NORTHEASTWARD EXPANSION OF THE NORTHERN ULTRA-HIGH PRESSURE (UHP) DOMAIN, WESTERN GNEISS REGION, NORWAY; EVIDENCE FROM A Fe-Ti GARNET PERIDOTITE/WEBSTERITE BODY

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To date ultrahigh-pressure (UHP) metamorphic rocks in the Scandinavian Caledonides are recorded in three domains within the Western Gneiss Region of Norway: Stadlandet-Nordfjord, Hareidland-Runde (ROOT et al., 2005) and Nordøyane-Otrøy (TERRY et al 2000; VAN ROERMUND et al. 2002; CARSWELL & VAN ROERMUND, 2003). Here we present field, mineral-chemical, microstructural and isotopic evidence that the northern UHP domain extends northeastwards to as far as Tornes on the mainland. An excellent preserved 1300 m^2 Fe-Ti type peridotite/websterite body at Svartberget lies along strike with similar occurrences between Raknestangen and Kolmannskog, thought to be of lower crustal origin (CARSWELL et al., 1983). The body comprises diopsidic clinopyroxene (Cpx) ($Wo_{47}En_{48}Fs_5$, Jd_{1-2}), orthopyroxene (Opx) (En_{84-86}, Al_2O_3 ~ 0.50 %), garnet (Grt) ($Pyr_{56}Alm_{29}Gross_{13}$) and olivine (5-20 % Fo_{83}). The main websterite body is cut by a network of coarse-grained (up to 20 cm) garnet-pyroxenite and garnetite veins consisting of unzoned diopsidic Cpx ($Wo_{46}En_{46}Fs_8$, Jd_4), Opx (En_{81-82}, Al_2O_3 ~ 0.16%), Grt ($Pyr_{50-52}Alm_{35}Gross_{11-13}$) and phlogopitic biotite (Phl_{85}). P-T estimates based on the Opx-Grt barometer of BREY & KÖHLER (1990) in combination with the Grt-Cpx thermometer of POWELL (1985) yield 2.6 GPa at 670 °C for the main body. Veins yield 6.4 GPa at 950 °C. Preservation of the markedly higher P-T conditions in the veins is considered to be due to the much larger grain size in the veins allowing lower Al_2O_3 values in Opx to be preserved.

Grt and Cpx in the veins contain multi-phase solid-inclusion assemblages of carbon, magnesite, dolomite, monazite, apatite, xenotime, titanite, pyrite, chalcopyrite, pentlandite, galena, Fe-oxides, orthite, gypsum, Ba-sulphates (+ Sr), Ca-sulphate (+ Sr), (unknown) W-, Al- and Al-Cl-silicates, Al-Fe-Mg-oxides, opx, cpx and grt. A micro-Raman spectroscopic study of the carbon is underway to verify the presence of micro-diamond.

Sm-Nd grt-cpx ages are 393 ± 3 Ma for the main body and 381 ± 6 Ma for the vein assemblage. ε_{Ndi} values are -3.5 and -8.5 respectively and indicate that the body was separated from the depleted mantle significantly before Scandian metamorphism. Sr-Nd systematics indicate that vein formation was concomitant with addition of crustal derived fluids. Together these data provide evidence of subduction of lower crustal rocks to ~200 kilometers depth with modification by C-O-H-rich crustal derived fluids (and diamond formation?).

References

BREY, G.P. & KÖHLER, T (1990): Journal of Petrology, 31, 1353-1378.
CARSWELL, D.A., HARVEY, M.A. & AL-SAMMAN, A. (1983): Bull. Minéral., 106, 727-750.
CARSWELL, D.A. & VAN ROERMUND, H.L.M. (2003): NGU Report 2003.057, 117-123.
POWELL, R. (1985): J. Metamorphic Geology, 3, 231-243.
ROOT, D.B. (2005): J. Metamorphic Geology 23, 45-61.
TERRY, M. P., ROBINSON, P & KROGH RAVNA, E.J. (2000): Am. Mineralogist, 85, 1637-1650.
VAN ROERMUND, H.L., CARSWELL, D.A., DRURY, M. & HEIJBOER, T. (2002): Geology, 30, 959-962.