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**MINERALOGY AND GEOCHEMISTRY OF IRON OCHRES
FROM THE WEATHERING ZONE OF PYRITE DEPOSIT
AT WIEŚCISZOWICE, LOWER SILESIA**

The aim of this study is the chemical and mineralogical composition of iron ochres which are to be precipitated from the acid mine water in the abandoned pyrite mine at Wieściszowice.

The pyrite deposit is located in the Rudawy Janowickie Mountains, within the Leszczyniec volcanic formation. This formation includes a bed of sericite-chlorite schists with pyrite mineralization. The schists with pyrite form 4 km long and 100 m wide zone. The deposit is of monomineral nature (pyrite only) and the mineralisation is of impregnation type. Rare polymetallic mineralization comprises Cu, Zn and Pb sulphides and Sb, Cu and Pb sulphuric salts and is present only in thin veins. The secondary minerals at Wieściszowice are related to the oxidation of pyrite and the interaction of acid mine waters with the sericite – chlorite schists (Parafiniuk 1996).

X-ray diffraction, differential X-ray diffraction and infrared spectroscopy have been used for phase identification of iron oxyhydroxides. Chemical analyses of mine waters and sediments have been carried out by means of ICP MS method. The basic physical and chemical parameters of water (temperature, pH, conductivity) have been measured during field sampling.

The iron ochres are composed of goethite, ferrihydrite and lepidocrocite. These minerals precipitated as thin films on the water surface in galleries and poorly consolidated stalactites and stalagmites. They also formed in places where Fe-rich mine waters mix with fresh water of the nearby stream (Rdzawy stream).

The most common iron oxyhydroxide at Wieściszowice is goethite. This mineral is present in two variations. It forms a very thin film on the surface of the stagnate waters in old galleries. X-ray diffraction patterns of those crusts are typical for pure goethite. Sometimes goethite crusts mark old water levels on adit walls. In that case its structure is more ordered in comparison with younger goethite generation.

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The second variety is usually a fine-crystalline goethite formed as a result of the recrystallization of ferrihydrite. It cements fragments of rocks in the stream and forms stalactites in old galleries.

Ferrihydrite is a common iron oxyhydroxide at Wieściszowice. It forms very fine precipitation and incrustation on fragments of rocks and plants in the stream running below the mine dumps. Lepidocrocite has been found as admixture in some ferrihydrite samples.

The mine waters are strongly acidified with sulphuric acid, what results in pH 2.55 - 2.9, and a very high concentration of iron (up to 990 mg/l) and sulphate ions (up to 4 500 mg/l) (Table.1). Acid waters from adits, open casts and mine dumps are collected by the Rdzawy stream and mixed with fresh water (pH = 8.7; 46 mg/l of SO₄ and 0.6 mg/l of Fe).

sample	T	pH	Al	Ca	Cd	Co	Cu	Fe	K	Mg	Mn	Na	Ni	Sr	V	Zn	Cr	SO ₄
	1		51.			0.7					10.		0.4	0.6		1.0		
RS76	5	2.9	5	320	0.2	5	2.4	995	2.3	334	2	4.5	5	8	0.1	7	0.2	3961
	1					0.3							0.2					
RS75	1	8	84	270	0.1	9	2.3	230	1	176	3.5	5.7	6	0.4	0	0.6	0.9	2450

Table1. Chemical composition of selected water samples from Wieściszowice.

The content of heavy metals in ochre precipitates are closely related to geochemical character of acid mine waters. The iron sediments precipitated in adits located in the northern part of the mine (e.g. sample RS78) are enriched in these elements in comparison with the similar samples from its southern part (e.g. sample RS81) (Fig.1). This observation correlates well with presence of polymetallic ore mineralisation (Cu, Zn, Sb, Pb, As) in northern part of deposits (Piestrzyński and Salomon 1977).

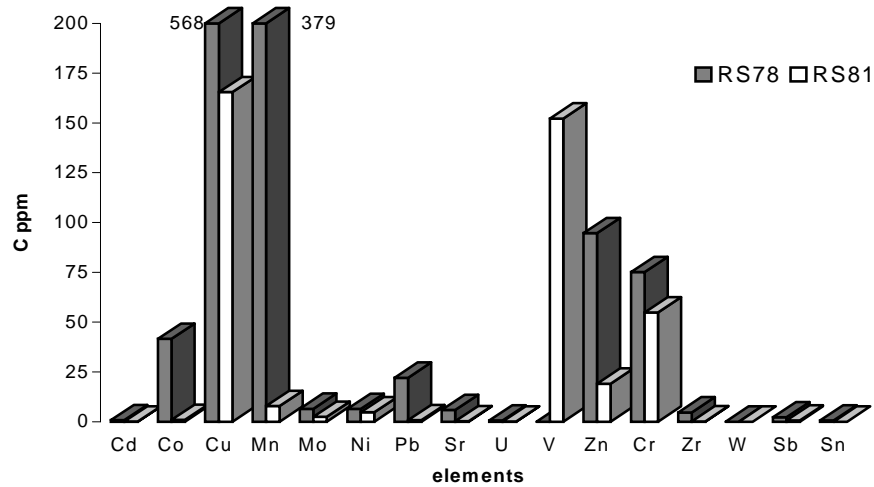


Fig. 1. Heavy metals in ochres from workings of Wieściszowice mine.

Ochres precipitated in dumps seepage have lower content of heavy metals than ochres from adits (Fig. 2). This is a result of monomineral character of mine refuse, composed of schists with pyrite remnants.

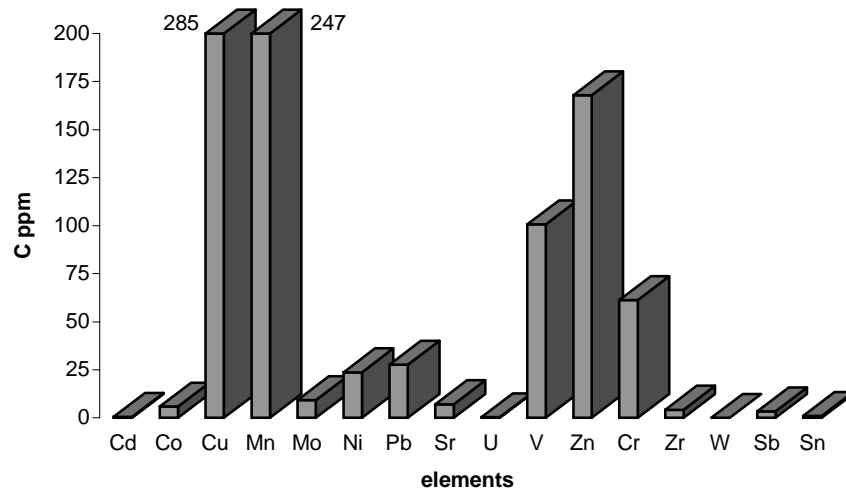


Fig. 2. Heavy metals in ochres from big seepage of acid mine waters.

The smallest concentration of heavy metals was noted from sediments of the Rdzawy stream (Fig. 3). Higher content of these elements was recorded from the place where the acid mine waters from dumps enter the fresh water of the Rdzawy

stream (e.g. sample RS79). Several hundred meters away from the mine the content drops significantly (e.g. sample RS74).

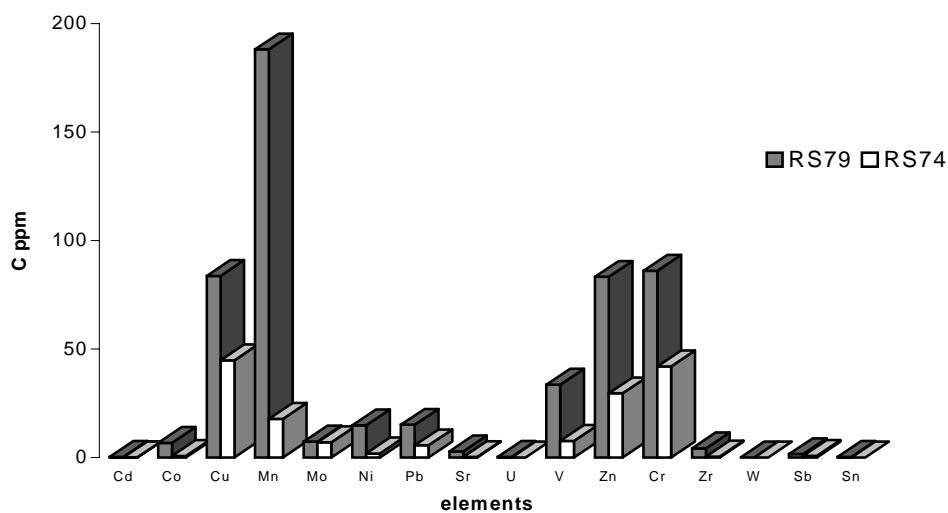


Fig. 3. Concentration of metals in ochres from the Rdzawy stream.

Acknowledgments: *The study was supported by the KBN grant no. 3 PO4D 060 22.*

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