Effects of K-metasomatism on the REE compositions of Precambrian Aravalli paleosols, Northwestern India

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Metamorphosed and metasomatised Precambrian paleosols occur at the base of the Paleoproterozoic Aravalli Supergroup, NW India. These paleosols have developed on granitic, gneissic and amphibolitic parent rocks constituting the 3.3 to 2.5 Ga basement gneissic complex. The paleosols have probably developed between 2.5 and 2.2 Ga. Based on detailed studies, it has been proposed that these rocks have witnessed a complex evolutionary history of metamorphism followed by metasomatism [1].

Rb-Sr isotopic analysis on wholerock and mineral separate samples have been carried out to delineate the timing of alkali metasomatism and to assess its effects on rare earth element (REE) and Th, U elemental compositions. The Rb-Sr isotopic data of paleosol samples yielded an age of 1399±26 Ma with a very high Sr_i of 0.75145±0.00063. The $^{87}Sr/^{86}Sr$ data show a good correlation with 1/Sr values indicating that the observed straight line between Rb-Sr isotope compositions may be a result of mixing. However, the overlying metasomatically altered basaltic rocks also yielded Rb-Sr age of 1397±53 Ma, indicating that the age obtained on paleosols may represent the timing of alkali metasomatism. Several Precambrian paleosols have also yielded Rb-Sr ages younger than their stratigraphic ages emphasizing the usefulness of paleosols as indicators of timing of alkali metasomatism [2].

Importantly, it has been noticed that Th, U and REE contents of the Aravalli paleosols are correlated with $^{87}Sr/^{86}Sr$ ratios indicating that they might have mobilized during alkali metasomatism. However, the Ce and Eu anomalies, which are more important for assessing the redox state of the Precambrian atmosphere appears to have been not correlated with the Sr isotope ratios.

References

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A synthesis of diamond and inclusion trace element studies

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We have performed in-situ trace element analysis of inclusions in diamond and of their diamond host by Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-MS). Impurities in the diamond host are attributed to sub-microscopic quenched melt inclusions which represent a metasomatic melt or a melt produced during mantle metasomatism. The trace element compositions of inclusions often indicate complex histories, this is difficult to reconcile with a syngenetic origin for diamond inclusions; therefore several workers prefer protogenetic growth.

We use partition coefficients to calculate the composition of melt in equilibrium with the crystalline inclusions and compare this to the analysed melt composition. If the inclusions are syngenetic, then the calculated and measured melt composition should lie along a fractionation trend. If the inclusions are protogenetic, then the diamond growth event will be one of a number of geochemical events affecting the included mineral. In either case, this data provides important information about the diamond growth event.

Traverses are used to look for distinct geochemical events and fractionation trends during diamond growth, with reference to the lattice-bound nitrogen concentration and aggregation state. This work forms a link between established inclusion studies and exciting new data from LA-ICP-MS fingerprinting of diamonds by provenance and paragenesis.