

Biomorphic structure of rich ores at the Tomtor REE deposit

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The Tomtor Paleozoic complex of ultramafic alkaline and carbonate rocks covers about 250 km² in northern Yakutia (Russia). It has a zoned structure with a carbonatitic core surrounded by ultramafite and foidolite and an alkaline-nepheline syenite periphery [1, 2, 3]. All rocks are weathered, the weathering profile upon P-REE carbonatite being the thickest and consisting of four layers: kaolinite-crandallite, siderite, goetite, and francolite (from top to bottom) [3]. Mineralization is the highest in redeposited and altered thinly bedded aphanitic kaolinite-crandallite ores, of slope-wash-lacustrine origin, with chemogenic phosphate [3] and Nb, Y, Sc, and REE enrichment. The richest ores are natural concentrates of Nb (up to 24%) and REE (to 39%) [1, 2, 3].

Monazite, pyrochlore, and crandallite-group minerals (goyazite, georceixite, and florencite) are main opaque phases in the rich ores. Pyrochlore occurs as euhedral cracked grains of sodic compositions, with Sr-Ba substitutions. Fine colloform aggregates of crandallite minerals make up the groundmass. Monazite exists as aggregates of 800-1200 nm long tubes, 300 nm in diameter, which perfectly correspond to pseudomorphs coating bacterial cells (monazite sheaths). Lanthanum phosphate precipitation on *Pseudomonas aeruginosa* cells was reported from experiments [4, 5].

Thus the high mineralization at Tomtor may be due to microbially mediated alteration of eluvium. Microbial fossils in the Tomtor ores were reported earlier [6] but no further study ever followed for the lack of solid proof. Prolific accumulation of monazite was possible in water of a persistent hot spring where hydrothermalism maintained a microbial community that concentrated trace elements.

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Understanding biogeochemical transformation and mobilization of Hg From river bank soils: South River, Virginia

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Between 1929 and 1950, mercury (Hg) was extensively used by the DuPont plant in the production of rayon acetate fiber in Waynesboro, VA and released into the South River. The contamination of Hg was discovered in the 1970s and remains elevated in water, soil, sediments, and biota.

The major objective of this study is to investigate Hg dynamics within the floodplain soils at South River Mile 3.5. Our over-arching hypothesis is to test if leaching of bank soils is a significant source of dissolved or colloidal inorganic Hg (IHg). The hypotheses on Hg loading mechanism include: (1) bank soil inundation is due to horizontal flow through a highly transmissive gravel zone at the base of the bank, vertical drainage of precipitation, and upgradient groundwater flow; (2) drainage occurs mainly through gravel zone wetting an organic rich soil; (3) hydraulics facilitate the downward or upward movement of the capillary fringe affecting soil redox potential, mineral dissolution, and leaching of IHg into dissolved/colloidal phases that are either directly transported to the river or methylated within the saturated zone of the bank and subsequently released.

This investigation will demonstrate preliminary data from a number of state-of-the-art in-situ monitoring sensors, such as custom-designed redox probes, soil moisture and temperature probes, pressure transducers installed at the site; and soil and pore-water chemistry. The sensors are used to characterize geochemical gradients and how they change over time, and to enable targeted sampling at Hg loading hot spots.