03	0.01	0.01	0.05	2.09	3.90	2.03	0.01	12
98554	2c	1.51	0.52	0.02	0.01	0.01	0.04	2.11	3.92	2.02	0.01	12
98554	3c	1.48	0.53	0.02	0.02	0.03	0.06	2.14	3.85	2.05	0.02	12
98554	4c	1.45	0.53	0.01	0.01	0.02	0.06	2.08	3.90	2.04	0.02	12
98554	5c	1.60	0.49	0.01	0.01	0.01	0.04	2.16	3.87	2.03	0.01	12
98554	6c	1.57	0.46	0.02	0.02	0.02	0.04	2.13	3.88	2.03	0.01	12
98554	7c	1.57	0.42	0.02	0.01	0.01	0.05	2.08	3.97	1.99	0.01	12
98554	10c	1.63	0.25	0.03	0.02	0.01	0.06	2.00	3.94	2.06	0.01	12
98554	11c	1.83	0.18	0.03	0.01	0.01	0.04	2.10	3.95	1.99	0.01	12
98554	12c	1.79	0.25	0.04	0.02	0.02	0.05	2.17	3.90	2.00	0.01	12
98554	13c	1.80	0.24	0.02	0.02	0.01	0.04	2.13	3.92	1.99	0.02	12

Number of atoms based on (O = 12).

and probably also during later retrogressive stages. Its crystallization pre-dates hydrothermal vein mineralization. It is documented in mica schist above the skarn body of the Antonín mine.

Dravite $NaMg_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$

Thin prismatic crystals of brown to nearly black and also blue colour fill rock fractures and occur in *quartz-dravite* veinlets. It is often accompanied by sulphides, mainly *pyrite*.

Dravite with a significant schorl component is a minor accessory in *muscovite-garnet* mica schists, sometimes with *chloritoid*. It is probably the most common *tourmaline* type in the district.

Graphite C

Graphite is a minor component in rocks of the district in a form of finely dispersed pigment [422].

Grossular $Ca_3Al_2(SiO_4)_3$

Grossular garnet is confirmed in skarns of the Jáchymov district. White *grossular* is reported from skarn in the Plavno shaft [413, 415].

Table 2. Chemical analyses of dravite.

sample	pt.	SiO_2	TiO_2	Al_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	Total
						weight %					
J187P	1	36.47	0.24	31.85	7.74	0.00	7.06	1.19	2.51	0.02	87.08
J187P	2	36.47	0.13	34.14	8.52	0.12	4.90	0.32	1.92	0.01	87.38
J187P	3	37.33	0.20	33.34	8.61	0.33	5.25	0.43	2.12	0.00	87.24
J187P	4	36.97	0.10	33.29	8.18	0.00	5.65	0.62	2.39	0.09	87.35
J188P	1	37.04	1.17	30.82	6.99	0.06	6.63	1.07	2.36	0.02	84.82
J188P	2	35.70	0.68	32.16	6.81	0.00	6.34	0.90	2.16	0.00	85.14
J190P	1	36.09	1.03	31.80	7.37	0.07	6.29	1.28	2.29	0.00	86.56
J189P	1	36.43	0.17	31.39	3.70	0.06	9.75	1.46	2.29	0.19	85.78
J189P	2	36.77	0.09	32.15	4.48	0.08	8.40	1.79	2.19	0.09	86.29
J191P	1	37.01	0.17	33.10	7.57	0.00	5.97	0.51	2.29	0.04	86.44
J191P	2	36.79	0.19	33.14	7.51	0.05	5.88	0.66	2.21	0.00	86.16

sample	pt.	Na	K	Ca	subtotal	Fe^{2+}	Mn^{2+}	Mg	Al	subtotal	Al	$*(BO_3)^{3-}$	Ti^{IV}	subtotal	Si^{IV}	O
					X-site					Y-site	Z-site				T-site	
J187P	1	0.80		0.21	1.01	1.06	0.00	1.73	0.20	2.80	5.97	2.85	0.03	2.88	6	29.19
J187P	2	0.60		0.06	0.65	1.14	0.02	1.17	0.67	2.33	5.80	3.05	0.02	3.07	6	28.90
J187P	3	0.67		0.07	0.74	1.17	0.05	1.27	0.52	2.48	5.86	3.00	0.02	3.02	6	28.97
J187P	4	0.75	0.02	0.11	0.88	1.11		1.36	0.53	2.47	5.83	2.98	0.01	3.00	6	29.00
J188P	1	0.77		0.19	0.97	0.98	0.01	1.66	0.35	2.65	5.76	2.88	0.15	3.03	6	28.96
J188P	2	0.70		0.16	0.86	0.95		1.57	0.48	2.52	5.82	2.90	0.09	2.99	6	29.02
J190P	1	0.73		0.23	0.96	1.02	0.01	1.54	0.43	2.57	5.74	2.88	0.13	3.01	6	28.99
J189P	1	0.72	0.04	0.26	1.02	0.50	0.01	2.37	0.11	2.89	5.92	2.92	0.02	2.94	6	29.09
J189P	2	0.69	0.02	0.31	1.02	0.61	0.01	2.03	0.35	2.65	5.79	2.97	0.01	2.98	6	29.03
J191P	1	0.72	0.01	0.09	0.82	1.03		1.45	0.52	2.48	5.85	2.98	0.02	3.01	6	28.99
J191P	2	0.70		0.12	0.82	1.03	0.01	1.44	0.52	2.48	5.90	2.92	0.02	2.94	6	29.08

Number of atoms based on (Si = 6) in T-site

$*(BO_3)^{3-}$ complete a sum from empirical formula

Hydroxylapatite $Ca_5(PO_4)_3(OH)$

The mineral occurs with *wollastonite*, *pyroxene, garnet*, *vesuvianite*, *quartz,* and *calcite* in skarn from the Svornost shaft [433].

Ilmenorutile $(Ti,Nb,Fe)_3O_6$

It is identified as 30 µm long crystal intergrown with *hematite* in *annite* in a greisen sample from the Rovnost I shaft, probably 8th level. Notable zoning seen in BSE images is due to variation in Nb, Ta, Fe and Ti contents.

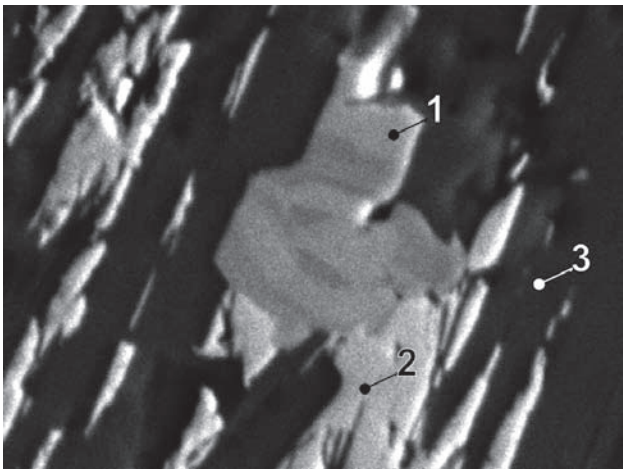

Fig. 4. J145P/D-1. 1 – ilmenorutile, 2 – hematite, 3 – annite. Greisen. Rovnost shaft, dump. BSE image. Magnification 2000×.

Leucite $K[AlSi_2O_6]$

Leucite (partly replaced by analcime) occurs in variable quantities in *nepheline* basaltoids and other foidite basaltoids of the district [422].

Nepheline $(Na,K)AlSiO_4$

Sandberger [468] described porphyritic *nepheline* basalt with *augite* from the Bratrství adit.

Maghemite γ-Fe_2O_3

Maghemite occurs in large, up to 2 cm long and 1 cm thick tabular crystals of metallic to semi-metallic appearance, with abundant red internal reflections. The crystals are subhedral to anhedral. It is abundant, intergrown in skarn at the Vladimír shaft, Plavno.

Marialite (scapolite group) $3NaAlSi_3O_8 \times NaCl$

Sandberger [468] described *marialite* as a grey rock-forming mineral in mica schist containing dark brown, fine-grained mica. The rock reportedly occurred in a quarry in the Bystřice brook valley ("Zeileisengrund") between the Saských šlechticů adit and former tabacco factory. Later attempts to confirm *scapolite* at this locality were unsuccessful. A case of sample meddling is suspected, as the locality pinpointed by Sandberger does not show grey alteration zones in mica schist with pyrrhotite along fractures which he described.

High *albite* contents in Na-rich schists of the eastern part of the district may suggest possible local *marialite* presence. *Marialite* was recently identified in skarn samples from dump of the Svornost shaft.

Scorzalite – $(Fe^{2+},Mg)Al_2(PO_4)_2(OH)_2$

Scorzalite occurs as light blue grains up to 5 mm long in pegmatite. It was found in the dump of the Rovnost shaft in 1946.

Table 3. Chemical analyses of scorzalite.

sample	pt.	Fe	Mn	Ca	Al	P	O	Total
				weight %				
PC-290	1	14.14	0.11	0.18	17.32	21.25	47.00	100.00
PC-290	2	14.80	0.24	0.14	16.89	21.18	46.74	99.99

sample	pt.	Fe	Mn	Ca	Al	P	O	Total
				number of atoms				
PC-290	1	0.78	0.01	0.01	1.99	2.12	9.09	14
PC-290	2	0.82	0.01	0.01	1.95	2.12	9.08	14

Recalculated on 14 apfu for anhydrous phase

Smithsonite $ZnCO_3$

Smithsonite occurs in *quartz* cavities and along fractures in rock-forming minerals in association with *grossular*, *titanite*, *barian orthoclase*, *epidote*, *sphalerite,* and *allanite* in skarn at the elevation point Stráž [433].

Thorite $(Th,U)SiO_4$

Single grain of *thorite* 15 µm long was identified, enclosed in greisen from the Rovnost I shaft, probably 8th level.

Wollastonite $CaSiO_3$

It was identified in skarns as needles up to 5 mm long with *grossular*, *diopside*, *vesuvianite*, and *calcite*. The skarns occur in an outcrop near Mathesius evangelic chapel and in the dump of the Svornost shaft.

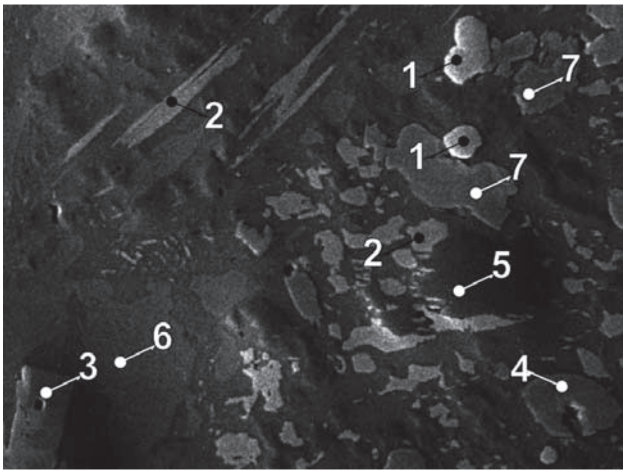

Fig. 5. Spurr3. Euhedral crystals of apatite, wollastonite, vesuvianite, apophyllite relics and corroded garnet in carbonate-quartz matrix. 1 – apatite, 2 – wollastonite, 3 – vesuvianite, 4 – garnet, 5 – quartz, 6 – apophyllite, 7 – pyroxene. Skarn. Plavno. BSE image. Magnification 325×.

Zircon ZrO_2

Zircon is a common accessory mineral mainly in schists and gneisses in the district. Anhedral grains up to 30 μm are most typical. It was also identified in greisen from the Rovnost I shaft, probably 8[th] level. *Zircon* from this sample contains low Hf and encloses a minute *uraninite* grain.

Table 4. Calculated unit-cell parameters of zircon from Jáchymov.

sample	*a*	*c*
	(Å)	
J-912	6.6168(4)	5.9936(7)

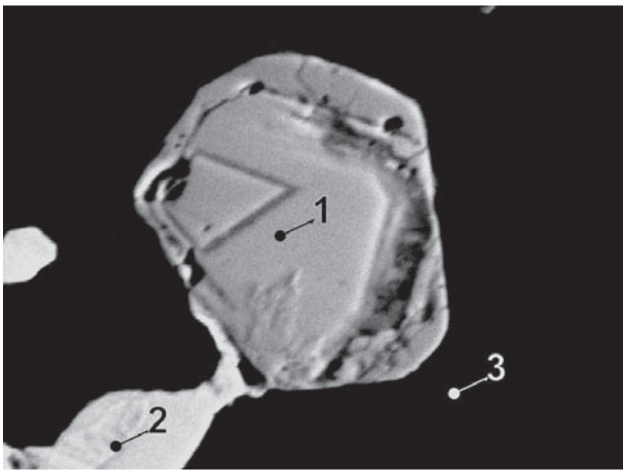

Fig. 6. J089P/D. 1 – zircon, 2 – tennantite, 3 – quartz. Giftkies adit. BSE image. Magnification 1000×.

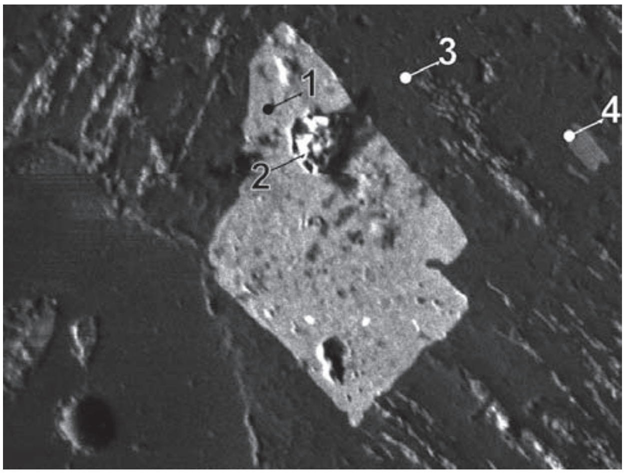

Fig. 7. J145P/F. 1 – zircon, 2 – uraninite, 3 – annite, 4 – hematite. Greisen. Rovnost I shaft, dump. BSE image. Magnification 270×.

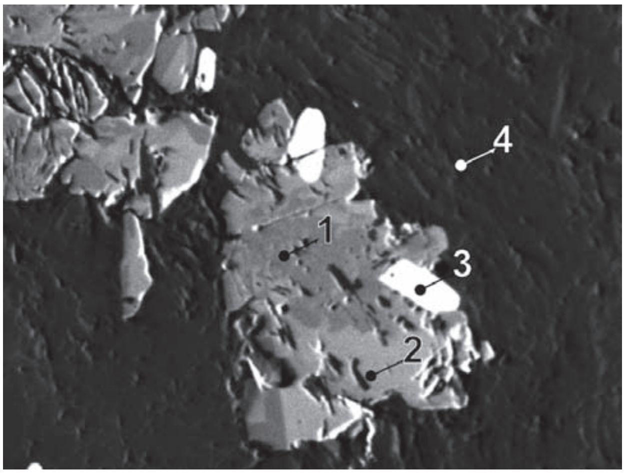

Fig. 8. MP544B/D. 1 – rutile, 2 – W-Sn-rutile, 3 – zircon, 4 – mica. Nikolaj shaft, cross-cut to Rovnost I. BSE image. Magnification 480×.

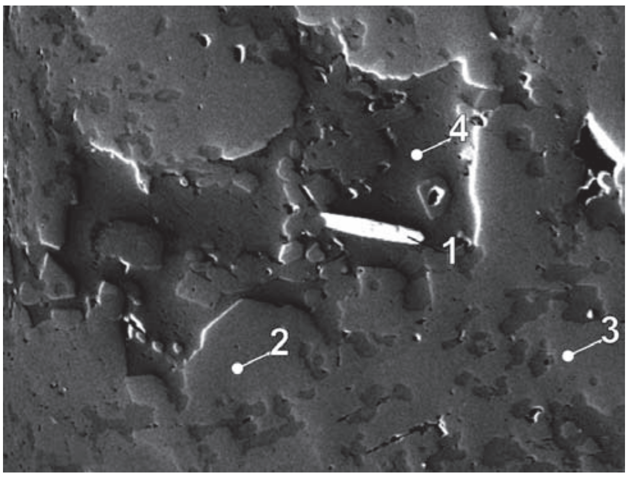

Fig. 9. SR99114/a. Prismatic zircon crystal attached to pyroxene in calcite aggregate, set in garnet-pyroxene matrix of skarn. 1 – zircon, 2 – garnet, 3 – pyroxene, 4 – calcite. Skarn. Plavno. BSE image. Magnification 145×.

Dodatek k sekundárním a horninotvorným minerálům jáchymovského rudního okrsku

Doplnění dalších dat k popisům sekundárních minerálů a horninotvorných minerálů uveřejněných v 1997 [475]. Čejkait, pseudojohannit, švenekit a vajdakit byly určeny z Jáchymova jako nové minerály a schváleny CNMMN.