

**SULFIDE INCLUSIONS IN MUGUNSKOE COAL DEPOSIT, IRKUTSK BASIN**

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Nowadays the problem of high sulfur content of coals is relevant for several reasons. The high sulfur content of coal has been recognized as the source of air pollution problems.

There are a few publications on the problem of sulfur content of coal, but among of them about sulfide inclusions in Mugunskoe coal deposit.

The purpose of our research is to find out mineralogical and geochemical composition of the sulfide inclusions in the coals.

Research methods included the macro- and microscopic description of the iron sulfide samples, which was conducted with the use of "LOMO POLAM P-312" polarizing microscope and the stereoscopic microscope "MBS-2." Determination of gross elemental composition of sulfides performed by X-ray fluorescence X-ray crystal diffraction spectrometer vacuum «Spectroscan Max GV» (analyst A.K. Sherstnev). It was determined the content of oxides:  $Al_2O_3$ ,  $Fe_2O_3$ ,  $SiO_2$ ,  $P_2O_5$ ,  $CaO$ ,  $K_2O$ ,  $MgO$ ,  $TiO_2$ ,  $MnO$ , and a number of elements: Cr, Co, Ni, Cu, Zn, Sr.

Mugunsky coal mine belongs to the Irkutsk coal basin, which is located in the southern part of the Irkutsk region, stretches for 500 km along the north-eastern slope of the Eastern Sayan from Nizhneudinsk to Lake Baikal [3]. Coal with ash content of 7-15%, rarely up to 23%, but in some fields Irkutsk basin have a high sulfur content (on average 5-6%) [1].

The investigations revealed that some of the samples contained makronoduls iron sulfides up to 10 cm in diameter (Fig. 1).



*Fig. 1. Concretion marcasite with pyrite crystals*

The study of polished sections showed that the nodules are composed of pyrite and marcasite. Marcasite is considered more characteristic of brown coals of the world [2]. Marcasite composes the spherical body up to 3 centimeters in diameter, which cross the thin pyrite veins. The samples established quartz grains whose sizes in some samples (mainly pyrites) achieve 0.2 mm.

Some samples of pyrite crystals are presented. They have the form of a regular octahedrons and pentagondodekaedrs (Fig. 2). Their dimensions vary from a few millimeters to two centimeters. It should be noted that in the aggregate crystals form a concentrated cluster, which may indicate an excess of sulphur material in an ancient peat bog.



*Fig. 2. Clusters of pyrite crystals*

In some of the investigated samples marcasite are presented by plate radiating units in coal (Fig. 3a). Sulfide minerals also found as the form of narrow streaks in the coal (Fig. 3b).



Fig. 3. a) aggregates of marcasite in coal sample; b) - veinlets of sulphides in the coal

According to the atomic emission spectral analysis, for pyrite set higher concentrations of Fe, S, Cu, Ca, P, Cd, Si, Al, Na, Ti, U, and for marcasite - Fe, S, Cu, Mn, Ca, Si, V, Ti.

The results of determining total composition pyrite and marcasite samples, according to X-ray fluorescence analysis are shown in Table.

Table

The total composition of pyrite and marcasite (according to X-ray fluorescence analysis)

Oxide	Pyrite	Marcasite
	Content, %	
Al <sub>2</sub> O <sub>3</sub>	10.76	12.00
Fe <sub>2</sub> O <sub>3</sub>	81.26	78.15
SiO <sub>2</sub>	5.69	6.28
P <sub>2</sub> O <sub>5</sub>	0.13	0.17
CaO	0.11	1.12
K <sub>2</sub> O	0.20	0.13
MgO	1.48	2.04
TiO <sub>2</sub>	0.35	0.10
MnO (ppm)	141.70	51.33
Element	Pyrite	Marcasite
	Content, ppm	
Cr	14.62	36.22
Co	1913.08	1077.57
Ni	17.56	-
Cu	425.76	207.55
Zn	80.26	58.86
Sr	4320.88	2087.73

Thus, nodules and veins of pyrite and aggregates of marcasite present the sulfide inclusions in Mugunskogoe coal deposits. It should be noted that we have studied samples are present both forms of iron sulfide.

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