

Rare-earth Resources of India – Yamuna Singh, Formerly, Atomic Minerals Directorate for Exploration and Research, DAE, Begumpet, Hyderabad - 500 016. (E: yamunasingh2002@yahoo.co.uk)

The rare-earth elements (REE) are a group of 15 elements from La to Lu. Due to their geochemical coherence Y and Sc are also included under this group. They are divided in to two groups: La to Eu as Light REE (LREE) and Gd to Lu as Heavy REE (HREE). Both Y and Sc are clubbed with HREE. In recent time there is a very fast growing demand for REE due to their applications in various advanced technological fields. Rare-earth primary products are mainly used as raw materials for high-purity individual rare-earth chemicals, and in the making of petroleum and environment protection catalysts, misch metal and polishing powders. Specific fields of their applications include metallurgy, permanent magnets, terfenol, magnetic refrigeration, magneto-optic materials, ceramics, electronics, chemical, optical, phosphors, nuclear, hydrogen storage, superconductor. Until a decade ago or so, China was the main supplier of REE. However, after drastic restrictions on REE supply imposed by China, suddenly there is quantum jump in exploration activities world over, including India, to keep a pace with ever growing REEs demand from various quarters. In this respect, the main REE resources identified in India are contained in inland riverine placer deposits, beach placer deposits and carbonatite and alkaline rocks. The first one is mixed resource of both Y-HREE and LREE, whereas the last two form resources mainly for LREE.

Streams draining Chhotanagpur granite gneiss complex (CGGC) terrain in central India contain both LREE and Y-HREE-bearing economic mineral concentrations as inland placers along their courses and banks/flood plains. Potential REE mineral-bearing such placers are known in CGGC terrain along the courses of (a) Deo, Girma, Halwai and Pojenga rivers in Kolebera and Simdega districts of Jharkhand and (b) Siri, Baljora, Champajharia streams in Jashpur district; and Padri, Baghro, Nawadih, Bhairapur, Goga, Sukhnaiya and Dumhat rivers in Balrampur and Sarguja districts of Chhattisgarh. Additionally, moderate to minor REE resources occur in other parts of the country: (i) Granitic soils of Darba area, Bastar district, Chhattisgarh; (ii) Stream sediments along Vasava and Ujol rivers in Baroda district and Joz river in Panchmahal district (Gujarat) in the environs of Erinpura-Godhra granite; (iii) Stream sediments near Dharmawaram area in Karimnagar district and Pathapalem area, Mehbubnagar district, Telangana; (iv) Soils in the vicinity of Tonnur-Pandavpura granitic bodies, Mandya and Hassan districts, Karnataka; (v) Soils in Rangampetta (South Arcot district) and Kulampatti (Salem district), Tamil Nadu; (vi) Sands along the banks of Kameng river,

East Kameng district, Arunachal Pradesh; (vii) Residual soil in Kanyaluka area, along Singhbhum shear zone, Jharkhand. Apart from these resources, Per-alkaline granites, rhyolites, microgranites and tuffs of Siwana ring complex in Rajasthan hold potentials as primary resource for REE. Additionally, apatite-magnetite veins occurring within pegmatites in Kasipatnam area, Visakhapatnam district, A.P. have recorded attractive REE concentrations.

Several decades of exploration has proved substantial reserves of LREE contained in monazite and other associated minerals in the beach sands of Kerala, Tamil Nadu, Odisha and Andhra Pradesh. Some of these deposits, namely, Chavara in Kerala, Manavalakurichi in Tamil Nadu and Chhatrapur in Odisha, are being mined by IREL, a public sector undertaking of DAE, for REE since last few decades. About 12 million tonne of monazite resource is estimated along the coasts of India.

Carbonatites and alkaline rocks are receiving focussed sustained attention for LREE resources. In western India two carbonatite complexes, which hold large potentials for LREE resources are Ambadongar (Gujarat) Kamthai (Rajasthan). The estimated resource of Ambadongar carbonatite is more than 12 million tonne, at an average grade of 1.16%, whereas the estimated REE resource of Kamthai deposit is 7.36 million tonne, with average grade of 1.62% REO. Pakkanadu carbonatite in Tamil Nadu is also emerging as a promising REE resource-base. About 41.88 million tonne of REE resource has been established in in-situ residual soils of the Samchampi carbonatite complex in Shillong, Meghalaya. Equally potential for REE resources may be weathered phosphatic rocks derived from carbonatites of Beldi-Kutni area, West Bengal. Other carbonatite bodies like Sung Valley in NE India; and Sevattur, Samalpatti, Jokkipalli, Khamambettu, etc., in southern India also appear to hold promise for limited REE resources.

New emerging domains for seeking REE resources in India are from ion adsorption clays, quartz pebble conglomerate (QPC), iron oxide breccia complex, phosphorite, coal ash, laterite, red mud, tin slags, phosphate ore, tailings from Pb-Zn-Cu ore, blast furnace slag of steel plants, electronic waste, etc. Initial results appear encouraging in certain cases. Sustained efforts in evaluating possibility of recovering REE from such domains may prove rewarding in long run. Discovery of large REE resources, especially Y, Dy, Eu and Tb in off the Coast of Japan inspires confidence in finding similar REE resources in sea floor of Pacific Ocean and 90°E ridge zone for possible sea bed mining in India.

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