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ABSTRACT

This article consolidates the results of studying the deep structure of the lithosphere of the Central Tien Shan, which aimed to identify the main tectonic elements in its geophysical models. We have compared the structural and geological data with the information on the deep structure obtained by geophysical methods and from the positions of earthquake hypocenters in the study area. According to geological concepts, the Tien Shan orogenic belt is characterized by longitudinal and transverse segmentation. The boundaries of the Northern, Middle, Southern

Western and Eastern segments of the Tien Shan are deep-seated fault structures. In deep faults and channels of heat and mass transfer, endogenous processes are localized. High-velocity, geoelectrical and thermal models consider such faults and channels as contrasting objects that can be referred to as indicators of these processes.

Our analysis of the locations of earthquake hypocenters from NNC, KNET, CAIIG, KRNET, SOME catalogues shows that seismic events are strongly confined to the fault zones and the boundaries of large blocks. A correlation between the anomalies of geophysical fields suggests the degree of inheritance of tectonic structures and the boundaries of the main tectonic segments of the Tien Shan. To compare the crustal and upper mantle heterogeneities reflected in different geophysical fields, we have analyzed seismic tomographic sections based on volumetric seismotomographic models geoelectric and velocity sections along profiles across the main tectonic elements of the study area. The sections are used to identify the zones with relatively low (i.e. reduced) seismic wave velocities and detect the deep-seated longitudinal segmentation of the folded belt. Objects showing anomalous seismic wave velocities are found in the seismotomographic sections at all the depths under consideration. The most contrasting differences in the velocities of P- and S-waves are typical of the depths of 0-5 km and 50-65 km, showing the most clearly observed Northern, Southern and Western segments of the Tien Shan. In general, the velocities of P- and S-waves at the Northern Tien Shan are higher than those at the Middle and Southern segments. We have analyzed the distribution of geoelectric heterogeneities identified from magnetotelluric sounding data in order to determine the boundaries of the main tectonic elements that are considered as the zones of increased electrical conductivity confined to the boundaries of the fault structures. The distribution of earthquake epicenters clearly reflects the segmentation of the Tien Shan into the Northern, Middle and Southern segments and shows the Western and Eastern Tien Shan relative to the Talas-Fergana fault. Ourstudies of the crust and the upper mantle of the Tien Shan have confirmed that the abovementioned tectonic segments have differences in their deep structures Based on a comprehensive analysis of the study results, we can qualitatively identify a relationship between the distribution of the velocity and geoelectric heterogeneities in the crust and upper mantle, seismicity and the stress-strain state of the crust.