NEW MINERALOGICAL AND GEOCHEMICAL INFORMATIONS ABOUT THE UKRAINIAN CHROMITE ORE DEPOSIT "KAPITANKA"

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Geological background

The purpose of the research of a small Ukrainian chromite ore deposit called "Kapitanka" was to gather new information about the genesis of this deposit through mineralogical and geochemical analysis of chromite samples.

"Kapitanka" deposit is located in Central Ukraine, in the western part of the Kirovograd Region. Geologically, the deposit is settled in crystalline massif in the southern part of the Ukrainian Shield, one of the major units of the East European Platform. The host rocks consist mainly of paleoarchaic enderbite and granulite rock facies, one of the oldest in Europe at 3.6 billion years old (PIECZONKA & PIESTRZYŃSKI, 2009). Chromite ores are located within ultramafic rocks that are partly serpentinized (KULISH *et al.*, 2002). Almost 100 ultrabasic massifs in that region, forming Pervomaisk–Holovanivsk structure, have been identified. Chromite occurrences are already confirmed within 11 of them (KANEWSKY, 1996). "Kapitanka" deposit is the largest one of them, and the only one which was briefly exploited. Even though it is the best-described body in that formation, its genesis is still uncertain. Some structural elements, such as lenticular shapes of bodies, as well as serpentinization, indicate podiform type deposit, however, the geotectonic position is still discussed. Chemical analysis of nearby Lipovenskie massif strongly indicates stratiform type deposit by Cr_2O_3 to Fe_2O_3 ratio of 1.73 and low content of SiO_2 = 0.27%. For comparison, chromites from another nearby massif have Cr_2O_3 to Fe_2O_3 ratio above 2, indicating the podiform type of the deposit (DUKE, 1995).

Methods

Rock samples were gathered in 2018 at one of the abandoned outcrops. Eleven of them were selected to further research after macroscopic description. These samples were prepared for microscopic study in both reflected and transmitted light under the Nikon Optiphot polarizing microscope. Microscopic observation enabled the selection of samples for the microprobe EDS (FEI Quanta 200FEG) and WDS (Jeol JXA-8230 Super Probe) chemical analyses. All microscopic observations and analyses were carried on at the Faculty of Geology, Geophysics and Environmental Protection of AGH University of Science and Technology. Electron microscopic analyses were conducted with the help of Prof. A. Piestrzyński and PhD G. Kozub-Budzyń.

Results and conclusions

Examined rock samples show various properties. Chromite mineralization occurs in both massive and disseminated forms. Host rocks of disseminated ores consist of unaltered olivine and clinopyroxenes. One specimen was a part of quartz vein, with frequent fuchsite instances. Two heavily weathered samples consisted of goethite and muscovite; these samples were taken from "mysterious" puppets found in overburden oxidized layers.

Besides chromite, as expected, the most common ore mineral in samples are magnetite, hematite and ilmenite. XRD analyses confirmed the occurrence of various chromite types, magnetite and ilmenite; and indicated the presence of galaxite. Other minerals confirmed by this method were quartz, jadeite, goethite and kaolinite.

The spinel crystals have maintained idiomorphic shapes and are very rarely fractured, which indicates small tectonic activity in the local massif. Exsolution of solid solution occurs in the spinel crystals in half of the samples. EDS analysis of samples shows that chromium spinel separated into two phases. One phase contains 20% of chromium and 30% of iron; and the other, reduced content of chromium and enriched in iron (8% and 55%, respectively).

Results of WDS analyses of homogeneous chromite crystals have been plotted on the classification diagrams. Most of them indicate podiform type deposit. All samples had Cr_2O_3 to Fe_2O_3 ratio higher than 2 (5.08 minimum), which also confirms this theory (DUKE, 1995). Known deposit type, small tectonic activity of the area and small depth make "Kapitanka" deposit attractive for future exploitation, although, further analyses are required to define accurate resources and average content of chromium, which determines the economic value of this deposit.

References

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