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Abnormal high surface heat flow caused by the Emeishan mantle plume

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It is commonly believed that increase of heat flow caused by a mantle plume is small and transient. Seafloor heat flow data near the Hawaiian hotspot and the Iceland are comparable to that for oceanic lithosphere elsewhere. Numerical modeling of the thermal effect of the Parana large igneous province shows that the added heat flow at the surface caused by the magmatic underplating is less than 5mW/m^2. However, the thermal effect of Emeishan mantle plume (EMP) may cause the surface hear-flow abnormally high.

The Middle-Late Emeishan mantle plume is located in the western Yangtze Craton. The Sichuan basin, to the northeast of the EMP, is a superimposed basin composed of Paleozoic marine carbonate rocks and Mesozoic-Cenozoic terrestrial clastic rocks. The vitrinite reflectance (Ro) data as a paleogeothermal indicator records an apparent change of thermal regime of the Sichuan basin. The Ro profiles from boreholes and outcrops which are close to the center of the basalt province exhibit a ‘dog-leg’ style at the unconformity between the Middle and Upper Permian, and they show significantly higher gradients in the lower subsection (pre-Middle Permian) than the Upper subsection (Upper Permian to Mesozoic). Thermal history inversion based on these Ro data shows that the lower subsection experienced a heat flow peak much higher than that of the upper subsection. The abnormal heat flow in the Sichuan basin is consistent with the EMP in temporal and spatial distribution. The high-temperature magmas from deep mantle brought heat to the base of the lithosphere, and then large amount of heat was conducted upwards, resulting in the abnormal high surface heat flow.