Rhomb porphyry lavas from the Oslo Rift revisited: New insights from construction-related boreholes and cores

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The Oslo Rift formed about 300 million years ago and is characterized by emplacement of subaerial lavas and an extensive sub-volcanic system of sills, dykes, and plutons. The lavas range in composition from ultramafic melilitites and basalts, to evolved trachytes and rhyolites. The earliest stages of volcanism were dominated by plateau basalts (the B1 series) followed by trachytes (including rhomb porphyries), and later stage caldera-related basalts, rhyolites and ignimbrites. Historically, research on the lavas has gone through many phases and several key lava regions are well mapped based on outcrops. In the case of the rhomb porphyry lavas in Krokskogen, which is one of the most well-known rock types in Norway outside the geoscience community, almost no geochemical and petrological data are available, and the volcanology is still poorly researched. Moreover, weathering and a dense vegetation cover has made detailed field observations challenging.

Here we use construction-related boreholes to obtain new knowledge about the development of the rhomb-porphyry volcanism in the Krokskogen area. This study relies on the extensive geotechnical exploration undertaken during the past decade as part of planning for a railroad tunnel and the new E16 road between Sandvika and Sundvollen. Numerous boreholes, including fully cored boreholes up to 450 m deep, were drilled and logged by geotechnical companies along the railroad and road transects.

We present wireline logs, geochemical, and volcanological results from one of the boreholes. The hole is 407 meter deep and the upper 350 meters contain interbedded sandstones and lava flows. The basal lava flow, the B1 basalt, is 21 meters thick and is overlain by 1.2 m of conglomerate and sandstone, followed by four types of rhomb porphyry (RP). These are named RP1 to RP4 and have been mapped as distinct flows regionally based on colour and phenocryst shape and size. Our study shows that the flows are also geochemically distinct. We have identified a total of 38 individual flow units in RP1-4, with average thicknesses of 8.8, 5.2, 2.5, and 6.0 m respectively. Several of the flow units in RP1 and RP4 have eroded tops. Moreover, alluvial-type deposits are common between the flow units in addition to sandstone beds that show dynamic interactions with the lavas. In RP2-4 welded breccias with altered volcanic glass and deformed vesicles are common in the upper parts of individual flow units, interpreted as fallout deposits close to the fissure volcano.

We conclude that the construction-related boreholes represent a unique opportunity to further understand the development of volcanism in the Oslo Rift. Fully cored boreholes make high resolution studies possible, including studies of lava units and interlayered sediments or flow tops, which are rarely preserved in outcrops. Collaboration with key agencies will lead to better knowledge transfer related to important construction-related themes such as volcanic evolution and heterogeneities, and water leakage.