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Evolution of the Jan Mayen Ridge - new geochemical and geophysical data from the Jan Mayen Fracture Zone

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Geochronologic and geochemical data derived from sea-floor samples dredged from the Jan Mayen Fracture Zone together with seismic data provide new insight into the tectonomagmatic evolution of the Jan Mayen Ridge. Based on the seismic data, the Jan Mayen Ridge is believed to represent an off-rifted fragment of East Greenland continental lithosphere that since early Miocene has drifted 400 km into the North Atlantic as a result of sea-floor spreading along the Kolbeinsey Ridge. At present the Jan Mayen Ridge is uniquely located at the Mid-Atlantic Ridge north of Iceland.

During the recent G.O.SARS research cruises a suite of volcanic rocks, as well as sandstones and conglomerates that are predominantly made up of volcaniclastic material were recovered from the southern escarpment of Jan Mayen Fracture Zone east of Jan Mayen. The conglomerates contain carbonate shell fragments that yielded 87Sr/86Sr age of ca. 32 Ma, which probably reflects the time of deposition of these volcano-sedimentary rocks. U-Pb ages of detrital zircon from the samples show age distribution consistent with an East Greenland source region characterized by a wide age pattern with significant Archaean and Early Proterozoic component. A population of angular zircons provides the youngest ages around 30 Ma, which are consistent with the Sr-age data from the shell fragment. These young zircons are most likely derived from the local volcanic material and do accordingly date the volcanic activity.

Chemical analyses of individual volcanic clasts in the conglomerates show that they belong to the trachytic suite, and correspond mainly to hawaiites and trachyandesites. They are geochemically very similar to the recent volcanic rocks of the Jan Mayen Island. The maximum age of some of the volcanic clasts obtained by Ar-Ar whole-rock dating is consistent with the age of the youngest detrital zircons and with the Sr-age of the shell fragment.

The new data suggest that the alkaline volcanism in the Jan Mayen area may be traced 30 My back in time. It is yet unknown however, whether or not the volcanic activity has been continuous since that time. The lack of a significant crustal contamination of the volcanic rocks of the Jan Mayen Ridge and in the Jan Mayen Fracture Zone is consistent with the results of seismic survey that suggests an existence of continental lithosphere beneath the northern part of the Jan Mayen Ridge farther south of the Jan Mayen Fracture Zone, i.e. farther from the volcanic center.

Geophysical data suggest that spreading along the Kolbeinsey Ridge started ca. 25 My ago. The ca. 30 Ma magmatic event recorded in the dredged samples from the Jan Mayen Fracture Zone seems to reflect an episode of alkaline break-up magmatism associated with the off-rifting of the Jan Mayen micro-continent.