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Characterizing carbon mineralogy through Earth history with data-driven techniques

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The large and expanding mineralogical and geological data resources have created an opportunity to characterize changes in Earth's near-surface mineralogy through deep time [1]. These findings, driven by advanced analytical and visualization techniques such as mineral ecology [2], network analysis [3], and affinity analysis, offer insight into the geologic and biologic evolution of our planet over the past 4.5 billion years.

Using databases such as the RRUFF Project, the Mineral Evolution Database (MED), and mindat, we explore the spatial and temporal distribution of carbon minerals on Earth's surface while considering the multidimensional relationships between composition, oxidation state, structural complexity [4], and paragenetic mode. These methods also allow us to make predictions about the number of mineral species yet to be discovered on Earth's surface [2], to statistically predict the locations at which to find specific mineral species, and to estimate probabilities of mineral occurrence at a given location on Earth's surface.

[1] Hazen et al. (2008) Am. Mineral. 93, 1693-1720.
[2] Hazen et al. (2015) Can. Min. 53(2):295-324.
[3] Morrison et al. (2017) Am. Mineral., 102, 1588-1596. [4] Krivovichev et al. (2013) Min. Mag. 77(3), 275-326.