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Sulfide mineralogy and sulfur isotope systematics of Newania carbonatites, India

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The 1473 Ma old Newania carbonatite complex of India is one of the unique carbonatite complexes in the world, because they are magnesium- and iron-rich in composition, having dolomite, ankerite and magnesite as major carbonate minerals, contain graphite and sulfide minerals, and devoid of any associated alkaline silicate rocks [1-3]. Previous studies, based on $\delta^{13}C$- $\delta^{18}O$ and radiogenic Nd-Sr isotope ratios, suggest a mantle origin for these carbonatites [2, 3].

Here, we report sulfur isotope data for carbonatites from this complex along with their $\delta^{13}C$ and $\delta^{18}O$ values. The aim of this study is to provide further insights into the magmatic or post-emplacement histories and source of sulfur in these carbonatite magmas. Pyrrhotite is the primary sulfide phase, which coexists with ferroan magnesite. The $\delta^{34}S_{V\text{-}CDT}$ values of sulfide in six carbonatite samples range from -1.4 to +2 ‰ without any MIF-S signatures ($\Delta^{33}S$ values vary from -0.02 to -0.13‰). The overlapping $\delta^{34}S$ values of these carbonatites with Earth's asthenospheric mantle (0±2 ‰) [4] and the co-existence of sulfides with ferroan magnesites suggest the following: (i) sulfur in these carbonatites are mantle derived, (ii) sulfides were formed under reducing conditions and (iii) change in the oxidation state of the magma did not impart any isotopic fractionation. Based on $\delta^{34}S$ values of these carbonatites along with the $\delta^{13}C_{V\text{-}PDB}$ (-4.2 to -5.2 ‰) and $\delta^{18}O_{V\text{-}SMOW}$ (+6.2 to +7.3 ‰) of magnesite, we suggest that carbonatites of the Newania complex were derived from a primary mantle source without any influence of recycled components. This hypothesis also corroborates mantle like $\delta^{44/40}Ca$ and $^{87}Sr/^{86}Sr$ of these carbonatites; the latter suggesting limited role of recycled components in the mantle source of Newania carbonatites [5].

Reference: [1] Doroshkevich et al. (2010) *Mineral. Petrol.* **98,** 283-295; [2] Ray et al. (2010) *Mineral. Petrol.* **98,**269-282; [3] Ray et al. (2013) *Contrib. Mineral. Petrol.* **166,** 1613-1632; [4] Peters et al. (2010) *Chem. Geol.* **269,** 180–196; [5] Chakrabarti and Banerjee (2019) *AGU abstract* V51E-0093.