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Porphyry deposits of the Urals

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The Urals region is known mostly for its chromite, PGE, VHMS and Au orogenic (mesothermal) deposits. However it also hosts over 30 porphyry and porphyry related deposits and occurrences (including epithermal and skarn types). In the northern Cis-Polar and Polar Urals porphyry deposits are rare – only the Lekyn-Talbey Cu porphyry (Polar) and the Yanoslor Mo porphyry (Cis-Polar) deposits along with a few prospects and occurrences are known. In the Middle and South Urals porphyry deposits are more widely distributed. They are confined to three main N-S trending volcanic belts, i.e. the Tagyl−Magnitogorsk, East-Uralian and Valerianovka megazones, and are genetically linked with subduction-related calc-alkaline magmatism.

The westernmost Tagyl−Magnitogorsk megazone consists mostly of a series of Silurian to late Devonian oceanic island arcs, which host Au-Cu and Cu porphyry deposits. They are associated with diorite, quartz-diorite, and locally gabbro-diorite porphyries, e.g. the Early Devonian Gumevskoe Cu-Au skarn-porphyry deposit in the Tagyl segment, the Devonian Salavat and Late Devonian Voznesenskoe Cu porphyry deposits in the Magnitogorsk segment, and the Late Devonian – Early Carboniferous Yubileinoe Au porphyry in the Mugodzhary sector.

The East Uralian volcanic megazone comprises fragments of volcanic arcs of Late Devonian to Early Carboniferous age. Cu and Mo-Cu porphyry deposits are mostly related to diorite and quartz diorites. The best examples are the Carboniferous Mikheevskoe (Mo)-Cu deposit and the Late Devonian to Early Carboniferous Birgilda-Tomino ore cluster. The latter includes several porphyry deposits (Kalinovskoe, Tomino, and Birgilda), the Bereznyakovskoe Au-Ag-Te epithermal ore field, and the Biksizak base-metal carbonate replacement deposit.

The eastern Valerianovka megazone comprises Carboniferous Andean-type calc-alkaline volcano-plutonic complexes and hosts several copper porphyry deposits including the Benkala Cu porphyry deposit in Kazakhstan. Most porphyry Cu deposits of the Urals are related to intrusions of calc alkaline K-Na and sometimes Na series. Cu-Mo and Mo porphyry deposits are rare and are associated with sub-alkaline granodiorite porphyries (e.g. Verkhneuralskoe in the Magnitogorsk megazone and Talitsa in the Middle Urals).

There is a general evolutionary trend of porphyry-related magmatism in the Urals from Na to K-Na series in space (from west to east) and from Na via K-Na to K series in time (from Devonian to Carboniferous). Both trends correlate with a decrease in the Cu/Mo ratio and increase in Mo/Re ratio in ores.

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