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Mineral network analysis: Exploring mineralization and mineralizing environments via machine learning and large data resources

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In this study, we employ mineral network analysis [1] to explore the trends between minerals and their formational environments [2], and to identify and characterize trends in geochemistry, paragenetic mode, age, and much more related to the complex geologic and biologic evolution of mineralization on Earth [e.g., 3-4].

Mineralization and associated mineralizing environments on Earth and other planetary bodies are incredibly complex. In order to understand the history of our planet, or others in our solar system, it is critical that we fully characterize the nuanced, multifaceted relationships between geochemical environments, specifically their physical, chemical, and biological conditions, and the minerals that form as a direct result of these conditions. This allows insight into the mineral and geological evolutionary history of our planet, geochemical processes through deep time, and on the prediction of planetary biosignatures.

Large and expanding data resources have created an opportunity to characterize changes in near-surface mineralogy through deep time and to relate these findings to the geologic and biologic evolution of our planet [5-7]. We employ the RRUFF Project (rruff.info), the IMA list of mineral species (rruff.info/ima), the Mineral Evolution Database (MED; rruff.info/Evolution), the Evolutionary System of Mineralogy Database (ESMD; odr.io/esmd), EarthChem (earthchem.org), and the Astromat (Astromat.org). Most recently, we have expanded these data resources to include a dataset of over 5,500 mineral species and all known modes of formation [1]; these data provide a platform to explore complex relationships between all known mineral species and their paragenetic modes across our solar system, through deep time.

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[6] Liu et al. (2017) Nat Comm, 8:1950

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