Sulfur isotopic survey of 3.8 Ga supracrustal rocks of the Nuvvuagittuq greenstone belt

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Our knowledge of the environmental conditions of early Earth is contingent on the preservation of the early Archean rock record. The Nuvvuaggituqq greenstone belt (NGB), Northeastern Superior Province, Canada is an Eoarchean volcano-sedimentary suite that was emplaced prior to 3.75 Ga [1], and possibly before 3.83 Ga [2]. By expanding the planetary sampling of coherent supracrustal rock packages of this age, it provides an opportunity to access 'global' information on Earth's Eoarchean surface environment [3].

Recent detailed mapping of the NGB reveals a geology dominated by cummingtonite-amphibolites [4]. Conformable bodies of gabbroic and ultramafic rocks within the amphibolites are thought to be sills that tapped mantle-derived magmas [4]. Minor lithologies within the NGB include a banded iron formation (BIF) with cm-scale quartz-rich and magnetite-rich laminations, a pyrite-bearing quartzite in gradational contact with the BIF, and rare felsic bands [4].

We measured the bulk S isotopic composition ($\delta^{33}S$, $\delta^{34}S$, $\Delta^{33}S$) in 33 samples covering the entire lithological suite. The amphibolites and the sills they enclose exhibit similar S isotopic characteristics ($-5.3‰ \leq \delta^{34}S \leq 7.5‰$; $-0.02‰ \leq \Delta^{33}S \leq 0.32‰$). The rare felsic bands are uniformly enriched in ^{34}S ($0.6‰ \leq \delta^{34}S \leq 3.3‰$) with $\Delta^{33}S$ values from -0.02 to 0.11‰. A single sample of the pyrite-rich quartzite falls in this range. The BIF is also enriched in ^{34}S ($1.1‰ \leq \delta^{34}S \leq 3.1‰$) but exhibits a wide range of ^{33}S anomalies ($0.17‰ \leq \Delta^{33}S \leq 2.21‰$). Like other Eoarchean metasediments [5], the BIF preserves isotopic evidence of S cycling through the Eoarchean surface environment while ^{56}Fe enrichments in the same rocks [3, 4] offer a possible record of coupled S and Fe cycling at 3.8 Ga.

[1] Cates & Mojzsis (2007) *EPSL* **255,** 9-21. [2] David *et al*. (2002) *MRNF QC DV2002-10*, 17p. [3] Dauphas *et al*. (2007) *EPSL* **254,** 358-376. [4] O'Neil *et al*. (2007) *Dev. Precam. Geol.* **15,** 219-255. [5] Mojzsis (2007) *Dev. Precam. Geol.* **15**. 923-970.

Multiple crustal thickening events by tectonic wedging in the assembly of the northern Appalachians

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New Pb and Nd isotopic compositions of Neoproterozoic rocks in southern New England show that orthogneisses from in the Lyme and other domes were derived from evolved sources whereas orthogneisses found in rocks folded around the Lyme dome were derived from primitive sources. Both have been assigned to the Avalon terrane. By comparison with type rocks in Newfoundland, these suites are assigned to the Gander and Avalon zones, respectively. The restored cross section around the Lyme dome reveals a tectonic wedge similar to that identified in the subsurface in Newfoundland. The Avalon-Gander boundary is defined by a distinctive aeromagnetic high that can be traced to the Long Island platform where it is crossed by the USGS seismic line # 36. With revised locations of terrane boundaries, the line shows the Avalon-Gander boundary dipping west to the Moho, where Gander crust was delaminated from the mantle. Regional geochronology and thermochronology suggest that delamination occurred in the late Paleozoic. The less well defined Gander-Laurentia boundary may dip west to mid-crustal levels and then east, in a wedge-shape that implies intra-crustal wedging of Gander crust from mantle. Magma ages suggest that the wedging occurred in the Silurian. Thus crustal wedging occurred in Newfoundland and in southern New England, and crustal-scale wedging was a major mechanism of continental assembly and crustal thickening during Paleozoic orogenesis.