Geothermal Gradient in the South Moroccan Basins Determined from Oil Well Temperature Data

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The study concerns the Errachidia-Boudenib, Essaouira-Agadir and Tarfaya-Laayoune basins. It attempts to study the geothermal behaviour of the Anti-Atlas structure and the geodynamic activity in the region, well known by the 1962 earthquake of Agadir.

This work is based on 580 temperature measurements obtained from 128 on shore and off shore oil wells distributed as follows: 49 Tb (mud temperatures) and 14 Tdst (Drill Stem Test) in the Errachidia-Boudenib basin, 298 Tb and 48 Tdst for Essaouira-Agadir basin, and 155 Tb and 16 Tdst for the Tarfaya-Laayoune basin. An empirical relation based on the difference between Tb and Tdst is used to correct mud temperatures. Estimated geothermal gradients range between: 16°C/km and 36°C/km, with an average value of 28°C/km in the Errachidia-Boudenib basin; 14°C/km and 35°C/km, with an average value of 21°C/km, in the Essaouira-Agadir basin; and 17°C/km and 35°C/km, with an average value of 21°C/km, in the Tarfaya-Laayoune basin.

The regional distribution of geothermal gradients in the Errachidia-Boudenib basin shows that the relatively high geothermal gradients could be related to subsidence and the basement proximity, respectively, in the south-eastern and southern sectors of the basin.

In the Essaouira basin, the higher observed geothermal gradient in the centre is discussed in relation to the deep hydrodynamic effects while it is related to the basement faulting in the Agadir basin.

The Tarfaya-Laayoune basin presents two domains with a relative high geothermal gradient (greater than 30°C/km): the on-shore domain characterized by a great fault basement of N65 to N70 direction revealed by geophysics and the off shore domain where the Miocene volcanoes of the Canary Islands contribute to increased geothermal gradients.