

GEOLOGICAL AND TECTONIC CHARACTERISTICS OF THE TERRITORY OF THE REPUBLIC OF UZBEKISTAN IN THE CONTEXT OF SEISMIC DANGER

N.R. Tajibayeva¹ and *S.A. Saidova²

¹*National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan*

²*“Institute of Hydrogeology and Engineering Geology” State Establishment, Tashkent, Uzbekistan*

**Author for Correspondence: zulhumoru01@gmail.com*

ABSTRACT

The work is dedicated to the geological and tectonic characteristics of Uzbekistan's territory in the context of seismic hazard assessment. The purpose of the research is to identify and describe the main geological and tectonic factors determining the level of seismic activity in the region. The work examines the stratigraphy and lithology of the sedimentary cover, the deep structure of the Earth's crust, active faults and zones of increased fracturing, and modern movements of the Earth's crust. An analysis of the relationship between the geological structure, tectonic structure, and distribution of earthquake epicenters was conducted. Based on the obtained data, the seismic potential of individual tectonic elements and zones was assessed.

Keywords: *Geological And Tectonic Structure, Seismic Hazard, Seismicity, Faults, Tectonics*

INTRODUCTION

The relevance of the topic is determined by the following factors: a high level of seismic risk, insufficient study of geological structure and tectonic structure, the development of territories and an increase in technogenic load, the problem of earthquake prediction, and the importance of considering local geological conditions.

Many regions of the world are characterized by an increased level of seismic activity, which poses a significant threat to human life, infrastructure, and the economy. Timely and accurate assessment of seismic hazard is crucial for reducing earthquake-related risks. In a number of regions, the geological structure and tectonic structure have not been sufficiently studied, which makes it difficult to assess the seismic potential of the territory and predict possible earthquakes. At the same time, the intensive development of territories, the construction of large industrial facilities, dams, nuclear power plants, and other critical structures in seismically hazardous areas increases the vulnerability of the population and economy to earthquakes. When designing and constructing such facilities, it is necessary to consider the seismic hazard of the territory.

Despite significant achievements in the field of seismology, accurate prediction of earthquake times, locations, and magnitudes remains a complex and unresolved task. Geological and tectonic studies allow for obtaining additional information about the patterns of earthquake occurrence and increase the effectiveness of forecasting. The seismic effect caused by an earthquake can vary significantly in different regions, depending on the local geological conditions (soil, relief, presence of groundwater). Geological and tectonic studies allow for the consideration of these factors in seismic microzoning and the design of earthquake-resistant structures. The use of modern methods of geological mapping, remote sensing, geophysical research, and mathematical modeling allows for obtaining more detailed and reliable information about the geological structure and tectonic structure of the territory, which increases the accuracy of seismic hazard assessment.

Thus, conducting a geological and tectonic characterization of the region's territory in the context of seismic hazard is a pressing scientific and practical task, the solution of which will increase the efficiency

of territory planning, the construction of earthquake-resistant structures, and reduce the risks associated with earthquakes.

MATERIALS AND METHODS

Research aimed at the geological and tectonic characterization of the region's territory in the context of seismic hazard requires the integrated application of various methods that allow for comprehensive information on the geological structure, tectonic structure, and activity of the territory.

In this regard, the methodology includes: analytical method (analysis: literature sources, remote sensing data, seismological data, data on modern movements of the Earth's crust; field methods (geological, tectonic mapping, structural analysis, paleoseismological studies); geophysical methods (gravimetry, magnetometry, electrical exploration, seismic exploration, seismotomography); geochemical methods (analysis of the chemical composition of underground waters and gases, namely, identification of anomalous concentrations of chemical elements and gases associated with tectonic processes; methods for processing and analyzing data (processing seismological data to determine seismicity parameters, geostatistical analysis, mathematical modeling, i.e., building models of the stress state of the Earth's crust and the propagation of seismic waves). Geoinformation technologies (GIS) - integration and visualization of various types of data for spatial analysis and identification of relationships between geological, tectonic, and seismic characteristics.

The proposed methodology allows for a comprehensive study of the geological structure and tectonic structure of the region's territory and a justified assessment of its seismic hazard.

RESULTS AND DISCUSSION

Geological and tectonic characteristics. A complex complex of sedimentary, igneous, and metamorphic rocks, from the Proterozoic to the Quaternary, participates in the geological structure of Uzbekistan.

In the vertical section of the upper exposed part of the Earth's crust, Archean-Lower Proterozoic crystalline base, Riphean-Lower Devonian platform cover, Middle Upper Paleozoic folded foundation (hercynites), Upper Triassic-Paleogene young platform cover, Neogene-Quaternary epiplatform orogenic complex are distinguished [8].

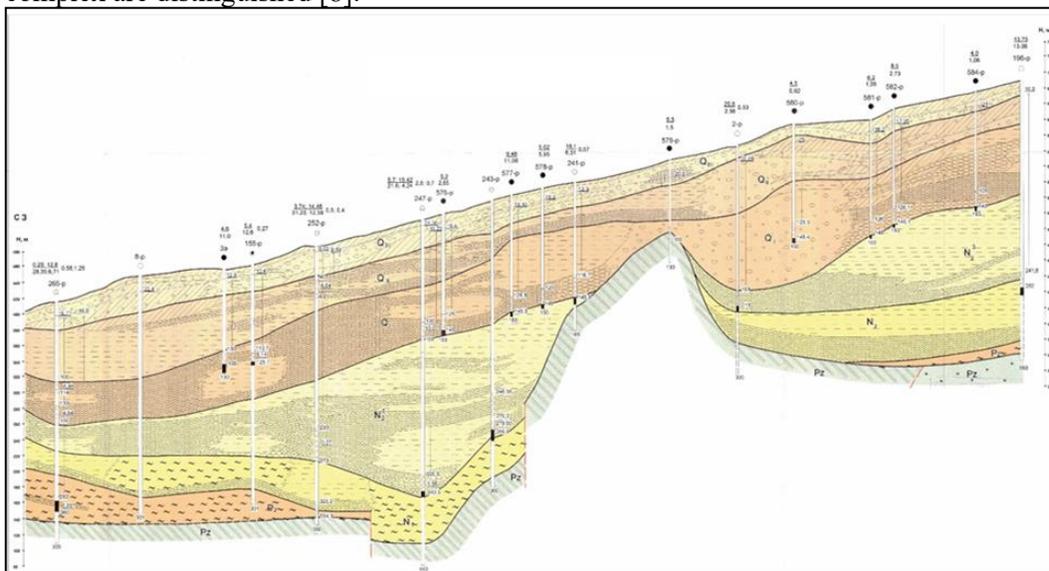


Figure 1. Cross-section

In its crystalline base, two structural complexes are found: the lower, archaic, is exposed in the southwestern part of the Hissar Range, and the southern part is exposed by wells in the Southern Aral Sea

Research Article

region and the Bukhara-Karshi region. It consists of products of the magmatic-gneiss and amphibolite-plagioclase metamorphic facies (granite-gneiss) with layers of quartzites, orthamphibolites, marbles, gneisses, and others, with a thickness of 4-5 km. The deposits are compressed into a system of dome-shaped structures, complicated by linear steep and overturned folds. Extending of folds from sub latitudinal (Southern Uzbekistan) to northwestern (Western Uzbekistan).

The Upper Lower Proterozoic complex is exposed in Western Uzbekistan as a metamorphosed sedimentary-volcanogenic layer with a thickness of up to 4-6 km, a greenstone complex). The thickness is composed of a system of gentle linear folds of northwestern (Northern Nuratau) and northeastern (Western Bukantau) strike (Fig. 1).

The Riphean-Lower Devonian platform cover is represented mainly by terrigenous rocks (up to 5 km) and, in terms of structure, together with the crystalline base, forms an ancient platform.

Due to tectonic activation processes, the Mangyshlak-Hissar marginal depression, the Karakum-Hissar superimposed andesite volcanic arc of the Carboniferous, and a number of magmatic areas with granitoids of the late Paleozoic period have emerged. Hercynides constitute the peripheral zone of the Ural-Mongolian belt and include three branches (systems) of geosynclines and their intermediate massifs in the late Paleozoic, respectively expressed by linear megaanticlinoria separated by zones of deep faults:

a) The northern branch of geosynclines (Bolshe-Karatau, Chatkal, and Naryn) borders the North Tien Shan's caledopids from the south and lies at their front bend. The Hercynian stage is formed by red sandstones of the Frank stage of the Upper Devonian, limestones of the Upper Devonian and Lower Carboniferous, terrigenous rocks, and is breached by large massifs of granitoids of the Late Paleozoic. The deposits of the Chatkal geosyncline are compressed into a system of anticlinoria and their dividing graben-synclinoria of north-eastern strike.

b) the lower branch of geosynclines (buried Central Ustyurt, South Tien Shan, and Kokshal) is formed by terrigenous-carbonate flysch formations of the Middle Devonian, Middle Carboniferous, and in some places by in-mountain malasses of the Upper Carboniferous - Lower Permian, and is compressed into a system of linearly elongated anticlinoria complicated by faults, higher-order folds, overlaps, and shariages. Ophiolitic belts and serpentinite malage zones have developed along deep faults. The deposits are dissected by massifs of granitoids and alkaline granites and syenites of late Paleozoic age.

c) The third branch of geosynclines is represented by Uralides buried under the Mesozoic cover (Southern Aral Sea region and the Aral Sea area) and consists of terrigenous and volcanogenic layers with chains of small placers of basic and ultrabasic composition and massifs of granitoids of the Carboniferous age. Between these three branches of geosynclines, relatively stable mid-level massifs of Northern Ustyurt and Kurama-Fergana (Syrdarya) are located, in the structure of which the pre-rifey-crystalline base, the rifey-lower Devonian platform cover, and the middle-upper Paleozoic geosynclinal cover of complex structure (consedimentation brachiostructures, superimposed depressions and molds, fault-facing folds, horsts, grabens) are involved, which are combined with superimposed marginal systems (Tamdy-Karachaty, Predchatkal, etc.), volcanic arcs with terrestrial volcanic products of an Andesite (Carboniferous Kyzylkum-Fergana) and Datsitoliparite (Upper Paleozoic Kurama Ores) composition; large massifs of granitoids. Granitoid laccoliths are characteristic, the largest bodies of which formed during the Carboniferous period (Tulyaganov *et al.*, 1980).

The Upper Triassic-Paleogene cover is composed of marine and continental deposits. Its formation culminated in the formation of the Turan-Tian-Shan epipaleozoic platform. Structures in general form inherit hercynid structures and are represented by sublatitudinal domes (Southern Tien Shan, Central Ustyurt, Central Kyzylkum, etc.), separated by large syneclises (Tajik, Fergana, North Ustyurt, Syrdarya) (Ibragimov, 1978).

The modern structure is represented by the Turan Plate in the west and the Tian Shan platform orogenic (cord-block) region in the east. Large-radius uplifts and depressions are characteristic of the plate, while the largest linear domes (Chatkal-Kurama, Alai-Turkestan mega-anticlinoria) and intermontane depressions (Fergana and Tajik mega-synclinoria) are characteristic of the orogene

(Fig. 2). Megasyntinoria are represented in the modern relief by mountain ranges of varying lengths, each representing a dome-shaped uplift (or a chain of dome-shaped uplifts), sometimes of linear shape, complicated by regional faults, high-order disjunctive and plicative dislocations.

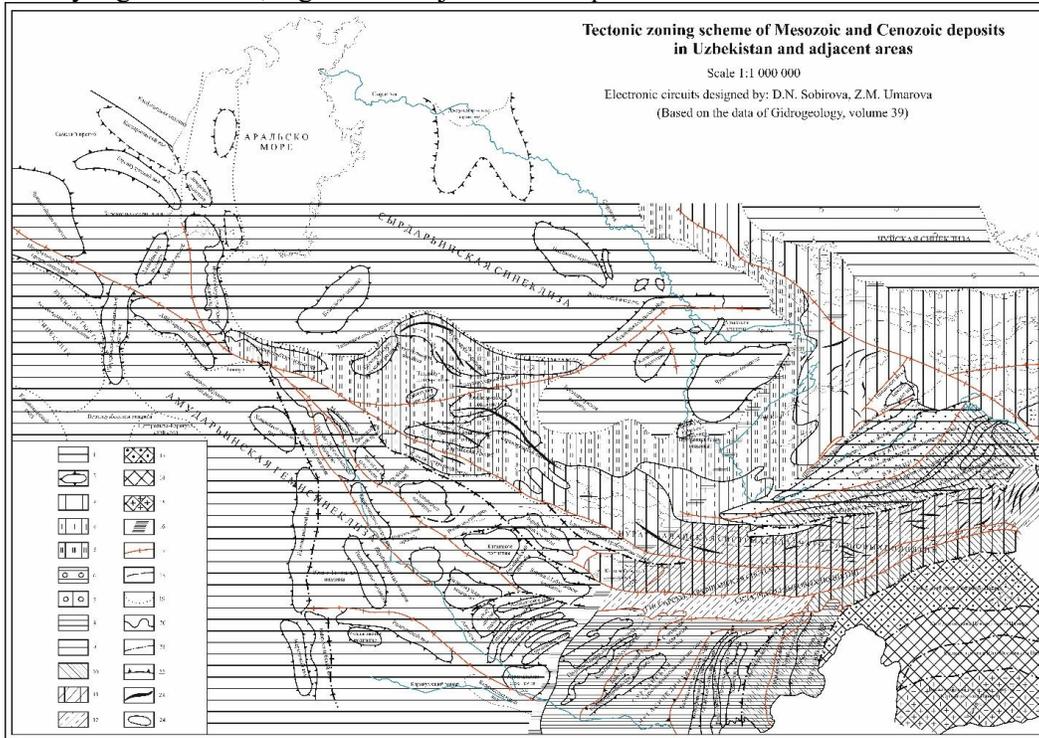


Figure 2. Scheme of tectonic regionalization of the Mesozoic and Cenozoic deposits of Uzbekistan and adjacent regions

Platform on a Hercynian base. Areas of prolonged subsidence (plate): 1-depressions and depressions; 2-groups of lifts, lifts, lifts, and shafts. Areas of stable uplift (shields): 3 - regions that did not experience subsidence during the Mesozoic and Cenozoic; 4-involved in the depression in the neogene; 5-subjected to short-term subsidence in the Mesozoic and Cenozoic. On the Caledonian base: 6-regions of prolonged subsidence; 7-stable lifting areas; Platform orogenic region.

Areas of prolonged calm subsidence in the Mesozoic and Paleogene and the manifestation of sharply differentiated movements in the Neogene; 8-developed in the Mesozoic-Paleogene pericraton zone; 9-developed within the Mesozoic-Paleogene shield; 10 areas of increased tectonic activity in the Mesozoic and Paleogene (magmatism, angular discord, etc.) Areas of stable uplifts transformed in the Neogene into folded-block structures: 11-developing on the Mesozoic-Paleogene shield; 12-periodic subsidence in the Mesozoic and Paleogene and transformation into folded-block structures in the Neogene. Folded region at the site of the Alpine geosyncline: 13 - Hersin catolids - a smooth structure involved in the folded development regime in the Alpine cycle; 14-Alpine folding and magmatic region; 15-region of the middle massif of the southwestern Pamir.

Other signs: 16-the boundary between regions with varying thickness of the Earth's crust (according to geophysical data) and simultaneously the western boundary of the territory that has survived post-Paleogene activation; 17-Main deep faults, formed in the Alpine stage, dividing large tectonic zones; 18-Main Alpine and Hercynian regenerated faults; 19 - boundary of synclises (hemysynclises) and domes; 20-boundaries of the areas within the shield and slab; 21-boundary of folded zones within the geosynclinal region; 22-boundaries of uplifts, shafts, and anticlinal zones; 23-axes of some Hercynian structures; 24-Paleozoic outcrops.

The ancient denudation surfaces carrying fragments of marine Mesozoic and Paleogene formations of the Tian Shan are elevated in axial zones to a height of 3-7 km above sea level, which is a measure of the resulting amplitudes of the latest tectonic movements of a positive sign. At the same time, shallow marine Paleogene formations in the central part of the Fergana megasyncline lie at a depth of more than 7.5 km, and in the Surkhandarya - more than 5 km, which characterizes the total amplitude of descending movements.

The mountainous region of the newest contrasting movements, possessing a multi-kilometer amplitude, is replaced by the Turan Plate plains in the northwest. An exception is the western subsidence region of the Turkestan and Zarafshan ranges: the Nuratau, Zirabulak-Ziaetdin, Karatyubinsk mountains, and the Zarafshan intermountain depression, where a region of relatively intensive recent tectonic movements in the form of a relatively narrow protrusion penetrates deep into the platform body. The highest points of the Nurota Mountains are located at an altitude of 1.5 - 2.0 km above the surface of the depressions, and the thickness of the Cenozoic mollasses in the Zarafshan Basin reaches 2.5 km. Thus, the range of the latest movements in this area reaches 3-4 km.

Within the Central Kyzylkum system of protrusions, individual fragments of the foundation, preserved after the late Cretaceous and Paleogene transgressions, were primarily raised by faults and formed large horst-anticlines: Kuldzhuktau, Auminzatau, Tamdytau, and others.

In the Amu Darya depression, the epiplatform stage was marked by the formation of transverse depressions to the previously dominant structures, which divided the Bukhara tectonic stage into separate uplifts. Such depressions include the Tuzkoy, Rometan, and Yambashin.

Some areas of the Beshkent depression experienced significant subsidence. Transverse dislocations are more pronounced the closer a particular region is located to the Tian Shan border. They cover both the regions of the Amu Darya depression and the adjacent zone of the Central Kyzylkum system of protrusions, creating cross-sectional structures (Agitma depression, etc.).

Analysis of the seismic hazard of the territory of Uzbekistan. The territory of Uzbekistan belongs to the Central Asian region, characterized by a complex geological structure and high tectonic and seismic activity of the Earth's crust. Approximately 55% of the republic's territory can be affected by earthquakes with a magnitude greater than 5 ($M > 5$). 25 million people live in this region. 120 cities, founded several thousand years ago and in the last century, are located in seismically hazardous areas.

Uzbekistan is one of the most densely populated countries in Central Asia. The total area of the country is 447,400 km². The high level of seismic risk for Central Asia is characterized not only by seismic hazard but also by the vulnerability of buildings and structures. Earthquakes in Uzbekistan have long been a great danger, causing human casualties and material losses. Since it is in the seismically hazardous territories of the republic that the majority of the population lives, and residential, civil, and industrial buildings and structures, as well as infrastructure facilities, are located, the problem of assessing and reducing seismic risk is particularly relevant.

The territory of Uzbekistan is located in the Central Asian zone, which is characterized by a complex geological structure and high tectonic activity of the Earth's crust. It experiences the deforming influence of large blocks of the consolidated Earth's crust: in the north and west - the Central Kazakhstan Shield and the Turan Plate, in the east - the Tarim, in the south - the Indian platforms.

The relief of Uzbekistan is very diverse, although it is one of the most flat republics in Central Asia. The mountainous region occupies the eastern and southeastern parts of the republic and represents the periphery of the powerful Tian Shan and Pamir-Alay mountain ranges, alternating with intermountain depressions or open foothill plains with a general tendency towards decreasing absolute heights towards the west. The main elements of the mountain region are structural systems: Chatkal-Kuramin, Nurat-Turkestan, Hissar-Zarafshan mountain uplifts and their intermountain and foothill depressions: Fergana, Tashkent foothill basin, Surkhandarya intermountain depression and small mountain depressions- Gallya-Aral, Koytash, Nuratin, Arnasay.

The plain-plain region occupies about 70% of the republic's territory and includes the Bukhara-Karshi steppe, the Zarafshan delta, Kashkadarya, Akchadarya, Sarykamish, the modern Amu Darya delta, the Ustyurt Plateau, and the Kyzylkum Desert. Thus, the relief of the territory of Uzbekistan combines high mountain ranges and the intermountain depressions that divide them, transitioning in the west and northwest into flat spaces, which is related to the geological development of the region (Ibragimov, 1980, Abdullabekov, 2002).

According to historical data, more than 500 earthquakes with a magnitude greater than 5 ($M > 5$) have occurred in the territory of the republic. Instrumental observations have been conducted in Uzbekistan since July 13, 1901, when one of the world's first seismic stations was opened in Tashkent. To date, unique seismological data for 100 years have been collected, 24 digital stations are operating throughout the republic, and in the near future, the installation of another 8 stations is planned. The Institute of Seismology of the Academy of Sciences of the Republic of Uzbekistan has a unified (general) catalog of strong earthquakes in Central Asia. Between 1955 and 2010, 82 earthquakes of magnitude were recorded in the territory of Uzbekistan.

$M > 5$. Of these, $M=5,58$, $M=5.5-14$, $M=6,4$, $M=6.5-4$, $M=7 - 2$. Analysis of earthquakes based on historical data and registration of modern seismic events showed that catastrophic earthquakes with an intensity of 9 points (according to MSK - 64) in the territory of Uzbekistan were observed in Khorezm (1209), Fergana (1822), Andijan (1902), Karatag (1907), Chotkol (1946), Gazli (1984), and Tashkent (1984), where earthquakes with a magnitude of 9 were recorded. (Abdullabekov, 2002).

The seismicity of the Republic's territory is due to the peculiarities of the deep structure of the Earth's crust and the upper mantle of the Central Asian basin of the mountainous-folded region. It has been established that the most intensive movements occur along the junction zones of geological structures and the nodes of tectonic disturbances, creating the possibility of earthquakes.

R.N. Ibragimov, depending on the historical-structural situation and seismicity within Uzbekistan, identified seismically hazardous regions (geodynamic districts): Fergana, Tashkent region, Samarkand, Bukhara-Karshi, Central Kyzylkum, Surkhandarya, within which seismotectonic structures are located, differing not only in the nature, scale, and time of manifestation of the latest tectonic movements but also in the distribution of earthquake foci (Ibragimov, 1980, Abdullabekov, 2002, 2011). Within each region, seismic structures have been established, which in turn are divided into seismogenic zones caused by active ruptures.

A seismogenic zone is a fault or fault system in the Earth's crust that, at a certain stage of the region's tectonic activation, episodically generates strong earthquakes due to various movements of active geological structures (blocks) along them. Geological structures separated by active faults are concentrators of seismotectonic stresses, and faults themselves are systems for discharging seismic energy, i.e., foci of earthquakes of various magnitudes. On the earth's surface, they are represented by epicentral, i.e., Pleistocene regions of strong earthquakes with possible residual deformations.

Three categories of seismogenic zones have been identified in the territory of Uzbekistan, where earthquakes with a maximum magnitude (M) and intensity (J) are possible in the future: 1) $M < 7.5$ and $J < 9$ points; 2) $M < 6.5$ and $J < 8.3$ points; 3) $M < 5.5$ and $J < 7$ points. Below, the characteristics of seismogenic zones are presented (Table 1).

The table presents 31 seismogenic zones: Fergana-Talas, Chatkal-Atoynak, North Fergana, Namangan, Andijan, South Fergana, Kursab, Taldisu, Chatkal, Sandalash, Angren, Pskem-Tashkent, Nurekata, Langar, Ugam-Karzhantau, Mogoltau-Pistolitau, Besapan-Northern Nurota, Bukantau, North Tamdyn, North Kuljuktai, South Auminzatau, Zarafshan, Predkyzylkum, South Tian Shan, Bukhara, Sultanuizdag, Hissar-Kokshal, Kyzylarya-Langar-Karail, Boysun-Kugitang, Surkhandarya-Sherobod-Kelif, Babatag-Keykitau. Each seismogenic zone is caused or represented by certain structures (regional, active faults) of varying length and width (Fig. 3.). Analysis of the history of development showed that in any parts where disorders occurred, movements of varying nature and intensity occurred at different times. Taking into account the activity of the latest tectonic differentiated movements within the above-mentioned

seismogenic zones, earthquakes of varying intensity are predicted. In some zones, a number of paleoseismic dislocations have been identified, indicating the possibility of future destructive earthquakes with $M < 7.5$ and $J < 9$ points (Table. 1).

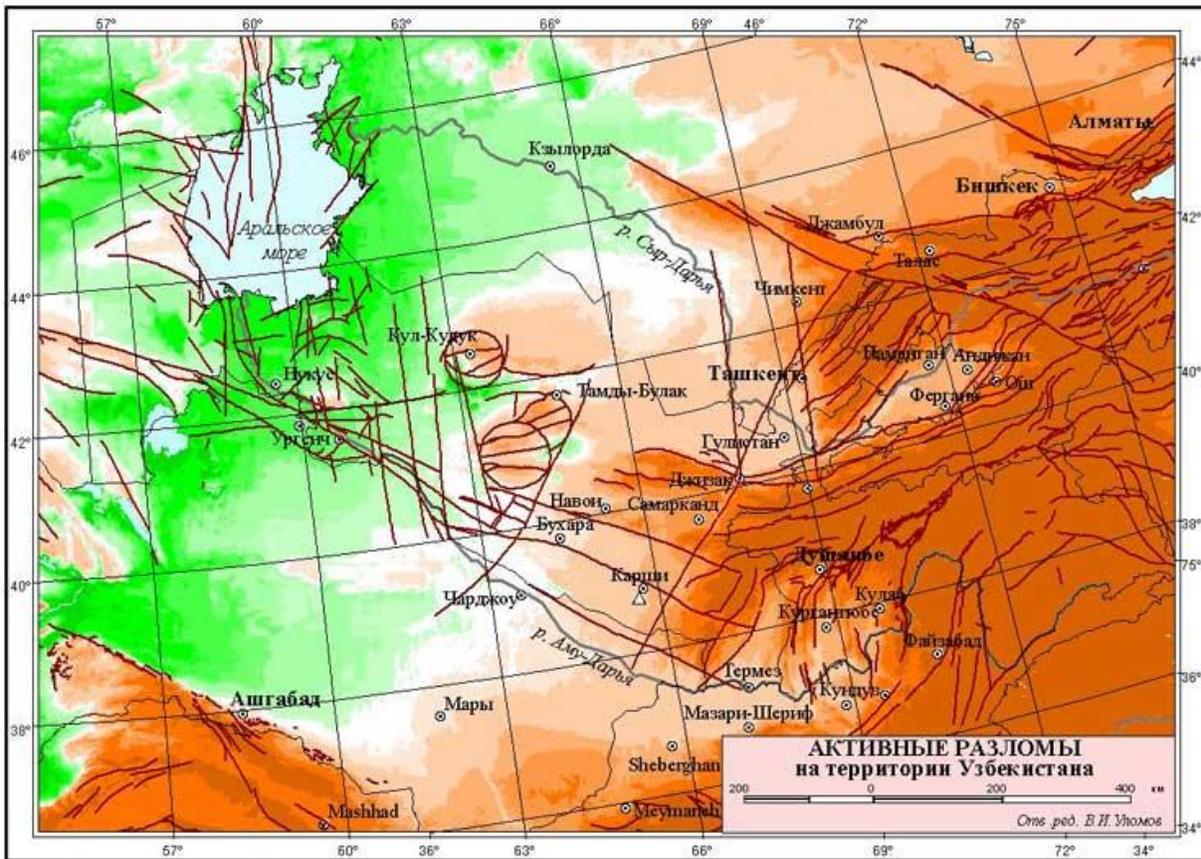


Figure 3. Map of active faults in the territory of Uzbekistan

Table 1: Characteristics of Seismogenic Zone Categories (territory of Uzbekistan)

No.	Names of seismogenic zones	Connection with structures	Traces of past earthquakes	Earthquake manifestation probability forecast
I.	Fergana-Talas	Regional Tian Shan fault	Chotqol earthquake (1946) Paleoseismic dislocations of Talas, Karaulja	Potentially politically hazardous (boundary seismic strength $J=8-9$ points, $M < 8$, $H < 20-30$ km)

II.	Chatkal-Atoynak	Chatkal-Atoynak and Fergana faults	Chotkol earthquake (1946)	Maximum seismic intensity >9 points, M=7.8 H<20-25 km
III.	North Fergana	Chatkal-Atoinaxy	Destructive earthquakes are known	M<7.5 J=9 points
IV.	Namangan	North Fergana flexural-faulted zone and Baubashata fault	Earthquakes with J=8-9, points	M<7.5. J=9.
V	Andijan	North Fergana flexural-faulted zone	Earthquakes: (838, 1882, 1902) with J=9 points (1903, 1942, 1947) with J=7-8 points	North-eastern part; M<6.5 J=8 points
VI.	South Fergana	The same-name faults along the northern slopes of the Alai and Turkestan ranges	Urtepa earthquakes (1897, 1923), Kyrkkol (1907), Frunze (1974). Haydarkan (1977). Isfara-Batkest.	M<6.5, J=8 points
VII.	Kurshabi	system of the same-name faults	Earthquakes: Kurshabskoye (1924) with M<6.5. J=8 points: (1974) with M<5.1. J=7 points	
VIII.	Taldysu	Kugarian and Kukyan fault systems	Earthquakes with M<5.3-6.4. J=7-8 points	M<6.5. J=8 points
IX.	Chatkal	Selected conditionally	Poleo-seismic dislocations, earthquakes with J=9 points	M<7.5 J=9 points
X	Candalash	system of the same-name fault		
XI.	Angren	North-South Angren Faults	Earthquakes: Bukineskoye (1967) with J=6-7, points: Koshtepinskoye (1965) with M<6.1 J=7 points	Northern part: M<6.5 J=8 Southern part: M<5.5 J=7
XII.	Pskem-Tashkent	Pskem Surfacing and Karzhantau Surfacing System	Earthquakes: Pskem (1937) with M=6.5 H=20 km, J=8 points Khalbatsky (1972)	Strong earthquakes are possible
XIII.	Nurekata	Nurekata faults	Strong earthquakes have not been recorded, but this zone	M<6.5 J=8 points

			is identical to the last two seismogenic zones.	
XIV.	Langar	Aksu-Maidantali and Boganali faults	One earthquake (1967) with J=6 points is known.	M<5.5 J=7 19 points XV.
Ugam-Karzhantau	Ugamine fault	M<5.5 J=7		points XVI.
Mogolotau-Pistolitau	XVII.			
Besapano-Northern Nurota	Besapan-Northern Nurota faults	Several earthquakes with M<5.5 J=6-7	points M<5.5 J=7	points XVIII.
Bukantau	Bukantau faults	Several earthquakes with M<4.5-5.5. J=6-7	points Active zone M<5.5 J=8	points XIX.
North Tamdyn	system of the same-name fault	M<5.5 J=8		points XX
North Kuljuktai	North-Kuljuktai-Karatau-Turkestan Faults	Strong earthquakes in Bakhmal (1955) with M<5.2 J=7	Points: Gallyaaralskoye (1967) with M<5.1 J=6 points M<5.5 J=8	points XXI
South Auminzatau	M<5.5 J=7 points			XXII.
Zarafshon	South Kuljuktai-Zarafshan.Pre-Zylamine faults	M<5.5 J=7 points		XXIII.
Pre-Kyzylkum	XXIV.			
South Tianshan	system of the same-name fault	Gazli (1976.1984) with M<7.1 J=9 points	M<7.5 J=9 points	XXV.
Bukhara	Bukhara-Hissar-Kokshal fault	Бухара-Гиссаро-Кокшальский разлом	Earthquakes (818) with M<6.5 J=7 points: (1208.1821) with M<6.4 J=8 points	M<6.5 J=8 points
XXVI.	Sultanuizdag	It is conventionally identified as a result of the articulation of all major seismic-generating faults of Western Uzbekistan.	Kunya-Urgench (1208) with J=7-8	M<5.5 J=7 points
XXVII.	Hissar-Kokshal	System of -Bukhara-Hissar-Kokshal faults.Boysun-	Earthquakes: Karatag (1907) with M<7.4.	

		Kugitang.Surkhantau-Sherabad	J=7 points: Fayzabad (1943) with M-6.1. J=8 Haitian (1949) with M<7.4 J=9 points	
XXVIII.	Kyzyldarin-Langar-Karail	Hissar-Kokshal, Kyzyldarin faults and Langaro-		M<6.5 J=8 points
		Karelian flexural-faulted zone		
XXIX.	Boysun-Kugitan	Boysun and Kugitang faults system	Strong earthquakes: Boysun (1935, 1968) M<6.2 J=7-8 points	M<6.5 J=8 points
XXX.	Surkhantau-Sherabat-Kelif	Curtain-shaped rupture breaches, embankments and overlaps		M<6.5 J=8 points
XXXI.	Babatag-Keykitau	System of embankments and floats		

CONCLUSION

In the structure of the Earth's crust, fault disruptions are of great importance, most of which were established in the initial stages of its formation and periodically renewed (regional faults) or arose along the edges of large structures (marginal faults, ring and half-ring faults). In zones of tectonic disturbances, the most intensive growth of local anticlinal folds was noted, which was accompanied by earthquakes. Thus, the modern structural plan reflects the synthesis, the interference of inherited northwestern and newly formed north-eastern structures.

Within the studied territory between seismogenic zones, there are vast areas where there are no geological prerequisites for the occurrence of destructive earthquakes of 7 points or more. Their generation was not registered. However, these areas were affected by tremors from neighboring seismogenic zones. Sometimes, an increase in earthquake intensity was observed here, not exceeding the values of nearby seismogenic zones. In addition, a large number of weak earthquake epicenters with magnitude $M \leq 4.5$ were identified in the same areas. They are likely caused by the emergence of small cracks and cracking of the Earth's crust during deformations of various geological structures.

REFERENCES

- Dobrovolsky I.P (1984).** Mechanism of tectonic earthquake preparation. M. USSR Academy of Sciences.
- Ibragimov R.N (1978)** Seismogenic zones of the Middle Tien Shan. T. FAN.
- Catalog of earthquakes of Uzbekistan for 2001-2005. Complex expedition of the IS of the Academy of Sciences of the Republic of Uzbekistan. Tashkent (2006).
- Abdullabekov K.N. et al. (2002).** Seismic regionalization and earthquake forecasting in Uzbekistan. T. HYDROINGEO
- Abdullabekov K.N(2007).** Problems of Seismology in Uzbekistan. Journal, IS RUz, Tashkent 272 p.
- Saidova S.A (2011).** Study of the hydrogeodeformation field in the territory of the Republic of Uzbekistan // Collection of theses of the Republican scientific and technical conference. "Priority directions of geological study of subsoil, hydrogeological and engineering-geological research in the Republic of Uzbekistan. Tashkent P. 226-228.
- Sobolev G.A (1993).** Fundamentals of Earthquake Forecasting. - M.: Nauka, 344 p.

Vartanyan G.S (2008). Some deformation mechanisms of the Earth's endodrenage system functioning and seismicity // *Domestic Geology*. No. 2, pp. 18-27.

Tulyaganov Kh.T., Yaskovich B.V (1980). Geological map of the Uzbek SSR. Tashkent, "Fan" Publishing House of the Uzbek SSR, 200 p.

Sadovsky M.A (2004). Geophysics and explosion physics. - M.: Science, 440 p.