A New Process-Based Mineral System Classification Linked to Commodities

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Several deposit and mineral system classifications are available in the literature, with most focused on detailed analysis of a few deposit types using the mineral systems approach. However, these classifications are often not comprehensive and/or are too complex for non-expert users. This study presents a new mineral system classification which aims to address these problems. The new classification is exhaustive and incorporates new deposit types to account for current and potential future critical mineral resources (e.g., high purity silica). In addition, we review and classify the presence of economically extractable elements for each deposit type according to their global and local significance, with the aim of creating a simplified mineral system classification where mineral systems and deposit groups are linked to potential economic commodities.

For the classification, deposit types are grouped into broad mineral systems using similarities in critical processes that relate to metal, fluid and ligand sources, energy sources, fluid-flow drivers and pathways, architecture and depositional gradients. The mineral systems are then associated with broad geological features instead of geodynamic and tectonic settings, as commonly used in other classifications, to make the classification easier to apply, particularly given that geodynamic and tectonic settings are often debated in the geological record, especially for the Archean and Proterozoic. Furthermore, some mineral systems can develop in more than one geodynamic or tectonic setting, making these less reliable criteria to apply in a classification due to the many-to-many relationships.

The new classification comprises 202 deposit types categorized into 86 deposit groups that are associated with 13 mineral systems and six mineral system classes. This approach to mineral system classification may help explorers in regions where the geology is complex or relatively unknown by linking geological features to possible elemental enrichment and may assist industry, academia and government in conducting commodity-based mineral potential assessments.