# Metamorphic process of the Tromso Nappe in the Scandinavian Caledonides based on P-T-t history of felsic gneiss

*Yasuhiro Monta[1], Takao Hirajima[1], Ryosuke Kato[2], Yasuhito Osanai[2], Nobuhiko Nakano[2], Tatsuro Adachi[2], Shuhei Sakata[3], Jaroslaw Majka[4], Marian Janak[5]

1. Kyoto University, 2. Kyushu University, 3. Gakushuin University, 4. Uppsala University, 5. Slovak Academy of Science

Zircon grains have a potential to retain UHP minerals as inclusions, such as Coe and Jd, from the later stage overprint (e.g., Tabata et al., 1998). Therefore, the comprehensive study on Zrn is a potential tool to determine the exact spatial distribution and the formation timing of UHP belt. The Scandinavian Caledonides formed by continental collision between Laurentia and Baltica during the Ordovician to the Devonian, and are composed of a stack of several nappes. The Tromsø Nappe is traditionally ascribed to the Uppermost Allochthon (i.e., the uppermost tectonostratigraphic unit in the Caledonian nappe stack), containing abundant eclogites and ultramafic rocks within the host felsic gneisses, schists, marbles and calcsilicate rocks. UHPM conditions were reported from eclogites at two localities (Tonsvika and Tromsdalstind) as well as Dia-bearing gneiss hosting UHP eclogite at Tonsvika (e.g., Ravna & Roux, 2006; Janák et al., 2013). However, the country rocks hosting eclogites and peridotites have not been investigated in detail with respect of P-T conditions except of older work by Krogh et al. (1990). Therefore, we carried out petrological and Zrn geochronological study on felsic gneiss from Holmevatn, where Cr-rich eclogite and garnet peridotite were investigated previously (Ravna et al., 2006; Janák et al., 2015), recording P-T conditions up to 2.8 GPa and 800˚C, close to UHPM. Felsic gneiss shows an augen texture characterized by cm-size Pl porphyroclasts in the gneissose matrix mainly composed of micas, mm-size Grt and Qtz. Si-content and Mg# of Ms are homogeneous in each grain (6.14-6.41 for O=22 basis and 0.60-0.74, respectively). X-ray mappings of representative Grt grains show a zoning structure, such as Ca-poor (Grs9-15) and inclusion-rich (including Ky) inner-core, Ca- and inclusion-poor outer-core and Ca-rich rim (Grs18-26). The Ca-rich rim is absent from the most grains of Grt. Outline of inner core shows an irregular shape, suggesting that some garnet was partially resorbed before the outer-core formation stage. Most Pl grains show a zoning from Ca-rich (An26-33) core to Ca-poor (An15-25) rim. The Zrn grains also show zoning structures composed of oscillatory zoned core, thin dark mantle and bright rim in CL image, and include Qtz, Ms, Bt and Ap in the core. The LA-ICPMS U-Pb Zrn dating gives the concordant ages of 2800-950 Ma for the core and 490-430 Ma for the rim. The Zrn core shows high Th/U ratio (> 0.10), the HREE over LREE and Ce positive and Eu negative anomaly, suggesting the magmatic origin (e.g., Hoskin & Ireland, 2000). The Zrn rim shows low Th/U ratio (< 0.10), depleted HREE and negative Eu anomaly, suggesting the metamorphic origin in the Pl stability field. The age spectra of the Zrn core are similar to those of the East Greenland Caledonides (e.g., Watt et al., 2000), suggesting the studied rock could be derived from the Laurentia but also detrital zircons from the Laksefjord and Gaisa Nappes indicating Baltican origin (e.g. Gee et al. 2017). The Zrn rim ages overlap with the previous report of Corfu et al. (2003) using ID-TIMS (e.g., U-Pb Zrn age of 452.1 +/- 1.7 Ma from eclogites and U-Pb Ttn ages of 451-448 Ma). Zr-in-Rt thermometry and GASP barometry give 640-700˚C and 1.5-1.7 GPa for the Grt and Pl cores. The same thermometry and Grt-Hbl-Pl-Qtz barometry give 550-570 C and 1.1-1.2 GPa for the rim pairs. The P-T conditions of the Grt core stage are similar to those of D1 stage in metapelite reported by Krogh et al., (1990). Above mentioned results from conventional thermobarometry and zircon composition suggest that felsic gneiss probably did not experience UHPM, but crystallization of metamorphic zircon during exhumation cannot be excluded (e.g. Kohn et al., 2015). Moreover, all analyzed inner-rims of garnet (Grs18-20) show no Eu anomaly, suggesting formation in the absence of Pl,

 

at eclogite facies conditions.

Keywords: Caledonian Orogeny, U-Pb zircon age, REE pattern

 