Heat flow in the Caspian – Black Sea Region and its tectonic implications

R. I. Kutas

An analysis of the heat flow distribution over the territory of Caspian – Caucasus – Black Sea region shows that tectonics and evolution of the earth's crust are the dominant factors affecting the nature of the geothermal field. The region is characterized by a complex combination of high and low heat flow density. Heat flow density ranges from 20 to more than 100 mW/m^2. High heat flow (>70 mW/m^2) is related to zones of young volcanic activity. In the Lesser Caucasus heat flow varies from 65 to 95 mW/m^2. The values of 80-110 mW/m^2 are reported for Eocene magmatic arc. High heat flow (60-145 mW/m^2) can be observed in the central part of the Great Caucasus. Such a high geothermal activity can be explained by extensive Neogene and Quaternary volcanic activity which was expressed on the surface more to the south by the creation of the Elbrus volcano. Characteristic features are heat flow density anomalies running transversal to the main course of the Alpine units. They are related to deep fault zones, crossing these structures. In the Great Caucasus one of these zones running from Quaternary massif of the Elbrus to Pyatigorsk are associated with outcropping laccolites and the Stavropol arch in the north.

The folded structures of the Great Caucasus, Crimea, Dobrogea are characterized by intermediate heat flow density (50-75 mW/m^2). The mean heat flow is 48 mW/m^2 in Crimea Highland, 52 mW/m^2 in western part of Great Caucasus and 55 mW/m^2 in south-eastern part. The geothermal feature of these units strong depends on their previous evolution, age of their extension and inversion.

The ancient Georgian crust block which lies between the Greater and Lesser Caucasus is characterized by decreased heat flow values ranging from 40 to 50 mW/m^2. On the Moesian and Scythian Plates the heat flow density increases to an average of 50-60 mW/m^2. Some anomalies of increased heat flow (60-80 mW/m^2) can be associated with Mesozoic – Cainozoic extension (Karkinit, Indol, Stavropol) and folding (Prikumsk, Kanev – Beresansk, Tarkhankut uplifts) zones. In contrast to the increased heat flow of rift zones the Alpine fore deep show low heat flow values (35-50 mW/m^2). They depend on the age of the original basement. Low heat flow (20-50 mW/m^2) found in intermountain depressions and the inner sea basins (Rioni, Kura, Black Sea and South – Caspian) i. e. over subduction sedimentary basins.