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Updated geothermal gradient and heat flow maps of offshore Malaysia

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Abstract: An update of the geothermal gradient and heat flow maps for offshore Malaysia is presented based on available data and information compiled from the archives of PETRONAS and its partners. More than 600 new datapoints calculated from bottom-hole temperature (BHT) data from oil and gas wells were added. In addition, about 150 datapoints were taken from heat flow probe measurements at the sea floor in the deep-water areas off Sarawak and Sabah, along with direct measurements of sediment thermal conductivity. In general, the data show that the Malay Basin has relatively high geothermal gradients (average ~47 °C/km). Higher gradients in the basin centre are attributed to crustal thinning due to extension. The Sarawak Basin has similar above-average geothermal gradients (~45°C/km), whereas the Baram Delta area and the Sabah Shelf have considerably lower gradients (~29 °C/km to ~34 °C/km). These differences are attributed to the underlying tectonic setting; the Sarawak Shelf, like the Malay Basin, is underlain by an extensional terrane, whereas the Sabah Basin and Baram Delta east of the West Baram Line are underlain by a former collisional margin (between Dangerous Ground rifted terrane and Sabah). The deep-water areas off Sarawak and Sabah (North Luconia and Sabah Platform) show relatively high geothermal gradients overall, averaging 80 °C/km in North Luconia and 87 °C/km in the Sabah Platform. Using the appropriate sediment thermal conductivity models, the geothermal gradients were converted to heat flows. The average heat flows are: Malay Basin (92 mW/m^2), Sarawak Shelf (95 mW/m^2) and Sabah Shelf (79 mW/m^2). In addition, the average heat flows for the deep-water areas: Sabah deep-water fold-thrust belt (66 mW/m^2), Sabah Trough (42 mW/m^2), Sabah Platform (63 mW/m^2) and North Luconia (60 mW/m^2). The results of this study further enhanced our insights into the similarities and differences between the various basins and their relationships to tectonic history and hydrocarbon occurrences.

Keywords: Geothermal gradient, thermal conductivity, heat flow, Malaysia, temperature data

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