Tectonomagmatic evolution of the Sveconorwegian orogen recorded in the chemical and isotopic composition of 1070–920 Ma granites

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The Sveconorwegian province, SW Scandinavia, formed as a result of accretionary processes along the SW margin of Fennoscandia, between ca. 1140 and 920 Ma. The province contains suites of 1070–920 Ma felsic magmatic rocks that formed at the active, Sveconorwegian margin. Emplacement of the 1060–1020 Ma, magnesian Sirdal Magmatic Belt (SMB) in the core of the Sveconorwegian active margin, was followed (990–920 Ma) by intrusion of ferroan hornblende-biotite granites (HBG) also in this core (HBGc) and closer to the orogenic foreland (HBGf).

SMB granites have a mean A/CNK ratio of 1, a mean zircon saturation temperature (T_{Zr}) of 815°C, and εNd(t) between -1 and 1. HBGc granites have a mean A/CNK ratio of 0.9, a mean T_{Zr} of 851°C, and εNd(t) between -4 and 0. HBGf granites, closer to the foreland, are weakly peraluminous with A/CNK >1, have high U+Th contents, a mean T_{Zr} of 783°C, and εNd(t) ranging from -4 to -8.

The chemical and isotopic data suggest an increasing involvement of evolved continental crust during orogenic evolution, and towards the orogenic foreland. The change towards more evolved compositions coincides with westward-directed subduction of the Fennoscandian foreland, beneath the orogen, as indicated by ca. 980 Ma eclogite-facies metamorphism. The introduction of Palaeoproterozoic Fennoscandian crust appears to have modified the isotopic composition of the mantle wedge, and may even have melted to give rise to the HBGf, located immediately above the downgoing slab. The high magmatic temperatures recorded by the HBGc are consistent with melting of a fairly refractory source, such as that left behind after extraction of the SMB melts, with the necessary heat derived from asthenospheric melts during extension of the entire orogen.

Despite highly evolved compositions, this study shows that granites can be excellent recorders of changes in source(s) and melting processes, which in turn reflect evolving tectonic regimes.