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UNSTRUCTURED ORGANIC MATTER AND ITS RELATION TO GOLD MINERALIZATION IN ŻŁOTY STOK AU-AS DEPOSIT (WESTERN SUDETES)

INTRODUCTION

Unstructured organic matter composed mainly of low molecular weight aromatics occurs within the contacts between the Kłodzko-Żłoty Stok granitoids and Paleozoic rocks hosting the gold-bearing arsenic and magnetite-pyrrhotite mineralizations. Mineralized samples have the higher TOC content, pointing to remobilization of organic matter by the hydrothermal fluids. Results of organic geochemical and previous isotope studies suggest that the hydrocarbons were formed by thermal alteration of indigenous kerogen, and that at least part of the sedimentary/metamorphic cover was not metamorphosed prior to intrusion.

METHODS OF INVESTIGATION

Rock samples for chemical analyses were collected from the Western and Central Ore Fields of the Żłoty Stok deposit. Gold contents were measured by the FASS and GF-AAS methods, and major elements and trace metals by XRF method carried out on the Philips PW 2400. For organic geochemical analyses, coulometric method and Coulomat 702 LI-Ströhlein device, applied to finely ground samples (0.063 mm).

RESULTS

The organic matters have been found in samples with loellingite and sulfides mineralization represented by arsenopyrite, pyrite, and pyrrhotite in association with magnetite. Sulfide aggregates encrustate large blebs of elongated unstructured organic matter, or occur on the contact of organic forms with carbonates, quartz and serpentine group minerals (Mikulski and Speczik, submitted). Three major types of mineralized rocks hosting organic matter have been recognized:

- 1) Black serpentinites with dominance of magnetite–pyrrhotite or loellingite-arsenopyrite ores,
- 2) Dolomitic marbles with thin black serpentinite veinlets accompanied by sulfides (pyrite, pyrrhotite, arsenopyrite–loellingite) mineralization,
- 3) Altered calc-silicate rocks with loellingite-arsenopyrite mineralization.

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Table 1. Total organic carbon concentrations (wt%) in mineralized rocks from the Western Ore Field of Złoty Stok Au-As deposit

Lithology	Type of ore mineralization*	Arithmetic mean / number of samples	Range
Black serpentinites	mg-po; lo-asp	0.54 / n=8	0.16–3.23 0.08–0.19
Dolomitic marbles	py; po; lo-asp	0.62 / n=7	0.12–1.89
Calc-silicate rocks	lo-asp	0.11 / n=17	0.04–0.23

*Abbreviations: mg–magnetite; po–pyrrhotite; lo–loellingite; asp–arsenopyrite; py–pyrite

The total organic carbon (TOC) content of 32 samples ranges between 0.04 and 3.20 wt% with an arithmetic mean value of 0.33 wt% for the whole population. In general the calc-silicate rocks have lower contents of organic matter and only in strongly mineralised samples TOC slightly increased up to 0.23 wt%. Most of black serpentinites are strongly mineralized and have high arsenic and gold concentrations with arithmetic mean values 8.07 % and 5.27 ppm, respectively. The barren dolomitic marbles have TOC values ranging between 0.12 and 0.21 wt% and traces of gold (6–41 ppb) and arsenic (232–675 ppm). The mean value of TOC for barren dolomitic marbles is 0.16 wt%, i.e. almost 4 times lower than for mineralised dolomitic marbles. There is no correlation between TOC and major or trace elements (Fig. 1), (Mikulski and Speczik, submitted).

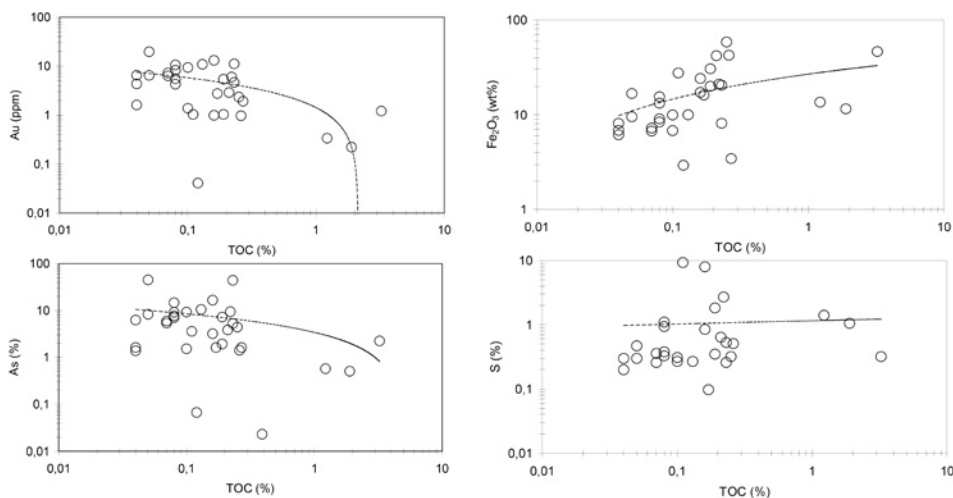


Fig. 1. The variation logarithmic plots of TOC and selected elements in mineralized samples from the Western Ore Field of the Złoty Stok Au-As deposit.

In the specific group there occur several correlations of TOC with S (2nd group $cc = 0.84$; 3rd group $cc = 0.54$), Fe_2O_3 (1st group $cc = 0.43$; 2nd group $cc = 0.51$), MgO

(2nd group $cc = 0.80$), Cu (2nd group $cc = 0.94$). No notable differences in gold correlations, with other elements, were found between the different data sets, except for elements characteristic for specific host rocks. Gold shows a very strong correlation with As ($cc = 0.83$; $n = 32$), and weaker correlation with Co ($cc = 0.39$), Cd ($cc = 0.47$), and SiO_2 ($cc = 0.42$). This is confirmed by mineralogical and microprobe studies, that yield a gold association with loellingite, arsenopyrite, and less frequently with Co, Ni sulfoarsenides. Gold correlation with quartz is explained by development of silification in zones of arsenic mineralization.

CONCLUSIONS

In the Western Ore Field of the Złoty Stok Au-As deposit mineralised samples from fractured zones have elevated TOC contents. However, geo-chemical results revealed no correlation of TOC with gold, metals and major elements distribution. It is explained by remobilisation of organic carbon from primary sediments by mineralized hydrothermal fluids originated in magmatic source. The temperatures that affected organic matter of marine origin were credibly above $400^{\circ}C$, what agrees with results from mineralogical and fluid inclusion studies (Mikulski 1996). Preliminary results of the REE distribution in arsenopyrite-loellingite and pyrrhotite-magnetite ores show negative Eu anomaly and strong correlation coefficients of Au with, Bi, As, and with REE that indicate for strong affinities of metal-bearing post-magmatic hydrothermal fluids with granitoid magmas (Mikulski and Speczik, submitted).

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