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Evidence for surface-derived sulfur in Eoarchean TTGs from the Itsaq Gneiss Complex, SW Greenland

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Eoarchean TTGs form the cores of Earth's oldest cratons. Competing hypotheses concerning the geodynamic context of TTG formation in the Eoarchean, including vertical and horizontal tectonic processes, continue to be debated. Constraining the nature of the source rocks that melted to form the TTGs is a crucial part of resolving this debate. To address this topic with a fresh view, we present first multiple sulfur isotope analyses on a well characterized suite of Eoarchean TTGs and associated amphibolites from the 3.6-3.9 Ga Itsaq Gneiss Complex, southern West Greenland. We apply our results to investigate whether surfaced-derived sulfur was incorporated into the source rocks of juvenile TTGs and the mantle sources of potentially genetically related amphibolites. Sulfur isotope analyses were performed by gas source mass spectrometry. In addition, sulfide textures and chemical compositions were analyzed by electron microprobe. Small but significant nonzero $\Delta^{33}S$ and $\Delta^{36}S$ values were measured in the TTGs, with $\Delta^{33}S$ values from 0.00‰ to +0.30‰, and $\Delta^{36}S$ values from -0.13‰ to +0.80‰. The amphibolites had $\Delta^{33}S$ values of -0.01‰ and +0.14‰, and $\Delta^{36}S$ values of +0.08‰ and +0.23‰. The $\Delta^{33}S$ values of the TTGs support previous studies proposing a genetic link between them and local amphibolites with tholeiitic composition (e.g. [1, 2]) and reveal that both rock types have incorporated surface-derived, mass-independently fractionated sulfur. The presence of this isotopic signal indicates that crustal recycling processes, possibly similar to modern horizontal tectonics, were active as early as 3.8 Ga. We also observe combined isotopic and sulfide textural evidence for modification of the sulfur isotope signal in the TTGs following their emplacement in their source amphibolites, related to metamorphic processes taking place during crustal thickening in the Eoarchean.

1. T. J. Nagel, J. E. Hoffmann, C. Münker (2012), *Geology* 40, 375-378.
2. J. E. Hoffmann, T. J. Nagel, C. Münker, T. Næraa, M. T. Rosing (2014), *Earth and Planetary Science Letters* 388, 374-386.