



The origin and fate of eclogite-facies rocks in the SW Scandinavian Caledonides: a U-Pb and Rb-Sr study

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Most large-scale deformational and metamorphic features in the Scandinavian Caledonides occurred during Scandian times (430-395 Ma), which involved the collision between the proto-continents Laurentia and Baltica and the deep (ca. 200 km) subduction of the Baltoscandian margin. In spite of this pervasive regional metamorphism, some crustal fragments in the orogen retain an intriguing geochronological record of short-lived subduction-exhumation cycles from earlier stages of the Caledonian Wilson Cycle. One such terrane fragment is the Jæren nappe, SW Norway, which contains ca. 470-Ma eclogites. Because terrane correlations are ambiguous and not supported by geochronological evidence, the geological significance of these eclogites remains unclear. To further unravel the history of these rocks, U-Pb zircon and Rb-Sr mica geochronology were applied to their paragneiss host rocks.

In each of the studied samples, some zircon analyses provided concordant or slightly discordant Caledonian ages, providing a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 469 ± 6 Ma (2σ). This age group, representing newly-formed rims and recrystallized patches of older zircon, is identical to the HP age of the eclogites as recorded by Lu-Hf geochronology (471 ± 1 Ma, [1]). This observation is interpreted to document that the eclogite protoliths and their host rocks underwent HP together as a coherent unit. The majority of U-Pb zircon analyses provided detrital age populations around 0.61, 0.92, 1.0-1.4 and 1.6-1.9 Ga. In addition, some zircon grains yielded Archaean ages (< 3.2 Ga). Such a detrital component occurs in sediments of a tectonically-overlying volcano-sedimentary complex and has been attributed to palaeogeographically proximal Laurentic source areas in the British Isles [2]. The euhedral, acicular morphology of the studied grains, their high degree of metamictization, and their large grain size (> 0.3 mm) favor such a nearby source over the distal Archaean terranes of Baltica. This illustrates the exotic nature of the Jæren nappe in relation to its current geological setting.

Geothermobarometry [3] showed that the eclogites and paragneisses underwent near-adiabatic exhumation from ca. 90 to 25 km depth at ca. 700 °C, followed by supra-Barrovian overprinting, and steady cooling along a 'hot' geotherm (ca. 30 °C/km). Our Rb-Sr dating of phengite, phlogopite, and biotite revealed mostly early Scandian apparent ages (ca. 420 Ma). The results of this study suggest that the Jæren nappe represents a crustal fragment that was subducted in a region that was distal to Baltica. The eclogite-paragneiss association was rapidly exhumed through the subduction channel before stalling at the base of the crust where it was thermally overprinted. Subsequent tectonic transport over great distance and obduction onto the Baltic hinterland was completed at the onset of Scandian continental collision and subduction.

References: [1] Smit et al. (2008) *J Metam Geol* 26: 959-979; [2] Pedersen et al. (1992) *Terra Nova* 4: 217-222; [3] Smit et al. (2010) *Contrib Mineral Petrol*: DOI: 10.1007/s00410-009-0440-3.