Limited Hadean continents from combined $^{142-143}$Nd- ^{176}Hf isotopic compositions of Eoarchean rocks

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The modern depleted mantle is characterised by positive ε_{Nd} and ε_{Hf} and high Sm/Nd and Lu/Hf, at least partially reflecting the extraction of low Lu/Hf and Sm/Nd continental crust over time. If large amounts of Hadean continental crust were formed and preserved, then the early Archean mantle should show similar features and this will be reflected in the Hf and Nd isotopic compositions of Archean rocks. Using ^{176}Hf and ^{142}Nd (the latter formed by decay of extinct ^{146}Sm; half life =103 My) isotopic data from the oldest (≥3.8 Ga) terrestrial terranes including new results from SW Greenland, the Yilgarn, Western Australia, and Mt. Sones, Antarctica, we show that the trace element characteristics of the Hadean mantle could not have been generated by extraction of voluminous continental crust. For example, initial Hf isotopic compositions from Greenland zircons from the same samples yielding positive ^{142}Nd and ^{143}Nd anomalies (and requiring early, large Sm/Nd fractionation) are all within error of chondritic values [1, 2] (using λ^{176}Lu= 1.867 x 10^{-11}yr^{-1}). Thus, continental crust formation, which generates large Sm/Nd AND Lu/Hf fractionation, was not the primary mechanism of Hadean mantle depletion. Using models of mantle source volumes and ages of crust formation and including data uncertainty estimates, we quantify Hadean continental mass at the start of the Archean. The SW Greenland data for example, constrain the amount of ≥4.4 Ga crust present at 3.8 Ga to be 0±10% of the present day continental mass.

These observations counter conjectures of voluminous early continental crust formation. Furthermore, the absence of extreme positive ε_{Hf} in ca. 3.8 Ga rocks suggests that the heterogeneous ^{176}Hf compositions of some >4.0 Ga Jack Hills detrital zircon populations relates to a localised or ephemeral source feature. Mantle isotopic patterns with correlated, positive initial ε_{Hf} and ε_{Nd} were not established until after 3.6 Ga and reflect progressive growth of continental volume

[1] Hiess *et al.*, *GCA* (in review). [2] Bennett *et al.* (2007) *Science* **318**, 1907-1910.

Study of mineral-microbe assemblages down to the nm-scale in carbonate microbialites

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Microbialites, including stromatolites, have been extensively used as indicators of ancient life on Earth. Biological and abiotic processes contributing to their formation are however still poorly constrained [1]. Among others, two issues should be addressed to improve our capability of discriminating biotic from abiotic processes affecting the formation of microbialites: 1. Improving characterization of microfossils in microbialites and distinguishing ‘primary’ microfossils from secondarily-colonizing endolithic microbes. 2. A better description of the mineralogical textures at the submicrometer scale to understand how carbonates nucleate and grow in stromatolites. Here, we will present a combination of microscopy and spectroscopy techniques (FIB, TEM, STXM and NanoSIMS) to study endolithic bacteria in modern microbialites from an alkaline crater lake from Satonda, Indonesia, as well as the chemistry and the texture of aragonite in these stromatolites. Several textural features are described, including a chemical and structural description of the interface between an endolithic microbe and the aragonite matrix as well as morphological variations of aragonite from nanosized grains to micrometer-sized fibers, or clusters of small aragonite crystals sharing a common crystallographic orientation. These nanotextural features are discussed in light of their formation process.

[1] Benzerara *et al.* (2006) *Proc. Natl. Acad. Sci. USA* **103**, 9440-9445.