International Journal of Geology, Earth & Environmental Sciences ISSN: 2277-2081
An Open Access, Online International Journal Available at http://www.cibtech.org/jgee.htm
2020 Vol. 10(1) January-April, pp. 7-12/Olegovich
Research Article

THE STRUCTURE OF THE FERGANA BASIN CRYSTALLINE BASEMENT SURFACE

***Mordvintsev Dmitriy Olegovich**
Institute of Geology and Geophysics, Tashkent, Uzbekistan
**Author for Correspondence*

ABSTRACT
The Fergana Basin is one of the biggest intermountain basin of the Southern Tien Shan. It has a very long history of studies. Nevertheless, there are still no precise viewpoints about the structure of Fergana basin crystalline basement. The features of crystalline basement surface of the Fergana basin is presented in this article. Map was made of the subsurface data obtained from drilling the area. This map is the first for the area in such format.

INTRODUCTION
The Fergana Basin, located in the east of the Republic of Uzbekistan, is the largest intermountain depression in Uzbekistan, as well as the oldest oil and gas-producing region in Central Asia (Fig. 1). In a first approximation, the structure of the Fergana Basin could be divided into the South Step, North Step and Central Graben. All these elements are separated from each other by tectonic faults - the South Fergana and North Fergana faults, respectively. In addition, there are many structures of larger orders (anticlines, synclines, small faults, etc.) (Abidov *et al*. 1992, Akramkhodjaev and Saidalieva, 1971).

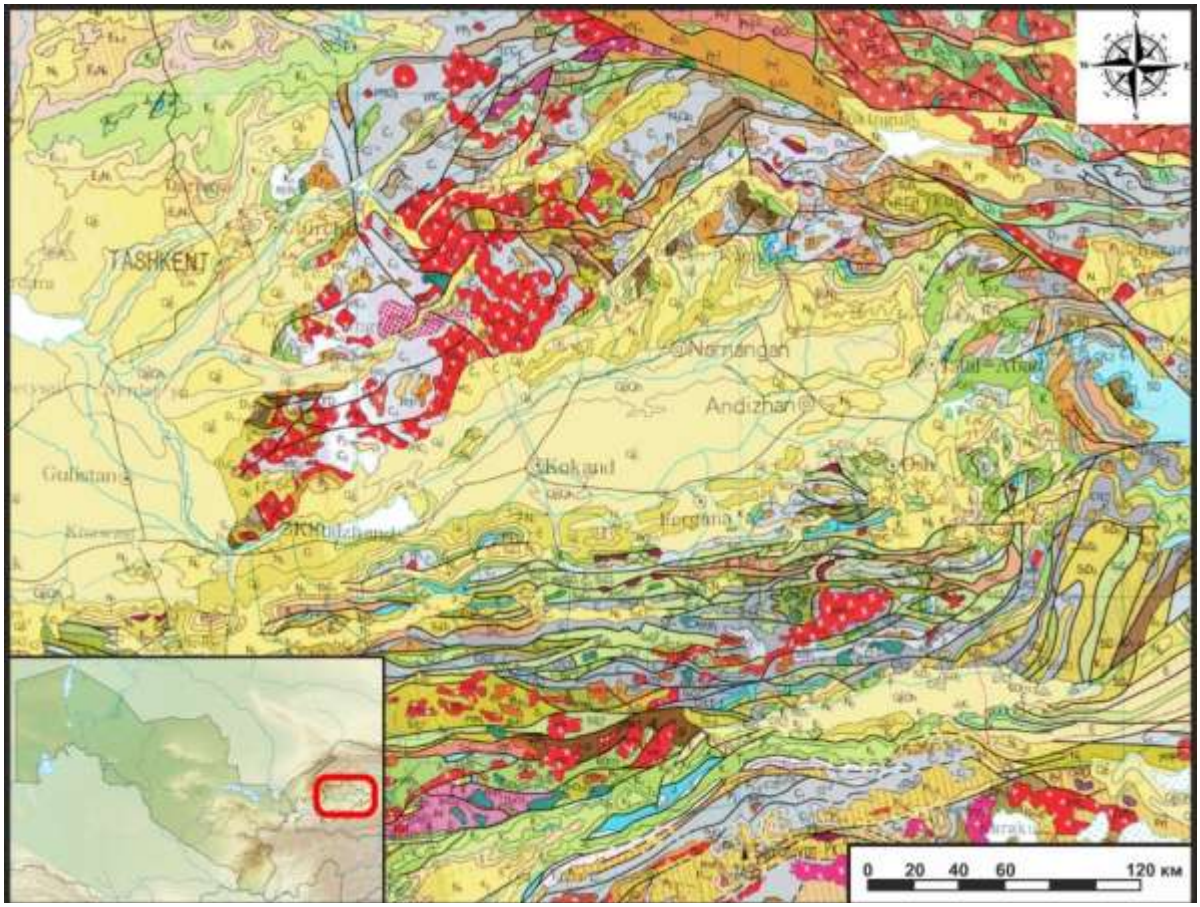

Figure 1: Geological map of the Fergana basin (from Atlas of geological maps of Central Asia and adjacent territories, scale 1: 250000. Authors: Geological Publishing House, Beijing, China, 2008.)

There are plenty of works devoted to the geological and tectonic structure of this region (Abidov *et al*. 1992, Akramkhodjaev and Saidalieva, 1971, Zunnunov *et al*., 1973, Mordvintsev 2009, 2010, 2011, Mordvintsev and Radjabov, 2018, Tal-Virsky, 1982).

Many of them still have not lost their relevance. Despite this, researchers have not focused on the crystalline basement region. To date, there are two relief maps of the basement of the Fergana basin, created by Mordvintsev and Mordvintsev in 2009 and in 2011, respectively (Mordvintsev 2009, 2010, 2011) (Fig. 2, 3).

The map of 2009 was built on the 1: 500 000 scale models of the deep structure, while the map of 2011 was built on the 1: 200 000 scale. On these maps, the relief structure of the crystalline basement is fairly well displayed, the main faults are highlighted, and the basic elements of the tectonic structure of the Fergana Depression, such as the South and North Steps, and the Central Graben stand out quite confidently. The relief structure of the Central Graben was shown for the first time.

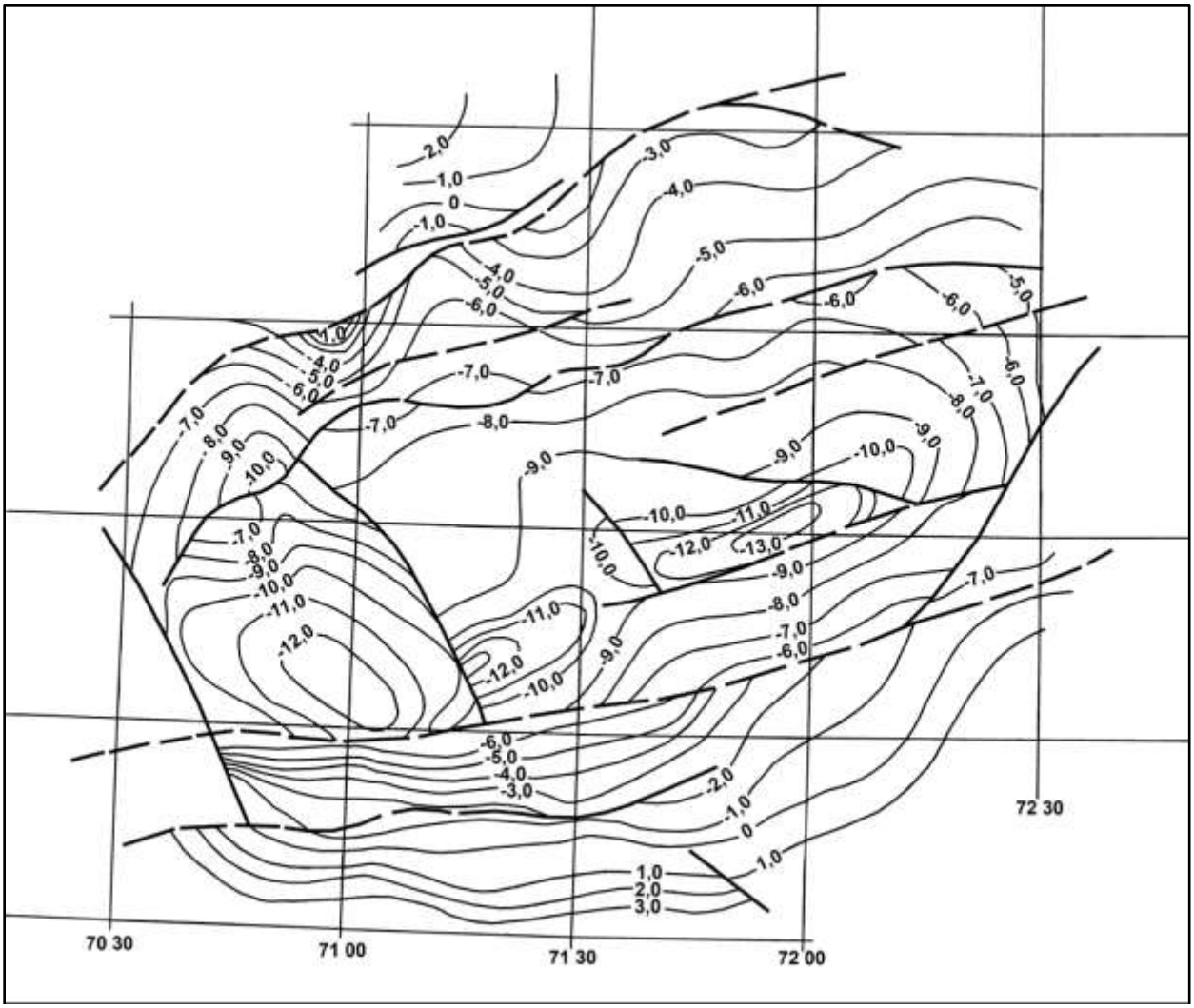

Figure 2: Relief map of the Fergana basement crystalline basement surface (Mordvintsev and Mordvintsev, 2009)

In addition, the petrophysical characteristics of the basement rocks were also given in these works.
However, despite a gradual increase in the accuracy of the relief drawing, these maps no longer meet the requirements of the modern geological science. They do not have a strict binding to a geological, geophysical, and drilling data, because many elements of them were completed "by hand".
The map proposed in this article is a logical continuation of these works, but at a higher technological level.
The thing, we want to pay an attention, is the determination of the crystalline basement. Just to answer the question "What the basement is?". Because very often, various researchers understand this term as a completely different geological and structural units; usually, they mean simply the formation of the Paleozoic.

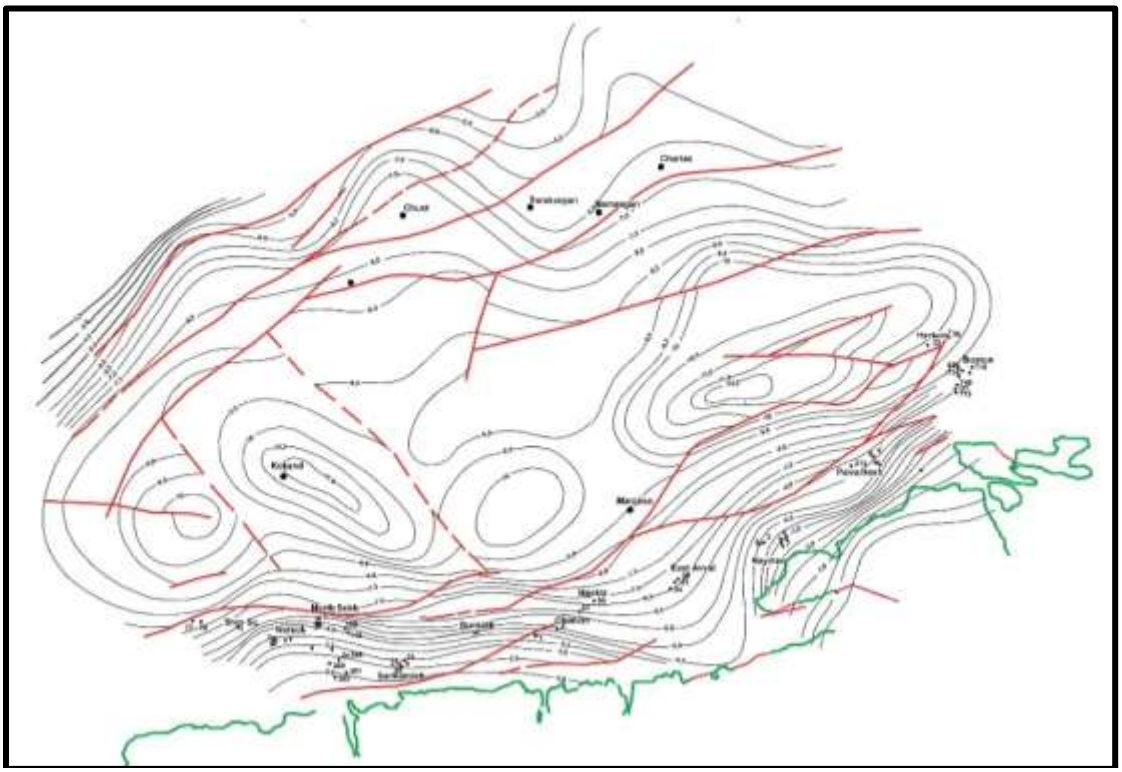

Figure 3: Relief map of the Fergana basement crystalline basement surface (Mordvintsev and Mordvintsev, 2011)

As stated in Fuzailov (1978), a crystalline basement is a complex of rocks, characterized by a wide range of specific properties that distinguish it from overlying strata: a certain formation composition, high thickness of the rocks composing it and their variability across stretching, intense regional metamorphism and deployment, the nature of the internal structure of folded, discontinuous and block structures, their genesis, and the saturation of magmatogenic formations.
A study of the morphology of the crystalline basement surface of the Fergana Basin will allow a fresh look at the processes of geological and tectonic evolution of the region. Namely, on the features of inherited development, power, distribution of tectonic stresses, etc.

MATERIALS AND METHODS

The map, proposed in this article, unlike previous constructions, is rigidly tied to the geological interpretation of geophysical information, seismic data and drilling. A network of profiles was used as the basis for the map, according to which a deep structure was modeled (Fig. 4).

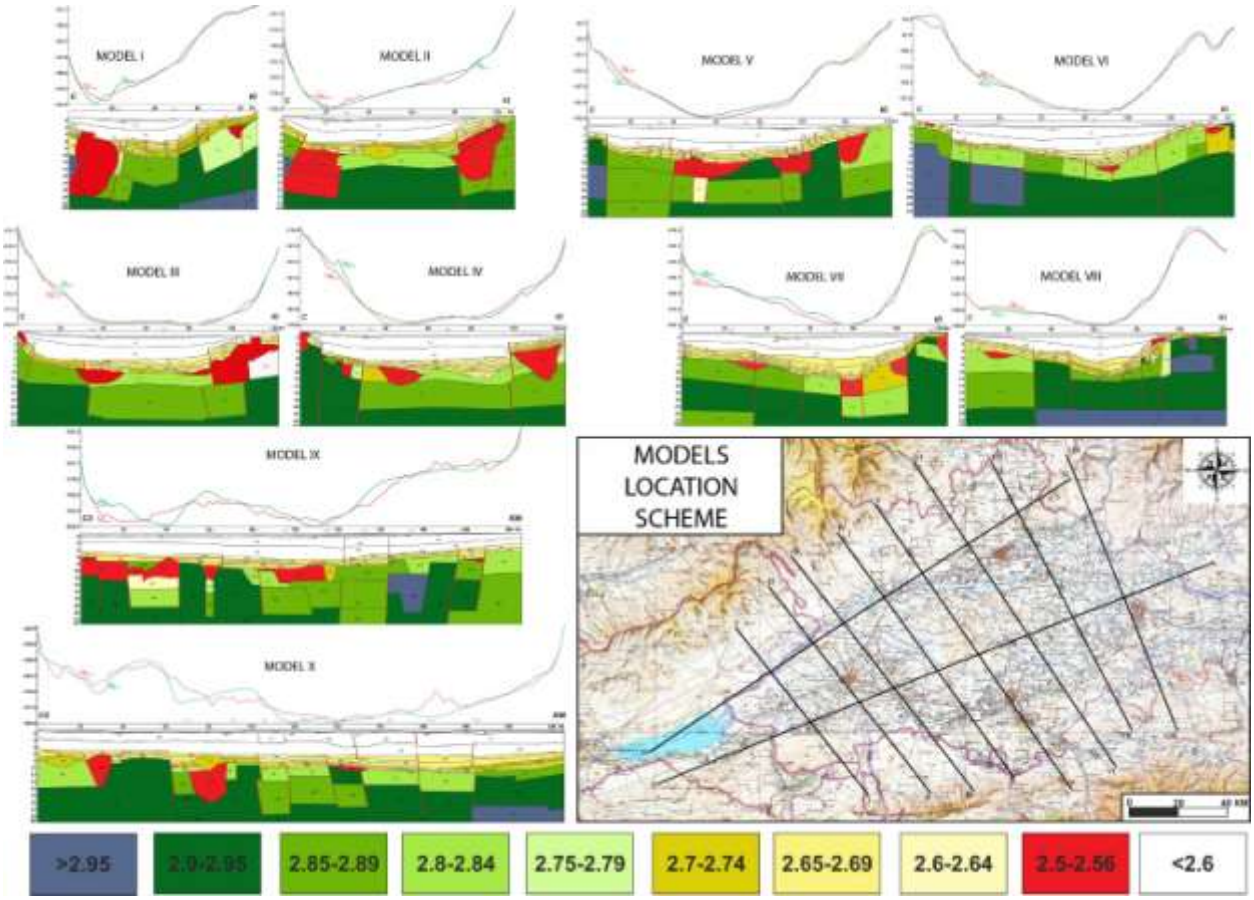

Figure 4: Density models

Modeling was carried out by the method of automated selection, elaborated by E.G. Bulach (Bulach and Levashov, 1987).

The algorithm of the software, which was used to create the models, is based on the principle of minimizing the discrepancy between the input values of the Δg field and the calculated anomalies from the approximately constructed model.

The main criterion by which the models were created was the density of the rocks. For a crystalline basement, it ranges from 2.85 to 3.0 g/cm^3. Such high densities correspond, according to interpretation, to basic and ultrabasic rocks. At the same time, the southern part of the Fergana Basin on the crystalline basement is denser than the northern part. This is clearly seen on profiles IX-IX and X-X.

RESULTS AND DISCUSSION

There is also densities increasing eastward. If in the west of the profile the basement blocks have densities in the range from 2.85 to 2.9 g/cm^3, then, moving east, the density range is shifting towards 2.9 - 2.95 g/cm^3. Nevertheless, in some places blocks with densities in the range of 2.85-2.87 g/cm^3 are still fixed.

Objects having a density of 2.5-2.56 g/cm^3 are located, for the most part, precisely within the crystalline basement. They are concentrated, as can be seen from Fig. 4, in the western part of the Fergana basin.

If we simplify the description a little, we can say that the basement blocks correspond to blocks of the earth's crust, which are allocated under the Paleozoic sequences at a depth of about 2-3 km from them.
From the point of view of morphology, the crystalline basement of the Fergana Basin has the next main elements of its structure: the North and South Steps and the Central Graben, limited by the zones of the North and South Fergana faults (Fig. 5).

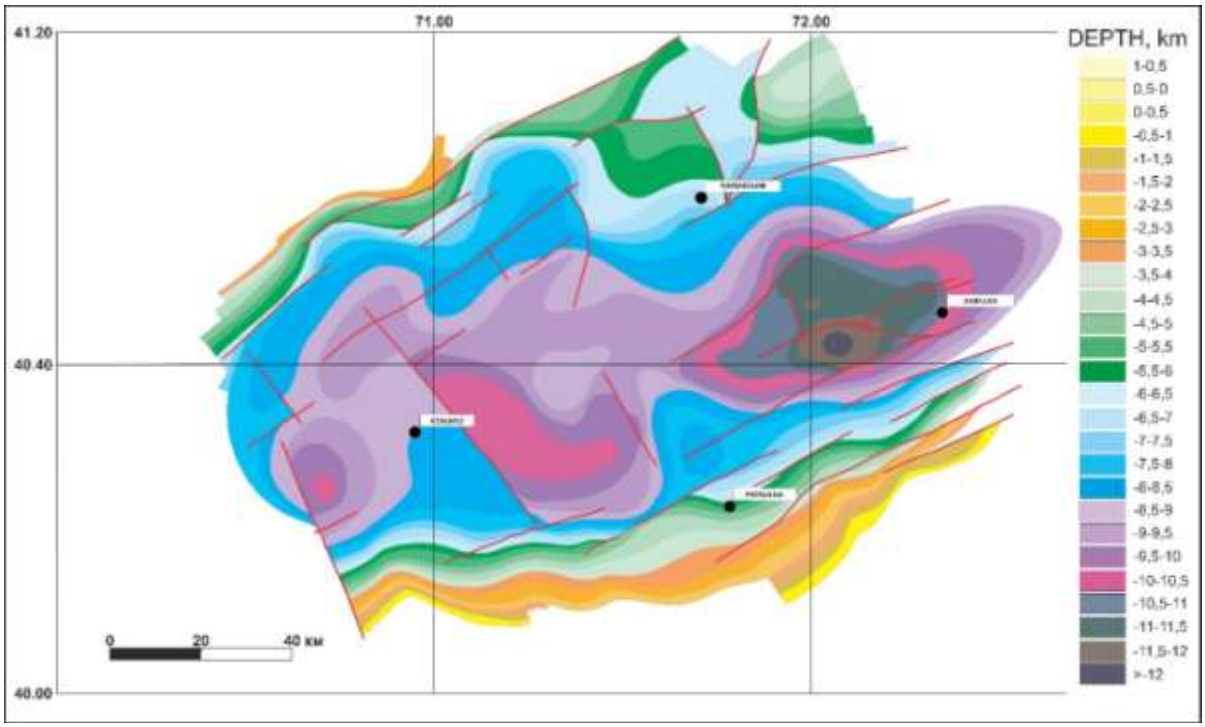

Figure 5: Fergana basin crystalline basement relief (Mordvintsev, 2018).

According to the constructed models, the axial parts of the North and South Fergana faults are inclined towards the sides of the basin, which indicates the thrust nature of the development and formation of the basin. This location of faults is also confirmed by seismic data.
The basement depth at the South Step is 1 to 6 km. It is a monocline plunging in the north and north-west directions.
The zone of the South Fergana Fault is very fragmented. It would be more correct to call it a flexure-discontinuous zone.
The width of the step is about 15 km, in some places increasing to 25 - 30 km.
According to the morphology of its surface, the Central Graben can be divided into three zones. From west to east: deflection, uplift and deflection.
The westernmost deflection is characterized by dimensions of 60 by 40 km. The depth of the roof of the crystalline basement is from 8.5 to 10.5 km. In this case, the most submerged part is shifted to the west of the deflection. From west and east, the described deflection is framed by discontinuous disturbances going across the strike of the basin. The continuation of these faults also extends to the Paleozoic surface.
East of this deflection there is an uplift that we attribute to the second zone. At the same time, the fault discharge amplitude is 2 - 2.5 km. Further to the west this discharge passes into the uplift. On the whole, within the entire selected zone, the depth of the crystalline basement is from 8.5 to 10.5 km, rising eastward. The size of the rise is approximately 60 to 40 km.

Eastward, there is a strong deflection of the basement relief to a depth of 12 km or more. This deflection has a shape elongated parallel to the strike of the basin, and is limited from the north and south by discontinuous faults. The dimensions of the deflection are 75 by 27 km.
A structural ledge is observed in the Namangan region with depths of the crystalline basement surface ranging from 5.5 to 6.5 km.
Another ledge is noted west of the described structure. Here, the surface topography of the basement falls to a depth of 7.5 - 8.5 km.
The northern side monoclinically plunges in a southeast direction to a depth of 5.5 - 6.5 km. The North Fergana fault is represented by a single zone of violations.
Summing up, we can say that the crystalline basement of the Fergana depression is a pronounced structural floor, clearly distinguished by geological and geophysical information. A well-mapped division of it into the main structural elements of the region, such as the South Step, the North Step and the Central Graben, shows that the geological and tectonic development of the Fergana Basin was inherited. And the processes of bending and sinking affected the entire section, in which the foundation is only the most deeply submerged part.

REFERENCES

Abidov AA, Kalomazov RU, Pedder YuG, Pshenichnaya ZD, Yurtaev YuS, Khojimatov AX, Rashidov AX and Starokozhev BA (1992) A New Scheme of Tectonic Zoning of the Fergana Depression. *Geology of Oil and Gas, 11.*

Akramkhodzhaev AM and Saidalieva MS (1971). Fergana oil and gas basin. *NEDRA, Moscow, 280 pp.* Atlas of geological maps of Central Asia and adjacent territories, scale 1: 250000 (2008). *Geological Publishing House, Beijing, China.*

Babadjanov TL, Kunin NYa and Luk-Zilberman VI (1986). The structure and oil and gas potential of deep-seated complexes in Central Asia according to geophysical data. *Tashkent, "FAN".*

Bulakh EG, Levashov SP (1987). Construction of density models using the method of sequential accumulation of anomalous masses. *Kiev: Naukova Dumka, 60.*

Mordvintsev DO (2009). The main features of the deep structure of the Fergana Depression according to geophysical data. *Environmental protection in the oil and gas complex. 12, Moscow. 49-51.*

Mordvintsev DO (2010). Features of the deep structure of the Fergana Depression and their relationship with the location of oil and gas fields. *Materials of the All-Russian Conference "Earth Degassing: Geotectonics, Geodynamics, Geofluids; Oil and Gas; Hydrocarbons and Life", October 18-23, Moscow, IPG RAS S. 361-364.*

Mordvintsev DO (2012). New views on the deep geological structure of the Fergana depression according to geophysical data. Features of the relief of the structural surface of pre-Mesozoic formations. *Geology and Mineral Resources, Tashkent* 4 *55-60.*

Mordvintsev DO (2011). New views on the deep geological structure of the Fergana depression according to geophysical data. Features of the deep structure of the crystalline basementment. *Geology and mineral resources, 6. Tashkent, 41-46.*

Mordvintsev DO and Radjabov ShS (2018). The deep structure of the earth's crust as a search feature (for example, the Fergana Depression). Materials of the international conference "Earth Sciences", Tashkent, November 22-23, 25-27.

Tal-Virsky BB. (1982). Geophysical fields and tectonics of Central Asia. *M.: Nedra, 271 p.*

Fuzaylov IA (1978). The structure of the consolidated crust of the western dive of the Tien Shan. *Tashkent, Fan.*