

The Nunasvaara graphite deposit, northern Sweden: New geochemical and U-Pb zircon age results for the host greenstones.

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The Nunasvaara graphite deposit, located in north-central Norrbotten, represents the largest known metamorphic graphite occurrence in Sweden (JORC indicated resource¹: c. 5.6 Mt, 24.6% C_g, 10% cut-off). Mineralization consists of disseminated to massive c. < 0.1mm graphite, within a schist horizon that forms part of a relatively conformable, polydeformed Paleoproterozoic greenstone succession (basalts, tuffs, doleritic sills, intercalated sedimentary rocks). We present new lithogeochemical, Sm-Nd isotope and U-Pb SIMS zircon results from the Nunasvaara area that provide new petrogenetic insights into this graphite-bearing greenstone sequence.

In general, least altered basalts and doleritic sills have sub-alkaline, high-Fe tholeiite signatures, with flat to mildly LREE-enriched, chondrite-normalized REE patterns (La/Yb_N = 1.0 to 3.9 and 1.4 to 4.1, respectively). Tuffaceous rocks have tholeiitic basalt to basaltic andesite compositions and similar REE systematics. U-Pb SIMS zircon dating of a doleritic sill intruding footwall metasedimentary rocks has yielded a precise igneous age of 2144 ± 5 Ma (2σ , $n = 10$). This date constrains the timing of mafic magmatism and provides a minimum age for the deposition of volcanoclastic and sedimentary material. Whole-rock $\epsilon\text{Nd}_{(2.14 \text{ Ga})}$ values range from +1.4 to +4.0 for basalt (± 0.4 ϵ -units; $n = 4$), +0.5 to +3.8 for dolerite ($n = 3$), and +2.3 to +2.9 for the basaltic tuffs ($n = 3$). These data fall close to the depleted mantle evolution curve and are characteristic of ‘juvenile’ magmatism with a relatively short crustal residence time.

The geological and geochemical features of the Nunasvaara greenstones indicate a tholeiitic magmatic event with intermittent sedimentation at c. 2.14 Ga. The positive $\epsilon\text{Nd}_{(2.14 \text{ Ga})}$ values suggest mafic magmas were derived from a sub-continental source region, with little contribution from the Archean Norrbotten craton (i.e., typically negative ϵNd character by c. 2.14 Ga). Subsequent metamorphism, including graphitization of carbonaceous sediment, is attributed to Svecokarelian-cycle tectonothermal events.

¹Talga Resources Ltd, 2012