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REE enriched Carbonatite from Kamthai area, Barmer district, Rajasthan, India: imprints of a $\delta^{34}S$ depleted mantle source.

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Carbonatite located at Kamthai area, Barmer district of Rajasthan hosts one of the easily minable rare earth element deposits of India. Geologically these carbonatite rocks are intruded into Tertiary alkaline complex formed by the reactivation of Malani Igneous province which was emplaced during late Proterozoic. In Kamthai area, carbonatites occur as plug, sills, dykes and veins within the nephelinite and Ijolite host rock. An ellipsoidal shape carbonatite plug trending E-W, with shades of brown colour have characteristic panther skin texture. It is marked by intermingling of lensoidal patches (cm to mm scale) of leucocratic and melanocratic phases which results in the characteristic panther skin texture. The leucocratic portions are made up of barium carbonate / calcites and melanocratic portions comprised of Fe and or Mn carbonates. Calcites of leucocratic portions are medium grained and modally comprises of ~85 to 95% of total volume. This plug having depth persistence of 30 to 50 meters retaining the same texture.

Next abundant occurrences of carbonatite are marked as veins which are exposed in the north eastern part of the area. Veins occur in radial pattern as well as cluster at places and intruded by later phonolite dykes. Length of the veins varies from few meters to 50 meters width from few mm to 6cm. Mineralogically, in these veins, calcite as well as siderite are the voluminous phase (~90%) with REE minerals. At the south eastern part of the area small dykes of 20 m length and 1 to 1.5 m width displaying elephant skin weathering are present.

EPMA mineralogy shows vein type carbonatite comprised of calcite, strontianite, biotite and bastnasite and Dyke type comprised of calcite, K feldspar, barite, strontianite while panther skinned plug comprised of calcite, leucite, rhodochrosite, amphibole and strontianite in the decreasing order of

abundance in each type. Vein type carbonatite has characteristic bastnasite mineral, dyke type has euxenite where as panther textured type is rich in rhodochrosite and leucite. Strontianite and baryte are common in all the varieties. Cao-MgO-(FeO+MnO) diagram (Fig. 1) shows that carbonatites are either sovite or ferro carbonatite. Panther skin carbonatites are ferro type where as dyke type is sovite type. Vein type carbonatite include both sovite and ferro carbonatites which could be of two different phases. All the phases of carbonatites show trace and REE signature of a similar/ same mantle source with REE abundance varies from 0.63% to 15.09%.

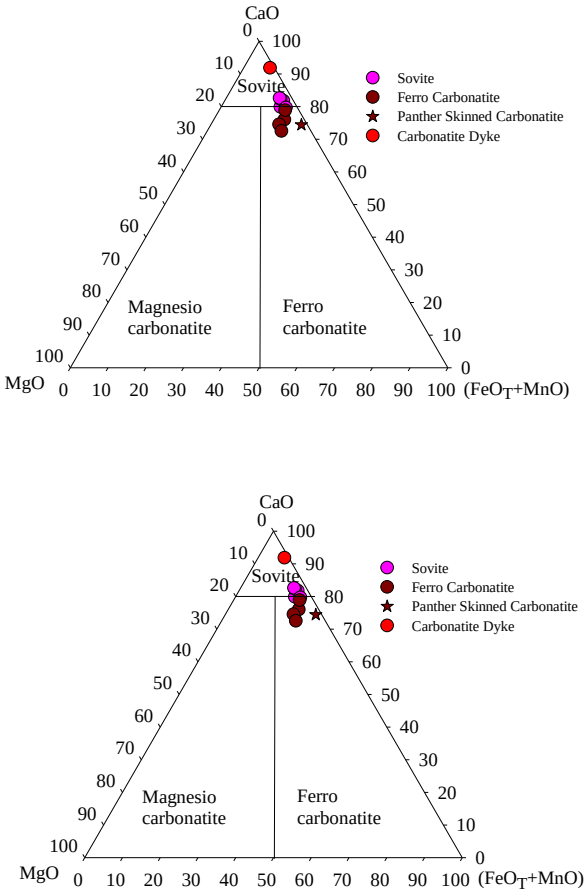

Figure 1. Different varients of carbonatites.

$\delta^{34}S$ values of pure fraction of pyrite separates from the host rock of carbonatites show a narrow range varying from -1.8 ‰ to -7.6 ‰. Out of the 6 sulfide samples analyzed, 5 samples has an average of -6.2 ±0.8 ‰ which are significantly depleted in lighter sulfur isotopes and one sulfide sample has a $\delta^{34}S$ value of -1.8 ± 0.4 ‰ which is

more close to a mantle value of 0 ‰. If the rocks would have undergone any hydrothermal fluid activity it would have significantly enriched the heavier ^{34}S and hence any sort of such activity can be ruled out. It can be further interpreted that the source of sulfur was from a ^{34}S depleted mantle which was heterogeneous at that time.