# Determining the Curie Depths in the United Arab Emirates: Insights into Regional Thermal Structures and Tectonic Terranes

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## Abstract

We have determined the depth of the Curie isotherm in the United Arab Emirates (UAE) by employing a modified centroid methodology based on the fractal distribution of sources. The resulting spatial distribution of Curie depths and geothermal gradients aligns with the gradients determined from bottom hole temperature measurements in exploration wells, revealing three regions of shallow Curie depths with NNE–SSW to NE–SW trends. These include (1) the north-western offshore area of the UAE with 11–25 km Curie depths; (2) a stretch within central UAE from the Shah field in the south-central to the northern offshore region of Dubai, characterized by Curie depths of 10–25 km, geothermal gradients of 22.1–55.3 ◦C/km, and heat flows of 55.3–138.3 mW/m$^2$; and (3) the eastern part of the UAE from Al Ain to Dibba and the Gulf of Oman, with medium Curie depths of 25–30 km. Two N–S to NE–SW trending corridors with deeper Curie depths between 35 and 50 km and lower geothermal gradients and heat flows of 11.1–15.8 ◦C/km and 27.8–39.5 mW/m$^2$, respectively, border these regions of shallow Curie depths. We interpret these regional NE–SW trends to tectonic terranes consisting of magmatic arcs and microcontinental fragments that have amalgamated to form the crust beneath the UAE. Moreover, many large hydrocarbon fields directly above or adjacent to these shallow Curie depth zones imply a possible critical role of these zones in the maturation, migration, and entrapment of hydrocarbons within the UAE. Additionally, these zones, marked by high heat flow (>100 mW/m$^2$) and pronounced geothermal gradients (~40 ◦C/km), could serve as potential focal points for future geothermal exploration.