

The Friningen Garnet Peridotite (central Sweden): a good example of the characteristic *PTt* path of a cold mantle wedge garnet peridotite

Mattia Gilio and Herman L.M. van Roermund

Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands. m.gilio@students.uu.nl

Orogenic peridotites from the Seve Nappe Complex (SNC), central Scandinavian Caledonides, were traditionally interpreted as fragments of sub-oceanic, lapetus-related, lithosphere, incorporated into the Scandian nappe pile during the Caledonian orogeny. This interpretation was first challenged by Van Roermund (1989) who described for the first time the occurrence of garnet-bearing peridotites from an area around lake Friningen, northern Jämtland, central Sweden. Here the ultramafic bodies consist dominantly of garnet-dunite, -harzburgite and -lherzolite, with minor internal eclogite- and/or garnet pyroxenite layers/dikes. In one of these bodies, called the Friningen Garnet Peridotite (FGP), evidence was found of an Archean to mid Proterozoic origin for the M1 mineral assemblage as well as an early Caledonian (≈ 454 Ma) age for a second (M2) HP mineral assemblage (Brueckner et al., 2004). More recently, evidence for UHPM conditions was found in the M2 mineral assemblage of the internal eclogite/garnet pyroxenite dike (Janák et al., 2012). However, in all studies reported above the characteristic Pre-Caledonian metamorphic conditions of the FGP were not determined adequately. This concerns the topic of the present work. Pre-Caledonian HP-HT metamorphic conditions of $1100\pm 50^\circ\text{C}$ and $P > 1.7$ GPa are now determined for the early M1a assemblage (ol+opx+cpx+high-Cr grt). These physical conditions were followed by an inferred early Caledonian exhumation event down to $750\text{-}900^\circ\text{C}$ and $1.0\text{-}1.5$ GPa (M1b). The early-Caledonian UHPM evidence (M2; 800°C - $P=3.0$ GPa), discovered within an eclogitic dyke, is mainly displayed in the FGP by low-Cr M2 grt replacing the M1b assemblage. The phase of isothermal decompression (M3a; 800°C - 1.0 GPa) described in the eclogitic dyke has not been recognized in the mineral assemblage of the FGP. However, M2 mineral compositions of most grt₂, opx₂ and cpx₂ indicate a strong metamorphic overprint at $T=600^\circ\text{C}$ and $P=1.0$ GPa (M3b). We also report here the finding of the stable mineral assemblage dolomite+grt+ky+zr±phg in the eclogitic dyke and of Sr-bearing carbonates in multiphase solid inclusions within M1a opx, cpx and ol. These inclusions are evidence for an early Caledonian subduction zone fluid infiltration event. The FGP can thus be interpreted as a mantle wedge garnet peridotite that originates from a cold and thick lithospheric mantle wedge, incorporated into the subducting continental crust (SNC) during “early Caledonian” subduction. Absolute timing of the M1b assemblage is uncertain but interpreted to be related to lapetus formation. The *PTt* path of the FGP gives important information about the role of the SNC during early Caledonian and Scandian collisions between Baltica and Laurentia (Gee et al, 2013).

References

- Brueckner H.K., Van Roermund H.L.M., Pearson N. (2004). An Archean to Paleozoic evolution for a garnet peridotite lens with sub-Baltic Shield affinity within the Seve Nappe Complex of Jämtland, Sweden, Central Scandinavian Caledonides. *Journal of Petrology* 45, 415-437.
- Gee D., Janák M., Majka J., Robinson P., Van Roermund H.L.M. (2013). Subduction along and within the Baltoscandian margin during closing of the lapetus Ocean and Baltica-Laurentia collision. *Lithosphere* 5, 169-178.
- Janák M., Van Roermund H.L.M., Majka J., Gee D. (2012). UHP metamorphism recorded by kyanite-bearing eclogite in the Seve Nappe Complex of northern Jämtland, Swedish Caledonides. *Gondwana Res.* 23, 865-879.
- Van Roermund H.L.M. (1989). High-pressure ultramafic rocks from the allochthonous nappes of the Swedish Caledonides metamorphism. In: Grayer, R.A. (Ed.), *The Caledonide Geology of Scandinavia*. Graham and Trotman, Norwell, Massachusetts, 205-219.