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High resolution 2D reflection seismic profiling in the Scandinavian Caledonides for defining ICDP drilling sites

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The COSC (Collisional Orogeny in the Scandinavian Caledonides) project is a scientific continental drilling project with main emphasis on tackling key questions concerning orogenic processes and, in particular, the evolution of the Scandinavian Caledonides. Two fully cored boreholes of c. 2.5 km each are being planned in the Åre-Mörsil area of west central Sweden to allow detailed analysis of the tectonostratigraphic units and their deformation and metamorphism.
In 2010, a c. 36 km long high resolution 2D reflection seismic profile was acquired in this region as a site survey to enable optimal placing of the two boreholes. With a nominal source and receiver spacing of 20 meters, more than 1800 source points were activated using a mechanical source. At the same time, a second, almost 7 km long profile was acquired to connect the new profile with an older regional profile, which was acquired in the years 1987-92. Decoding was done based on the Swept Impact Seismic Technique and processing of the data followed a standard processing sequence for the most part. An extension to the 2010 main profile, c. 15 km long, was acquired in 2011, using the same acquisition parameters, and is currently being processed following a similar processing sequence.
The 2010 section revealed a highly reflective and complex subsurface with reflections spanning the entire length of the profile down to at least 9 km. The Seve Nappe, underlying allochthon and the basal décollement are distinguished by correlation with surface geology and existing information from previous surveys. An optimal location for the first western borehole, primarily targeting the Seve Nappe, has been proposed on the basis of the 2010 section.
Preliminary results of the new data acquired in 2011 also show a highly reflective upper crust with a number of distinct reflections standing out in the shot gathers. The stacked section reveals a clear continuation of the décollement towards shallower depths. The slightly west-dipping sub-horizontal reflections attributed to this sole thrust are here located between about 2 km in the west and 1.5 km in the east. A few very prominent basement reflections are also seen and at least one of these appears to approach or even converge with the décollement in the central-eastern part of the section. A potential location for the second eastern hole, targeting the basal décollement and basement reflections, is being investigated based on this newly acquired data.