

Temperature conditions beneath the Ukrainian Carpathians at present time and in the past

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One of the urgent tasks during paleotectonic reconstructions in any region is the determination of PT-conditions in its depth at present time and in the past to establish direction and character of their changes and, respectively, to estimate contribution of various driving forces in geodynamic processes. However, if the pressure may be estimated from the depth, the temperature is one of the most hardly determined parameters. The traditional method of extrapolation to different depth of data on temperature measurements in the upper horizons of the Earth's crust gives very conflicting results and requires the control by some other methods. For this purpose we have carried out the complex analyses of results of investigations of the Ukrainian Carpathian deep structure peculiarities by different geophysical methods, taking into account a number of petrologic restrictions. To obtain the possibility for comparison, interpolation and extrapolation, data not only from the Carpathians, but also from adjacent areas were chosen to this analyses. On this basis, the model of modern distribution of temperature in conformity with depth on the territory from Pannonian depression to the Ukrainian shield, had been constructed. This model does not contradict MTS, MVP, seismological and seismometric, magnetometric data, neither petrological and regional geology data. According to this model for example, the temperatures, at the Moho corresponds to the following values: beneath Transcarpathian depression — 800°C, beneath Carpathians —

900°C, beneath Volyno-Podolia — 600°C, and at a depth of 100 km — 1300°C, 1200°C, 1000°C respectively.

To estimate the temperature of the upper mantle in the past (in Neogene times) we used results of investigations of mantle xenoliths (spinel lherzolites) from Pliocene basalts of the Pannonian depression. Calculations of temperatures from the composition of coexisting clino- and orthopyroxenes from these xenoliths show values $T=1050-1100^{\circ}\text{C}$. This is also confirmed by the presence in olivine of gliding systems, that are active under such, relatively low and comparable with modern, values of temperature.

Temperature of the upper mantle in more remote past (Early Mesozoic) was determined on the strength of investigations of protrusions of the Carpathian ultramafic rocks, also represented by spinel lherzolites. Calculations led us to establish the temperature of the last equilibrium in paragenesis clinopyroxene-orthopyroxene, that corresponded to 940°C. Even if we assumed, that protrusions were transported to the surface from the most upper part of spinel lherzolites existence area (30–35 km), we, nevertheless, have to agree that the temperature of the upper mantle at this time (as well as in the Pliocene) did not exceed modern one.

In conclusion: all above mentioned data, confirm, that temperature conditions beneath the Carpathian region did not significantly change during long period of time, from Early Mesozoic up to the present. The mantle matter melting with subsequent magmatism was not the result of the increase of temperature, but of the decrease of pressure. This assertion should be taken into account in geodynamic reconstructions.