

RELIEF OF THE PRE-MESOZOIC SEQUENCES OF THE FERGANA BASIN ACCORDING TO THE GEOPHYSICAL DATA

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ABSTRACT

In this article, we offer you the modern view on morphology of a structural surface of the Paleozoic. The constructed map is hardwired to a coordinate grid and completely correlates with the data of drilling (where wells reached the pre-Mesozoic sequences). The principal difference of this map from the previous maps and schemes is the full compliance of the pre-Mesozoic relief to the geological and geophysical data. The map executed in 1:200000 scale.

INTRODUCTION

Researches, dedicated to the surface of the pre-Mesozoic sequences, are an important stage in the studying of geological and tectonic evolution of all Fergana basin. The studying of morphology features of any surface is the way to determine the reasons, which have led to formation of the observed structures. Thereby shedding the light on ambiguities of the history of geological and tectonic evolution of the area. For many decades, during the studying of the Fergana basin, the set of schemes and maps of its tectonic framework was constructed (Tal-Virskiy, 1982, Abidov *et al.*, 1992, Akramkhodjaev and Saydaliyeva, 1971, Babadzhanov *et al.*, 1986)]. However, most of them were dedicated to structures of a sedimentary cover.

For deeply laying surfaces, one of the most known maps was the map of the tectonic structure of the Fergana basin, created by B.B. Tal-Virsky (Tal-Virskiy, 1982). This map constructed in 1970 according to the geophysical materials, was rather exact for that time. Nevertheless, there were a number of shortcomings within this map - a part of the pre-Mesozoic relief was completed by transformation down a section, based on the data for the Turkestan layers of the Paleogene (Eocene). The relief of the Central graben was rather poorly presented in this map. However, this map quite long time was a basis for different ideas of a deep relief of the Fergana basin.

Then, in 2009-2013 Mordvintsev and Mordvintsev conducted the researches directed to the studying of a deep structure of the Fergana basin (Mordvintsev 2011, 2012, Mordvintsev and Mordvintsev, 2013). Because of these works, the morphology of structural surfaces of the Paleozoic and the crystalline basement were significantly specified, data about densities of the basin's section up to the depths of 50 km, and data about the composition of the pre-Mesozoic sequences have been obtained.

MATERIALS AND METHODS

For map creation we have used the complex of geological and geophysical data, such as drilling data and data of seismic, gravimetric and magnetometric surveys. According to all these data we have created the models of the deep geological structure of the Fergana basin. Then, based on the elaborated models, we have constructed the relief map of the pre-Jurassic.

RESULTS AND DISCUSSION

First thing that attracts attention is that the basic structure elements of the Fergana basin (Northern and Southern Steps and Central Graben) are clearly visible in the relief of the pre-Mesozoic surface (fig. 1). In addition, there are plenty of faults, overall, having the extension subparallel to the general extension of a basin.

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The Southern Step is looks like homocline extended from the southwest to the northeast and, which submerged in the north and northwest direction. In the widest central part, its width reaches about 30 km, in general, remaining within 12-15 km.

According to the depths variations, we may divide the Southern Step into two large extended zones.

The first, southernmost, zone presented by rather flat immersion of the pre-Mesozoic in the northern and northwest directions. The depth varies from 0 m (outcrops) to 3 – 3.5 km.

The second zone is located northward and characterized by the isolines gathering, especially in a South Fergana fault zone. Depths vary from 3.5 to 6 km. It is possible to tell rather surely, that slope of immersion directly connected with the existence of the Southern Fergana fault here.

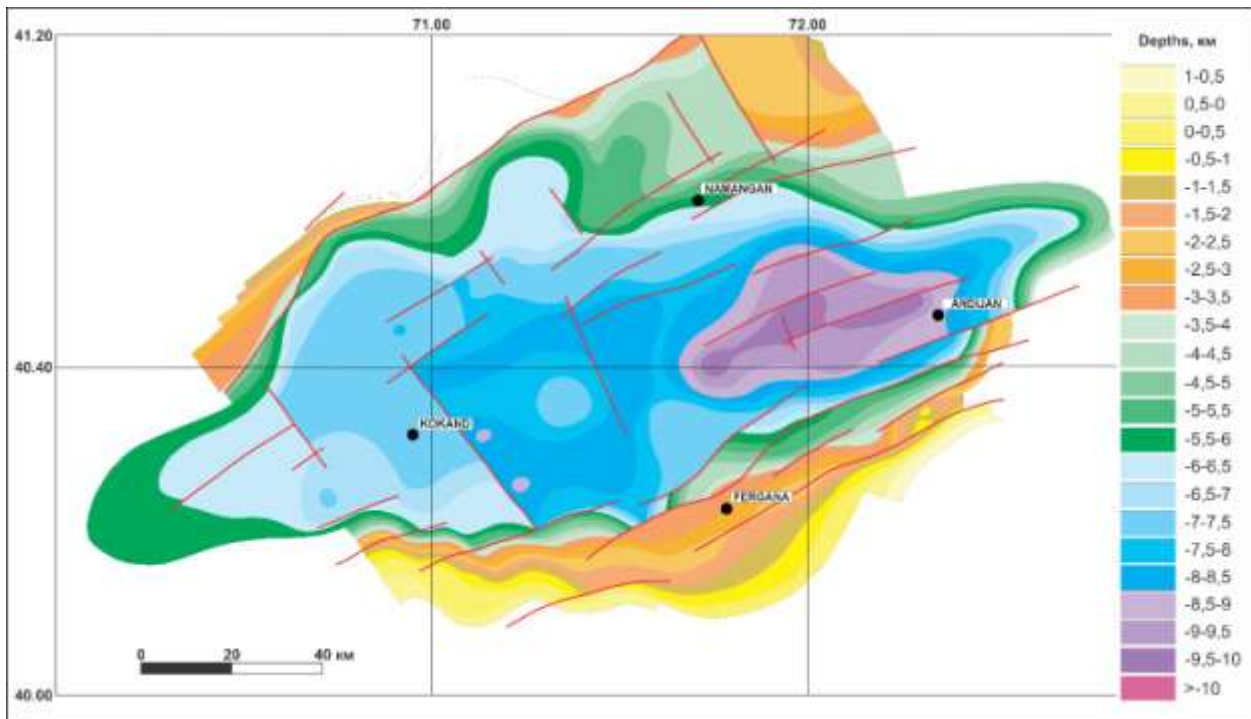


Figure 1: Relief map of the Fergana basin pre-Mesozoic surface (Mordvintsev, 2018.)

The Central Graben has rather smooth relief in the most part of its territory. Nevertheless, its surface could be divided into three large zones.

The first, western, represents rather flat trough in the direction of the center of a basin, with the depths variations from 6 to 7.5 km. Its size is about 60 per 60 km. To the east of Kokand, on the extended normal fault, crossing the basin, this trough separates from a raising, which can be isolated as the second zone. Dumping amplitude is about 1 – 1.5 km.

The second zone has the sizes of 45 per 60 km. A surface of the pre-Mesozoic is located on the depths from 7 to 8.5 km. Eastward this zone also limited by the fault, crossing the basin.

Eastwards the strong immersion of a pre-Mesozoic surface to the depths of 10 and more km observed. This extremely low has the extended form and the linear sizes about 80 per 40 km. In its central part, few faults are creating the steps.

To the north of Namangan flat immersion of the pre-Mesozoic surface to the center of the basin is noted. A little to the west, there is a structural ledge at a relief of the considered horizon. Depths rate from 3.5 to 6 km.

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The Northern Step separated from the Central Graben by the Northern Fergana fault. As well as the Southern Step, it looks like a homocline, but submerged from the north to the southeast. The surface of a pre-Mesozoic is at the depths from 1 to 3.5 km here.

Unlike the Southern Fergana fault, which expressed as a zone of several extended subparallel faults, the Northern Fergana fault looks like one linearly extended violation.

Considering a zone of the Southern Fergana fault and morphology of its surface, it would be more correct to call it not the Southern Fergana "fault", but the Southern Fergana "flexure-fault zone".

The relief of pre-Mesozoic surface rather good displays those processes of compression, which happened in the limits of the Fergana basin during past eras. According to schemes of the geodynamic activity of Central Asia, the main direction of compression is the southeast - northwest (Thomas *et al.*, 1999, Coutand *et al.*, 2002, Shayakubov and Dalimov, 1998). In the pre-Mesozoic relief to this corresponds the most submersed site of the Central Graben where the arrays of the Pamir-Alai "crush" under themselves the Paleozoic sequences of the Fergana basin. Further, there is a raised site, which displaced to the center of the basin. That explains the fact that the main direction of the movement of masses not rectilinear, but on an arch, which bents counterclockwise.

Such picture we may observe while compress of a flexible plate. Its edge, where is the maximum pressure will be pulled down, other part at the same time, will rather raise. According to the model of a regional isostasy (Angevine *et al.*, 1990) earth crust can be presented in the form of the layer consisting from flexibly connected blocks. Where, when rendering pressure upon one of blocks, the morphology of all layer changes. That we also observe on the example of the Fergana basin.

Thus, it is possible to note that processes of global tectonics - the Indian-European collision exerted impact on formation of a Paleozoic relief of the Fergana basin.

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