

Structurally controlled magma emplacement in the Knaben area in Vest Agder, Norway

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The Knaben area lies within the recently defined Sirdal Magmatic Belt and is mainly known for its history of molybdenite mining. Within the dominating porphyry granite of the region, a N-S striking ($\sim 30^\circ$ dip towards the east) zone, with a varying density of older xenolith sheets of amphibolite and granitic gneiss makes up the Knaben area, and has shown to be important for understanding the magma emplacement mechanisms and is hence of relevance for the molybdenite mineralisation. The molybdenite is mainly disseminated in a grey granite, and also related to structures and pegmatites within the older sheets of granitic gneiss. Detailed geological mapping combined with geochronology, geochemistry, and structural analysis are used to unravel the tectonic history of the area. The Knaben area could possibly comprise a boundary between two individual plutons in the Sirdal Magmatic Belt, or a zone with remaining host rock. Geochronology of different domains shows no age difference in the later, less deformed granite. The earlier recognised xenoliths of amphibolite and granitic gneiss are more coherent than previously indicated, and some have been mapped as continuous bodies throughout the area, while others thin out as schlierens in the porphyry granite. These sheets have served as pathways for the porphyry granite. The structural analysis reveals consistent “top to the west” kinematics, with the ubiquitous presence of multi scalar duplexes, sigma clasts, thrust related pegmatites and associated asymmetric folds. An anastomosing shear zone network has been mapped out in detail within the area and is spatially associated with the distribution of molybdenite deposits. This style of kinematics is found within the earlier sheets, and within deformation bands in the later porphyry granite, and substantiates a consistent thrust related tectonic style during pluton emplacement, suggesting a syn-tectonic emplacement mechanism. Observations suggest a close temporal and spatial relationship between the placement of the grey granite, the thrust related structures and the molybdenite mineralisation.