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DISSERTATION TITLE:	*Dynamics of sub-volcanic systems in sedimentary basins and related mechanisms of host rock deformation*

Vulkaner er en trussel mot livet på jorda, samtidig som de er en kilde til økonomisk velstand ved at de gir fruktbar jord. Vulkaner er vanlige men likevel er lite kjent om prosessene i jordskorpen som fører til deres opprinnelse. I denne avhandlingen er det brukt laboratoriemodeller for å undersøke samspillet mellom varm, smeltet stein (magma) og de omkringliggende bergartene i undergrunnen. I fremtiden kan kunnskapen fra disse modellene bidra til å forutse potensielle farer og forbedre leting etter ressurser og geotermisk energi.

Many people live close to or in areas where there are volcanic activities. Volcanic soils are extremely rich of minerals and provide a good base for agriculture. But they also represent a risk for an eruption. One of the essentials for reliable risk assessment and efficient exploration of important geothermal/mineral/oil-gas reservoirs associated with volcanoes, is to understand the effect of magma (hot, molten rock) on the rocks below them. Since active volcanos are highly dangerous, whereas old, inactive systems are often deeply buried under rock and water, any obtaining data and understanding of the interaction between magma and its surrounding rocks is difficult. Instead, we use laboratory models to simulate and understand (geological) processes of magma-rock-interactions in nature.

In the PhD study, I analyzed a high quality 3D seismic (“images of the subsurface”) data set from the Møre Basin/Norway with one (rare) borehole for oil/gas exploration. The rocks containing a potential gas-reservoir were most likely deformed by the underlying ~56 Ma old Tulipan magma body, but turned out to be uneconomic for exploration. However, the 3D data from the borehole provides invaluable information regarding the shape of the Tulipan magma body and its effect on the surrounding rocks. In addition, the Tulipan was related to one of the major climate changes of the past. To investigate the effect of weak or strong rocks on magma bodies and their final shape in detail, I used cutting-edge laboratory models. Each of the models monitored the injection of solidifying oil, as a magma analogue, into a box filled with various powders, which resemble different rock types in nature. The findings from several experiments of magma simulations below a volcano show that thin plate-like shapes develop in materials representing strong types of rocks, whereas thick cork-like shapes develop in weak rock analogues.

This PhD work was carried out in a laboratory at PGP-NJORD, University of Oslo, which setup is worldwide the first to simulate processes for a wide range of magma shapes as we find them in nature. The knowledge gained from our models may help to improve the forecast of potential risks related to active volcanoes, such as the 2018 Kilauea eruption on Hawaii.