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Breakup magmatism style on the North Atlantic Igneous Province: insight from Mid-Norwegian volcanic margin

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The distribution of breakup-related igneous rocks on rifted margins provide important constraints on the magmatic processes during continental extension and lithosphere separation which lead to a better understanding of the melt supply from the upper mantle and the relationship between tectonic setting and volcanism. The results can lead to a better understanding of the processes forming volcanic margins and thermal evolution of associated prospective basins. We present a revised mapping of the breakup-related igneous rocks in the NE Atlantic area, which are mainly based on the Mid-Norwegian (case example) margin. We divided the breakup related igneous rocks into (1) extrusive complexes, (2) shallow intrusive complexes (sills/dykes) and (3) deep intrusive complexes (Lower Crustal Body: LCB).

The extrusive complex has been mapped using the seismic volcanostratigraphic method. Several distinct volcanic seismic facies units have been identified. The top basalt reflection is easily identified because of the high impedance contrast between the sedimentary and volcanic rocks resulting in a major reflector. The basal sequence boundary is frequently difficult to identify but it lies usually over the intruded sedimentary basin. Then the base is usually picked above the shallow sill intrusions identified on seismic profile. The mapping of the top and the base of the basaltic sequences allows us to determine the basalt thickness and estimate the volume of the magma production on the Mid- Norwegian margin. The thicker part of the basalt corresponds to the seaward dipping reflector (SDR).
The magma feeder system, mainly formed by dyke and sill intrusions, represents the shallow intrusive complex. Deeper interconnected high-velocity sills are also mappable in the margin. Interconnected sill complexes can define continuous magma network >10 km in vertical ascent. The large-scale sill complexes, in addition to dyke swarm intrusions, represent a mode of vertical long-range magma transport through the upper crust. The deep intrusive complex represents the Lower Crustal Body (LCB) which is observed along the margin and characterized by high P-wave velocity bodies (Vp> 7km/s). On the Vøring margin a strong amplitude dome-shaped reflection (the so-called T-Reflection) has been identified and interpreted as the top LCB.

In the sedimentary part of the margin, sill intrusions are the major feeder system and seem to be connected with LCB. In the volcanic part of the margin, dykes represent the main feeder system and lie above the thicker part of the LCB.