THERMAL MODELING OF THE YERMAK PLATEAU WITHIN THE NORWEGIAN-GREENLAND SEA

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ABSTRACT

This research describes and tests models of crustal evolution on a transform margin by analyzing heat flow data which was collected from the Norwegian-Greenland Sea.

The Yermak Plateau (80°-82°N) adjacent to continental Spitsbergen is unusually warm (138 mWm^{-2}) relative to its surroundings. This area is presently being subjected to regional heating, creating a broad domed-shaped heat flow profile in contrast to the more normal cooling shape of oceanic crust. High heat flow in the northwestern part of this Plateau is probably the site of recent volcanic and/or intrusive activity which may extend to the high heat flow zone located to the north west of the Molloy Ridge (80°N).

The major axis of Knipovich Ridge spreading (79°N) occurs along a detachment fault system which may dip about 40°-50° towards Svalbard, making it a part of the upper-plate. A secondary detachment is proposed for the Yermak Plateau which is dipping towards the Knipovich Detachment Fault and intersect it. It is shown that stretching and thinning has begun under the Yermak Plateau at a rate of 0.32 cm/yr which is slower than the Knipovich Ridge spreading at a rate of 0.8 cm/yr.

There are two parallel bands of heat flow, one along the Knipovich Ridge and the other along the Svalbard continental margin. Further north both the Molloy Ridge and neighboring Yermak Plateau are zones of high heat flow. High heat flow complications suggest that faults on the Yermak Plateau may be a new location for magmatic injection oriented parallel to the Knipovich Ridge. This evidence indicates that when rifting occurs along a transform margin magmatic injection may also occur across several detachment faults.

Based on the examination of seven models, the best data fit suggests simple shear extension of 40 km at the rifting velocity of 0.32 cm/yr for a duration of 35 m.y. which was followed by a rapid narrowing to a width of less than 10 km. It is shown that pure shear extension model can not match the measured heat flow or the theoretical calculated values. Asymmetric pure shear extension model with an average spreading rate of 0.32 cm/yr fits better with the observed topographic features.

Based on the analyses of heat flow data a tentative model for Yermak Plateau and Knipovich Ridge is proposed: a transform fault, originally located between Nansen Ridge (82°N) and the propagating ridge of the Norwegian-Greenland Sea extends into the present-day Yermak Plateau. Intrusive zone of the Yermak Plateau rifting occurs along "a system of detachment faults" instead of

"a single detachment fault". The major detachment evolved into the Knipovich Ridge and a minor detachment are now evolving into an intrusive zone on the neighboring Yermak Plateau.