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Discovery of microdiamond in the Åreskutan Nappe of the Seve Nappe Complex, overlying the COSC-1 drillhole

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The Seve Nappe Complex (SNC) crops out for about 800 km along the Scandian mountain belt in northwestern Sweden. In the central Scandes of Jämtland and Tröndelag, the SNC has been mapped 200 km westards into the hinterland, via the Tömmerås and Trollheimen antiforms into the northern parts of the Western Gneiss Region. The Complex is dominated by psammitic metasediments and amphibolites derived from dolerites, basalts and gabbros (locally ultramafites) comprising an outer continental margin assemblage, inferred to represent the Cryogenian-Ediacaran, extended outer margin of Baltica. Although most of the SNC is in amphibolite facies, eclogites and garnet peridotites are locally preserved both in Sweden and farther west in Trollheimen. More pelitic metasediments occur at higher levels in the Complex and the high grade metamorphism is usually accompanied by partial melting and leucogranites. Isotope dating indicates that HP/UHP metamorphism is of mostly of Ordovician age and related to continent-arc subduction during closure of the Iapetus Ocean.

In recent years, closer investigation of the high grade metamorphism has led not only to the identification of UHP assemblages in the eclogites and garnet peridotites (Janák et al. 2013, Klonowska et al. 2014), but also that the host paragneisses contain clear evidence of subduction (Majka et al. 2014), with microdiamond inclusions in garnet. Most recently on Åreskutan (Klonowska et al., this volume), on the mountain top above the COSC-1 drillhole, diamond-bearing gneisses have been found. Garnets in Åreskutan gneisses are characterized by inclusion-rich cores. Graphite, carbonates, quartz and CO_2-fluid inclusions together with diamonds and moissanite are concentrated in swarms. Garnets are homogeneous, almandine-rich (Alm65–68Prp26-33Grs3-5Sps2-3). However, the highest grossular content is observed in garnet cores (5mol.%). Phengite is characterized by Si content of 3.19-3.47 apfu. Thermodynamic modelling indicates peak pressure conditions within diamond stability field.

To identify diamond and moissanite we used micro-Raman spectroscopy technique. Diamonds range in size from 1μm to 3μm, moissanite grain is 3μm across. Raman peaks assigned to microdiamond vary between 1330 and 1332 cm^{-1}. Additional Raman peaks near 1350, 1580 and 1600 cm^{-1} show partial transformation of diamond to graphite. Moissanite, the natural form of SiC, exhibits negative crystal shape. Raman peaks assigned to moissanite occur at 969, 799, 783 and 777 cm^{-1}. SEM images show the direct contact of both minerals with garnet.

The COSC-1 drillhole, in the footwall of the Åreskutan Nappe, penetrating 2.5 km of the poorly exposed lower parts of the SNC, is known to have a complex Ordovician tectonothermal history, with leucogranites of similar age to those in the Åreskutan Nappe (440 Ma) and also substantially older (470 Ma). No evidence of HP metamorphism has yet been reported. COSC investigations are expected to throw new light on the emplacement of subduction complexes onto adjacent continental platforms.

Janák et al. 2013. Gondwana Research, 23, 865-879. Klonowska et al. 2014. Geophysical Research Abstracts, Vol. 16, EGU2014-6440-2. Li et al. 2014. 31st Nordic Geological Winter Meeting, Sweden, 2014, Abstract Volume, p. 116, available online. Majka et al. 2014. Geology, 42, 1107-1110.