

# Sm-Nd and REE Characteristics of Tourmaline and Scheelite from the Björkdal Gold Deposit, Northern Sweden: Evidence of an Intrusion-Related Gold Deposit?

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## Abstract

The Björkdal quartz vein-hosted gold deposit is located ~25 km northwest of Skellefte in northern Sweden, within a Paleoproterozoic volcanosedimentary sequence at the margin of a quartz-monzodiorite granitoid. Northeast-trending (030°–050°) quartz veins from the eastern open pit within the Björkdal deposit contain quartz, scheelite, tourmaline, calcite, and sulfides, with visible gold. Vein quartz shows undulatory extinction and sutured margins or is polycrystalline in form, features which suggest postcrystallization deformation. Coarse scheelite crystals (>5 mm) within the quartz veins are crosscut by thin veins of quartz, calcite, sulfides, and gold. The calcite in these crosscutting fractures is variably replaced by biotite or actinolite. Tourmaline from the quartz veins has low total REE contents (<1 × chondrite) and LREE-enriched patterns [(La/Sm)<sub>N</sub> = 2.8–4.5, (La/Yb)<sub>N</sub> = 1.8–5.1] with strong positive Eu anomalies (Eu/Eu<sup>o</sup> = 3.9–17.4). In contrast, the scheelite has a bell-shaped REE pattern, enriched in MREE, but also with positive Eu anomalies (Eu/Eu<sup>o</sup> = 1.4–2.4). The REE pattern of scheelite results from a strong crystallographic effect, largely due to the size of the Ca site and charge balance. Sm-Nd dating of scheelite from the Björkdal ore yields an age of 1893 ± 34 Ma, which coincides with a previously suggested age of the host intrusion. The ε<sub>Nd</sub> values of the scheelite (+1.8) and <sup>87</sup>Sr/<sup>86</sup>Sr initial ratios of the tourmaline (0.7013–0.7014) are also consistent with derivation of REE and Sr in these minerals from the Jörn granitoids. Overall, the petrographic, geochemical, and isotopic data strongly suggest that Björkdal is an intrusion-related gold deposit, and that there is no requirement for involvement of external post-magmatic hydrothermal fluids.

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