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Strategic and Critical Element Potential of Indian Carbonatites

Yamuna Singh

Centre for Earth, Ocean and Atmospheric Sciences, University of Hyderabad, Gachibowli, Hyderabad-500046, India
E-mail: yamunasingh2002@yahoo.co.uk

Abstract

There is a growing demand for strategic and critical elements due to their expanding applications in various strategic and high technological fields. A synthesis of strategic and critical element potential of Indian carbonatites is presented. The data reveals that the carbonatites of western India contain substantial resources of these elements. The carbonatite of Amba-Dongar in Gujarat revealed about 25.70 million tonnes of ore containing 3.46 lakh tonnes REO, 19560 tonnes of Nb_2O_5, 6350 tonnes of ThO_2, 14770 tonnes V_2O_5, including anomalously high Mg, Ba and Sr. Another carbonatite complex at Kamthai in Rajasthan contains estimated resource of 7.36 million tonnes ore with average grade of 1.62% REO. Ore also has substantial amounts of Ga, Ge and Sr. In north-east India, estimated resources in Samchampi carbonatite are 300 million tonnes of Ti-hematite ore, 10 million tonnes of apatite ore with average grade of 35% P_2O_5. Additional resources include 10970 tonnes Nb, 3740 tonnes Ta and 3644 tonnes Y. Residual soil associated with Sung Valley carbonatite in Shillong Plateau revealed about 1300 tonnes of Nb_2O_5, contained in 6.75 million tonnes ore, mainly due to radioactive pyrochlore (8.50% ThO_2 and 2.2% U_3O_8). In south India, carbonatites at Pakkanadu-Mulakkadu revealed abundant monazite and some eschynite (24.02% REO), allanite (24.55% REO) and baryte, with promising REE resource-base. Another carbonatite body at Sevattur has indicated estimated resource of 360 tonnes Nb_2O_5, up to a depth of 250m, mostly due to radioactive pyrochlore (29.4% Nb_2O_5; 8.7% U_3O_8; 0.35-1.78% REO), besides about 1.2 million tonnes of vermiculite. About12 million tonnes of apatite ore with 11% of P_2O_5 up to a depth of 30m has been estimated in the Kutni-Beldih tract in Purulia district, West Bengal, eastern India. Apart from being source of P_2O_5, this apatite deposit also revealed notable concentrations of REE, U and Th. Several other carbonatite bodies from various parts of India have analysed elevated contents of strategic and critical elements (SCE). Assessment of SCE potentiality of some carbonatite bodies are under progress. Also, preliminary beneficiation studies have been carried out to extract SCE, especially REE from Amba-Dongar and Kamthai carbonatites. Similar investigations have also been performed earlier for recovery of strategic and critical minerals, namely, pyrochlore, apatite, magnetite, zircon and monazite from residual soils of Sevattur, Sung valley and Samchampi carbonatites. As mineral beneficiation study on carbonatite-based resources is scanty, it is necessary to investigate and develop dependable flow sheets for recovery of SCE from carbonatites of India in cost effective way.

Keywords: Strategic and critical elements, Carbonatites, India.