Paleomineralogy of the Hadean Eon

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The Hadean Eon, encompassing Earth's first 550 million years, was a time of significant planetary evolution. Nevertheless, prebiotic Earth's near-surface environment may have held no more than approximately 420 different rock-forming or accessory mineral species that were widely distributed and/or volumetrically significant [*1*]. This relative Hadean mineralogical parsimony is a consequence of the limited modes of mineral paragenesis prior to 4 Ga compared to the last 3.0 billion years. Dominant Hadean Eon mineralizing processes include the evolution of a diverse suite of intrusive and extrusive igneous lithologies; hydrothermal alteration over a wide temperature range, notably serpentinization; authigenesis in marine sediments; diagenesis and low-grade metamorphism in near-surface environments; and impact-related processes, including shock mineralization, creation of marginal hydrothermal zones, and excavation of deep metamorphosed terrains. On the other hand, the Hadean Eon may have been notably lacking in mineralization generated by plate tectonic processes, such as subduction zone volcanism and associated fluid-rock interactions, which result in massive sulfide deposition; convergent boundary orogenesis and consequent extensive granitoid-rooted continental landmasses; and the selection and concentration of incompatible elements in complex pegmatites, with hundreds of accompanying minerals. The dramatic mineralogical consequences of life are reflected in the absence of Hadean biomineralization; for example, the lack of extensive carbonate deposits and the associated restricted development of skarn and cave minerals prior to 4 Ga. Most importantly, it was not until after the establishment via photosynthesis of significant near-surface redox gradients that supergene alteration, redox-controlled ore deposition, and subaerial weathering in an oxidizing environment could diversify Earth's near-surface mineralogy. These post-Hadean processes may be responsible for more than 4000 of the more than 4800 approved mineral species. Any scenario for life's origins that invokes minerals as agents of molecular synthesis, selection, protection, or organization must take into account the limited mineralogical repertoire of the time.

[1] R.M.Hazen (2013) Paleomineralogy of the Hadean Eon: A preliminary list. *American Journal of Science*, in press.

Role of bacteria on the release of cesium from illite

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As a result of the nuclear accident in Fukushima, various radioactive elements such as cesium were dispersed in the atmosphere before being deposited on the soil within a distance of 80km around the nuclear power plant. Cesium with half-life of 30 years and properties similar to potassium accumulates in the clays, especially illite, of the upper soil horizons.

Among soil remediation methods, phytoextraction is the most appropriate one as it can be achieved *in situ* without any change of the biophysicochemical properties of the soil. Cesium uptake by plants depends on sorption/desorption reactions to/from the soil particles and on biogeochemical processes in the rhizosphere.

This work focuses on the bacterial mechanisms involved in Cs desorption from illite by estimating the amount of Cs released by desorption and/or as the result of illite alteration. Citric acid and oxalic acid that bacteria and plants are able to produce in soils were used in this work [1-2]. Illite alteration by these same bacteria also able to form biofilms at the surface of soil particles was studied [3-4]. Eventually experimental results were compared to those obtained by modeling.

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