Geothermal Heat Flow Map of Sumatra, Indonesia
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Abstract

Heat flow maps are valuable in a broad spectrum of the geosciences. Governments and resource agencies use heat flow maps for understanding regional geology, which in turn aid in better understanding of processes such as earthquakes, volcanoes, geothermal energy, petroleum and mineral exploration.

We are compiling a geothermal map of the Indonesian portion of Sumatra. In 2018, Indonesia produced 21% of its petroleum from Sumatra. The island is the largest island in Indonesia, with three regions of producing basins; North, Central and South. The region has been subjected to intense tectonic activity, especially in the last 70 million years. The subduction of oceanic crust from the southern region created the Sumatra Island arc. The arc is further complicated by the interaction of two plates, the Australian Plate and the Sunda Plate. The subduction zone extends from the Himalayan front to the Sunda arc basin evolution. There are two major forearc basins in the area; Simeulue and the Mentawai and Sumatran Fault Zones.

The highest geothermal gradients are found in the east central basin. The geothermal gradient values range from 35°C/km to 191°C/km. The geothermal gradient location extending from the southern region, progressing around two areas of higher geothermal gradients and east central basin. There is a low geothermal gradient for the interior of the basin ranging from 67.76 to 96.1 W/m². Heat flow values measured in W/m² for the South Sumatra Basin were greater along the margins of the basin than within the interior. Heat flow averages for the interior of the basin ranged from 87.7 to 96.1 W/m². The highest recorded values were southernmost in Sumatra Island, Indonesia.

Heat flow values, measured in W/m², for the South Sumatra Basin were greater along the margins of the basin than within the interior. Heat flow values along the coast of South Sumatra ranged an average of 149 W/m², while heat flow averages for the interior of the basin ranged from 87.7 to 96.1 W/m². The highest recorded values were southernmost in Sumatra Island, Indonesia.

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Our initial study, focus on the island of Sumatra, Indonesia is important not only for petroleum exploration, but also for mineral exploration and alternative (geothermal) energy development. The calculated heat flow for the Central Basin ranges from 77 W/km² to 257 W/km², typically ending once basement rock is reached. The geothermal gradient of the South Sumatra Basin, measured in Celsius degrees/kilometer, varies greatly along the margins of the basin, and lower within the interior. Along the east central to southernmost parts of the basin, the geothermal gradient ranged an average of 35°C/km to 191°C/km. The geothermal gradient for the interior of the basin ranged from 67.76 to 96.17 °C/km.

Governments and researchers alike use heat flow maps for understanding regional geology, which in turn aid in better understanding of processes such as earthquakes, volcanoes, geothermal energy, petroleum and mineral exploration.

Regional Map of Indonesia

Sumatra Island, Indonesia

Central Sumatra Basin

Southern Sumatra Basin

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