International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2015 Vol. 5 (2) May-August, pp. 150-155/Lola et al.
Review Article

KUMBEL-UGAM LINEATION (MIDDLE TIEN-SHAN)

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ABSTRACT
This article reviews Kumbel-Ugam fault of the Middle Tien Shan. It describes characteristics of deep faults and tectonic linear structures. Phases of tectonic magmatic activity of the Middle Tien Shan were identified within the age interval C_1 and P_1 with junction of two deep linear structures. Deep seated dislocation was established with geological-geophysical data. Development of Kumbel-Ugam linear structure was proved as regional long-lived deep structure resultant in numerous regenerations.

Keywords: *Fault, Linear Structure, Displacement, Magmatic, Basalts*

INTRODUCTION

Faults play an important and quite often leading role in formation of earth core structure as well as lithosphere of other regions. Disrupting thermodynamic regime of the upper Earth mantle, they appear as channels for penetration of magmas and fluids to the surfaces, being favorable structures for ore depositions. As many geological bodies, faults are characterized by certain set of parameters – length, penetration depth, width of the zone of influence, shift amplitude and located in space at a certain step range. Specialists of geological sciences - geologists, geophysicists, tectonophysicists express rather different attitude to the matter. Majority of geological specialists (Khoreva, 1964; Dedeev and Zapolnov, 1972; Khain, 1973) by fault penetration depth assume its connection with certain Earth shell (geosphere). Such idea is quite justifiable as such connection reflects energy source of faults generation especially large ones (Sheinmann, 1981). The type of magmatism associated with the fault is used as the indicator for deposition depth of the fault lower edge. It is based on the statement that composition of intrusive rocks controlled by rupture zone is dependent on the fact which layers of the Earth core and mantle are disrupted by it. Data on fault controlled magmatism are often used by geologists in solving the issue of depth class attribution to the fault (Klushin, 1968; Suvorov, 1973; Milstein, 1979). Frequently location of the fault on the crustal blocks boundaries is used as the main classificatory parameter for the faults scaling and therefore penetration depth identification.

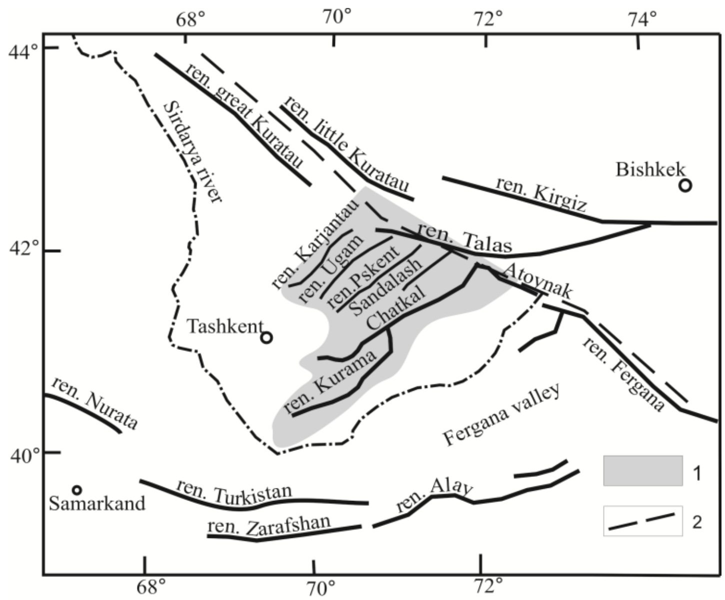
This idea was expressed by V.I. Khain: “the large the structures split by the deep faults are, then commonly the more the depth of the fault itself” (Khain, 1973). Therefore: “zones of mantle magma intrusions into the Earth crust and melting in the crust are confined to the faults which in all cases disturb continuity of subcrustal layer” (Milstein, 1979). Based on the set of criteria (apart from magma type) the following faults are completely no magma bearing: Thalasso-Fergana, Darvaz-Karakul and San-Andreas as well as Vakhsh overthrust. Such development can be explained by the influence of certain tectonic stresses types on magma controlling activity of the faults in their zones. In the event of compression stress, faulting will serve as potential or active channels for acidic magma but with tension stress – for basic magma. Significant influence of tectonic stresses types on magma bearing role of the faults was emphasized by Patalakha in his studies (Patalakha, 1967).

Linear structures are those which can be conceptually attributed by the set of lines of diagnostic parameters complying to according lines intersecting fault planes with selected sectional planes on geological-geomorphological maps, sections, block diagrams, schemes and models. Large faults of the Earth crust on the daylight surface show themseves on physical fields in form of linear and linear-ring-shaped anomalies as well as mineralogical, lythochemical, hydro- and atmochemical anomalies. The main classification parameter for linear structures is their origin to faults structures of the Earth crust. The key issue to understanding of the nature and properties of tectonic stresses generated in the Earth crust is identification and study of shear disturbances, and other tectonic structures are integral in geodynamic and genetic unity with their development.

Study Area

The region of study: Middle Tien Shan - geomorphological concept including the following ridges: Karzhantau, Ugam, Pskem, Sandalash, Chatkal and Kuramin with adjacent mountains Kalkanata and Mogoltau located westwards of Thalasso-Fergana fault. Administrative location of Middle Tien Shan is Eastern Uzbekistan (Figure 1).

Kumbel-Ugam fracture zone is characterized by all features of "long-lived" structures, which are being formed in the result of numerous regenerations and where its role in magmatism, sedimentation and metallogeny can be distinctly identified from stage to stage. We bring up the data which specify principal features of tectonic and magmatic activity revealing in specific geological formations of Kumbel-Ugam fracture zone. Some researchers call them Kumbel fault which is not quite accurate as the structure is not a single fault but series (zone) of separate different-aged fractures.



1-Region of study - Middle Tien-Shan ; 2-Thalasso-Fergana fault

Figure 1: Location of the study area, mountain ridges of West and Middle Tien Shan

Comprehensive Geological and Geophysical Analysis of Kumbel-Ugam Fault

Moving to substantiation of this lineament as regional, long-lived, deep, tectonic structure which triple time was connected with basic magma revealing starting from Early Carbonaceous and to Cretaceous, it is worth mentioning that geographical range of "kuramin" type magmatism (Dalimov, 2007) is limited by relatively inconsiderable (in geological scale) area of 20-25 thousand km^2 (Karjantau, Ugam, Pskem, Chatkal, Kurama and Mogoltau ridges). From this point of view the region of study occupies a special place in Tien Shan structure. We have split such tectonic-magmatic activity into two age phases.

Upper Paleozoic Tectonic-magmatic Activization

Volcano-intrusive complex is represented with uya suite (C_{1-2}) and Almalyk, Tekesh Low Carbon complexes, that confined to graben and fault zone depressions formed with volcanics of shoshonite-latite series and shonkinite-sienite-monzonite intrusives of absolute age 322-327 ± 15 M. years (K-Ar method, biotite), which quite confidently agrees with geological facts. Uya suite (C_1) - shoshonite-latite series is recognized within volcanogenic formations of uinskaya suite which development range is identified in Karjantau ridge, Ugam and Pskem river basins as well as Chatkal ridge. Volcanogenic-sedimentary deposits of uinskaya suite are preserved within small linear structures confined to the system of Kumbel-Ugam faults (Arapov, 1983; Tulyaganov *et al*, 1984). The age of complex is identified as serpukhov-low bashkir (C_{1-2}) which has been proved by fauna set. The suite sections are characterized by carbonate-terrigenous composition of its lower part, represented with alternating sandstones, limestones, siltstones and conglomerates. The upper part was formed mainly with tuffs, lavas, clastic lavas of trachybasalt, basalt, trachyandesitebasalt, with rare trachyte, andesite with interlayers of terrigenous rocks and limestone lenses. Suite thickness from 400 to 1200 m.

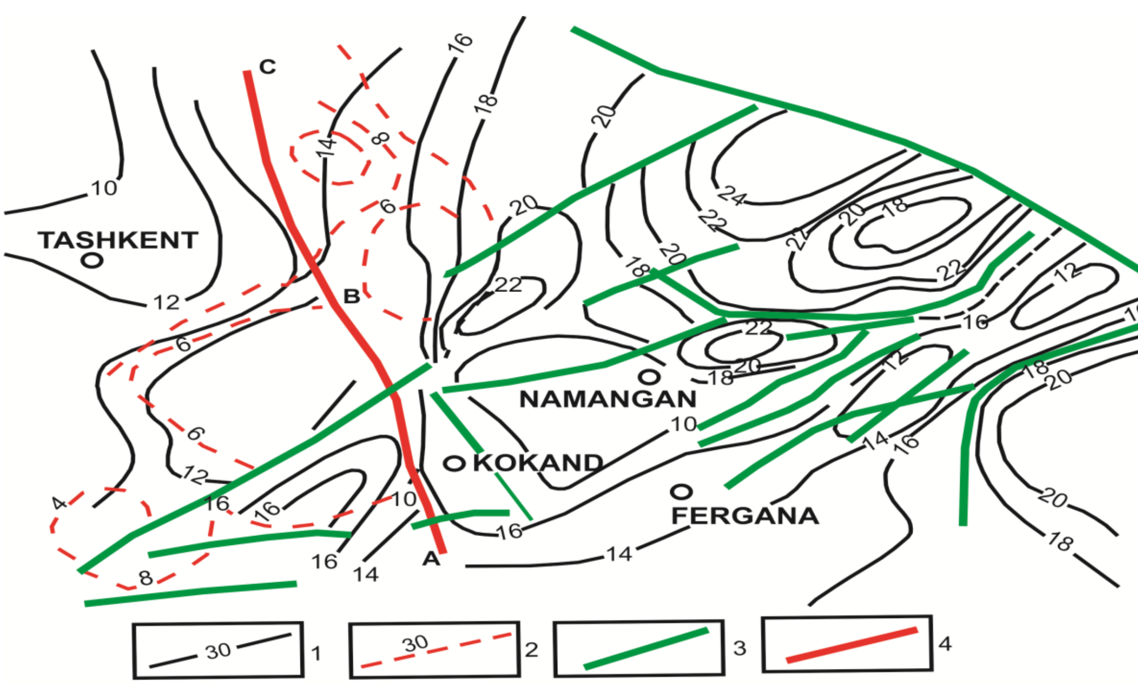
Redevelopment – Shurabsai suite (P_1) and Daubabinsk suite (P_1). Shurabsai suite is localized within Kassan, Kumlai-Koksarek, Chadak and Takely grabens (Arapov, 1983). First things which should be noted while analyzing rocks distribution of this formation are disseminated character and small scale. Shurabsai suite is represented with lavas and tuffs of trachybasalt, basalt, trachyandesitebasalt, trachyandesite and andesite, trachyte with interlayers of volcanomictous sandstones and siltstones. Volcanic activity characterized with fracture and fracture-areal type of eruptions was of mixed extrusive-explosive, rhythmical-oscillatory nature; this can be proved on example of Gavasai graben volcanites with emission of 50 impulses of volcanic activity, products of which generate not less than 23 packs (Ganiev, 1983). At that basalt and trachybasalt make - 65%, trachyandesitebasalt - 17%, andesite, trachyandesite and trachyte – 15%, trachydacite – less than 3%. Volcanites are chemically related to potassium-sodium subalkaline (high potassium) series type. Suite thickness varies from 400 to 2300 m. Formation age was dated as Asselian-Sakmarian by the set of organic remains. Absolute age under K-Ar method was set in the range 230-288 M. years and under Rb-Sr dating – 281±5 M. years at I_{Sr} = 0.70619 ± 0.00033. Daubabin suite (P_1) – leucitic tephrite and comagmatic intrusions of Irisu-Kaindin complex close up the series of Permian alkaline basic magmatites. Based on petrology data (Nurlybaev, 1973) alkaline rocks form two belts: Aksu-Badam (Kaindy, Irisu, Mashat, Badam, Ugam) and Arys-Borolday (Kulan, Jilandy and other intrusives). Alkaline magmatism of the first belt is revealed in form of comagmatic volcano-plutonic complexes – from alkaline ultrabasite through leucite basalt and to trachyandesite. The second volcano-plutonic belt was formed with more acidic rock types – from monconite-trachyandesite to sientie-trachyte. Absolute age of South Kazakhstan alkaline rocks is 260-300 M. years at average value of 278 M. years which agrees with their geological position. Irisu and Kaindin intrusives were identified (Nurlybaev, 1973) as typical sub volcanoes, formed on shallow depth and at that moment communicated with the daylight surface. These units are complex differentiated magmatic formations with concentrically-zonal structure. Volcanogenic formations of the area have the following formation sequence bottom-upward: 1) shurabsay suite; rhyolitic and trachyrhyolitic ignimbrite, tuffs, tuff lava of trachyrhyolitic and trachydacite composition (P_1) of 200-700 m thickness; 2) kyzylbulak thickness of pyroxene and amphibolic trachyandesite, their tuffs and lava-breccia (P_1^1); 3) badam thickness: lava, tuff lava, tuff-breccia, trachyte tuff, trachyandesite and epileucitic trachytes with interlayers of shoshonite, tuff-sandstones and tuff-siltstones. This suite is confined to sub volcanic bodies of camponite, trachyandesite, bostonite, trachydacite, trachyte, alkaline syenite-porphyry, plagiogranite and epileucitic trachyte. These listed volcanogenic formations are underlaid with leucitic basalt, leucitic and orthoclase basalt which complete Mashat depression named as daudabin suite.

The regional depth formation is not clearly studied yet. Total thickness of Kuramin zone crust is 40-45 km, increasing northwards to Chatkal zone up to 50-52 km and southwards to South Tien-Shan and Ferghana valley. We fixed some prevail of “basalt” bedding over “granite”. It is characterized with multiple positive magnetic and gravity anomalies (Tal-Virski 1982; Fuzailov, 1977). Seismological study of the Chatkal-Kuramin regional crust on the depth (Khamrabayev, 1971) for the first time revealed heterogenic formation of the upper part of the Earth crust, as the multiple interbeddings of higher (V_p = 6.6-7.2; 6.6-7.4 km/s) and lower velocities of seismic waves. These “beddings” were referred to as of “lower-” and “higher-velocity”. This was found in the upper part of the crust (“granite-gneiss” bedding). All “higher-velocities” were suggested for reference as “high-velocity anomalies”; and their general distribution within region is presented in Figure 2. Also the fault was found along the ABC line in ‘granite-gneiss bedding’. Geological interpretation of these anomalies was completed (Khamrabayev *et al,*1998) as “Kuramin” (sialic-femic) type of continental crust, which means the following: a) smaller thickness of “granite-metamorphic” bedding; b) prevail of “basalt” bedding over “granite”; c) multiple interbeddings of these "beds" in the upper part of the crust. He also assumed the link of Upper-Palaeosoic volcanism (C_1-P_1) with this type of crust.

Kustarnikova *et al*., (2012) characterized this period of geo-dynamic evolution in Middle Tien-Shan as formation of Turkestan quasi-platform. Taking this assumption we revealed conjugation of two deep lineations of Trans-Asian (Akhundjanov *et al*., 2005) latitudinal and Kumbel-Ugam (Sadikova, 2015) meridian (Figure 3).

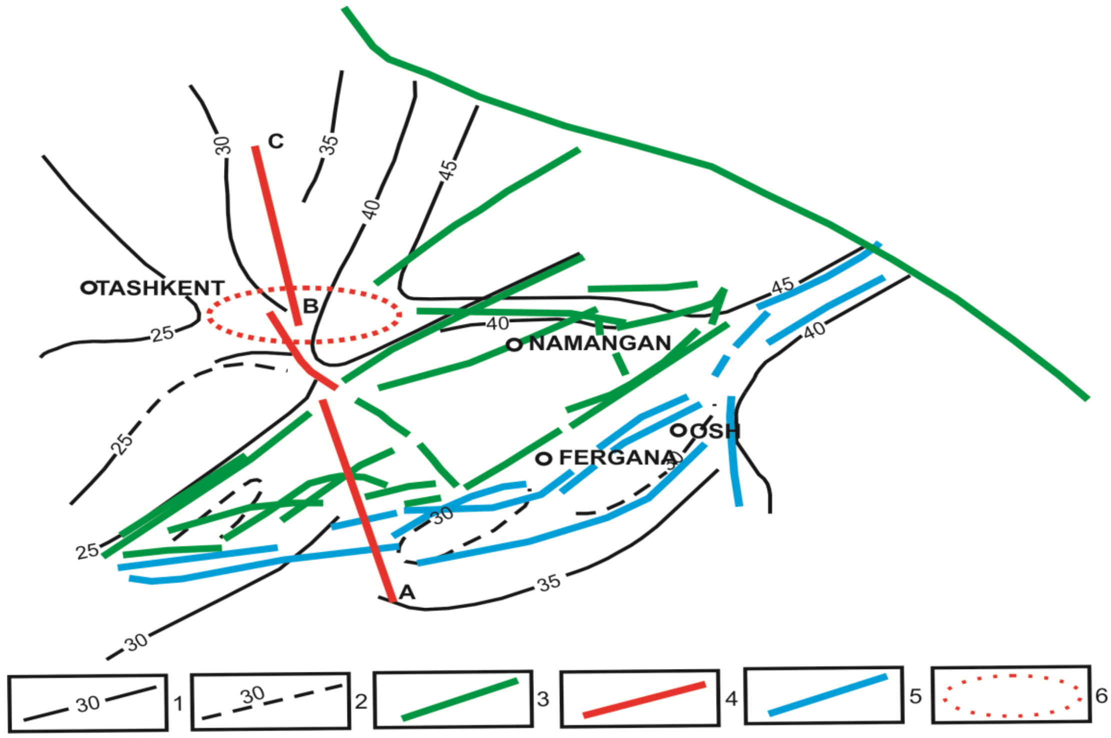
Mesozoic Tectonic-magmatic Activization

The main seam of alpine zone of Kumbel – Ugam faults from SE to NW crosses Kuramin and Chatkal ridges. In the North within Karzhantau this zone forms a 'pony tail' type split. On Southern slope of Kuramin ridge the Kumbel-Ugam faults were found under the cover of Mesozoic-Cenozoic formations of Ferghana depression create the benches in Paleozoic basement. The zone of fault is clearly outlined with negative forms of relief (saddles, gullies), presenting as a large modern drainage structure. Faults have the complex formation for the whole extent. At places Main seam is followed by a series of coulisse-shaped (Northern slope of Kuramin ridge) or parallel faults (Chatkal ridge). Horizontal shift along Alpine seam in younger Mesozoic-Cenozoic sediments does not exceed 1 km and characterizes right side fault. Alpine seam of Kumbel-Ugam faults zone perform attenuation of tectonic movements from ancient Mesozoic-Cenozoic sediments to younger ones. Significant right fault is found on the main seam for geological bodies of Upper-Paleozoic age. All geological formations of that age are characterized by the similar amplitudes of horizontal fault for 12-16 km. Same fault size for Jurassic sediments of Kyzylsu and Angren depression allows to clarify the age range for this fault (late Jurassic – lower Cretaceous), (Sadikov, 1964). Magmatism of that period reports to alkaline basaltoids of Angren-Jigiristan complex of K_1. The complex' rocks age is defined by the fact that they break Jurassic caolines of Jigiristan suite. Definition of basaltoids' absolute age by Rb-Sr method brought down to 97+12 M years (Isr = 0.071089 ± 0.00013), which is early Cretaceous (Dalimov and Ganiev, 2010). The fault existence is proven on (Figure3) for 'Basalts bedding'.



1 – Isolines of depths for «granite- gneiss» bedding; 2 – Isolines of the dome of intrusion for higher velocity rocks; 3 – tectonic faults; 4 – Kumbel-Ugam fault.

Figure 2: Schematic map of isoline for the bedding of «granite-gneiss layer» dome (V_P = 6.0-6.7 km/sec), (Hamrabaev, 1971))



1 – Isolines of «basalts bedding» dome; 2 – unconfident isolines; 3 – tectonic faults; 4 – Kumbel-Ugam fault; 5 – S. Fergana fault (similar to Trans-Asian lineation area); 6 – shift zone

Figure 3: Schematic map of isoline for the bedding of «basalts layer» dome (V_P = 6.8-7.4 km/sec), (after Ulomov, 1966; Hamrabaev, 1971; Tal-Virski, 1982), modified by the author

CONCLUSION

1. Analysing basic magma appearance as volcanogenic-sedimentary suite of Uya (C_1), and Shurabsai (P_1) on this territory we revealed conjugation of two main regional deep (mantle) tectonic lineations – Trans-Asian (Akhunzhanov *et al.*, 2005) latitudinal and Kumbel-Ugam (Sadikova, 2015) meridian, expressed as a strong activization of ultra-basic and basic volcanism of higher potassium alkalinity in W. Tien Shan.
2. Appearance of alkaline basaltoids of Angren-Jigiristan (K_1) complex shows the reflected activization in fault zone and change of geo-dynamic situation (Kustarnikova, 2014).

Taking into account the above mentioned materials, magmatism type, geological-geophysical data, the zone of Kumbel-Ugam fault is the main 'long- living' regional structure of Midlle Tien-Shan which was found through C_1- P_1.

REFERENCES

Ahundzhanov R, Kustarnikova AA, Rakhmanov KA, Sidorova IP and Khamrabaeva LI (2005). Trans-Asian lineation of academician I.H.Hamrabaev. *Geology and Mineral Resources* **2** 24-36.

Arapov VA (1983). *Volcanism and Tectonics of Chatkal-Kurama Region* (FAN Publishers, Tashkent) 256.

Dalimov TN (2007). The evolution and development of Chatkal-Kurama plume' model. *Geology and Mineral Resources* **3** 3-18.

Dalimov TN and Ganiev IN (2010). *Evolution of the Types of Magmatism in West Tien Shan. Tashkent* ("University" Publishers, Tashkent).

Dedeev VA and Zapolnov AK (1972). The scheme of morphogenetic classification of deep faults and their terminology. In: *Tectonics of Siberia* (Nedra Publishers, Moscow) 132-136.

Fuzaylov IA (1977). *The Structure of the Consolidated crust of Western Tien Shan Submerge* (FAN Publishers, Tashkent).

Ganiev IN (1983). Megaplagiofiric trachybasalt of Gavasaysky graben (Kuchar River, North Fergana). *Uzbtkistan Geology Review* **6** 7-11.

Khain VE (1973). *General Geotectonic* (Nedra Publishers, Moscow.)

Khamrabaev IH (1971). *Deep Crustal Structure of Uzbekistan on Geological and Geophysical Researches (Southern and Western Parts of the Middle Tien Shan)* (FAN Publishers, Tashkent) 212.

Khamrabaev IH, Seiduzova SS, Kustarnikova AA and Pak VS (1998). *The Nature of Strata and Boundaries of Lithosphere of Central Asia* (GFNTI Publishers, Tashkent).

Khoreva BJ (1964). Petrological features of crumple zones and the nature of their connection with depth-of faults. In: *Deep Faults* (Nedra Publishers, Moscow) 139-146.

Klushin IG (1968). Statistical research of the depth and spread for unevenly magnetized rocks. *Applied Geophysics* **52** 113-128.

Kustarnikova AA, Usmanov AI and Babadjanov AA (2012). *Metallogeny of Gold and Copper in Uzbekistan* (GPNIMR Publishers, Tashkent).

Kustarnikova AA and Sadikova LR (2014). Terrain analysis of the Midlle Tien Shan. *Report of Uzbek Academy of Sciences* **3** 44-47.

Milstein DM (1979). Some features of the structure and development of deep faults. In*: Tectonics and Deep Structures Soviet Union and its Regions* (Leningrad Publishers) 18-39.

Nurlybaev AN (1973). *Alkaline Rocks of Kazakhstan and its Minerals* (Nauka Publishers, Alma-Ata) 296.

Patalakha EI (1967). Magmatic permeability and energy of deep fault zones "mobility". *Soviet Geology* **11** 124-133.

Sadikov RA (1964). Kumbel of Ugam-shift. *Uzbek Geological Magazine* **3** 56-59

Sadikova LR (2015). Mantle magmatism of Kumbel-Ugam lineament. In: *Scientific Conference Actual Problems of Geology, Geophysics and Metallogeny* (IGG, Tashkent) 215-218.

Sheinmann Yu M (1981). Shifts and transform faults in lithosphere (tectonic-physical analysis of the problem). In: *Problems of Faults Tectonics* (Novosibirsk) 5-26.

Suvorov AM (1973). *Deep Faults of Platforms and Geosynclines* (Nedra Publishers, Moscow).

Tal-Virsky BB (1982). *Geophysical Fields and Tectonics of Central Asia* (Nedra Publishers, Moscow).

Tulyaganov HT, Yudalevich ZA and Corzhaev VP (1984). *Map of Magmatic Complexes of Uzbekistan* (FAN Publishers, Tashkent).

Ulomov VI (1966). *Deep Crustal Structure of South-Eastern Central Asia According to Seismology* (FAN Publishers, Tashkent).