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Dictionema Shales and Obolus Sandstone (Phosphorite) of the Baltic Sedimentary Basin: New Type of Complex Ore for Renium and Uranium, Platinoids and Rare-Earth Metals

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In the course of geological works in 2012-2014, commercial concentrations of some valuable metals have been identified in the Kaibolovo-Gostilitsky Prospect (500 sq. km) of the Baltic sedimentary basin, the Leningrad Region. In the layer of Dictionema shales (average thickness of 2.5 m) following chemical elements were identified: up to 1.29 ppm Re, to 1130 ppm U, 1-2 kg/t V, 40-50 mg/t on the average of platinum metals (predominantly Pd), etc. In the underlying Obolus sandstone (phosphorite) layer of average thickness of about 3 m, there are high concentrations of rare-earth metals (to 800-900 ppm), platinum group metals (predominantly Pd) (100-200 mg/t), and W (to 100 ppm).

Source of detritus for the formation of Dictionema shale and concentration of Re and other metals in them was ash material and material from the source area. Unique paleogeographic environment of the Early Paleozoic, the presence of extensive source area, onshore-offshore deposition environment, organic substance (4 to 15 % in Dictionema shale) played a leading part in the accumulation of Re, U, Mo, V, and other metals.

Prognosticated rhenium resources in the Dictionema shale layer are of more than 400 tons, platinum group metals (predominantly Pd) are 103 tons. In thousands of tons: 630 U, 777 rare earth metals (totally), 294 Rb_20, 12.3 Cs_2O, 4951 V_2O_5, 26.4 Sc, 17356 TiO_2, 649.6 Mo, 38.8 Ga, 297 Cu, 3724 Zn. In the Obolus sandstone (phosphorite) layer, prognosticated resources are as follows: platinum metals (predominantly Pd) - 257 tons, rare-earth metals - 2396 thousand tons, WO_3 – 236.5 thousand tons.
Experimental studies have shown the extraction of Re from Dictionema shale of more than 70 %. Method of complex processing of similar carbon-siliceous black-shale ore containing vanadium, uranium, molybdenum, rare-earth metals is available and partially realized in Kazakhstan (Bala-Sauskandyk deposit).

Economic-geological evaluation has shown possibility of profitable mining the sedimentary ore of the Kaibolovo-Gostilitsky area under condition of extraction of a set of valuable metals from Dictionema shale and phosphorite. Potential cost of valuable metals only in the studied area is tens of billions of US dollars.

Therefore, the Dictionema shale and Obolus sandstone (phosphorite) of the Baltic sedimentary basin are believed to be a new nonconventional type of complex ore for Re and U, platinoids, rare-earth and other valuable metals.