5.2.P09

Spatial variations of the geothermal heat flow measured on the Greenland ice sheet

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The knowledge on the geothermal heat flow from the rocks under the Greenland ice sheet is very limited. Only a few boreholes on the ice free coastal regions have been used to determine geothermal heat flow.

Measurements made on the Greenland ice sheet contain information on the geothermal heat flow with a very detailed spatial resolution from the deep boreholes and from the airborne radio echo sounding profiles.

Temperature measurements in the 2037 m deep borehole at Dye3, the 3027 m deep borehole at GRIP, the 3053 m deep borehole at GISP2, the 3001 m deep borehole at NorthGRIP and the 345 m deep borehole at Hans Tausen Iskappe contain climatic information as well as basal temperature gradients that can be used to determine the heat flow from the underlying bedrock. The determined values are unique due to the very homogeneous conditions of the ice surrounding the boreholes. The heat flow values are in the region 45-150 mWm^{-2}.

Airborne radio echo sounding (RES) profiles on the Greenland Ice Sheet show many internal layers as well as the surface and bedrock mapping. There is a large area in North Greenland were the deep internal layers have undulations with amplitudes of several 100 m not supported by bedrock or surface conditions. A calibration of the heat and ice flow conditions along the RES profiles with the detailed knowledge at the GRIP and NorthGRIP sites allows determination of the geothermal heat flow along these lines with a spatial resolution of 150 m. The results show very great variations over spatial distance of 10 km of the geothermal heat flow along the RES profiles with values between 45 and 300 mWm^{-2}. A region with very high geothermal heat flow, a hot spot, is found just where a big ice stream originates close to the center of the Greenland Ice Sheet.

The measurements from the Greenland ice sheet thus offer very detailed information on heat flow values and their variability especially when combined with data from the deep boreholes on the ice.

5.2.P10

Rajmahal flood basalts and kimberlites from the East Indian magmatic province: Sr-Nd-Pb evidence for Kerguelen plume head and axis derived magmas

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The Rajmahal-Sylhet-Bengal (RSB) flood basalt province (~117 Ma) in eastern India though spatially close to the active Kerguelen hotspot about 118 Ma ago can not be unequivocally correleted to this hotspot due to wide varietion in isotopic compositions of both the RSB and the Kerguelen hotspot lavas. However, we report Sr–Nd–Pb isotopic compositions ($^{87}Sr/^{86}Sr_i$ =0.70535 to 0.70561; $\varepsilon_{Nd}(T)$= –2.6 to –3.2; $^{206}Pb/^{204}Pb_i$ =17.88 to 18.07) of a co-eval (116±2 Ma) Group II kimberlite from this flood basalt province that is identical to recently identified pristine Cretaceous Kerguelen plume basalts from the Kerguelen Plateau and Broken Ridge ($^{87}Sr/^{86}Sr_i$=0.7051 to 0.7058; $\varepsilon_{Nd}(T)$= –0.2 to –2.9; $^{206}Pb/^{204}Pb_i$ ~18.0) [1]. This suggests that the Kerguelen hotspot could indeed be responsible for the ~117 Ma magmatic activity in Eastern India. While the RSB basalts were a product of the starting plume head, which was a mixture of source material and entrained continental lithosphere, and overprinted by crustal contamination, the kimberlites and the Cretaceous Kerguelen basalts were products of the uncontaminated plume axis or tail.

Reference

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