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Research Article

ASSESSMENT OF GEOPHYSICAL PARAMETERS OF FOCAL ZONES OF STRONG EARTHQUAKES IN SOUTHERN UZBEKISTAN

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ABSTRACT
This article presents preliminary results of static analyzes of the anomalous geophysical field over the territory of Southern Uzbekistan for the assessment of the geophysical parameters of focal zones of strong earthquakes. Catalog of focal zones of strong earthquakes located at high gradients of anomalous heat flow and at intersection of the faults have been established.

Keywords: *Catalog, Source Zones, Fault, Basement Map, Heat Flow, Anomalous Magnetic Field*

INTRODUCTION
Recently, on the territory of the Republic of Uzbekistan, in particular for a number of regions of South Uzbekistan, various types of seismological maps, reflecting the features of the seismicity of the region, such as areas of expected seismic activation for the coming years based on a set of predictive parameters of the seismic regime have been compiled by Artikov *et al.*, 2018. On this map, several zones of expected seismic activity of various radius, which require a geological analysis of the nature of these zones are highlighted.
The territory of southern Uzbekistan is covered by geological surveys, as well as gravity and aeromagnetic surveys at a scale of 1: 200000 (Fig. 1). As a result of the interpretation of magnetic fields by Kremnev (Abdullabekov, 2002), regional anomalies associated with the structure of the basement were identified, as well as subsequently local anomalies caused by inhomogeneities on the surface of the Paleozoic basement.

MATERIALS AND METHODS
Study methods
Despite the achieved successes and satisfactory seismological study of the territory of southern Uzbekistan, the geophysical characteristics and conditions of focal zones of strong earthquakes remain poorly studied. To determine the geological and geophysical characteristics of focal zones of strong earthquakes, anomalous magnetic and electromagnetic fields were analyzed, as well as a heat flow map in comparison with the depths of the Paleozoic basement.
These questions were solved according to nature of the structure of the magnetic field. It is noted that the main structure of the magnetic field of study area is expressed by the alternation of bands of positive magnetic anomalies of subaltitudinal strike, separated by zones of calm and low values of the field. The width of the zones is 40-60 lkm, the length is 100-200 km (Fig. 1). Chains of positive magnetic anomalies with a direction consistent with the general strike of folding are identified with faults. It is known that in our region the main strong earthquakes occurred in fault zones. In this case, the isolines of magnetic anomalies can be used for static analysis in order to determine the geological and geophysical characteristics of focal zones of strong earthquakes. A sharp change in the strike of anomalies, some

rupture and shift of anomalous bands, the presence of local anomalies with a strike that is unconformable with respect to the main system of magnetic anomalies, are interpreted by us as intersecting basement faults. According to earlier studies, the quantitative value of magnetic anomalies varies from -275 nT to + 150 nT. For the study area, the average value of magnetic anomalies is -84.49 nT.

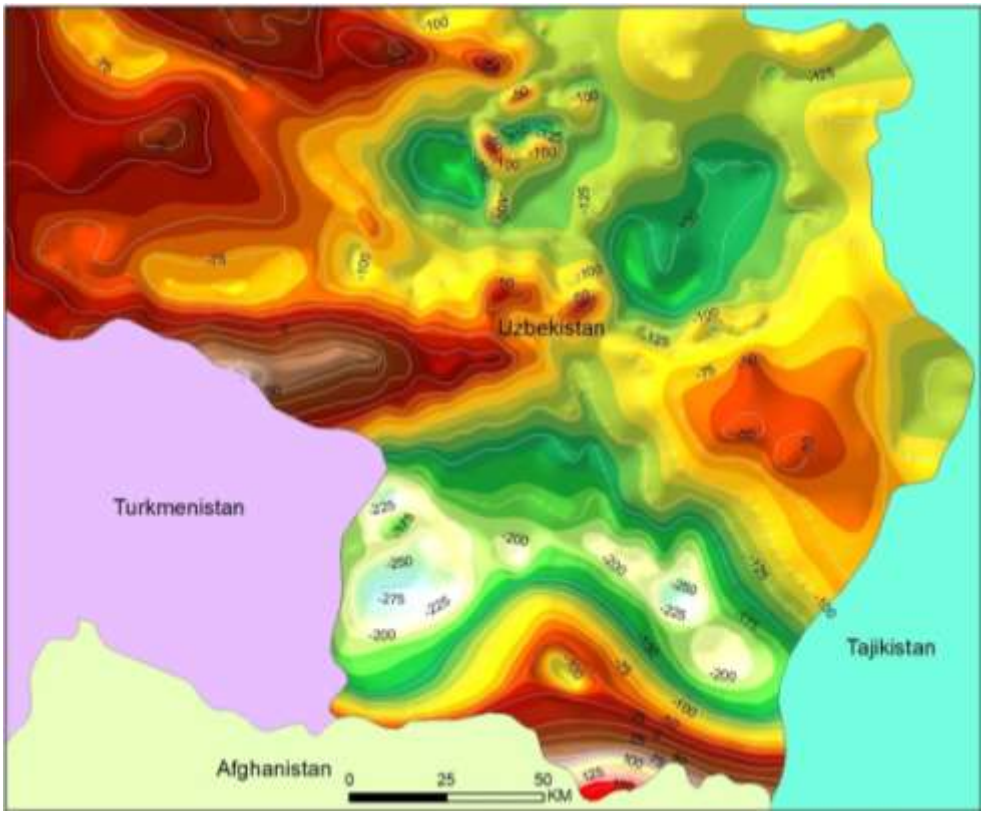

Figure 1: Magnetic anomaly map of study area (Southern Uzbekistan)

RESULTS

According to gravity survey data, it was found that the surface of the crystalline base is more differentiated over the study area, the depths vary from -1 to -7 km (in the Baysuntau mountains, it appears as outcroup). A system of faults of various orders, strikes, depths and, apparently, inception times, the crystalline basement is divided into a number of blocks occupying different hypsometric positions. The faults and, accordingly, the blocks of the basement of the western part of the area, limited by them, have a predominantly sublatitudinal strike, while the eastern one is characterized by a northeastern direction.

The relief of the pre-Mesozoic surface retains the general features of the surface of Paleozoic basement: it undergoes a general dip from east to west and is also subdivided by the fault zone into eastern and western parts of different nature. A large role of ruptured structures is noted, especially in the east, which gave the structure of the Riphean-Paleozoic strata a block character (Abdullabekov, 2002).

Earlier, as a result of the geotectonic interpretation of gravity anomalies, it was established that the region under consideration belongs to the Karakum-Tajik marginal massif, within the Riphean-Paleozoic stratum, lying on the Paleozoic basement, is strongly dislocated and can be considered a zone of occurring earthquakes (Alimukhamedov, 2011).

Seismic exploration was carried out by methods - deep seismic sounding, experimental production seismic research. Regional seismological work was carried out by the method of converted waves of

earthquakes (CWOE) – R.Z.Akhmerov, S.A.Zuev, T.E. Ergeshev, G.G. Karimova, T.E. Ergeshev, G.A. Mamonov, E.A. Goldvirt, R.S. Burnashev, D.Kh. Atabaev and others (Atabaev and Dolgopolov, 2013). Below is a seismic-geological section follows according to the results of CWOE method along the Mubarek-Baysun regional profile (Fig. 2).

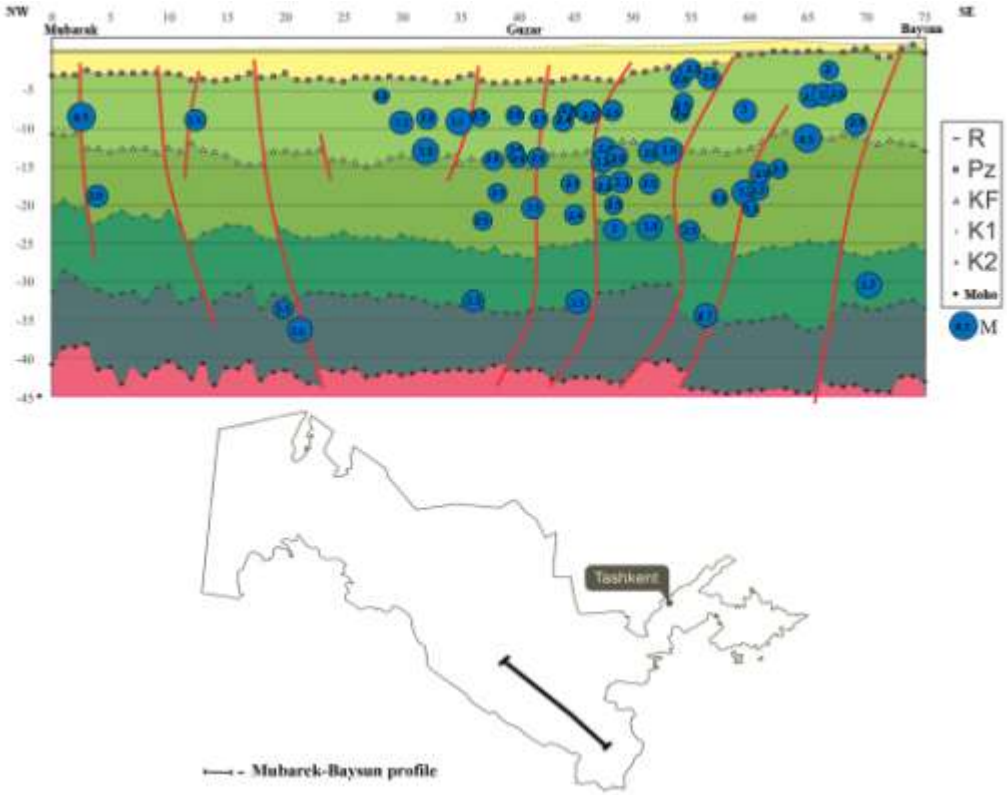

Figure 2. Seismic-geological section on base of converted waves of earthquakes (CWOE) method along the Mubarek-Baysun profile (according to D.Kh. Atabaev (2019), with the author's additions): *R-relief; Pz-upper part of the Paleozoic basement; KF-consolidated cortex; K1, K2-upper and lower layers of the earth's crust; Moho-border of Mohovichich; M-location of earthquake focal zones and magnitudes.*

The history of development, spatial position, zoning of tectonic structures of southern Uzbekistan, the emergence of folded systems are explained by the evolution of paleooceanic basins and their subsequent transformation into collisional-folded areas. Their formation is associated with the evolution of oceanic basins, the development of which predetermined the structure of folded systems and microcontinent separating them (Dalimov and Troitskiy, 2005). It is known that if at the first stages, when constructing a seismic zoning map, mainly seismic statistical data and "macroseismic" of strong earthquakes were taken into account practically without taking into account the geological structure, then later they began to use geological and geophysical data and information about the structure of the earth's crust.

With the increase in information about earthquakes using paleoseismic-geological, physical-mechanical, archaeological data and the deep structure of the earth's crust, it was possible to establish that the foci of strong earthquakes are orderedly concentrated in narrow linear zones and their junctions, marking different seismogenic structures (Atabaev, 2020). The latter create the preconditions for seismic structures to be at the heart of the seismic hazard of the territory as the primary source for all further cartographic transformations. In this series, the determination of places of probable occurrence of strong earthquakes

and seismotectonic zoning on a geodynamic basis are of priority importance, since it is the only timeless and invaluable material that is the fundamental basis for all comparisons and the identification of various links between geological structure and seismicity (Atabaev and Abdullaev, 2019). In active zones, the earth's crust is characterized by an anomalous heat flow, due to the fact that in the focal zones of strong earthquakes a heat anomaly is released, due to the deformation stress state of the earth's crust, based on this, maps of anomalous heat flow was compiled (Fig. 3).

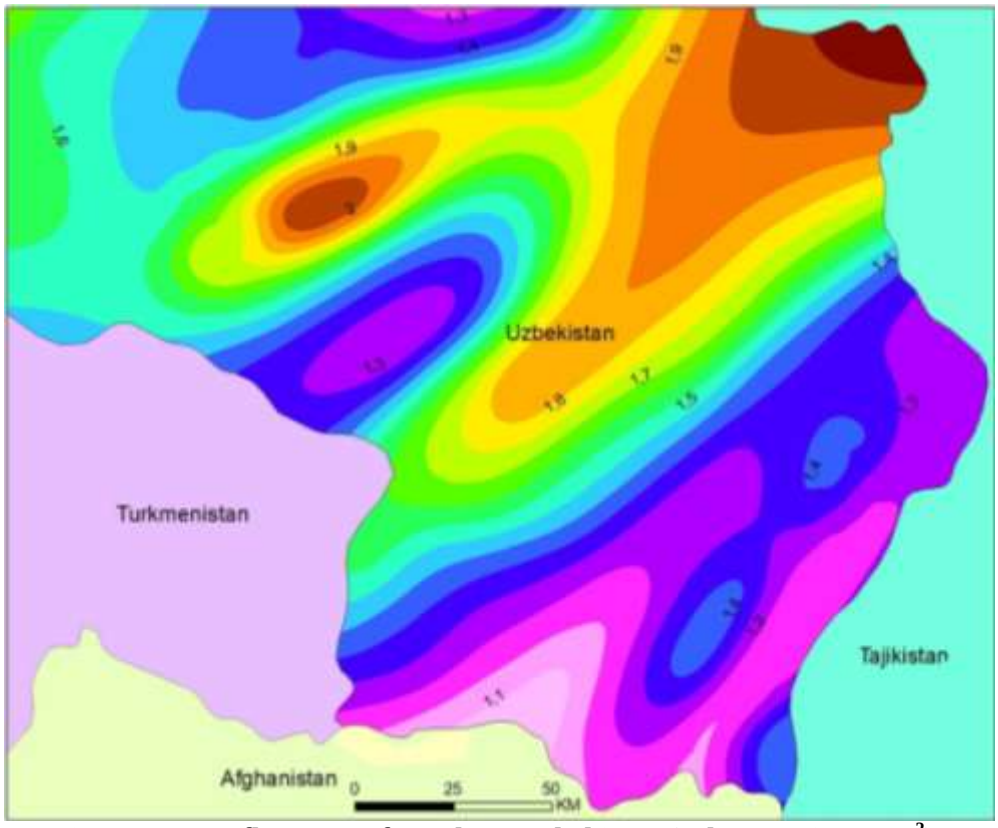

Figure 3: Heat flow map of Southern Uzbekistan (values are in Wt/m^2).

The study of the deep location of the hypocenters of strong earthquakes associated with deep faults during the analysis of the profile constructed by the CWOE method established the following:

- the hypocenters of numerous earthquakes correspond to the boundaries of the transition zones from the orogen to the platform, that is, the Karail-Lyangar deep fault zones;
- in the entire studied section, earthquakes are observed in the zones of deep faults or along the zones of their impact. On the analyzed profile, seismic hypocenters were not found at a depth of 25 to 30 km (Toshpatov, 2021);
- along the profile, it was revealed that for the territory of platform areas, earthquakes are characterized by lower depths and magnitudes. On the territory of the platform region of South Uzbekistan, earthquake foci are located at a depth of 10-20 km;
- in the upper part of the crustal profile, at depths from 30 to 38 km, earthquakes with a smaller number of hypocenters (up to 7) and a relatively strong magnitude are cataloged.

DISCUSSION

Thus, our research aimed at highlighting one of the topical issues of seismological work is associated with the study and assessment of the geophysical characteristics of focal zones of strong earthquakes. Of

course, the factual material currently available does not allow making a final conclusion, both about the complex geological structure of the region and about the features of the occurrence of the Paleozoic basement. Within the noted focal zones of strong earthquakes, it is necessary to take into account the geological and geophysical characteristics of various fields and different scales of their manifestation.
Correlation of materials obtained by various geophysical methods provides a more reliable basis for exploration of environments in which it is necessary to identify and evaluate local, low-contrast changes in geophysical parameters.

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