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Volcanism along the Jan Mayen Fracture Zone in space and time

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Continental breakup at the Paleocene-Eocene transition marked the culmination of a predominately extensional deformation in the North East Atlantic subsequent to the Caledonian orogeny. Numerous sedimentary basins of economic interest, which can now be found on the rifted continental margins, developed during this long-lasting extensional regime. While the major basin formation was not accompanied by significant volcanism, igneous activity increased to a large extent around breakup time. At the rift-to-drift transition in the NE Atlantic, volcanism developed in most regions fast into classical mid ocean ridge systems with spreading rates of 1 to 2 cm/year. However some regions did not develop into typical mid ocean ridge systems. Well-known is the post-breakup continuous excessive volcanic activity forming the Greenland-Iceland-Faeroes Ridges. But less known and studied is the atypical ocean floor volcanic activity along the Jan Mayen Fracture Zone.

In this invited presentation we will present new geochemical and radiogenic isotope data from offshore volcanic structures along the Jan Mayen Fracture Zone and the Jan Mayen ridge, sampled by ROV and dredging. Beside published data on early breakup related volcanism, the Jan Mayen island and the seamount Vestris, these new data are compared with new data from the Vøring Plateau (Leg 104) recovering the early volcanic continental breakup phase along the Jan Mayen fracture zone and published data on the recent volcanism on Jan Mayen.

In analogy to Early Paleogene nephelinites from the mid-Norwegian shelf and recent volcanic rocks from Jan Mayen and the seamount Vestris, most volcanics from the Jan Mayen Fracture Zone belong to a trachybasaltic suite. Partly these alkaline volcanic activities can be related to the different breakup events during the formation of the micro-continent Jan Mayen. Alkaline melts formed during the opening of the NE Atlantic between Jan Mayen and mid-Norway and later to the off-rifting of the Jan Mayen microcontinent from Greenland. However, not every alkaline magmatic activity along the Jan Mayen Fracture Zone can be related to a continental breakup event. The new data document that the Jan Mayen Fracture Zone system has been the locus of repeated alkaline volcanism in space and time. In addition to these alkaline rocks, we sampled also volcanic rocks with higher melting degrees within the Jan Mayen Fracture Zone, these melts have strong geochemical similarities to the Seaward Dipping Reflector Series magmas sampled at the Vøring Plateau.

A better petrogenetical understanding and characterization between both magma types sampled along the Jan Mayen Fracture Zone will shed light on the intrinsic geodynamic role of major fracture zones on the formation of melting anomalies and alkaline basalts within oceanic basins.