



Status and targets in the Collisional Orogeny in the Scandinavian Caledonides project

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The COSC project is a multidisciplinary international project with the aim to provide a deeper understanding of mountain belt dynamics in the Scandinavian Caledonides. Scientific investigations include a range of topics, from understanding the ancient orogeny to the present-day hydrological cycle. Six working groups comprise the project and include 1) tectonics, 2) geophysics, 3) geothermics, 4) hydrology, 5) microbiology and 6) drilling management and technology. This presentation provides an overview of the scientific goals of COSC and the first phase of drilling activities, which took place from April 28 until August 26, 2014 (COSC-1).

COSC investigations and drilling activities are focused in central Scandinavia, near Åre (Sweden), where rocks from the mid to lower crust of the orogen are exposed. Rock units of interest include granulite facies migmatites (locally ultra-high pressure), gneisses and amphibolites in the middle allochthon (Seve nappe) that overlie green-schist facies metasedimentary rocks in the lower allochthons (Särv and Jämtlandian nappes). The base of the lower allochthon marks the contact with the autochthonous Precambrian basement. Scientific drilling is a central part of the COSC project, and is motivated from a tectonic viewpoint to obtain (i) better understanding of the exhumation and emplacement of the hot middle allochthon, which may enable comparison with exhumation processes in the Himalaya-Tibet orogen, (ii) a broad understanding of orogeny and deformation in the middle to deep crust and upper mantle of mountain belts, and (iii) constraints on the abundant geophysical data that has been collected in the area. Drilling is divided into two phases, firstly to drill through the high grade Seve nappe into the underlying allochthon. The second phase (COSC-2) will target the tectonostratigraphic units below COSC-1 including the Caledonian décollement and the autochthonous Precambrian basement, and investigate the involvement of the basement in the Caledonide orogeny.

The working group at the drill site consisted of teams with three scientists and three drilling crew members. The on-site scientific duties included core documentation and photography, physical properties measurements, biological sampling and geological description of the recovered core. Additionally, borehole logging with a range of tools was performed by teams from Lund University and ICDP. The near vertical borehole was drilled to 2496 m, with almost 100 % core recovery. The top 2000 m consist of mostly sub-horizontal and shallowly dipping intermittent layers of gneiss and amphibolite, with lesser amounts of calc-silicates, metagabbro, marble and lenses of pegmatite. A thick package of mylonites and lenses of lower grade metasedimentary rock is found near the base of the borehole (depths >2100 m) and indicates that the borehole exited the high-grade middle allochthonous Seve nappe and entered the thrust contact zone between the middle and lower allochthons. The borehole does not penetrate into the less deformed lower grade Särv/Jämtlandian nappes and it is unclear where the end of the contact thrust zone occurs. Current scientific activities involve multidisciplinary detailed investigations of the drill core, further analysis of recently acquired seismic, gravity, magnetotelluric, and borehole geophysical data, and planning for the upcoming COSC-2 project.