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RUTHENIUM-CHROMIUM VARIATION: A NEW LITHOGEOCHEMICAL TOOL IN THE EXPLORATION FOR KOMATIITE-HOSTED Ni-Cu-(PGE) DEPOSITS *

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Abstract

We present a new lithogeochemical method to target prospective komatiites that may host Ni-Cu-(PGE) deposits. The new methodology is based on the geochemical properties of ruthenium (Ru) and chromium (Cr), elements that are immobile under most conditions; it relies on a restricted number of carefully selected representative samples and is applicable in highly altered terrains. Ruthenium is a platinum-group element (PGE) that exhibits contrasting geochemical behavior in sulfide-saturated and sulfide-undersaturated komatiites. Similarly to other PGEs, Ru shows highly chalcophile behavior in magmas that equilibrate with an immiscible sulfide phase. However, Ru is also compatible in chromite in sulfide-undersaturated systems. If we consider Cr concentration as an index of chromite abundance in chromite-saturated komatiites, we observe that Ru increases or decreases systematically with increasing Cr according to the sulfide saturation state of the magmatic system. In rocks that crystallized from sulfide-saturated melts, Ru contents decrease with increasing Cr. Conversely, in rocks that crystallized from sulfide-undersaturated melts, Ru contents increase with increasing Cr. As a result, on the basis of the Ru-Cr variation it is possible to discriminate whether a komatiite melt equilibrated with a sulfide liquid during crystallization. The strength of this method compared to previous PGE-based lithogeochemical techniques derives from combining the traditional use of the geochemical properties of a highly immobile and chalcophile element that records the ore-forming process (ruthenium) with the occurrence of a mechanically and chemically resistant mineral phase (chromite), which is generally preserved in highly altered komatiites.

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