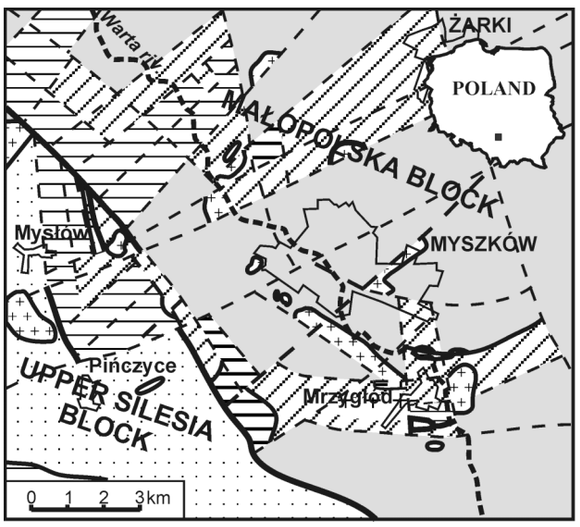
Magmatism and metamorphism of contact zone of Małopolska and Upper Silesian blocks as indicators of porphyry deposits

(1 fig.)

Ł. KARWOWSKI[1] – K. LASOŃ[2] – J. MARKIEWICZ[3] – M. TRUSZEL[4]

[1] Uniersity of Silesia, lkarwows@wnoz.us.edu.pl
[2] Polish Geological Institute, Upper Silesian Branch, klason@pigog.com.pl
[3] Polish Geological Institute, Upper Silesian Branch, jmarkiew@pigog.com.pl
[4] Polish Geological Institute, Upper Silesian Branch, mtruszel@pigog.com.pl

The investigated Mo-W-Co mineralisation recognized in the Myszków area is connected with magmatism developed along the Cracow-Lubliniec tectonic zone, that constitutes the contact between Małopolska and Silesian blocks (Fig. 1).



Late Carboniferous, coal-bearing formations

Middle and Late Devonian, carbonate formations

Ordovican

Precambrian (crystalline rocks)

Dacitoids, granitoids

Gabbrodisbases, diabases

Faults

Kraków-Lubliniec tectonic zone

Fig. 1 Geological map of the Myszków area, without Permian and younger formations (Buła, Markowiak, Habryń, 2001).

The mineralization is hosted in a complex that includes Vendian–Early Cambrian metamorphosed sedimentary rocks intruded by petrographically and genetically diversified association of intrusive rocks: granitoids (mainly granodiorites, less frequently granites), dacitoids (mainly dacites, rarer rhyolites), diabases, gabbros, lamprophyres (semilamprophyres), trachyandesites and alkaline trachytes.

The dominanting magmatism is of granitoid type, of Late Carboniferous age; it was recognized in the border zone of Małopolska Block (Myszków-Mrzygłód, Zawiercie, Pilica, Będkowska Valley). These intrusives may represent small individual bodies localized along the tectonic zone or the apical zones of the deep situated batholith.These rocks are commonly associated by subvolcanic rocks (dacites and rhyolites). All this complex is covered uncomformably by a sequence of Mezozoic and Cenozoic sediments (about 200 m)

The classification position of granitoids in the QAP plot and diagram R1-R2 (H. de La Roche et al., 1980) confirm predominance of granodiorite within this tectonic zone.

Peraluminous to metaluminous type of granitoids (A/CNK = 0,85–1,23) might have formed due to the anatectic differentiation after melting of the clayey or sandy rocks at conditions P-T of the amhibolite facies. The contents of rare earth elements in granitoids and dacites are low (REE<150 ppm); La 16–35 ppm, Ce 30–67 ppm, Nd 12–27 ppm, Sm 2–6 ppm, Eu 0.5–1.3 ppm, Gd 0–4 ppm. The REE normalized concentration patterns show less developed negative Eu anomaly (Eu/Eu*= 0.71–0.96). LREE are moderately enriched relative to HREE [(La/Yb) n =11–23]. Both LREE and HREE are also fractionated [(La/Sm) n = 2.8–5.2 and (Gd/Yb)n = 2.2–2.9]. Distribution of REE on the spider diagram confirmed the genetic connection between plutonic and subvolanic acid rocks (Markiewicz, 2002).

The magmatic rocks intrude the Vendian – Lower Paleozoic sediments metamorphosed under the conditions of the greenstone facies. The contact – metasomatic metamorphism younger then the regional one, is represented by skarns and metasomatites. Thermal activity of the intrusion was connected with the conditions of albite-epidote- hornfelse and hornblende-hornfelse facies.

Relicts of the magmatic fluids in zircon, apatite and quartz allowed to determined the initial crystalisation temperatures of:
– 1360 °C–1260 °C for zircon, apatite
– 1260 °C–1220 °C for quartz

The main crystallisation of quartz occurred at the temperature between 1160 °C–860 °C. Crystallisation temperatures of matrix in the dacite porphyries ranged from 900 °C to 800 °C.

Among the inclusions in magmatic quartzes some are with silica-rich melt and chloride-rich melt. These latter inclusions may indicate the separation of a chloride-rich fluid from the silica-rich fluid However, it is also possible that those inclusions could have been partly filled at a later time with highly saturated, chloride-rich brines.

The presence of chloride phase is the main indicator of development of postmagmatic fluids responsible for ore mineralisation.

The mineralisation of the Myszków area exhibits many features that are typical of porphyry deposits:
– small (700 x 800 m) intrusions of porphyritic granodiorites located at shallow (about 200 m) depths;
– high density network of fractures and ore-related veins cutting both the magmatic rocks and the wall-rocks;
– the zoning of ore mineralisation similar to zonings observed in other porphyry Mo and Cu-Mo deposits;

the zoning of hydrothermal alterations of rocks consistent with Lowell and Guilbert (1970) model for calc-alkaline assiociated porphyry deposits. K-metasomatism processes developed in magmatic and wall rocks show strong correlations with determined types of Mo-W-Cu ore assemblages. Unusual feature of the Myszków mineralization include high concentrations of tungsten and Variscian age.

Information obtained from geochemical studies allows to define the Myszków deposit as:
– stockwork molybdenite deposit related to granodiorite (according to F. Mutschler's et al., 1981 classification);
– stock type of calc-alkaline molybdenum stockwork deposits (according to G. Westra's and S. Keith's, 1981 classification) or
– fluorine-defiecient porphyry molybdenum deposit (according to T. Theodore's and W. Menzie's, 1984 classification).

Geochemical investigations of Myszków mineralisation suggest that the path-finders, listed in increasing distance from the centre, may be used in the search for concealed porphyry deposit: W, Mo, Cu-Ag, K, Be?, F, Sb, Hg, Au, Pb, Ba, As, Ag, Zn-Cd, Bi and Te.

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