Multiple sulfur isotope characteristics of felsic-mafic-ultramafic granulites from the Nilgiri Block, southern India

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The Nilgiri Block belongs to granulite belt in the southern part of Dharwar Craton, India. Co-genetic (~2500 Ma) suite of pyroxenite, mafic granulite, two-pyroxene granulite and charnockite are exposed from North to South in this region. All these rock types are metamorphosed under granulite facies conditions at P-T conditions at around 600 to 1500 MPa and 650 to 900˚C {1,2,3]. Based on a detailed mineralogical and textural characterization of sulfide minerals, Samuel et al. [3] observed that, two-pyroxene granulite and metagabbro consist of pyrite +/- minor pyrrhotite and charnockite has mostly pyrrhotite, with minor chalcopyrite. In this study we report preliminary multiple sulfur isotopic composition of a suite of Neoarchean granulite facies metamorphic rocks from the Nilgiri Block, southern India.

Our δ34S results fall in a narrow range, representing typical magmatic sulfur isotopic compositions, with pyroxenites having slightly positive values compared to near zero values for charnockites. The relationship between δ33S, δ34S and δ36S are generally close to the theoretical relationship for mass-depended fractionation. A general trend shows that heavier isotopes are fractionated and enriched in ultramafic-mafic rocks compared to felsic two-pyroxene granulite and charnockite. However, Δ33S and Δ36S values indicate minor, but systematic variations with respect to δ34S values.

The trend observed in sulfur isotopes can well be explained a mass depended fractionation, that could be correlated to differentiation of primary mafic magma to ultramafic-mafic cumulates and a felsic melt. Such process is mostly happening during arc magmatism, were basaltic magma produced during partial melting of mantle wedge, further differentiated to form ultramafic-mafic-felsic rock suites. Compared to a more prominent mass-independent fractionation of S isotopes in the Paleoarchean Dharwar craton [4], the dominant mass dependent fractionation towards south during Neoarchean could be related to a major shift in the tectonic style, with nominal contribution of sulfur from subducting components.

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