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Clay mineral evolution

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Abstract

Changes in the mechanisms of formation and global distribution of phyllosilicate clay minerals through 4.567 Ga of planetary evolution in our solar system reflect evolving tectonic, geochemical, and biological processes. Clay minerals were absent prior to planetesimal formation ~4.6 billion years ago but today are abundant in all near-surface Earth environments. New clay mineral species and modes of clay mineral paragenesis occurred as a consequence of major events in Earth's evolution—notably the formation of a mafic crust and oceans, the emergence of granite-rooted continents, the initiation of plate tectonics and subduction, the Great Oxidation Event, and the rise of the terrestrial biosphere. The changing character of clay minerals through time is thus an important part of Earth's mineralogical history and exemplifies the principles of mineral evolution.

Keywords: Clay minerals, biominerals, weathering, diagenesis, Mars mineralogy