REE-minerals of Tomtor complex

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The Tomtor complex of ultramafic rocks and carbonatite stores a unique deposit of Nb-REE mineralization [1]. The ores occur in three beds (Severny, Yuzhny, and Buranny) which lie over weathered carbonatite. The reported research led to the inference that the rich Tomtor ores were deposited in a shallow thermal lake as a result of hydrothermal-sedimentation and/or volcanic-hydrothermal-sedimentation processes, with mediation of thermophilic microbial communities [1]. The REE contents are also high in rare-metal carbonatite and in diverse lithologies of the weathering profile. Main REE mineral phases in the rocks and ores are: F-crabonates (bastnesite-(Ce), parisite-(Ce), kukharentkoite-(Ce)) and phosphates (monazite-Ce), xenotyme, and crandallite-group minerals (up to 10% REE) [1]). REE are also presnet as impurities in apatite, zircone, and pyrochlore.

Carbonatite, syenite, K-altered and fluorite-bearing rocks contain REE F-carbonates (bastnesite or parisite, or both), unlike the weathering profile and layered siderite. LREE are strongly predominant in rocks that bear REE F-carbonates.

Monazite is of rare occurrence in carbonatite but is a main REE-mineral in thin-layered ores and in weathering profile rocks. Monazite in the thin-layered ores occurs as monazite-halluasite (50 nm particles making a dense layer over 800—3000 halluasite pipes), acicular and platy, and exotic biomorphic aggregates [1]. Monazite in the weathering profiles exists as submicron crystals. La-Ce-Nd have different relative contents in REE phosphates of different morphological types. The Ce-La-Nd diagram shows a trend of variable Ce contents at a similar La-Nd proportion. The compositional heterogeneity shows up as positive Ce anomalies in chondrite-normalized REE spectra. Judging by the obtained data, Nb-REE thin-layered ores formed in unstable, contrasting, and changeable Eh-pH conditions.

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