International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2022 Vol. 12, pp. 118-131/Ogli and Abdurazakovich
Research Article

PECULIARITIES OF NEOTECTONIC MOVEMENTS AND DEFORMATIONS OF DIFFERENT RANKS OF THE SOUTH-WESTERN SPURS OF GISSAR (UZBEKISTAN)

[1]Dononov Jasur Ural ogli*, [2]Umurzakov Rakhinjan Abdurazakovich
[1]Karshi Engineering and Economic Institute, Uzbekistan
[2]Tashkent State Technical University, Uzbekistan
**Author for Correspondence*

ABSTRACT
The paper notes that in order to study the nature and mechanisms of formation of the structure of individual territories, it is necessary to decompose the total interference pattern of neotectonic movements and deformations into rank components. Such a methodological approach, as applied to tectonic movements, deformations and fields of tectonic stresses, is called tectodynamic analysis.
The description of the results of applying the decomposition technique for the decomposition of neotectonic movements and deformations of the Southwestern spurs of Gissar is given. It is shown that the structural patterns of neotectonic movements and deformations of the first, second and third ranks differ significantly. Elements of the main structures of the South-Western Gissar - Baysun-Kugitan, Surkhantau, Chakchar uplifts, Baysun trough, appear at the level of the third rank.
Structural diagrams of the orientation of discontinuities of different ranks were obtained: faults, large cracks, secant outcrops, cracks in outcrops. They testify to the predominance of northeastern (southwestern orientations) reverse faults, northwestern (southeastern) faults; the same pattern is observed in the orientations of large fissures intersecting outcrops. As for the cracks in the outcrops, there is a predominant dip of the planes to the southeast, and less to the northeast. Conclusions are drawn about the differences in the mechanisms of their formation.

***Keywords**: Neotectonics, Movements and Deformations, Tectodynamics, Rank Components, Mechanism of Formation, South-Western Gissar*

INTRODUCTION
One of the important factors influencing the location of mineral deposits is structural-tectonic. This factor also has a major impact on the location of oil and gas fields, and also determines the formation of earthquake sources. At the same time, indicators of neotectonic movements and deformations - amplitude, speed, sign, contrast, etc., are of the greatest importance. In recent decades, the interest of researchers in the tectonic factor has been combined with tectonophysical concepts that form the basis for studying the mechanisms of tectonic movements and deformations. Serious attention is paid to their aspects such as kinematics and dynamics. Many researchers are trying to pay more attention to geodynamics, the creation of geodynamic models that make it possible to explain many questions about the nature of ongoing geological processes.
The study of the mechanisms of formation of folds and ruptures in the middle of the last century was formalized in an independent direction - tectonophysics (Gzovsky, 1975). The main tasks of tectonophysics are the study of deformation regimes, the formation mechanisms of deformation elements of the Earth's crust, the study of forces and stress fields (Gzovsky, 1975; Gintov, 2005; Rebetsky *et al*., 2017; Seminsky et al., 2004). For this, a wide range of experimental (Sankov et al., 2020; Kocharyan et al., 2018) and computational-theoretical (Goncharov, 2010; Artikov *et al*., 2020) is carried out. Of particular importance are studies of the mechanisms of formation of earthquake sources (Kalmetyeva *et*

al., 2019; Kolodyazhny *et al.*, 2020) with the development of tectodynamic models of the latest tectonic movements and deformations (Umurzakov, 2012).

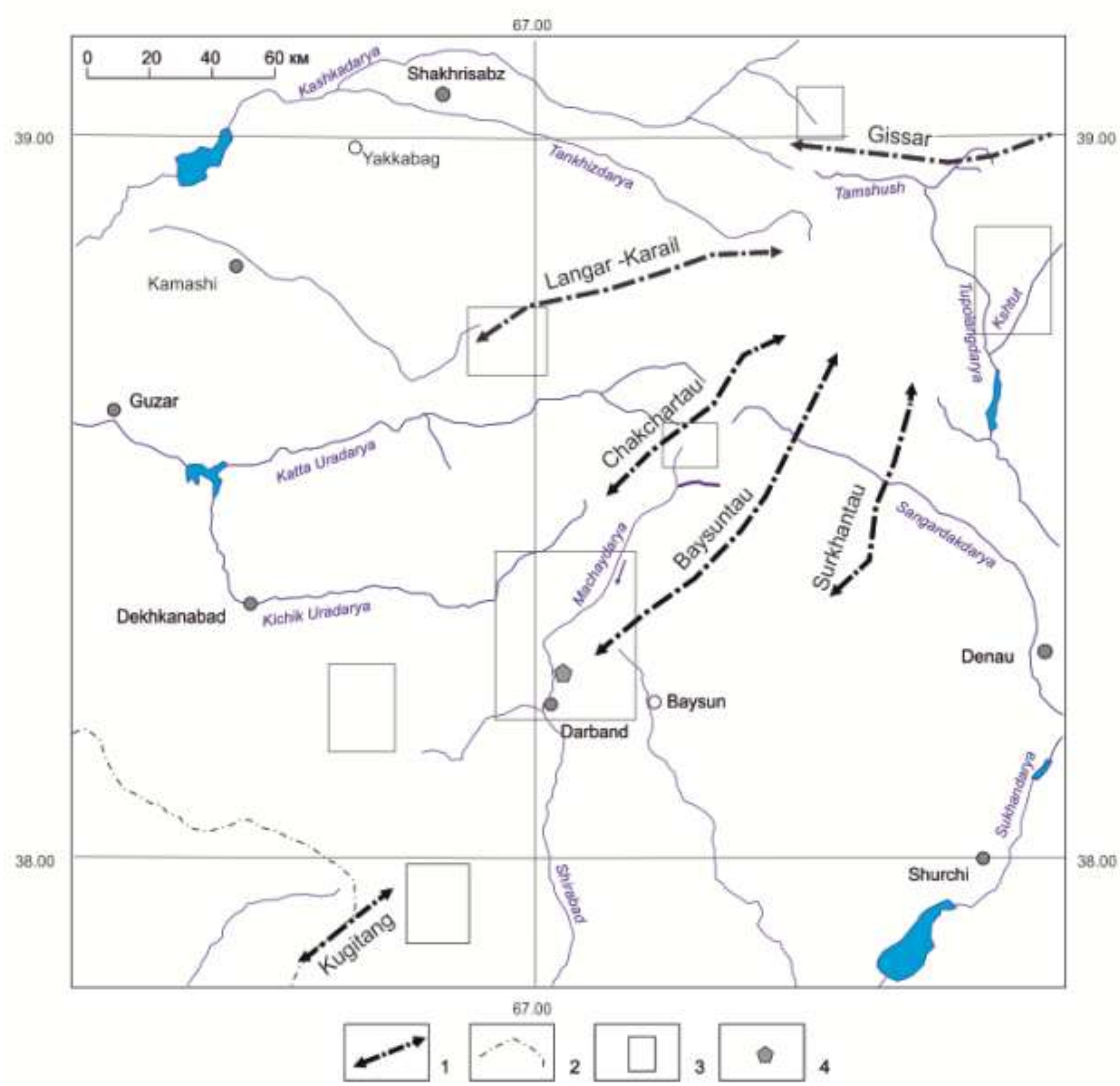

Figure 1: Overview map of the study area

1 - axes of strikes of mountain uplifts;

2 - state border;

3 – area of detailed studies;

4 - Educational and methodological research center named after professor A.A. Abidov.

It should be noted that the basis of model development should be the results of field tectonophysical studies of elements of faults and folded deformations. A detailed summary of the physical and geological foundations of modern methods of tectonophysical study of deformations in the field is given in the work of OB Gintov (2005). An overview of algorithms and methods for reconstructing stress fields from geological and seismological data is given in (Rebetsky *et al*., 2017). The work of Zh.V. Seminsky, K.Zh. Seminsky (Seminsky *et al*., 2004) is devoted to the tectonophysical analysis of the settings of localization of ore fields in fault zones. In (Sankov *et al*., 2020), on the example of Mongolia and adjacent territories in southern Siberia, the main results of studies of the stress-strain state of the latest Cenozoic stage of the development of the earth's crust are presented. An analysis of the sequence of manifestation of stress fields by type and spatial characteristics made it possible to establish the main patterns of evolution of the stress-strain state of the earth's crust in the study area over time (Sankov et al., 2020). At the same time, the rank approach to the study of stress and strain fields has become increasingly widely used. The

complex of studies with the separation of the rank components of neotectonic movements and deformations, fields of tectonic stresses was once called tectodynamic analysis by P.N.Nikolaev (Nikolaev, 1992). Its main element is a tectodynamic system, which represents a model of the interaction of tectonic movements, deformations and fields of tectonic stresses in a certain volume of the geological environment, characterized by emergent properties.

The multifactorial nature and discreteness of natural processes makes it possible to single out a hierarchy of different rank components of tectodynamic systems (Umurzakov, 2012; Nikolaev, 1992). Despite the fact that system analysis with the allocation of "tectodynamic systems" is used only by individual researchers, the structural-hierarchical approach to the analysis of folded-discontinuous deformation elements is currently widespread. For example, the work (Cheremnykh, 2018) presents the results of studying the paragenesis of faults of different ranks in the zones of large disjunctives in Western Transbaikalia. These examples show the possibilities of modern tectonophysical and tectodynamic analysis in the study of tectonically and seismotectonically active regions. This article presents some results of the application of the mentioned methods in the conditions of the Southern Tien Shan, where the Southwestern spurs of Hissar represent an independent object of study (Figure 1).

The purpose of this work was to study and analyze the features of individual rank constituent elements of the latest tectonics of this region, both with the involvement of published works and field materials.

MATERIALS AND METHODS

To solve the tasks set, a complex use of the methods of tectonophysical and tectodynamic analysis was carried out. Cartographic published materials on the geological structure (materials of the state geological survey of the State Geological Survey of the Republic of Uzbekistan), tectonics and the latest movements of the region, given in the works of (Ekshibarov, 1962; Arslanbekov, Nabiev, 1981; Zeisler, 1962; Pokrovsky, 1963; Akramkhodzhaev, Egamberdiev, Mirkamalov, Nartadzhiev, 1971; Atabaev, 2009; Atabayev, 2019) field structural-geomorphological and tectonophysical observations. Geotectonically, the region under study is characterized by an orogenic regime of neotectonic development and is represented by a strongly dissected relief. The core axial parts of the uplifts of anticlinal and horst-anticlinal types are composed of pre-Mesozoic formations (Figure 2). Along the periphery, Mesozoic Jurassic, Cretaceous, and Paleogene formations are in contact with them. Detailing of the geological section of the territory is well presented in Figure 2. Jurassic rocks are represented in the lower part by siltstones, clayey sandstones, limestones, in the upper part by hydrochloric anhydrite formation. Cretaceous rocks are represented by continental red-colored deposits (sandstones, gravelstones, sandy-argillaceous layers). The Paleogene is represented mainly by light limestones, shell rocks. They are overlain by red-brown sandy-clay deposits of the Neogene (Figure 2).

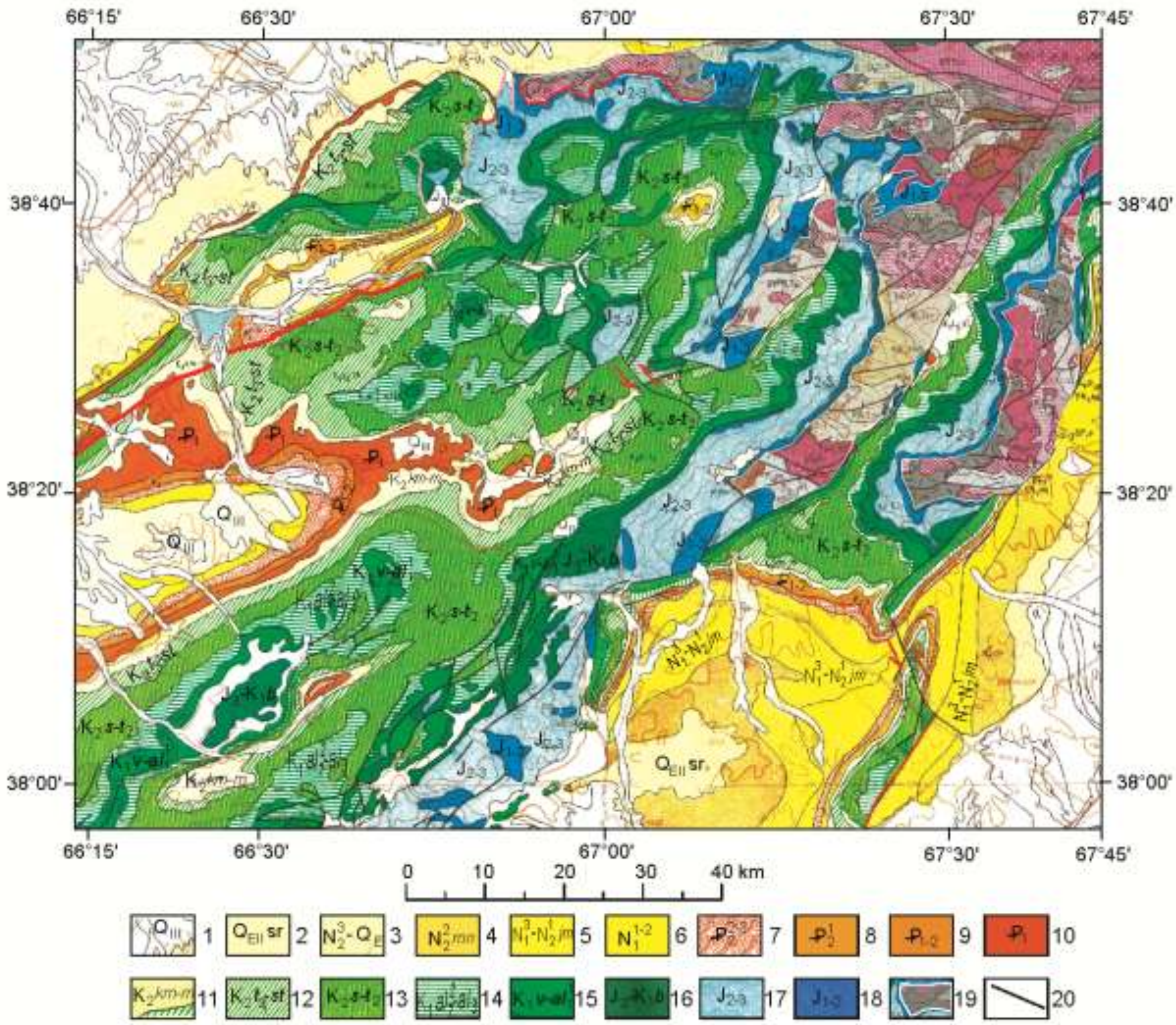

Figure 2 : A fragment of the geological map of the studied region of the South-Western spurs of Gissar (Materials of the State Committee for Geology of the Republic of Uzbekistan): Geological formations of various ages

1-2 - Quaternary, Pleistocene: 1 - upper link, Golodnostepsky, Dushanbe complexes - conglomerates, breccias, crushed stone sands, sandy loams, in places loess ; 2 – Sairob suite-gravelites, conglomerates, sandstones, siltstones; 3 - late Pliocene-Eopleistocene, conglomerates, sandstones, siltstones, salt and gypsum interbeds; 4 - Upper Pliocene, Munchak Formation - sandstones, gravelstones, conglomerates, siltstones; 5 - Upper Miocene-Lower Pliocene, Yamcha suite - siltstones, clays, sandstones; 6 – lower-middle Miocene. Shurysai, Gadzhak suites - siltstones, sandstones, clays, conglomerates, limestone and gypsum interlayers; 7 - middle-upper Eocene, the upper part of the Sugralin suites –greenish-gray clay, carbonate clays, in the lower part – gray, brownish marls with interlayers of light limestones; 9 – Lower Eocene, Givar suites – greenish-gray clays, marls below, less often limestones; 10 - Paleocene, Bukhara suites - sandy limestones, clayey gypsums, interlayers of dolomites.

Cretaceous system: 11-Campanian-Maastrichtian stages - limestones, gray clay sandstones; 12 - Upper Turonian substage - Santo stage: clays, sandstones, greenish-gray siltstones with interlayers of limestone-shell rocks; 13 - Cenomanian stage - Middle Turonian substage, clays, sandstones, siltstones; the Tyubegatan suite - clays. Sandstones, siltstones with interlayers of limestone-shell rocks, marls, gravelites; 14- The upper part of the Lower Albian-Upper Albian stages, the Shirabal suite - clays with interlayers of limestone-shell rocks, sandstones, gypsum; 15 - Valangian stage - the lower part of the Lower Albian substage, the Kyzyltash suite - red-colored siltstones, clays, sandstones, with interlayers of conglomerates and gravelites, marls, dolomites, gypsum.
Jurassic system: 16 - Upper Jurassic - Lower Cretaceous, Barriasian Stage, Gaurdak Series - salts, anhydrites (gypsum), siltstones, sandstones, conglomerates with interlayers of limestones, dolomites; 17 - middle - upper sections of the Jurassic, Kugitangskaya series (Gudzhumskaya suite) - limestones, sandstones, siltstones, dolomites, clays, gypsum interlayers; 18 - Lower-Middle Jurassic, Baysun suite - sandstones, siltstones, mudstones, clays, coals, conglomerates, marls; 19 – outcrops of pre-Mesozoic formations; 20 - discontinuous violations.

Quaternary deposits are found in depressions, erosion cuts and represent terraced steps in the relief. The main mountain rises are Surkhantau, Baysuntau, Chakchartau, and in the north of the territory - the Lyangaro-Karail uplift. In the South-Western spurs of Hissar, the manifestation of strong earthquakes is known: Baysun (07.08.1968, M=5.0), Lyangar (11.18.1971, M=4.8). Near the study area, within the southern and southeastern slopes of the Gissar uplift, the sources of a series of Karatag earthquakes (21.10.1907, M = 7.5., 7.3, 7.0), Chuyanchin earthquake (27.10.1907, M = 6.2) are known. In the depression part of the South Tajik Depression, sources of small and relatively shallow earthquakes appeared (1966, M=3.9; 1968, M=3.9).

When performing field observations, methods of field structural-geological, structural-geomorphological mapping, methods of geological survey and compilation of geological sections were used. In addition, tectonophysical study of deformation elements was carried out in rock outcrops: ruptures, folds, signs of kinematic displacements, statistical measurements of fracture occurrence elements, larger fractures and faults, elements of strike-slips, reverse faults, overthrusts.

A set of structural-geological methods for mapping deformation elements was used to reconstruct the axes of the main normal stresses - the kinematic method of O.I. Gushchenko, the method of statistical analysis of cracks by P.N. Nikolaev. A characteristic feature of the region under study is erosional dissection with the formation of large gorges, hollows, and erosion incisions.

The main water arteries are the Machaidarya, which passes into the Shirabaddarya to the south. In the west of the territory is the Guzardarya, which is formed by the tributaries of the Katta Uradarya and Kichik Uradarya. In the northern part of the territory is the valley of Kashkadarya. In the Machaidarya valley, as a result of the erosion of Jurassic rocks, large mountain gorges Darband and Tangisar were formed. When compiling a generalized schematic map of the latest tectonic movements (Figure 3), personal materials on individual areas and published data of Sh.U. Arslanbekov, K.A. Nabiev, V.N. Ekshibarov, B.B. Sitdikov, A.A. Yuryeva and others. This map served as the source material for the identification of components of different ranks of neotectonic movements. Nikolaev's decomposition method (Nikolaev, 1992) was used to compile rank maps of neotectonic movements. It consists in step-by-step averaging of the original map of the latest tectonic movements with a change in the area (window) of averaging.

An important part of the technique is the estimation of the size of the averaging area, which is selected taking into account the volumes of the active tectodynamic systems, which are characterized by integral properties. They are estimated based on the study of the dependences of the length of discontinuities and the distance between adjacent discontinuities, as well as the dependences of the distances between earthquake sources on their energy index (Nikolaev, 1992; Umurzakov, 2007).

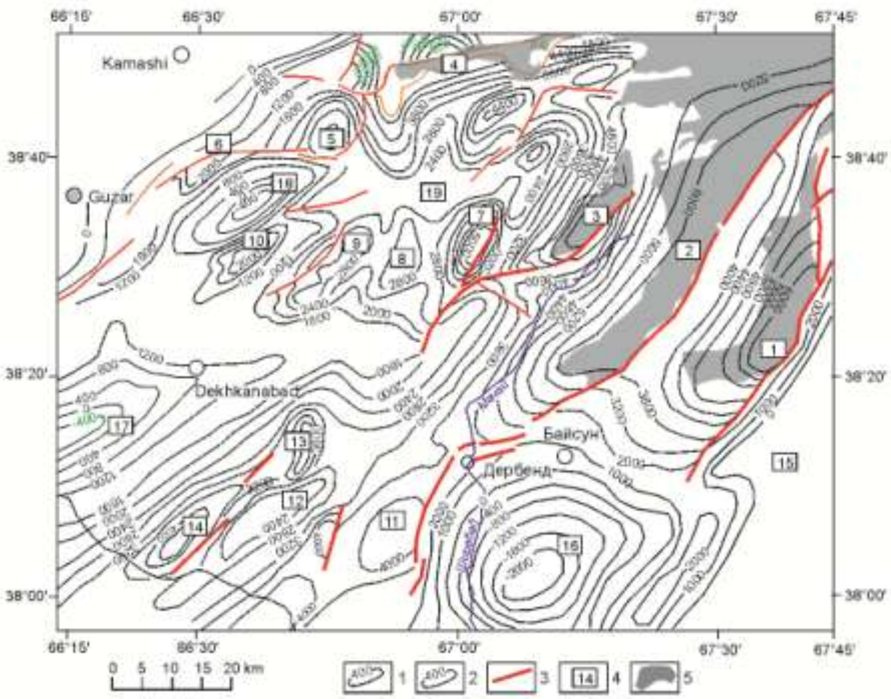

Figure 3: Consolidated schematic map of the total amplitudes of neotectonic movements and deformations of the Southwestern spurs of Hissar (compiled on the basis of published data by S.V. Ekshibarov, A.A.Yuryev, Sh.U.Arslanbekov, K.A.Nabiev and personal observations)
1-2: stratoisohypses along the top of the Oligocene deposits (bottom of the Neogene Tandyrcha Formation): 1 (solid line) – stratoisohypses, 2 (dashed line) – assumed on the basis of calculated data, above the modern eroded surface of the mountain relief; 3 – rupture of different morphological types; 4 - positive (uplift) and negative (subsidence) structures of different orders: Positive (uplift): large horst-meganticlines: 1 - Surkhantauskaya, 2 - Baysunskaya, 3 - Chakcharskaya, 4 - Ishakmaydanskaya; anticlines: 5 - Lyangarskaya, 6 - Amanatinskaya, 7 - Chigirtkalinskaya, 8 - Karasyrtskaya, 9 - Gaukhanskaya, 10 - Adamtashskaya, 11 – Sairobskaya, 12 – Gujum, 13 - Dzhibagilskaya, 14 - Tyubegatanskaya. Negative (depressions): 15 - Surkhandarya, 16 - Baysun, 17 - Dekhkanabad, 18 – Shorguzar; 19 – Katta-Uradarya group of salt domes; 5 - outcrops of pre-Mesozoic formations.

A detailed description of the methodology is of independent importance, and can take up a significant amount of the article. Separate works are devoted to them (Nikolaev, 1992; Umurzakov, 2007; Umurzakov, 2012). Here we note that for the region of the western part of the Tien Shan, R.A. Umurzakov obtained the characteristic volumes of tectodynamic systems of three ranks, the linear dimensions of which are: by area, the first rank is 300-800 km; second rank - 150-240 km; third rank - 60-100 km; in depth, respectively, more than 22-35 km, from 10 to 20-22 km, from 0 to 10 km (Umurzakov, 2007).
Together with general regional observations, detailed structural-geological and tectonophysical studies were carried out in some areas, the results of which were used to draw up detailed diagrams of the position and morphological features of discontinuous elements. Separate such sites are located in the Machaidarya valley, in the southeastern wing of Baisuntau (Derbend-Kapchigay-Yalgyzbulak-Tuda). The

zone of the South Baysun uplift passing here, which limits the Baysun uplift from the southeast, was studied in more detail.

RESULTS AND DISCUSSION

The results of the research are described and discussed in two aspects: on the one hand, maps-schemes of the rank components of neotectonic movements and deformations, on the other hand, the results of detailed field structural-geological and tectonophysical observations in certain areas of the territory. Figure 4 shows a schematic map of the total amplitudes of neotectonic movements and deformations of rank 1 (for this region). The whole area is experiencing upward movement. The maximum amplitude is observed in the northeastern section (near the city of Khodjapiryakh), where the maximum amplitude is 4600-4800 meters. Here, the total amplitude (without decomposition into ranks) is 5800-6000 meters (Figure 3). There is a general decrease in the value of the amplitude to the southwest and northwest.

At the level of the second rank, the total amplitude of movements and deformations varies from -2000 to 2500 meters. The uplift with a maximum value of 2500 meters shifts to the south, falls on the area near the latitude 38° 20' and the meridian 67° 20' - in the relief, this area falls on the region of the mountain with an absolute mark of 3921.0 meters of the Baysuntau ridge. The northeastern orientation of the folded structure is noted, which is characterized by symmetrical northwestern and southeastern limbs. Where there was an uplift at the level of the first rank (Figure 4) (in the northeast), there is a deep subsidence (less than -2000 meters) (Figure 5). In the western part, there is a deflection (-1250 meters) of a northeastern orientation, separated by a small saddle.

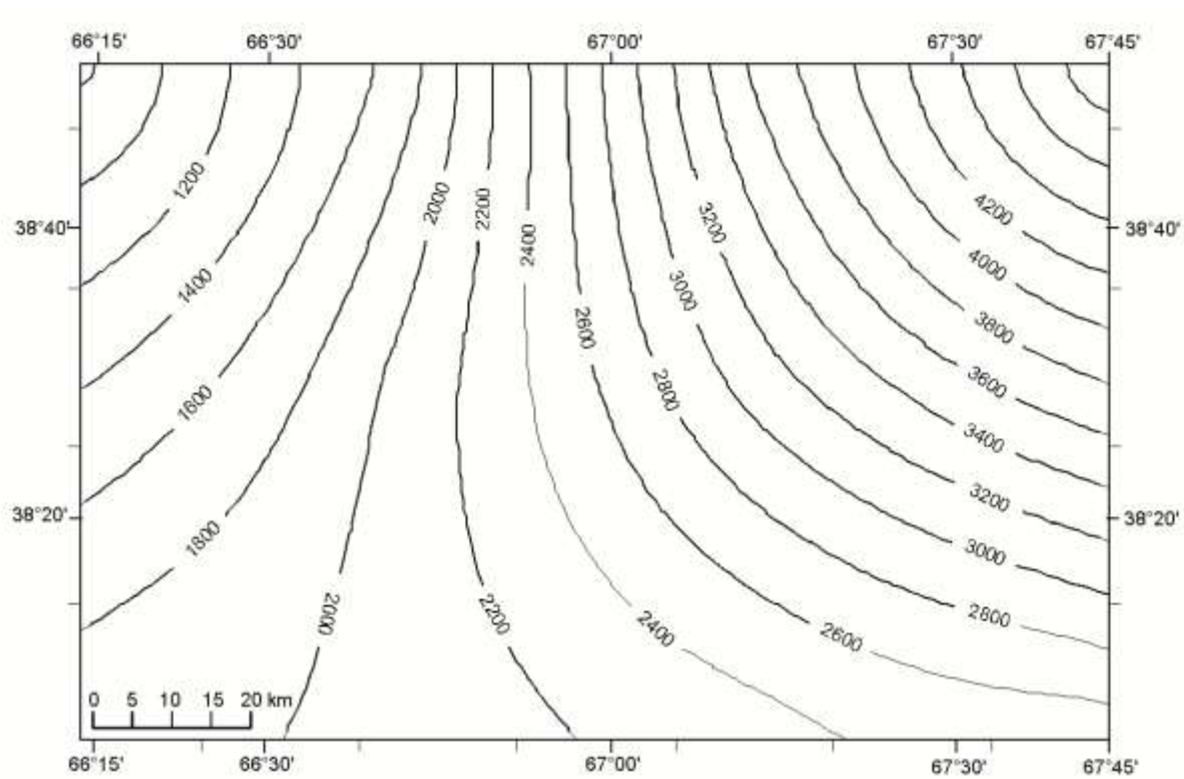

Figure 4: Map-scheme of isolines of the total amplitudes of the latest movements and deformations of the first rank of the South-Western spurs of Gissar

Figure 5 shows a map-scheme of the total amplitudes of the latest movements and deformations of the second rank. Figure 6 shows a map-scheme of the latest movements and deformations of the third rank. A more differentiated picture of the manifestation of ups and downs is visible. There is a general northeastern (southwestern) orientation of local uplifts and depressions, the relative amplitude of which reaches 1000-1500 meters. Surkhantau, Baysun-Kugitan, Chakchartau are clearly manifested, in the north - Lyangar-Karail, in the south-west - Tyubegatan.

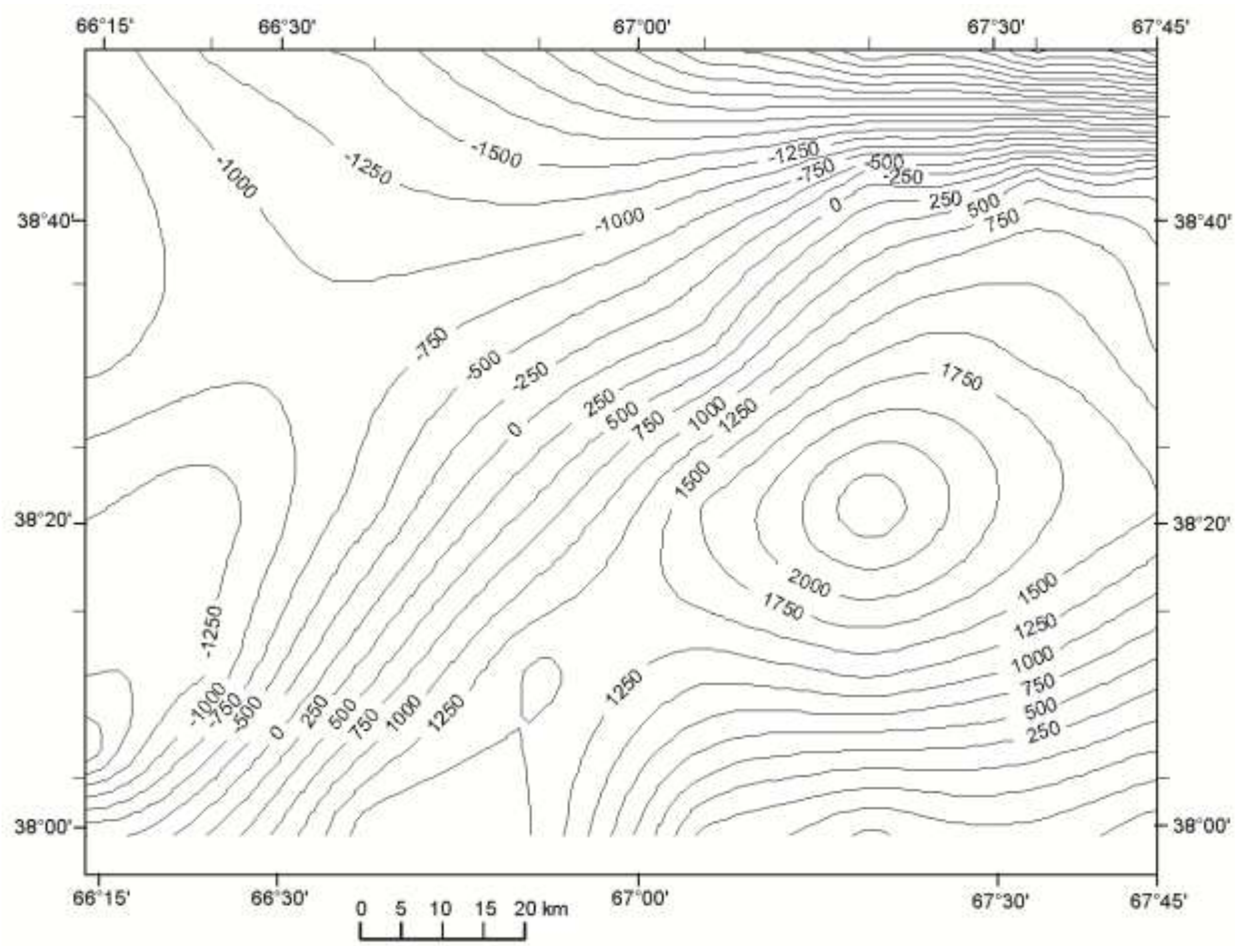

Figure 5. Map-scheme of isolines of the total amplitudes of the latest movements and deformations of the second rank of the South-Western spurs of Hissar

Closer to the southern part, the Baysun depression manifests itself. The Baysun-Kugitang and Surkhantau uplifts are characterized by an asymmetric structure of the wings - the southeastern wings have a steep slope, and the northwestern ones are gentle. Features of this structure of uplifts were also noted in the works of V.M. Zeisler, Sh.U. Arslanbekov, M.M. Madenov and others.
An analysis of the obtained materials on the structure of different-rank components of neotectonic movements clearly shows that a characteristic feature of the structure of the southwestern spurs of Hissar is noted only at the level of the third rank component. Structural patterns of folded structures of the first, second and third rank components have a sharp difference. All previous researchers, when explaining the nature of the formation of the structure of the SW spurs of Hissar, relied on the general superimposed (interference) pattern of movements and deformations. This circumstance led to the fact that researchers

do not have a unanimity of opinion, there is a fairly wide range of causal conditions for structure formation, which could be associated with different factors.

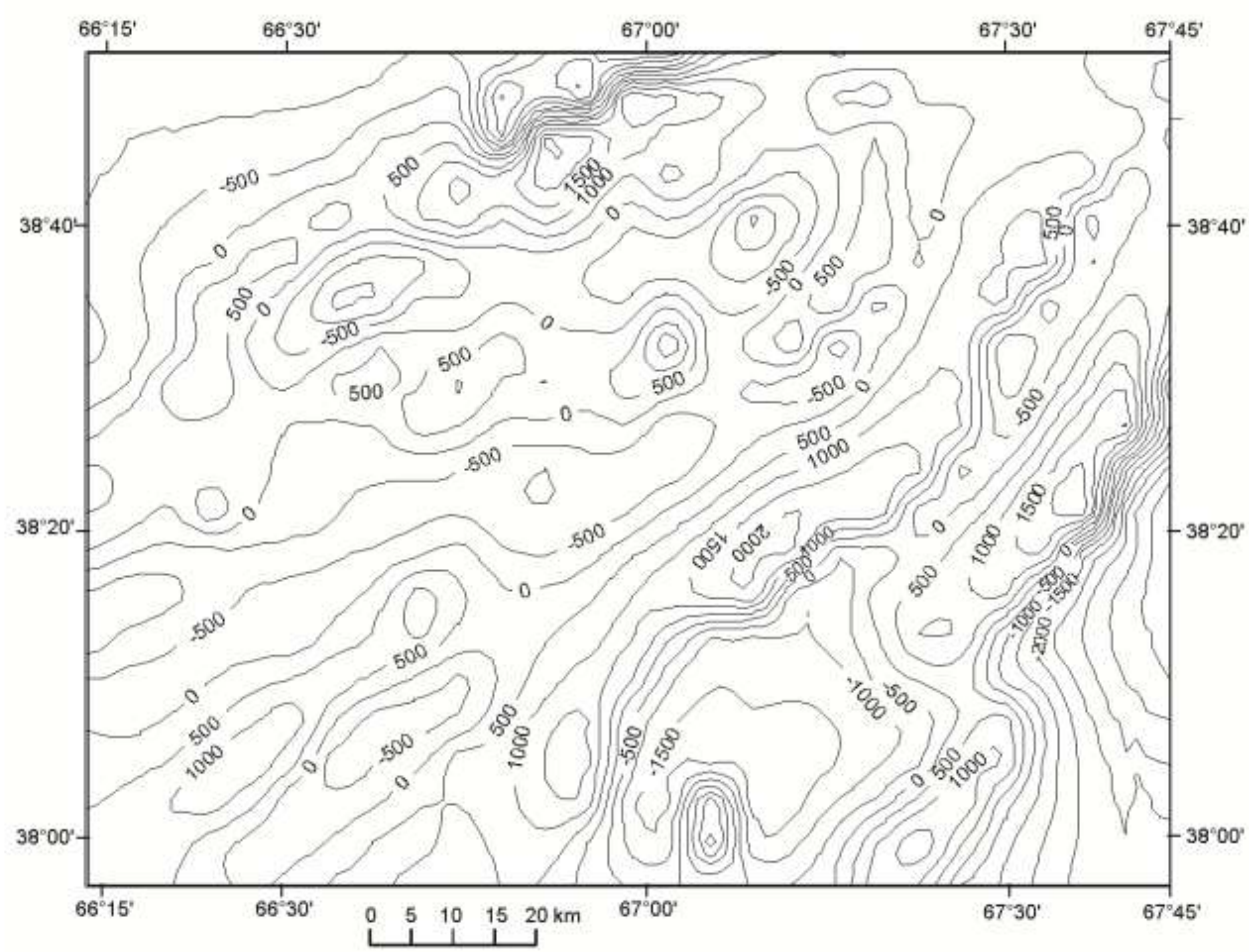

Figure 6: Map-scheme of isolines of the total amplitudes of the latest movements and deformations of the third rank of the South-Western spurs of Gissar

In addition to the cartographic materials noted above, we obtained important data on the structural and geomorphological features of folded-faulty deformation, their spatial orientation, and kinematic elements along ruptures and cracks. Among the faults that characterize the intensity and features of the deformation of the study area, it should be noted reverse faults observed in the valley of the river. Machai. One of them (Machai-Tangisar) stretches along the right bank of the Machaidarya and is characterized by the presence of folds and breaks, expressed in the relief. Figure 7 shows a photo-fragment of a separate section of a reverse-shear fault.

In the lower part of the figure, the azimuth of the dip of the layers is 310°, the angle is 15°, and in the upper part, the azimuth is 340°, the angle is 50°-55°. For the most part to the west, the fault is represented by interstratal displacement of large rock masses.

Figure 7: Fragment of the western part of the Machai-Tangissar reverse fault, 1.5 km west of the village of Past Machai (photo by R.A. Umurzakov, 2019)

An analysis of the materials of detailed studies of the development of discontinuous dislocations and fissure structures in the Machai valley, in the southwestern part of the Baysun uplift, showed the following. Figure 8 shows rose diagrams of discontinuity orientations, large fissures, secant outcrops and small fissures. Most of the faults (Figure 8, a) have a northeastern orientation and correspond to the general strike of the Baysun uplift. These are mainly reverse faults on the northwestern and southeastern limbs of the Baysun uplift. However, there are faults of northwestern strike in the axial part of the Baysun uplift, in the southeastern flank of the uplift, among which normal faults predominate.

Two orientations also predominate among the large cracks that cut rock outcrops (Figure 8, b) - northeast and northwest. In the summary rose-diagram of fracture dip azimuths in rock outcrops, dips to the southeast and northeast predominate.

It should be noted that A.V. Tevelev and B.V. Georgievsky (Tevelev et al., 2012) within the SW spurs of the Gissar, mainly distinguished large strike-slip and thrust structures. In this case, the slope of the displacement surfaces was characterized by their small values. Separate fragments of the reverse fault noted above, as well as a disturbance near the Khuzhamaykhona spring, can be attributed to such types of structures - these are large thrusts. Upper Jurassic deposits have undergone major slips at the contact of more plastic layers with terrigenous deposits.

This circumstance, the presence of a plastic hydrochloric-anhydrite stratum in the upper part of the Jurassic deposits, played an important role in the formation of the general structure of the region. However, the influence of this factor when considering the structural patterns of the latest movements and deformations of the first, second and third ranks turns out to be different. Perhaps this explains the existence of different opinions about the origin of the structures - under the influence of injection of salt-bearing accumulations into the crests of the folds; influence of diapirism processes; moving events, etc.

a b c

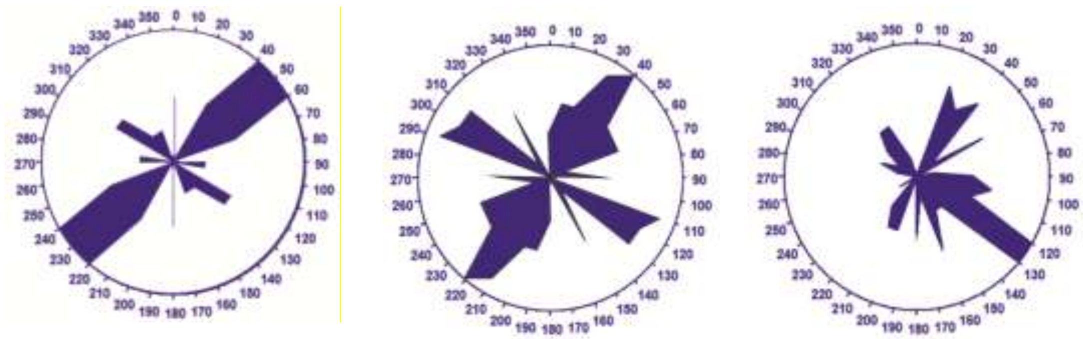

Figure 8: Summary rose-diagrams of the strike and dip azimuths of fault planes in the areas of detailed studies

a - strike rose of local faults with a length of 4 to 10 km; b - strike rose of large fissures cutting through rock outcrops; c - roses of dip azimuths of small fracture planes in rock outcrops

An important role in the formation of the structural appearance of the region under study was assigned to the influence of the foundation, which determined the stepped nature of the tectonic "relief". An analysis of these representations allows us to conclude that, to one degree or another, they take place, but are associated with the formation of structural patterns of different rank components. In the work of A.V. Pokrovsky, on the basis of the study of Paleozoic history, independent development of the southwestern spurs of Hissar was noted, regardless of the South Hissar zone (Pokrovsky, 1963).

The role of one of the main deep faults in the region, the Main Gissar (or South Tien Shan) fault, which extends directly in the zone of contact of the SW spurs with the main Hissar uplift, was shown. It seems that the structural pattern of neotectonic movements of the first rank was formed under the influence of deep processes that caused a sharp uplift of the northeastern section of the SW spurs of the Gissar. It is possible that these are upper mantle and intracrustal processes leading to longitudinal flattening of the earth's crust.

The situation is different with the formation of the second rank component, which is due to the intracrustal redistribution of matter with the maximum value of uplift amplitudes in the region of the mountain of 3921.0 meters of the Baysuntau ridge. A characteristic feature of the structure of the southwestern spurs of the Gissar at the level of the third rank component is the northeastern elongation, the asymmetry of folds with steep southwestern wings and gentle northwestern limbs, which can be associated to a greater extent with the action of a stress field with a subhorizontal northwestern (south-east) orientation of the compression axis, with the other two inclined. At the same time, the northeastern (southwestern) orientation of the extension axis leads to the formation of transverse faults noted in the axial part of Baysuntau and other parts of the study area.

CONCLUSION

Based on the studies performed, a summary map-scheme of neotectonic movements and deformations was compiled. It is an interfekrenional picture of superposition of movements and deformations of different ranks. Therefore, for a correct understanding of the structural plan and clarification of structural features, it is necessary to decompose the general map-scheme into rank components.

In relation to the region under study, according to the previously established estimates of the size of the scale parameters of tectodynamic systems, maps were obtained - diagrams of three rank components of tectonic movements and deformations. The structural plan of the first rank is a general positive uplifting structure. A large domed meganticline stands out, the arched part of which is in the northeastern part of the territory. The maximum amplitude reaches 4400-4800 meters. There is a decrease in the amplitude of uplifts to the southwest and northwest.

In the structural plan of the second rank, the total amplitude of movements and deformations varies from -2000 to 2500 meters. The rise with a maximum value of 2500 meters falls on the elevated part of the Baysuntau ridge (mountain with a mark of 3921.0 meters). The northeastern orientation of the folded structure is noted, which is characterized by symmetrical northwestern and southeastern limbs. In the western part there is a deflection (-1250 meters) of a northeastern orientation.

On the map-scheme of the third rank, the latest movements and deformations are more differentiated, local uplifts and deflections appear. There is a general northeastern (southwestern) orientation of local uplifts and depressions, the relative amplitude of which reaches 1000-1500 meters. Surkhantau, Baysun-Kugitan, Chakchartau are distinctly expressed, in the north - Lyangaro-Karail, in the south-west - Tyubegatan, Baysun depression. The Baysun-Kugitangskoe and Surkhantau meganticlinal uplifts are characterized by the fact that the southeastern limbs have a steep slope, and the northwestern limbs are gently sloping.

Statistical analysis of the spatial distribution of faults showed that longitudinal, northeast (southwest) strike of reverse faults prevail here, and to a lesser extent transverse faults of northwest (southeast) strike. Large fissures that cross outcrops at the observation points under study have a predominant northwestern trend, a smaller group has a northwestern (southeastern) strike. Statistical measurements of cracks at local observation points showed that the dip azimuths of crack planes are predominantly to the southeast, to a lesser extent to the northeast.

Preliminary assumptions are made about the mechanisms of formation of structural patterns of the first, second and third rank components of the study area. The pattern of neotectonic movements of the first rank was formed under the influence of deep processes that caused a sharp uplift of the area of the northeastern section of the SW spurs of the Gissar. It is assumed that this may be associated with upper mantle and intracrustal processes leading to longitudinal flattening of the earth's crust.

Intracrustal processes of matter redistribution led to the formation of a second-rank uplift corresponding to the middle part of the Baisuntau Ridge. A characteristic feature of the structure of the third rank component is small amplitudes (up to 1000-1500 meters), northeastern elongation, asymmetry of folds - with steep southwestern limbs and gentle northwestern limbs.

They are associated with factors of shallow action, determined by the action of a stress field with a subhorizontal northwestern (southeastern) orientation of the compression axis, with the other two being inclined. At the same time, the northeastern (southwestern) orientation of the extension axis leads to the formation of transverse faults noted in the axial part of Baysuntau and other parts of the study area. The results obtained will be used in the development of a tectodynamic model of the earth's crust and lithosphere of the study area, which is of practical importance for solving prospecting and seismotectonic problems.

ACKNWLEDGEMENT

The authors express their gratitude to the leaders of the Educational and Methodological Research Center named after Prof. A.A. Abidov, as well as Termez State University for creating favorable conditions for field work.

REFERENCES

Akramkhodzhaev A.M., Egamberdiev M.E., Mirkamalov H.Kh., Nartadzhiev M.N. (1971) Lithology, stratigraphy, oil and gas potential of Southern and Southwestern Uzbekistan, Tashkent 1-20.

Arslanbekov Sh.U., Nabiev K.A. (1981) Faults and geological processes (Southwestern Gissars). Tashkent, Fan. 104.

Artikov T.U., Ibragimov R.S., Ibragimova T.L., Mirzaev M.A. (2020) Models of the macroseismic field earthquakes and their influence on seismic hazard assessment values for Central Asia. *Geodynamics & Tectonophysics* 11(3), 606–623. doi:10.5800/GT-2020-11-3-0494.
Atabaev D.Kh. (2009) The history of development and the latest structural-tectonic plan of the Surkhandarya depression. *Bulletin of NUUz*, Tashkent, 4/1. 105-107.
Atabaev D.Kh. (2019) Deep structure and relief of the Surkhandarya megasyncline. 129.
Cheremnykh A.V. (2018) Parageneses of fractures in large fault zones of West Transbaikalia. *Geodynamics & Tectonophysics* 9(3), 889–908. doi:10.5800/GT-2018-9-3-0375.
Ekshibarov S.V. (1962) Tectonics and some issues of oil and gas content of the Mesozoic deposits of the southwestern end of the Gissar meganticline and the eastern part of the Kashkadarya depression. Tashkent: Publishing House of the Academy of Sciences of the Republic of Uzbekistan, 1962.- 128 p.
Gintov O.B. (2005) Field tectonophysics and its application in the study of deformations of the earth's crust of Ukraine. Kyiv: Phoenix,.- 572 p. (in russian)
Goncharov M.A. (2010) Applicability of similarity conditions to analogue modeling of tectonic structures // Geodynamics & Tectonophysics. V. 1. No. 2. P. 148–168.
Gzovsky M.V. (1975) Fundamentals of tectonophysics. Moscow Nauka 536 p. (in russian)
Kalmet'eva Z.A., Moldobekov B.D., Abdybachaev U.A. (2019) Correlation of the state of crustal stresses, seismicity and landslide activity (Fergana basin, Tien Shan). Geodynamics & Tectonophysics 10(4), 995–1009. doi:10.5800/GT-2019-10-4-0454.
Kocharyan G.G., Batukhtin I.V. (2018). Laboratory studies of slip along faults as a physical basis for a new approach to short-term earthquake prediction. Geodynamics & Tectonophysics 9(3), 671–691. doi:10.5800/GT-2018-9-3-0367.
Kolodyazhny S.Yu., Nekrasov A.I. (2020) Structural and dynamic distribution patterns of oil fields in the central part of the Volga-Ural anteclise. Geodynamics & Tectonophysics 11(1), 123–140. doi:10.5800/GT-2020-11-1-0467.
Madenov M.M. (1968) On the tectonic development of the southeastern part of the Turan Plate and some issues of its articulation with the epiplatform orogenic area. Uzbek geological journal. Tashkent. No. 5. - P.16-20.
Nikolaev P.N. (1992) Tectonodynamic analysis. Moscow: Nedra,. - 205 p.
Pokrovsky A.V. **(1963)** On the marginal deep fault of the Southwestern Gissar (Southern Tien Shan). Uzbek geological journal. Tashkent. 1963. No. 6. -p.52-57.
Rebetsky Yu.L., Sim L.A., Marinin A.V. (2017) From slickensides to tectonic stresses. Methods and algorithms. Moscow: GEOS Publishing House, - 234 p. ISBN 978-5-89118-740-5. (in russian)
Sankov V.A., Parfeevets A.V. (2020). The Cenozoic crustal stress state of Mongolia according to geological and structural data (review). Geodynamics & Tectonophysics 11(4), 722–742. doi:10.5800/GT-2020-11-4-0503
Seminsky Zh.V., 4. Seminsky K.Zh. (2004) Tectonophysical analysis of the localization of ore fields and deposits in fault zones of the earth's crust. Geology of ore deposits. V.46. No. 4. - S.292-304.
Tevelev A.V., Georgievsky B.V. (2012) Deformational history and oil and gas potential of the Southwestern Gissar (Southern Uzbekistan). Bulletin of Moscow University, ser. 4. Geology. No. 6. S. 21-35.
Umurzakov R.A. (2007) On the criteria for structural-hierarchical systematization in seismogeology // Problems of seismology of Uzbekistan – Tashkent. No. 4. -S. 137-145.
Umurzakov R.A. (2012) Late Cenozoic tectonic stresses and focal mechanism of some of the largest earthquakes of the Tien Shan Region // Comptes rendus – Geoscience, France. Parij. Volume 344, Issues 3-4, March-April 2012, Pages 239-246. Online publication complete: 25-APR-2012 DOI information: 10.1016/j.crte.2012.03.003. Article is now published online at: http://dx.doi.org/10.1016/j.crte.2012.03.003 .

Zeisler V.M. (1962) Block tectonics of the Southwestern spurs of the Gissar Range. News of higher educational institutions. Geology and Exploration. Moscow. No. 8. - S.21-32.