Interaction between Svecofennian crust and rapakivi granites along the SW margin of the Wiborg Batholith, southern Finland

Krister Sundblad[a], Bence Balogh[b], Evgenia Salin[c,d], Kjell Billström[d] and Jüri Plado[e]

[a]Pernå Research Center, Veturimiehenkatu 5, Turku, Finland, sundblad.krister@gmail.com; [b]Pernå Research Center, Veturimiehenkatu 5, Turku, Finland, benceb@gmail.com; [c]Department of Geology and Mineralogy, Åbo Akademi University, Turku, Finland, evgenia.salin@gmail.com; [d]Department of Geological Sciences, Swedish Museum of Natural History, Stockholm, Sweden, kjell.billstrom@nrm.se; [e]Department of Geology, University of Tartu, Tartu, Estonia, juri.plado@ut.ee

The Wiborg Batholith is an anorthosite-gabbro-granite rapakivi complex that was emplaced into 1.89-1.91 Ga metamorphosed Svecofennian crust in an extensional tectonic regime. The igneous activity started with the emplacement of the 1640 Ma Häme dykes (Luttinen et al. 2022) and was followed by two granitic pulses (Vaasjoki et al., 1991), which are represented by 1635-1628 Ma zircons in alkali feldspar mega-crysts and c. 1628 Ma zircons in the granitic groundmass (Heinonen et al., 2017). Indium-bearing magnetite-sphalerite bodies occur at Pahasaari in the 1633 ± 5 Ma Verla granite in the NW margin of the batholith, but even more significant indium-rich polymetallic mineralization occur at Sarvlaxviken, in the SW margin of the batholith (Cook et al., 2011).

This study is based on comprehensive remapping, geochemical characterization, and U-Pb dating of the granites along the SW margin of the Wiborg Batholith. Sm-Nd isotope work and paleomagnetic studies are also underway. At present, we have identified an igneous geochemical evolution trend, from the 1628.2 ± 2.4 Ma primitive wiborgite (host to In-rich veins) to the evolved 1625.2 ± 2.4 Ma Mo-Be-Cu-As-Sn-bearing Marviken granite and 1625.3 ± 1.7 Ma Saltkilen granite dykes, the latter thus representing the last igneous expressions in the Wiborg Batholith and is considered to be the engine for the hydrothermal activity responsible for the polymetallic veins in the Sarvlaxviken area.

Our research has also revealed significant intriguing interactions between the rapakivi granites and the Svecofennian crust. Numerous Svecofennian fragments, ranging in size from < 1 mm^3 xenocrysts to > 100 km^3 xenoliths, occur in the batholith margin. The 1629.6 ± 4.6 Ma Stormossen granite hosts significant amounts of 1877.1 ± 6.2 Ma (Svecofennian) and 1804 ± 7.5 Ma (Late Svecofennian) zircon xenocrysts as well as abundant 10 x 50 m large fragments of Svecofennian granitoids and amphibolites, providing clear evidence for extensive assimilation of older crust into the Stormossen magma.

The Högbergsträsket mega-xenolith is even more spectacular. It is a 32 km^2 big, kidney-shaped body, equally shared between 1870-1907 Ma (Svecofennian) and 1636 Ma rapakivi components. This mega-xenolith descended and rotated c. 30-40° northwards, along an ENE-trending axis, into a later (1628 Ma) pulse of the rapakivi magma. In this way, a profile can now be studied, from the lower levels of the ancient magma chamber (1636 Ma wiborgites), via the Eskodalen granite into the highest levels; ignimbritic volcanic rocks with an ongonitic geochemical signature. The Eskodalen granite hosts several In-bearing magnetite-sphalerite bodies which show a NS-trending zonation with magnetite stringers at lower levels (at Bockmossen) and an increasing Zn- and In-rich hydrothermal overprint (at Getmossmalmen), close to the overlying ignimbritic volcanic rocks. This peculiar ore type bears a correlation with the Pahasaari magnetite-sphalerite bodies in the 1633 Ma Verla granite.

References

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