Critical Ingredients of IOCG Mineral Systems: Insights from a New National Mineral Potential Model of Australia Using a Hybrid Approach

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Iron oxide copper-gold (IOCG) deposits are part of a contentious class of deposits wherein key formation processes are still highly debated. Resolving key processes necessary for the formation of IOCG deposits is critical as they contain many elements that are required for the transition to a low carbon economy. This study focuses on robust statistical analysis of new and updated mappable criteria used to represent as spatial proxies for IOCG mineral systems processes. Using a hybrid data- and knowledge-driven approach, a national-scale assessment of the mineral potential for IOCG mineral systems in Australia has been undertaken. A total of 149 mappable criteria were statistically assessed using the Kolmogorov-Smirnov test. From these, 14 criteria were found to show a satisfactory statistical relationship with known IOCG mineralization and were retained for the model. The statistical approach used in this study permits the assessment of the relative importance of each mappable criteria. Overall, the best predictors for IOCG mineral system are mappable criteria representing energy sources followed by ore depositional gradients, fluid pathways and architecture and sources of metals, fluids and ligands.

The mineral potential model successfully predicts the location of 91.7% of known IOCG deposits and occurrences in 8.3% of the area, reducing the exploration search space by 91.7% and opening new exploration search space in under-explored regions of Australia. Underexplored regions for IOCG that demonstrate favorable geological evolution and high prospectivity include the Delamerian Orogen, the Lamboo Province and Tanami Orogen, the western Gawler Craton, the Hooper Province and the Musgrave Province.

This study highlights how precompetitive geoscience data can be evaluated and utilized within a geologically and statistically robust framework to produce improved mineral system formation models and mineral potential models with strong predictive performance.