Geophysical Research Abstracts
Vol. 21, EGU2019-17142, 2019
EGU General Assembly 2019

New insights into convergence, thrusting and exhumation during continent-continent collision from the geothermobarometry of the deep COSC-1 drill core

Iwona Klonowska (1,2), Pauline Jeanneret (2), Johanna Holmberg (3), Jarosław Majka (1,2), and Henning Lorenz (2)

(1) Faculty of Geology, Geophysics and Environmental Protection, AGH University of Science and Technology, Kraków, Poland, (2) Department of Earth Sciences, Uppsala University, Uppsala, Sweden (iwona.klonowska@geo.uu.se), (3) Pöyry Sweden AB, Stockholm, Sweden

In this presentation, we show key results from the Collisional Orogeny in the Scandinavian Caledonides (COSC-1) ICDP project. The new knowledge improves our understanding of mid-Paleozoic (Scandian) mountain building, in particular the history and emplacement of hot allochthons, and is expected to have significance for the interpretation of ancient and modern continent-continent collisional systems in general.
The recent metamorphic and structural studies of the lower and middle parts of the Seve Nappe Complex (SNC; part of the Middle Allochthon) in Sweden, the research promoted by the "Collisional Orogeny in the Scandinavian Caledonides" (COSC) project, have improved our understanding of the subduction systems that existed along the Baltoscandian margin during Ordovician-Silurian closure of the Iapetus Ocean. The pressure-temperature-time-deformation (P-T-t-D) paths constructed for the SNC along the length of the mountain chain document well the deep subduction and exhumation to mid-crustal levels of this unit. The P-T-(t)-D history of the COSC-1 rocks, the Lower Seve Nappe (LSN) rocks collected from the 2.5km deep borehole drilled in 2014 near Åre, provide important constrains on the tectonic evolution of this unit.
In this contribution we summarize the recent geothermobarometric, geochronological and structural data collected for the SNC in Jämtland and their implication on the Caledonian subduction-exhumation history of the Baltoscandian margin. To reconstruct the tectonometamorphic evolution of the LSN a single element solubility thermometer, Titanium-in-Quartz, and elastic geobarometer, Quartz-in-Garnet were applied to the COSC-1 garnet-bearing micaschists with ± amphibole. Depending on the TitaniQ calibration equation and Titanium activity used for plotting the Ti isopleths the following P-T conditions were constrained: (1) 7-9kbar at 520-570ºC for garnet core and 14-16kbar at 630-670ºC for garnet rim (Huang and Audétat 2012 calibration) and (2) 6-8kbar at 420-480ºC for garnet core and 12-16kbar at 550-620ºC for garnet rim (Thomas et al. 2010 calibration). The microstructural studies show that the finite ductile strain pattern of the LSN results from the superposition of four tectono-metamorphic events. The initial event is defined by the S1 foliation that is still preserved in albite porphyroblasts and the initiation of garnet growth. Indeed, P-T conditions measured along the COSC-1 profile show a prograde garnet growth from blueschist to lower eclogite facies conditions. The M2-D2 event associated with garnet rim growth and the development of muscovite-biotite-plagioclase S2 foliation marks the end of the prograde path and peak metamorphic conditions. This event is overprinted by the M3-D3 event associated with the development of the main regional metamorphic and mylonitic fabric along the retrograde path. M3-D3 has been constrained at about 7.5 to 9.7kbar and 600ºC (Giuntoli et al. 2018). A final retrograde stage (M4-D4) under greenschist facies condition, associated with the development of C′shear bands and crystallization of chlorite, overprints this S3 mylonitic foliation.
The COSC-1 rocks record information about the subduction of the LSN (from M1-D1 to M2-D2 event) and exhumation and thrusting of the LSN above the underlying allochthons (from M2 to M4).

Research funded by NCN projects no.2014/14/E/ST10/00321 and 2018/29/B/ST10/02315
References: Giuntoli et al. 2018. JMetGeol.36(9). Huang&Audétat 2012. Geochim. Cosmochim. Acta 84. Thomas et al. 2010.ContribMineralPetrol.160(5).