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Exploring the Origins of Volcanism beneath the Jan Mayen Island and Surrounding Mid-Ocean Ridges

Prior geochemical research began to tell the geological story of the northernmost segment of the Kolbeinsey Ridge (specifically the Eggvin Bank), Jan Mayen Island, and the southernmost Mohns Ridge in the Arctic Ocean, but there are still many unanswered questions regarding the area's dynamic volcanism and abnormal geological features. In an effort to describe the underlying volcanism, specifically beneath Jan Mayen Island, previous researchers collected lava samples by dredging the ocean floor along the mid-ocean ridge segments for MORBS, mid-ocean ridge basalts, where the freshest, most glassy lava flows exist. These samples and newly collected fresh rock samples collected while aboard the *RV Poseidon* will better explain the two ridge segments (Kolbeinsey and Mohns), the Jan Mayen Island formation, the abnormally shallow ocean depths and the mantle source processes and composition of this area. By concentrating on the isotopic enrichment and trace element makeup of the collected lava flows from the two mid-ocean ridge segments and the nearby Jan Mayen Island, our research will help us to gain a better understanding and visualization of the long-lived trace element content of the mantle source(s). The radiogenic isotopes we find will fingerprint mantle reservoirs that are the sources of melts and describe the flows' ages and possible origin locations. U-series isotopes help establish rates of melting and melt migration, which in turn tells us something useful about solid and liquid upwelling rates. In a plume, we would expect the rates of mantle upwelling to be higher than normal ambient mantle flow, which should lead to faster melting. The melting rate sensitivity is also sensitive to the fact that minor rock types in the mantle, like eclogite, should melt much faster than typical peridotite. Sample analysis will indicate levels of element enrichment, which can signify a different origin mantle source composition. We will examine the trace elements using an Agilent Inductively-Coupled Plasma Mass Spectrometer (ICP-MS) and aim to measure radiogenic isotopic data using mass spectrometry facilities at the University of Wyoming and l'Ecole Normale Supérieure de Lyon. In the field, detailed high-resolution mapping of the bathymetry of the Eggvin Bank will be conducted using an autonomous underwater vehicle, to determine the freshest lava flows to further collect young samples, which is important for accurate U-series analysis. Data collected may or may not support our hypothesis: if U-series isotopes record strong fractionation of U and Th during melting, the source must contain residual garnet peridotite, which means the melt must have originated deep (~70 km) in the mantle. Garnet's presence in the melt tells more about the depth of the melt's origin, not whether or not the melt source is depleted or enriched. The only way to have garnet at shallower conditions is to melt something like an eclogite instead, but as mentioned above, their melting rates are expected to be much higher and the U-series isotopes are sensitive to this rate difference. Overall, our conducted research will further explain the heterogeneity of the mantle melt and physical and chemical processes deep under the oceanic crust the affect the structural and chemical features above the crust.