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Critical Mineral Exploration with Compiled Data: Joint Imputation and Clustering for Improved Analytics

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Exploration for critical minerals such as Li, Sn, W, and REEs presents a new challenge to geoscience as mineralizing processes and controls are often disconnected from current deposit settings. Smaller footprints, unique metallurgical requirements, and historically limited economic interest also contribute to this challenge when rapid discovery and production of critical resources influence the feasibility of global green energy targets. As exploration for these challenging targets leverages increasingly diverse data compilations, pitfalls related to variable precision, accuracy, and completeness of data become more pronounced and increase exploration risk. A new probabilistic imputation and clustering method was developed to overcome limitations from data gaps or lower precision vintages of data as well as extend the application of more comprehensive but less common techniques (e.g., hyperspectral). This method is demonstrated using lateritic material in the highly weathered southwest Yilgarn Craton in Western Australia, where a range of mineralization types have been reported.