

## **SYSTEM OF PALEOZOIC OIL AND GAS PROSPECTIVE LOCAL ANTIFORMS OF THE BUKHARA-KHIVA PALEORIFT**

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### **ABSTRACT**

The developed paleo geodynamic map and sequences of quasi-three-dimensional seismic geological model allow us to fully characterize the geodynamic regime and the internal structure of the central graben of the Bukhara-Khiva paleo rift. Within it, 12 oil-and-gas prospective local antiforms are distinguished with varying degrees of detail. The process of their formation can be associated with a small irregular transverse compression of the Paleozoic graben in the Mesozoic-Cenozoic time. According to the degree of dislocation of antiforms, the northwestern and southeastern playas were identified for the systematic organization of works.

**Keywords:** *Oil and Gas Prospective, Exploration, Central Graben, Three-Dimensional Space*

### **INTRODUCTION**

In 1994, a group of researchers headed by Abidov A.A. identified for the first time a buried paleo rift system within the Paleozoic complex of the Bukhara-Khiva region. According to the three-dimensional geological-geophysical model developed by them, the central graben with two sides, axial dyke and relict of mantle diapir were the main structural elements of the paleo rift. The central graben is an isolated sedimentary basin of Late Paleozoic age. It is located within the Chardzhou tectonic stage. Its northern boundary is the Uchbash-Karshi fracture zone. The southern boundary of the central graben is less pronounced and is represented by the Kandym and Dengizkul uplifts. According to the results of the later electrical exploration works carried out there by MTZ method, the northwestern part of the central graben is of the greatest practical interest for searching oil and gas deposits in the interval of the upper rift complex. Its increased productivity can be provided by the mix genetic scheme of natural hydrocarbon synthesis [Abidov *et al.*, 1994].

In 2009, a team of researchers led by Dolgopolov created a more detailed three-dimensional geological and geophysical model of the northwestern part of the Bukhara-Khiva paleo rift central graben. It enabled the Chandyr-West Kokchin, Bazarbai, East-Uchbash, and Taikyr-West Chukurkul antiforms to be identified as new local oil and gas prospects. They're intricately designed positive structures with certain elements that might act as oil and gas reservoirs [Dolgopolov *et al.*, 2009].

Further studies of the internal structure of the central graben of the Bukhara-Khiva paleo rift were aimed at developing quasi-three-dimensional seismic-geological models of oil-and-gas prospective local objects of antiform type within the sub-chexhol Paleozoic complex of the Bukhara-Khiva paleo rift to clarify their structural plan and determine further directions of geological exploration work. The methodology of these works included analysis of available geological and geophysical materials, mathematical formalization of modeled objects, complex reinterpretation of geological and geophysical data, construction of longitudinal and transverse seismic-geological systems, their synthesis in three-dimensional space and development of practical recommendations.

### **MATERIALS AND METHODS**

A composite geodynamic model of the ordered fault-block structure of the upper crust of the depression has been developed on the basis of drilling data, large-scale structural maps and reinterpreted seismic and geological sections. Taken together, it depicts fault-block structural plans of the crystalline basement,

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subcheval Paleozoic complex and Mesozoic-Cenozoic sedimentary cover, formed as a result of the impact of the Neogene-Quaternary geodynamic regime. Between the years of 2012 and 2016, G.S.Abdullaev, F.G.Dolgoplov, Z.Kh.Safarov, and others created a regional paleo geodynamic map and scheme of the position of local antiform type oil-and-gas prospective artifacts within the rift Paleozoic complex in the Bukhara-Khiva area. On this foundation, three-dimensional seismic-geological models of the Paleozoic antiforms of Chandyr, West Kokchi, West Chukurkul, Taikyr, Bazarbai-Khasankul, and Uchbash were developed. They were used to make practical recommendations for prospecting geophysical surveys using MOGT-3D seismic surveys, MTZ electrical surveys and deep drilling with the use of optimal field observation systems. The main scientific result of these studies was the development of models of single type oil and gas prospective objects with different degrees of their geological and geophysical exploration [Dolgoplov et al., 2012; Abdullayev et al., 2012; Abdullayev et al., 2012; Abdullayev et al., 2015 Abdullaev and Dolgoplov, 2016].



**Figure 1: Paleo geodynamic map of the central graben of the Bukhara-Khiva paleo rift with the location of oil and gas prospective local antiforms (compiled by: Rakhmatov U.N., 2021). 1 - Kyzylkum active paleocrine, 2 - Karakum passive paleocrine, 3 - northern and southern sides of paleo rift, 4 - central graben of paleo rift, 5 - Uchbash-Karshi flexural fracture zone, 6 - external borders of Bukhara-Khiva paleo rift, 7 - borders of central graben, 8 - discontinuities within the central graben, 9 - axis of extension of the paleo rift, 10 - isohypses of the surface of the subchannel Paleozoic complex, 11 - wells that penetrated the surface of the subchannel Paleozoic complex, 12 - oil-and-gas prospective local antiforms within the Upper Paleozoic rift complex.**

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In 2019, F.G. Dolgoplov and U.N. Rakhmatov compiled a regional paleo geodynamic map of location of local oil and gas prospective objects of antiformal type within the rift paleozoic complex in the southeastern part of the Bukhara-Khiva paleo rift. On its basis, three-dimensional seismic-geological models of the Divalkak-Matonat, Kemachi-Zekri, Sarkum-Darbazi, East Dengizkul, Kushab and Pamuk Paleozoic local antiformal structures were developed. They were used to make practical recommendations for prospecting geophysical works by MOGT-3D seismic, MTZ electrical prospecting and deep drilling methods using optimal field observation systems.

## **RESULTS AND DISCUSSION**

The geological and geophysical materials available to date allow a more complete characterization of the geodynamic regime and the internal structure of the central graben of the Bukhara-Khiva paleo rift, as well as an assessment of the possible number of oil and gas-prospective local antiformal structures located there. The paleo geodynamic map of the Bukhara-Khiva paleo rift, drawn by the author, shows fragments of the South Tien Shan accretionary prism and the Amu Darya passive margin, its two sides and the entire central graben itself as regional structures. It includes the northwestern closure, the central part of the maximum extension, the southeastern junction and the opening zone in the northwestern part of the Beshkent trough. Within its boundaries, 12 local oil-and-gas prospective antiformal structures are distinguished with different degrees of geological and geophysical study. Most of them are spatially confined to the axial extension line of the central graben and are characterized in terms of isometric shape. Three elongated antiformal structures near the northern flank of the central graben are also noted. Two more with a complex configuration of boundaries are located near the southern rim. In general, their formation process can be associated with a small irregular transverse compression of the central graben during the Mesozoic-Cenozoic, while its regional structure remained intact (Fig. 1).

Depending on the initial width of the central graben and the intensity of transverse compression, we can distinguish a less dislocated northwestern and a more dislocated southeastern zone. The degree of difference in their structural plans can be mapped by assembling sequences of quasi-three-dimensional seismo-geological models of local antiformal structures, proportionally placed in the central graben space.

The sequence of quasi-three-dimensional seismo-geological models in the northwestern zone of the central graben of the Bukhara-Khiva paleo rift includes the Uchbash, Taikyr, West-Chukurkul, Bazarbai-Khasankul Chandyr and West-Kokchi local antiformal structures. The Bazarbai-Khasankul, Chandyr and West Kokchi antiformal structures located along the extension axis of the central graben are the best studied there. They are characterized by a proven dome structure with a closed contour of their boundaries. The dome structural plans and the positions of the outer boundaries of the Uchbash, Taikyr, and West-Chukurkul antiformal structures should be considered conditional (Fig. 2).

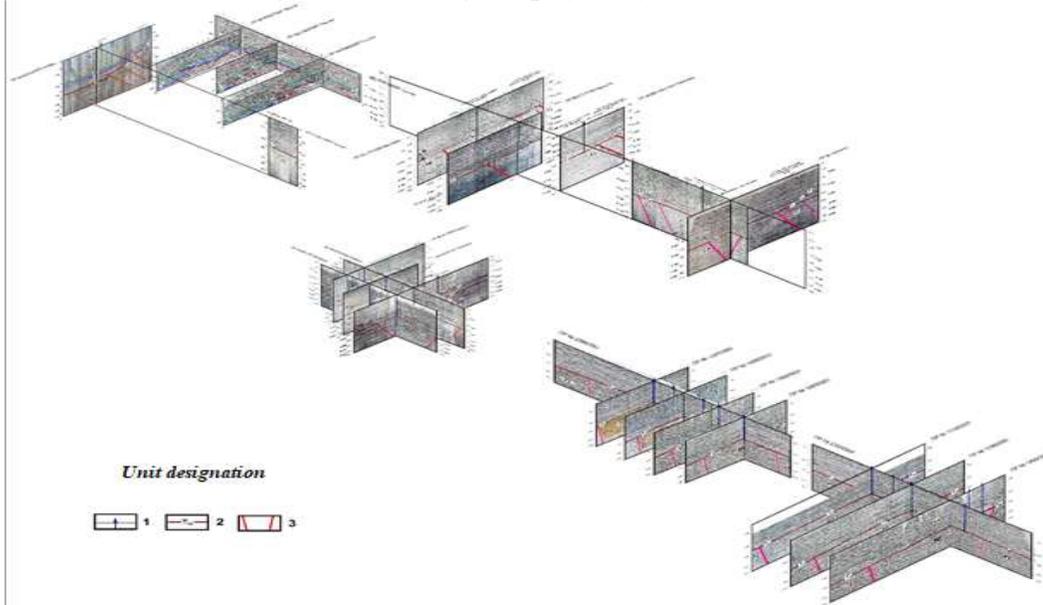
The sequence of quasi-three-dimensional seismic-geological models in the southeastern zone of the central graben of the Bukhara-Khiva paleo rift includes the Divalkak-Matonat, Kemachi-Zekrin, Sarkum-Darbazin, East Dengizkul, Kushab and Pamuk local antiformal structures. The best studied there are Divalkak-Matonat, Kemachi-Zekri, Sarkum-Darbazi antiformal structures. Dome structure and closed contours of their boundaries do not cause doubts. The dome structural plans and external boundaries of the East Dengizkul, Kushab and Pamuk antiformal structures should also be considered conventional (Fig. 3).

## **CONCLUSIONS**

Therefore, the achieved level of the conducted studies allows us to conclude that within the central graben of the Bukhara-Khiva paleo rift, there is a sufficient reserve of oil-and-gas prospective local antiformal structures for large-scale exploration for oil and gas in the "Paleozoic" rift direction. The relatively high degree of geological and geophysical exploration of individual objects cannot serve as a criterion for their prospects. According to the degree of their dislocation there, we can distinguish northwestern and southeastern plays for the system organization of works. Naturally, their subsequent detailing and prospecting should be

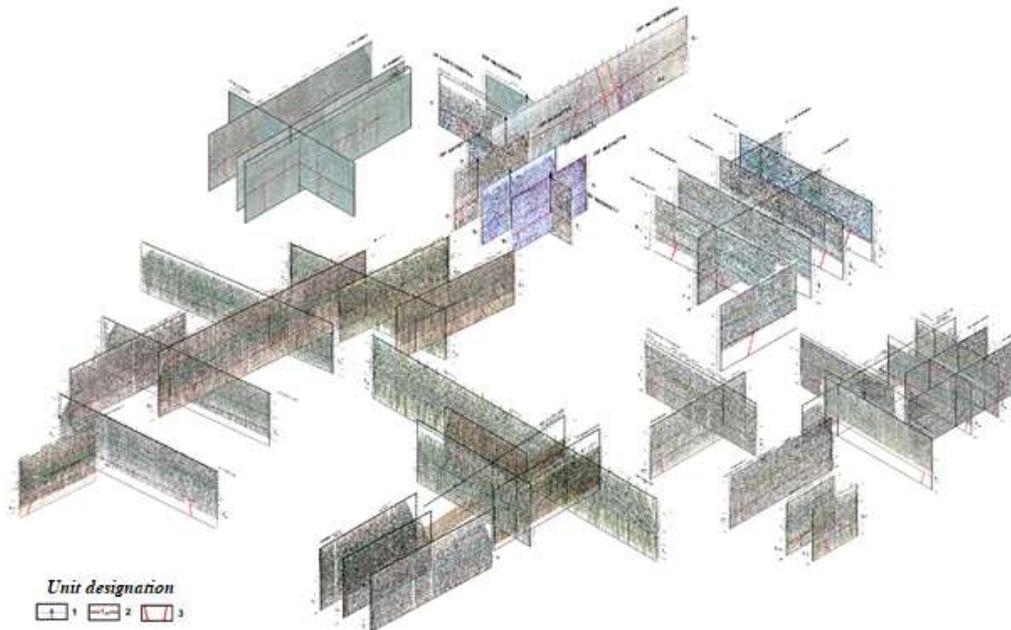
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based on new factual materials, including volumetric seismic surveys, parametric drilling, and other high-tech research methods, including basin modeling and play analysis.



**Figure 2: Sequence of quasi-three-dimensional seismic-geological models of oil-and-gas prospective local antiforms in the space of the northwest non-dislocated zone of the central graben of the Bukhara-Khiva paleo rift (compiled by: Rakhmatov, 2021).**

*1 - wells penetrating the surface of the Paleozoic rift complex, 2 - reference reflecting horizon confined to the upper boundary of the Paleozoic rift complex, 3 - discontinuities within the Paleozoic rift complex.*



**Figure 3: Sequence of quasi-three-dimensional seismic-geological models of oil-and-gas prospective local antiforms in the space of the south-eastern dislocated zone of the central graben of the Bukhara-Khiva paleo rift (Compiled by: Rakhmatov, 2021).**

*1 - wells penetrating the surface of the Paleozoic rift complex, 2 - reference reflecting horizon confined to the upper boundary of the Paleozoic rift complex, 3 - discontinuities within the Paleozoic rift complex.*

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