



Chemistry of apatite from AMCG-related ilmenite-apatite deposits of the Ukrainian Shield: petrogenetic indicators and economic potential

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The assimilation of continental crust exerts significant control over the compositional variations of massif-type anorthosites and the economic potential of the associated Fe-Ti-V±P deposits depends both on the starting magma composition and subsequent magmatic processes. Kieffer et al. (2024) demonstrated that the chemical composition of apatite can effectively record petrogenetic processes in mafic layered intrusions and presented a set of proxies for crustal contamination, corroborated by isotopic signatures. The purpose of this study is to utilize this approach to study ilmenite-apatite ores hosted by gabbroid intrusions within the Paleoproterozoic Korosten and Korsun-Novomyrhorod anorthosite-mangerite-charnockite-granite (AMCG) complexes in the Ukrainian Shield.

The ore-bearing rocks of the Fedorivka and Stremyhorod intrusions contain accumulations of ilmenite, apatite, and minor titanomagnetite, while the Nosachiv intrusion is devoid of magnetite and comprises two distinct ore types, each resulting from separate intrusive phases. The first one (I) formed olivine-bearing, apatite-rich lithologies, while the second phase (II) is characterized by abundant ilmenite, much lower apatite content, and an almost total absence of olivine.

Apatite from Fedorivka exhibits a mostly uncontaminated character, comparable to Sept Iles MCU II samples, while those from Stremyhorod suggest crustal contamination. Apatite from the two intrusive stages in Nosachiv plots in separate fields. The olivine-bearing Nosachiv (I), plots near the Fedorivka samples but simultaneously shows an increase in Th relative to the HREE. Nosachiv (II) exhibits distinctively higher (La/Nd)_N ratios, which might indicate contamination by more differentiated rocks (e.g. syenite). Apatite from Nosachiv (II) (Σ REE 3327-8663 ppm) and Stremyhorod (Σ REE 3700-6411 ppm) are significantly richer in REE than those from Fedorivka (Σ REE 1058-2008 ppm) and Nosachiv (I) (Σ REE 1753-2928 ppm). The Eu anomaly and Sr/Y ratio serve as indicators of fractional crystallization, with a decrease in Eu/Eu* from Fedorivka (0.47-0.53), Stremyhorod (0.24-0.27), Nosachiv (I) (0.13-0.15) to Nosachiv (II) (0.09-0.11).

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References

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