

U-Pb dating of garnet, monazite and apatite applied to understanding the polymetamorphic evolution of the Peräpohja and Kuusamo Belts, northern Finland

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The Paleoproterozoic (2.4 -1.9 Ga) Peräpohja and Kuusamo Belts of northern Finland host strategically important mineral deposits including orogenic Au-Co, and were metamorphosed at amphibolite to granulite facies during the Svecofennian orogeny (1.92-1.77 Ga). The Svecofennian is a long-lived (ca. 150 Ma) orogen which has been proposed to have five tectonic events. A compilation of monazite data from the whole of Finland presents age peaks at ca. 1880 Ma and ca. 1790 Ma which have been proposed to represent the D2 and D5 events. However, the relationship between these ages and the various metamorphic events recorded by the Peräpohja and Kuusamo Belts is unclear.

The northern Peräpohja Belt rocks preserve an earlier high-grade event (9-10 kbar and 700 °C), related to D1 thrust stacking, with a low P, high T overprint. Whereas the southern Peräpohja Belt rocks apparently record only a low-P, high-T event (3 kbar and 700 °C). Monazite and garnet from the northern Peräpohja Belt present ages of 1890-1880 and ca. 1860 Ma respectively, and apatite records an age of ca. 1790 Ma. In the southern Peräpohja Belt, garnet preserves an age of 1870 Ma and monazite is ca. 1790 Ma.

In the Kuusamo Belt, the rocks seem to record only one metamorphic event with peak conditions of 7 kbar and 650 °C. Monazite and apatite record ages of 1790-1760 and 1795 Ma respectively, whereas garnet records an age of ca. 1890 Ma, suggesting these rocks are actually polymetamorphic.

We interpret that the high-grade event recorded in the Peräpohja Belt occurred at 1890 Ma, and likely also affected the rocks of the Kuusamo Belt, resulting in garnet growth. The low-grade event recorded by the Peräpohja Belt, and the metamorphism recorded in the Kuusamo Belt relate to a large post-orogenic fluid infiltration event at ca. 1790 Ma, which resulted in dissolution-reprecipitation of monazite and resetting of apatite. This fluid event is likely related to deposition/reworking of Au-Co deposits hosted in the Peräpohja and Kuusamo Belts.