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THE CONTENT OF HEAVY METALS IN SELECTED POLISH ARAGONITES

Aragonite occurs in the zones of ore minerals alternation very often. The aragonite that crystallizes in the oxidation zone of zinc and lead deposits in the Tarnowskie Góry district, is relatively well known (Traube 1888, Żabiński 1960). Less known are aragonites crystallizing in the weathering zones of polymetallic ore veins in the Sudetes Mountains and from the zone of copper migration in the Holy Cross Mountains.

METHODS AND MATERIALS

The chemical composition of the aragonites was determined using the ICP-MS, X-ray diffraction and microprobe analyses (CAMECA SX-100) (Table 1).

Seven samples of aragonite from the Tarnowskie Góry area (Tarnowskie Góry: II/17/44, IV/44/768, IV/44/601, IV/44/485, IV/44/223, IV/44/226 – Fryderyk Mine, IV/44/64 – Brzeziny Śląskie Cecylia Mine) were investigated. The aragonite forms needle-like, radial intergrowths of white or pale green crystals growing on the surface of dolomite or galman ores. Four specimens of aragonite come from the Sudetes Mountains. Two of them were collected from the weathering zone of polymetallic mineralisation (chalcopyrite, tetrahedrite) in carboniferous rocks at Wałbrzych (II/18/2198 – Wiktoria Mine, II/18/1862). This type of aragonite forms dripstones with blue pigmentation. Aragonite from the polymetallic deposit at Stara Góra (Radzimowice) near Wojcieszów is blue and occurs as small stalactites and stalagmites growing on the surface of the ore veins (RS52). Aragonite from Rędziny near Kamienna Góra forms white radial aggregates on the weathered surface of arsenopyrite (RSR). Blue aragonite from the Holy Cross Mountains (RS2) crystallised in the fissures in Devonian limestones impregnated by chalcopyrite and malachite. Aragonites from basaltic vesicles (II/18/2139 Zareba Górna) and fissures in serpentinites (RS53 Grochów) were used as comparative material.

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RESULTS AND DISCUSSION

	Al ppm	As ppm	Ba ppm	Cd ppm	Cu ppm	Fe ppm	Mn ppm	Pb ppm	Zn ppm
RSR	0	182	47	0	14	307	0	0	59
RS 2	0	0	29	0	310	0	0	39	162
IV/44/64	0	0	126	16	0	0	0	16097	1241
II/17/44	0	0	215	37	0	0	0	23248	447
IV/44/768	0	0	10	0	0	0	0	14964	60
IV/44/601	0	0	0	9	0	0	0	20901	82
IV/44/485	0	0	24	5	0	60	0	15617	222
IV/44/223	0	0	6	34	0	0	7	15268	1884
IV/44/226	0	0	0	23	0	7	0	11301	5695
II/18/2198	0	80	85	22	3153	5	72	0	3516
II/18/1862	84	0	158	8	1305	1113	79	0	895
RS 52	57	0	40	16	617	321	4	0	986
RS 53	0	0	100	0	0	0	0	0	4
II/18/2139	76	0	0	0	0	0	0	0	6

Table 1. Content of selected heavy metals in the aragonites.

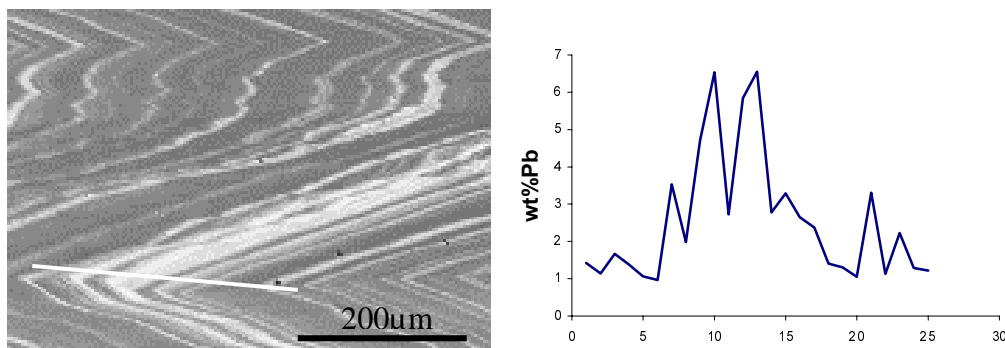


Fig. 1. BSE image of aragonite from Tarnowskie Góry (IV/44/768) compared with Pb concentration.

The high content of lead in the chemical analyses of the samples from the Tarnowskie Góry area is probably related to the occurrence of solid solution of $\text{PbCO}_3\text{-CaCO}_3$ in investigated crystals. The microprobe analyses indicate heterogeneity of aragonite crystals (fig. 1). Zones with very high content of lead, characteristic for pure cerusite, were not found. This fact may indicate the absence of small cerusite inclusions. The content of zinc and cadmium is high in the aragonite from Tarnowskie Góry. This high value was measured for the first time.

The earlier authors (*vide*Traube 1888) noted only the increased content of zinc in calcite.

The content of copper shows a different trend. It is highest in blue aragonite, that forms dripstones (II/18/2196, II/18/1862, RS2, and RS52). The microprobe investigation shows the absence of zones with the increased content of copper, what indicates the presence of small inclusions of copper carbonates (Table 2).

Conc. Cu % weight	RS2	RS50	RS51	RS52
	0,18	0,32	0,03	0,06
	0,19	0,20	0,01	0,05
	0,1	0,11	0,30	0,04
	0,08	0,42	0,28	0,03
	0,08	1,00	0,34	0,01
	0,12	0,70	0,45	0,04
	0,17	0,82	0,39	0,05
				0,03
				0,06
				0,04
				0,04
				0,05
				0,03

Table 2. Concentration of copper in blue aragonites.

The highest content of arsenic was found in the aragonite (RSR) that covers weathered arsenopyrite from Rędziny.

The presence of cadmium in the aragonite may be a result of the liberation of this element from sphalerite (sphalerite from the Stara Góra deposits contains 1,06 % mol of CdS whereas sphalerite from Tarnowskie Góry contains 0,5% mol of CdS).

The content of the elements analysed in the aragonites from different parts of Poland is very closely related to the geochemical environment of their crystallisation. The aragonites from the oxidation zones of Zn-Pb deposits and the weathering zones of polymetallic (Cu, As) mineralisation are enriched in heavy metals and arsenic. This feature allows distinguishing aragonite that crystallised in hypergenic conditions from the aragonites that were formed in low temperature hydrothermal solutions (II/18/2139) and Ca rich solutions in serpentinite massifs (RS 53) (Kozłowski 1995, Heflik *et al.* 2001). Aragonites, which crystallized from hydrothermal solutions, are pure and don't contain heavy metals.

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