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Thermal Event of The Emeishan Large Igneous Province and Its Resource Effects

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The Emeishan large igneous province (LIP) in southwestern China, is a massive magmatic event during the Middle-Late Permian and significantly affected the regional thermal regime, fossil energy formation, ore genesis, and environmental crises. This study integrates various paleothermal indicators to reconstruct the thermal history of the Sichuan Basin since the Paleozoic, particularly the thermal conditions during the Emeishan LIP activities. We revealed the Permian thermal pulse event induced by the Emeishan LIP and the spatiotemporal distribution of the thermal effects, as well as its impact on the maturation of the Palaeozoic source rocks. Apatite and zircon fission track and (U-Th)/He dating verify a pulsating high thermal anomaly lasting 10 Ma in the mid-Permian. Southwestern China experienced a pre-LIP rapid warming event with a surface temperature increase of 19 °C within 5 Ma, followed by a post-LIP rapid cooling process of nearly 5 Ma (a decrease of 17 °C). The range of the thermal effect is 600~650 km. The heat flow anomaly significantly decreases with the increase in distance from the axis of the mantle plume. The highest heat flow anomaly is in the central region of Yunnan, with heat flow exceeding 130 mW/m². The pulsating thermal event accelerated the maturation and cracking of organic matter. By analyzing the maturation and generation of the hydrocarbon source rocks and temperature histories of reservoirs for crude oil cracking in the Sinian-Cambrian, the study probes the natural gas accumulation process and temporal constraints for the Sinian-Paleozoic from a geothermal perspective. The Cambrian paleo-oil reservoirs in the central Sichuan basin experienced crude oil cracking during 170~180 Ma.