

## Trace Elements Vectors in Pyrite and Molybdenite from Elatsite PCD, Bulgaria

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The Elatsite porphyry copper deposit (PCD) is one of the largest porphyry deposits in Bulgaria (185 Mt at 0.4% Cu, 0.3 g/t Au, 0.68–1.9 g/t Ag, 0.07 g/t Pd, 0.02 g/t Pt) and is situated in the Srednogorie ore district, which is a part of the Apuseni-Banat-Timok-Srednogorie metallogenic belt. The deposit is hosted in the granodiorites of the Vezhen pluton ( $314.8 \pm 4.5$  Ma) and in Upper Cretaceous subvolcanic rocks represented by quartz-monzodiorite and granodiorite porphyries ( $92.1 \pm 0.3$  Ma). The Re/Os age of ore mineralization is  $92.43 \pm 0.3$  to  $91.88 \pm 0.5$  Ma. The Elatsi-1 strike-slip fault, trending  $125^\circ$  to  $135^\circ$  and dipping to the southwest at  $75^\circ$  to  $85^\circ$ , roughly divides the deposit into two parts. The northern part consists of granodiorites and Paleozoic green schists, while the southern one is dominantly composed of Upper Cretaceous porphyries and less of green schists and granodiorites.

The recent study is based on 93 LA-ICP-MS analyses (Perkin-Elmer ELAN DRC spectrometer with New Wave UP193FX LA device) from the late pyrite D-veins and quartz-molybdenite veins. Samples were selected from 13 drill holes, covering a depth of 500 m and a lateral N-S extent of 1.4 km.

Magnesium, Ti, Cr, Mn, Co, Ni, Cu, Ge, As, Se, Sr, Te, Pb, and Bi are the most common trace elements in the late pyrite-rich D-veins from the Vezhen granodiorites. Cobalt content varies from 0.79 to 3025 ppm, Ni from 1.87 to 947 ppm, As from 0.52 to 1,023 ppm, Se from 41 to 1,487 ppm, Te from 0.60 to 60 ppm, Ge from 0.22 to 25 ppm, and Bi from 0.04 to 6.99 ppm. High positive correlation coefficients were calculated for Co/As ( $R = 0.953$ ), Ge/Se ( $R = 0.937$ ), Pb/Bi ( $R = 0.880$ ), Mg/Cu ( $R = 0.847$ ), Ti/Mn ( $R = 0.682$ ) and Se/Te ( $R = 0.528$ ). Ge, As, Se, Ni, Bi, and Te contents are higher in the deeper southern deposit parts (~785 m), while Cr and Co stay relatively constant.

The molybdenite samples were collected from the Vezhen granodiorites (NE and NW sectors) and also from the quartz-monzodiorite porphyries in the southern part of the deposit. Re, Cd, Ag, Te, Ba, Co, Se, Pb, and Bi are the most abundant trace elements in molybdenite. Re concentration varies from 650 to 5,707 ppm and increases toward the deeper parts of the deposit. Average Re content is also about three times higher in the porphyries (3,743 ppm) as compared to the granodiorites (1,174 ppm).

Taking into account that the Cu and Mo grades increase toward the center of the Elatsite PCD, located in granodiorites and monzodiorite porphyries in the southern deposit parts, we could conclude the following:

- Ge, Se, Ni, and Te in the D-vein pyrite increase in order of magnitude from 2 to 100 times from the marginal to the central parts of the porphyry system;
- Bi, As, and Co decrease in the late pyrite in order of magnitude from 2 to 5 times toward the center of the porphyry system;
- Re concentration in molybdenite also increases toward the central and deeper parts of the Cu porphyry system.