Collisional Orogeny in the Scandinavian Caledonides (COSC): The importance of the Alum shale for seismic and EM interpretations of crustal structure

C. Juhlin[1]
[1]Dept. of Earth Sciences, Uppsala University, christopher.juhlin@geo.uu.se

SUMMARY

Mountain belts (orogens) have influenced, and do influence, geological processes and climatic conditions considerably, perhaps more than any other natural phenomenon. The Alpine-Himalayan mountain belt is the prime example of a collisional orogen today. However, research in an active orogen is mostly constrained to observe and interpret the expression of processes at the surface, while the driving processes act at depth, often at mid-crustal levels (20 km) and deeper. About 440 million years ago, an orogen comparable in dimension and tectonic setting to today's Alpine-Himalayan orogen was developing in what is western Scandinavia today. Since then, erosion has removed much of the overburden and exposed the deep interior of the orogen, facilitating direct observation of rocks that are deep in the crust in modern orogens. During collision, large sheets of rock (allochthons) were transported hundreds of kilometers from the present-day west to east over the subducting Baltica continent. This transport was facilitated by the presence of the Alum shale formation which acted as a lubricant within the mountain belt. Due to its resource potential (hydrocarbons, U, V, Mo, Ni and more), the Alum shale has been extensively investigated throughout Scandinavia and its chemical composition shown to vary geographically and stratigraphically. Less information is available on its physical properties, in particular seismic velocity and resistivity. However, its presence is often invoked to explain geophysical observations and for geological interpretations. The planned COSC-2 borehole (fully cored to 2.5 km) in central Sweden will provide unique information on the physical properties of the Alum shale at depth and its geophysical response through downhole in-situ measurements and integrated surface geophysics. These measurements will help us to better understand the results from larger scale surface geophysical surveys in the mountain belt and how to interpret them geologically.

Keywords: seismic reflection, magnetotelluric, allochthon, resistivity, seismic velocity