New Heat-Flow Observations in a Hotspot Swell: the Reunion-Mascarene Plateau

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Abstract

Terrestrial heat-flow information, generally derived from sea-bottom measurements, can be important to validate theories on the origin of hotspot swells. Strikingly, hotspots are characterised by the lack of high heat-flow values. This is often argument against reheating of the lower half of oceanic lithosphere as a mechanism forming the associated swells. However, it was recently argued that the thermal signature of hotspots can be widely obscured by fluid circulation. Other analyses conclude that hydrothermal flow may redistribute heat only near the swell axes and that the small heat-flow anomalies indicate that the mechanisms producing hotspots do not significantly perturb the thermal state of the lithosphere. In this paper, we investigate the heat flow of the Reunion-Mascarene Plateau hotspot area, an aseismic topographic ridge (western Indian Ocean). We review the available sea-bottom heat-flow determinations and present results of the first heat-flow observations on Mauritius Island, which is considered the second youngest island in the long-lived Reunion mantle plume track. Only marine measurements ranked as of high quality were considered in our study. We reprocessed the heat-flow data for the sediment perturbation, assuming a simple model with constant sedimentation rate, and available sediment thickness and seafloor age data. We recorded temperatures in a hole drilled for geothermal exploration and measured thermal conductivity from core samples from the Mauritius Island. Both marine heat-flow data and the new onshore observations confirm the small size of the heat-flow anomaly in the Reunion-Mascarene Plateau, and at the swell axis, perpendicular to the hotspot track, the heat-flow maxima, which should occur for a lithospheric reheating, are not observed.

Keywords: Fluid flow, Mantle plume Heat flow measurements