Carbonatites: Enigmatic Magmatic Rocks, with Special Reference to India – P. Krishnamurthy, Geological Society of India, Bangalore - 560 019 (E: krisvij@gmail.com)

Carbonatites, defined as carbonate-rich rocks of igneous origin, pose considerable challenges in understanding their genesis and evolution. These mantle-derived, rare, magmatic rocks are enigmatic in many facets compared to their associated co-magmatic rocks. These include: (a) The very-low viscous, water-soluble, Na- and K-carbonate (nyererieite and gregoryite respectively)-bearing lavas with low temperature (500-600°C) of eruption with only one active volcano as an example (e.g. Ol Doinyo Lengai, Tanzania) in contrast to the numerous acid and basic lava eruptive centres that are well-known around the world. (b). Carbonatites show very high solubilities of many elements considered rare in silicate magmas, and they have the highest known melt capacities for dissolving water and other volatile species like halogens at crustal pressures. With such 'fluxing and fusing' characters, carbonatite magma, actively reacts and 'fenitises' the country rocks through Na and K metasomatism when they get emplaced. Thus the carbonatite magma loses its Na and K, a feature rare to other magmatic rocks. (c) Primary mineralogy is highly variable from simple carbonate species to a variety of silicate, oxide, phosphate, niobates, rare-earth carbonates and others not found in more common igneous rocks. This feature, unlike other magmatic rocks, influences the variety and size of mineral deposits including the formation of 'super-giant' resources such as Nb (Araxa, Brazil) and rare-earth (Bayan Obo, China). (d) They can be direct partial melts or co-magmatic with a variety of mantle-derived silicate magmas such as nephelinite, melilitite, kimberlite, phonolite, trachyte, basanite, alkali

pyroxenite, ijolite and others from which they can form through liquid-immiscibility or through crystal-liquid differentiation. (e) Carbonatites can also be formed as low-temperature, carbo-thermal residual fluids rich in CO₂, H₂O and fluorine forming calcite-barite-fluorite veins which may lack the higher abundances of some trace elements.

Carbonatites of India, found in some twenty four (24) localities, are associated with a variety of rocks as mentioned above and range in age from late Achaean (e.g. Hogenakal and Khambamettu, Tamil Nadu) to late Cretaceous (e.g. Amba Dongar, Gujarat). These are briefly reviewed with regard to their anomalous features.

Suggested reading:

1. Jones, A.P., Genge, M., and Carmody, L. (2013). Carbonate Melts and Carbonatites. *Rev. Mineral. Geochem.*, v.75, pp.289-322.
2. Krishnamurthy, P. (2017) Carbonatites of India: Part 1. Field relations, petrology, mineralogy and economic aspect. pp. 1-2.
3. Krishnamurthy, P. and Veena Krishna (2017) Carbonatites of India: Part 2. Geochemistry, Stable and Unstable Isotopes and Petrogenesis. pp.26-28. References 2 and 3 in: International Seminar "Carbonatites-alkaline rocks and associated mineral deposits", Amba Dongar, India. December 8-11, 2017. Abstracts. Edits. S.G. Viladkar, Raymond A. Duraiswami and P. Krishna-murthy
4. Mitchell, R. H. (2005). Carbonatites, carbonatites and carbonatites. *Canadian Mineral.*, v.43(6), pp.2049-2068.

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