Conquering the sub-surface: Taking on the Oslo Rift lava pile and infrastructure development

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The Oslo region is the most densely populated area in Norway, with a growing population and a constant need for expansion of infrastructure. Geologically, the Oslo region consists of a basement overlain by folded Cambrian to Silurian sedimentary rocks, unconformably covered by Permian lavas and intrusions, e.g., Larsen et al. (2008). The lava pile is dominated by rhomb-porphyry and subordinate basalt flows; more evolved rocks are preserved in and around caldera structures. The Permian igneous rocks formed in an active rift setting, which also caused extensive faulting and fracturing.

Fault zones and layers which act as aquifers have been the reason for several incidents and has led to delays and cost overruns during infrastructure projects in the Oslo region. Improved understanding of the geology and in particular the relationship between the lava rocks and ground water flow may mitigate some of these issues in future development. In this project we study drill cores, borehole data, and outcrops from three large ongoing infrastructure projects which cut through the lava pile west of Oslo; a railroad tunnel, a water supply tunnel, and a new highway. Parts of the lava rocks in the area have previously been inaccessible for detailed studies, and this is a unique opportunity to describe them and their behaviour. The project combines drone imaging, field mapping and sampling of outcrops with logging of drill cores, wireline log interpretation and fluid flow measurements. Access to the outcrops before potentially problematic sections (such as fractured zones, faults, dykes, and altered tuff layers) are sprayed with concrete is a key feature in this project. In addition to data from the ongoing infrastructure projects, we will also build a database of incidents (e.g. rock falls, issues related to ground water) along existing roads and tunnels, and identify the geologic cause for the incident. An increasing population in the Oslo region leads to a continuous demand for more infrastructure, and more knowledge on how the fracture patterns, dykes and different lava flow units affect rock strength and control ground water flow can help to make future projects less expensive and more sustainable. We find that more collaboration and exchange of data and hands-on experience between industry, infrastructure providers and academia is essential for better decision-making and more sustainable development.

References

Bjørn T. Larsen, Snorre Olaussen, Bjørn Sundvoll, Michel Heeremans, 2008: The Permo-Carboniferous Oslo Rift through six stages and 65 million years. *Episodes, 31 1,* 52-58