Petrology of magmatic rocks drilled on the Mid-Norwegian margin

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The volcanic rifted margin of Mid-Norway is well constrained by seismic reflection data and bore hole data. About 50 years ago it was first proved that seismically imaged seaward-dipping reflectors were composed of subaerial basalt flows (Hinz, 1981). More recently focus has been on testing the hypothesis that Northeast Atlantic magmatism caused abrupt environmental disturbances known as the Paleocene-Eocene Thermal Maximum about 56 Myr ago (Planke et al., 2023; Berndt et al., 2023), and on constraining mantle melting models resulting in excess magmatism (Berndt et al., 2019). Ten drill cores have intersected the magmatic rocks of the Mid-Norwegian margin, including Deep Sea Drilling Program Leg 38 (1974), Ocean Drilling Program Leg 104 (1985), International Ocean Discovery Program Leg 396 (2021), and industry core. We have compiled all available geochemical data for the magmatic rocks of these drill cores, including our unpublished data. Basaltic compositions are dominant, but the drill cores also include silicic rocks such as dacite. Trace element compositions show that some of the basalts are strongly contaminated by continental crust, and the dacite even reflect direct crustal melting (Morris et al, 2023). The uncontaminated basalts display a range of trace element compositions reflecting signatures from depleted to enriched mantle source components. Calculated mantle potential temperatures are elevated relative to ambient mantle (Hartley et al., 2023). Estimated depths of mantle melting are relatively deep for basalts in the most landward drilling sites and relatively shallower for basalts drilled further seaward. In general the compositions of the uncontaminated basalts and their estimated mantle melting conditions appear to have been similar to Iceland today, and modulated by lithospheric thinning and segmentation of the rifted margin.

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