HEAT FLOW MAP OF THE PACIFIC OCEAN AND THE ADJACENT CONTINENTS AND ITS GEOLOGICAL-GEOPHYSICAL INTERPRETATION

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The presence of two elongated belts of the increased heat flow values is characteristic of the Pacific Ocean and the adjacent North-American and Australian continents and the Eastern part of Asia. The first belt,which may be called the West Pacific, strikes along the western part of the Pacific Ocean. It covers the Asia-Pacific transition zone with its marginal seas, island arcs and trenches. The major part of Australia is also included in this belt of the increased heat flow values. The observed heat flow values vary from (-28) to 1214 mW/m^2 within the belt, that testifies to the sufficient differentiation of the heat flow density within the latter. The negative heat flow values are confined to the Kuril-Kamchatka trench and its vicinity. They testify to the downward heat flow migration but not the upward one,for example due to the flux of the marine waters in the Earth's interiors.

The second belt corresponds to the East Pacific Midocean Rise with its northern protrusion. In contrast to the Western Pacific, it may be called the East Pacific one. The heat flow is sufficiently variable inside of this belt, as well as within the West Pacific Belt, its observed values ranging from (-59) to 3065 mW/m^2. The shape of the heat flow anomalies is rather variable. Both the isometrical and the elongated anomalies are observed, the long axis being oriented along and across the belt. The contours of the anomalies are often sinuous. The most extensive and elongated anomalies are confined to the northern part of the belt (the latutude of Alexander Archipelago and Queen Charlotte Islands).

The zone of the increased heat flow values, striking to the Central-American Isthmus, is separated from the belt under consideration in the area of the Galapagos Islands. The East Pacific Belt of the increased heat flow values embraces the major part of the territory of the USA,namely: the Rocky Mountains, with their Front Range and Coast Ranges, the Cascade Range,Colorado Plateau and the other morphological elements. The greatest positive heat flow anomaly of the belt is confined to the California Peninsula or, in other words, to the junction of the midocean rise with the North-American Plate. The elongated and comparatively narrow heat flow minimum, dividing the northern part of the above belt into two parts: marine and continental, corresponds to the central and southern parts of the Front Range.

We may note the following in respect to the nature of heat flow in the West and East-Pacific Belts.

Taking into account the sufficient number of evidences,testifying to the presence of a great lot of sources of the fresh lava flows and recent volcanic eruptions in the area of the East Pacific Rise, the heat sources or the complete or the partial melting zones are located at a comparatively shallow depth, probably within the range of the first ten km or somewhat deeper. Evidently, the same may be related to the northern part of this belt, elongated along the coast of North America. The character of sharp variation of the heat flow anomalies affirms such interpretation of its geological nature. As for the West Pacific Belt, the active volcanoes, heat sources and the other signs of shallow occurrence of magma chambers are mainly confined to the island arcs, being the narrow stripes within the limits of the above belt.There does not exist the clear evidence of shallow occurrence of the partial melting zones in the remainder, far greater, part of the belt. It is affirmed by the less intensity and variation of the anomalies if to compare with the East--Pacific Belt. However, the calculations show, that the partial melting zones occur at a relatively shallow depth, not exceeding 10 km, within the limits of the separate, the most intensive heat flow anomalies.

The above stated allows us to suggest, that the convective heat transfer plays the major part in the East Pacific Belt, while the conductive one - in the West Pacific Rise.

The Central part of the Pacific and the inner regions of the adjacent continents, located outside the West and the East Pacific Belts,are characterized by the heat flow values, close to the mean terrestrial or lower ones. Thus, the mean heat flow value amounts to 56 mW/m^2 (359 determinations) in the Pacific bed, while in the west of Australia it attains to 40 mW/m^2 and in the Pacific platform - to 45 mW/m^2. Its value varies within the range of 25-50 mW/m^2 in the central and the eastern parts of North America. As a rule, the shape of the anomalies is rounded and complicated one, without intensive strikes. The vast, and relatively increased heat flow anomaly should be distinguished within the central part of the Pacific, its intensity exceeding 100 mW/m^2 in the region northeastwards the south extremity of the Hawaiian Arghipelago. The heat flow anomaly, corresponding to the Baikal rift zone, is distinguished from the general pattern. Its shape is elongated along the rift zone, the intensity reaching 328 mW/m^2 at the mean of 70 mW/m^2 (230 determinations).

The dynamics of the formation of the partial melting zone in the Okhotsk, Bering and Japan Seas is determined by solving the non-steady-state heat conduction equation. The partial melting zone ascends gradually upward and reaches the depths of 8-10 km from the sea bottom in 25-30 mln.years after its origin, affecting the lower and middle parts of the Earth's crust. These zones are fixed in a lot of areas of the above seas, and evidently, they represent the formations, from which the intracrustal-type bodies will originate in the geological future. The partial melting zones are not marked outside the marginal seas to depths of 100 km.

The comparison of the geothermal calculations with the data obtained by the other geophysical methods allows us to assume, that the partial melting zones are the outstepping far upward uplifts of the asthenosphere.

It is pointed out, that the depth and the morphology of the geothermal asthenosphere correlate well with those of the electrical asthenosphere and sufficiently differ from the depth and the morphology of the seismic and density asthenospheres. It is logical, because it is a well-known fact that the electrical resistence within the partial melting layer decreases by some orders (if magma chambers are linked galvanically), while the velocity and density decrease only by the first units-tens percent.