Geologic Nature of the Gravity Anomalies of the Amuro-Bureya Field

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The subsurface geology of the broad territory of the Amuro-Bureya field is hidden under a cover of horizontal Neogene and post-Pliocene sediments; therefore, interpretation of the gravity anomalies here is difficult. The problem of the nature of the gravity anomalies of the Amuro-Zeya depression can be solved only by other geophysical methods, taking into account the overall structure of the intermontane depression occupying an intermediate position between a geosyncline and a typical platform.

Three structural stages can be distinguished in the geology of the Amuro-Zeya depression:

1. The lower structural stage (basement of the depression), which reflects the geosynclinal phase of development of the region, is composed of intensively metamorphosed and deformed rocks of pre-Paleozoic and Paleozoic age. This complex is intruded by numerous granites of different age, which greatly intensified the regional metamorphism of the host rocks. The pre-Paleozoic and Paleozoic sediments have been deformed into linear folds.

2. The structural stage, corresponding to the intermediate phase is composed of marine and fresh-water continental sediments of Jurassic(?) and Cretaceous age. Sills, dikes, and intrusives of andesite and trachyte are prominent in the Mesozoic sediments. The effusive activity ceased at the end of the Late Cretaceous. The Mesozoic sediments are considerably less deformed than are the Paleozoic and pre-Paleozoic units. Among the structures are found comb-like and box-like forms with steep flexural flanks related to faults in the basement. Morphological features of the Mesozoic fold structures confirm the deep nature of their formation and the connection with vertical differential displacements of individual blocks of the basement. The tectonic forms flatten out upward along the section. In this connection the box folds are sharply expressed in the lower horizons, but in the Upper Cretaceous sediments they change into brachy-anticlines with very gentle dips on the flanks.

The cessation of effusive activity in the Late Cretaceous and the flattening of the structures upward along the section were governed by a weakening of the tectonic activity at the end of the Mesozoic Era.

3. The platform structural stage, which consists of weakly deformed detrital continental Tsagayan (Cr2-Pg1) and younger sediments, is warped into very gentle brachy-anticlines; these outline the gross irregularities of the relief of the top of the Mesozoic complex. The maximum thickness and the most complete section of the Tsagayan formation has been established in the Mesozoic downwarps. The opposite picture is observed on the positive Mesozoic structures. Thus, the structural plan of the Tsagayan was inherited in its basic features from the Mesozoic stage of development.

The inheritance of the main structures in the Mesozoic and Tsagayan sediments, expressed by a repetition of the structural forms from horizon to horizon, should intensify the gravity effect related to the structure and relief of the surface of the pre-Mesozoic basement.

The nature of the gravity anomalies can be elucidated by simultaneous analysis of the Bouguer reduction and data from vertical electrical sounding (VEZ). The latter shows the behavior of an electrical marker horizon of infinite resistivity identified as the top of the pre-Mesozoic crystalline basement; it also gives information on the unit above the marker horizon, to which are referred the lacustrine-continental sediments of the Lower Mesozoic.

The problem of the nature of the gravity anomalies is solved by the example of the Amuro-Tomsko-Zavitin interfluve. (The geophysical information used here is from a report by Ye. G. Chestnyy and G. N. Tkachev.)

In the west of the territory under examination (between the Amur and Zeya Rivers), electrical data (Figs. 1 and 2) show clearly two north-south-trending structural zones, which have complicated structure. The western of these is recorded as very narrow anomalies of $q_{km}$ (ordinate of minimum on the VEZ curve) and $S$ (total longitudinal conductivity) with a large jump in the values at the boundaries. This structural zone coincides with the Sychevsko-Sergiyev depression with a deep subsidence of the base of the conducting horizon; on the north it plunges to a depth of 1500 m. This zone consists of two depressions: a north (Sychev) and a south (Sergiyev) separated by an uplift. The Sychevsko-Sergiyev subsidence corresponds to a deep, sharply expressed gravity depression, the boundaries of which coincide with the boundaries of the structure. The Sychev and Sergiyev depressions are characterized by isolated negative gravity anomalies.

The deeper Sychev depression corresponds to minimum values of $\Delta g$. The transverse uplift separating the depressions coincides with high values of $\Delta g$. The boundaries of the Sychevsko-Sergiyev depression zone (particularly on the east) are marked by large horizontal gradients of the values of $\Delta g$; these reach 5 mgal per 1 km. These steep gradients of the gravity anomalies and also the