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Fe-U-PGE-Au-Ag-Cu Deposits of the Udokan–Chiney Region (East Siberia, Russia)

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Introduction. Cupriferous sandstones-shales and magmatic copper–nickel deposits mark out the western and southern boundaries of the Siberian Craton accordingly. Of special interest are the Paleoproterozoic deposits of the Udokan–Chiney mining district (Gongalskiy, Krivolutskaya, 2008). Copper reserves and resources of this region are estimated at more than 50 Mt. Half of them is concentrated at the unique Udokan Deposit and the second half is distributed among sedimentary (Unkur, Pravoingamakitskoye, Sakinskoye, Krasnoye, Burpala) and magmatic deposits of the Chiney (Rudnoye, Verkhnechineyskoye, Kontaktovoye), Luktur and Maylav massifs.
Results. It was established that the ores are characterized by similarity in chemical composition (main, major and rare elements that are Ag, Au, PGE) and mineral assemblages with varying proportions. It is important to emphasize that Fe role in mineralization was previously ignored. Meanwhile the Udokan deposit contains 10 Mt of magnetite metacrystals so as chalcocite ores may contain up to 50% magnetite too. It has been recently found that the Chiney titanomagnetite ores comprise commercially significant uranium and rare-earth metal concentrations (Makaryev et al., 2011). Thus the Udokan–Chiney region comprises Cu, Fe, Ti, V, U, REE, Ag, Au, PGE. These deposits differ from similar objects, the Olympic Dam in particular, by a much smaller content of fluid-bearing minerals.
Copper mineralization at the Udokan is represented by chalcocite–bornite ores. They occur as ore beds conformable with sedimentary structures or as cross-cutting veins. The central zones of the former are often brecciated. They are rimmed by fine magnetite, bornite, and chalcocite dissemination. Bornite-chalcopyrite and chalcopyrite-pyrite veins are known at the lower levels of the Udokan ore bed. Such ore compositions are predominant in other ore deposits in sedimentary rocks (Pravoingamakitskoye, Unkur) and have a hydrothermal origin. Silver grades are up to 370 g/t in grab samples (Gongalskiy et al., 2008a). The long-lived Udokan–Chiney ore-magmatic has small areal extent of explosive rocks and breccias (n*10 m) with massive sulfide veins (chalcopyrite, pyrrhotite) which are similar to Sudbury offset dikes. While the same vertical zones at the Rudnoye deposit have been confirmed over 0.5 km downward from the lower contact of the Chiney massif.
Conclusions. Multielement and similar mineralogical composition ores of different deposits in the Udokan–Chiney area reflect long evolution of ore processes in very movable block of the crust. Observed combination of magmatic, sedimentary and partially hydrothermal deposits is a result of the telescoping of a wide range of metals into a limited area.
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