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Research Article

COMPARATIVE ANALYSIS OF THE FERGANA DEPRESSION WITH THE CENOZOIC BASINS OF THE WORLD AND ITS RESULTS

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ABSTRACT
The article considers the results of comparative analysis of geological and tectonic conditions of Cenozoic basins of the world and Fergana oil and gas bearing basin. As a result of the analysis it is established that in the conditions of the Fergana oil-and-gas bearing basin in the central part in the Neogene deposits of the Cenozoic, potentially oil-and-gas bearing strata of Miocene-Pliocene sediments can be additionally identified.

Keywords: *Fergana Cavity, Oil and Gas Bearing Basins, Neogene, Pliocene, Miocene, Comparative analysis*

INTRODUCTION

As a result of comparative analysis of single-type oil-and-gas bearing basins, the pattern of distribution of oil and gas deposits, missed, i.e. untested and unstudied in other basins oil-and-gas bearing horizons, some inaccuracies of stratigraphic partitioning of the section, oil and geological zoning and other are revealed. On this basis, the author made a comparative analysis of the Fergana oil-and-gas bearing basin with the same-type Cenozoic basins of the world. At the same time, in this work, oil and geological zoning, typification and classification of oil and gas bearing basins are not considered. About 390 oil-and-gas bearing and possibly oil-and-gas bearing basins and provinces are identified in the world, of which more than 130 with participation of Cenozoic sediments. In 54 basins, Cenozoic sediments are the main oil and gas bearing sediments.

Classification of oil-and-gas-bearing provinces and basins from the position of tectonics, tectonic-dynamics, historical-tectonics and geodynamics in different years performed: (A.A. Abidov 2009); (I.O. Brod 1964); (I.O. Brod *et al.,* 1965); (M.S. Burshtar 1973); (A. Bailey and Bally, 1975); (M.I. Varentsov and K.N. Kravchenko 1962), (V.G. Vasilyeva et al. 1964), (I.V. Vysotsky 1971), L.E. Levina (Kuznetsov et al. 1970); M.K. Kalinko (1969, 1977); V. D. Kozyrev (1977); H. Klemme (Klemme 1971, 1975); (I. I. Nesterova et al. 1975); (V. B. Olenin 1966); (A. Perrodon 1970); (Porter and McCrossan 1975); (V.A. Raaben (1977); (Soeparjadi 1975); (B.A. Sokolov 1968); (T. Tompson 1976); (E.V. Tchaikovsky 1977); (Beka K and Vysotsky IV 1976); (Uspenskaya NY and Towson NN 1972); (Abidov AA 1994); (Abidov AA 2006).

As a result of long studies, about 20 classification types of oil-and-gas bearing basins and provinces have been developed, but none of them can be considered universally accepted, i.e. complete, since the development and formation of the basins themselves, oil and gas formation and oil and gas accumulation in the platform and geosynclinal-fault zones are very different. This factor does not allow to create a single universal classification for all types of basins.

MATERIALS AND METHODS

In this work, I.O. Brod and I.V. Vysotsky's (1965) classification was chosen for comparative analysis of the geological and tectonic conditions of Cenozoic basins of the world and Fergana region. According to this classification, the oil and gas basins of the world are divided into three large classes: platform flat;

foothill and intermountain basins. The Ferghana depression is assigned to the class of intermountain basins of post-Paleozoic folded systems and modern geosynclines, with a relatively simple structure, with terrestrial frames Fig.1.

As a result of comparative analysis of these basins, the stratigraphic distributions of oil and gas bearing Cenozoic sediments have been studied. All stratigraphic sections of the geological section of the Cenozoic sediments, up to the Quaternary, in one or another basin are oil and gas bearing. Placement of deposits in the Cenozoic sediments is considered in more detail on the example of the Vienna-Moravian, Ploiesta, Kobystano-Kura and West-Turkmen oil and gas bearing basins, where the greatest number of oil and gas bearing strata in Cenozoic sediments, especially in the Neogene part of the section is observed.

The geologic section in all basins consists of sedimentary deposits, beginning in the Neogene, more rarely in the Paleogene (Eocene or Oligocene) and ending in the Plio-Pleistocene (sometimes continuing to the present day). The lower part, up to the top of the Miocene, consists of transgressive series of marine sediments (as the Paleogene marine carbonates in Fergana), which include thick clayey strata, usually considered as oil-bearing. The upper part of the section includes a

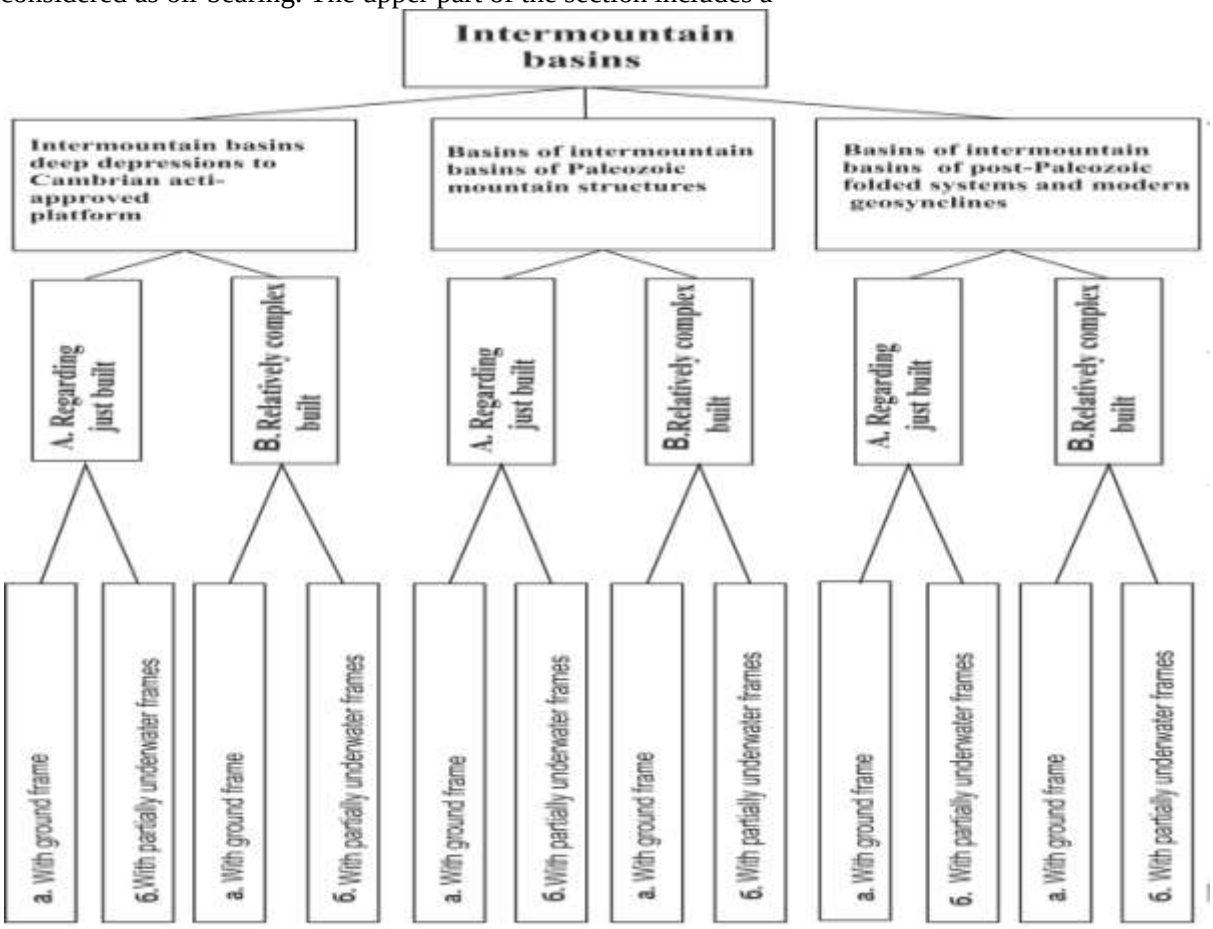

Fig. 1. Classification of oil and gas bearing basins (OGB) of the world I.O. Brod and I.V. Vysotsky and others 1965.

regressive marine series of sediments, transitioning upper in the section to the continental series. This part of the section is characterized by increasing enrichment with sandy material and accumulation of sandy horizons serving as reservoirs (like the Bactrian sequence of the Central Fergana megasyncline).

The field structures are anticlinal and brachiatic anticlinal, stratigraphic positions of productive deposits are predominantly Miocene, Pliocene and sometimes Oligocene, deposit types are massive vaulted and

vaulted tectonically screened. The lithological composition of productive horizons is sandstones interbedded with clays, marls, and conglomerates, clay shales, siltstones, mudstones, tuffs, etc. Miocene Neogene sediments contain up to 15 oil and gas bearing strata, (Fergana Depression-3) and Pliocene up to 20-21 (Fergana Depression-2). According to the classification of I.O. Brod and I.V. Vysotsky, the author added to the map with indication of oil-and-gas bearing basins located in one group that is in class "Intermountain depressions" (Fig.2).

The Neogene part of the Cenozoic sediments section of Fergana basin is in the second place after the Paleogene sediments in terms of predicted hydrocarbon resources and recoverable resources will be 125.4 million tons of fuel equivalent (Abdullaev *et al.*, 2021). In this connection, carrying out a comparative analysis of the Fergana basin with other similar basins of the world and determining the priority areas of exploration for oil and gas is important practical importance.

RESULTS AND DISCUSSION

The Vienna-Moravian intermountain basin is located at the junction of the Alps and the Carpathians, extending from SW to NE. It is a stepped graben, bounded around the edges by large faults with an amplitude of 100-150 to 2,500 m. The geological section is mainly composed of sandy-clayey and clayey-mergelitic sediments with a total thickness of 6000m, commensurate with the Fergana depression. It is variable over areas both in facies and in thickness, there is a decrease in thickness towards side parts, coarse-grained sediments and uncoordinated occurrence of layers within the Neogene complex (Uspenskaya and Towson 1972).

Intermountain post-Paleozoic fold systems and modern geosynclines: 2- Selavik, Norton Bethel, Nushagak; 3-South Alaska; 5-Fraser; 6-Coastal pacific; 7-Pasco; 8-Rocky mountains; 9-Californian; 19-20-North and South Cuban; 21-Gaitian; 22-Coastal caribbean; 23-Colombian; 24-Maracaibo; 25-e Tokuyo; 26-Tui Cariaco; 27-Cauca; 30-Guayaquil; 38-Titicaca; 42-Central (Longitudinal) Valley; 54-Viennese-Moravian; 55- Pannonian; 56-Transylvanian; 57-Central Carpathian; 61-Iberian Peninsula; 63-Vale Latina; 64-Sicilian; 65-Adriatic; 66-Thracian; 67-Thessalian; 76- East Black Sea; 77- South Caspian; 81-Afghan-Tajik; 82-Fergana; 109-West Kamchatka and Sakhalin; 110- Indigiro-Khromsky; 111-Kolyma; 112-Penzhinsky; 113-Anadyr; 114-Central Kamchatka-Olyutorsky; 115-East Kamchatsky; 116-Adara; 119-Isfahan, Jezmuran, Omani-Mekran, Dashte-Kevir, Dashte-Lut, Helmand, Kharan; 123-Assamese; 147-Taiwanese; 148-Japanese islands; 150-Irrawaddy-Andiman; 151-Indosinian; 152-Sunda islands; 153-Vogelkop; 154-North New Guinea; 159-New Caledonian; 160-New Zealand; 161-West Atlas (Moroccan); 162-North Atlas; 163-Central Atlas; 164-East Atlas (Tunisian).

Fig.2. Map of the main oil and gas bearing and possibly oil and gas bearing basins of the globe (Compiled by Urmonov A.Kh. 2022)

The field structures are domed anticlines and brachyanticlines, disturbed by faulting. Stratigraphic positions of productive deposits are mainly Miocene, Pliocene and sometimes Eocene-Paleocene, types of deposits are reservoir vaults, reservoir vaults lithologically screened, reservoirs tectonically screened, massive in the structural ledge. The lithological composition of productive horizons - sands, fine- and medium-grained sandstones, glauconite sandstones, fractured, basal conglomerates, interstratified with

clays, marls and pebbles, lignite beds, etc. Miocene deposits of Neogene contain up to 18 oil-and-gas bearing strata (Fergana-3).

The Eastern Carpathian Mountains is a marginal trough of the Precarpathian-Balkan oil and gas bearing basin located in the southern and eastern part of Romania, northern Bulgaria and part of Moldova. The latitudinal part of the East Karpatian regional trough is confined to the large Ploiestini-Fokshan Pliocene trough. Its structure involves a powerful complex of Cenozoic deposits, clearly divided into two floors: the upper Neogene, which forms the fulfillment of the troughs and does not participate in the framing of the basin, and the lower Paleogene, which underlies the upper and also composes the mountain framing of the trough. The stages are separated from each other by a break (Aquitaine Stage) (Uspenskaya and Towson 1972).

Field structures are narrow, strongly compressed anticlinal folds, brachyanticlines, complicated in the vault by intrusion of saline sediments and strongly disturbed by faults and surges, stratigraphic positions of productive deposits, mainly Miocene, Pliocene and sometimes Oligocene, types of deposits - reservoir vaults, reservoir vaults stratigraphically screened, reservoirs tectonically screened. The lithological composition of productive horizons is sand, sandstones, interbedded with calcareous clays with interlayers of lignite, marls and pebbles, etc. Miocene Neogene deposits contain up to 11 oil-and-gas bearing strata (Fergana-3) and Pliocene deposits up to 10-12 (Fergana-2) (Fig.3).

Kobystan-Kurinsk oil-and-gas bearing area is confined to the South Caspian oil-and-gas bearing province. The latter, in the form of a large intermountain trough, extends in the west between the mountain structures of the Greater and Lesser Caucasus, in the east between the Kuba-Dag, Greater Balkhan, Lesser Balkhan ridges, in the north between the Kopet-Dag spurs and Elbrus-Khorasan to the south. The western part is represented by a narrow centric valley that opens into the Caspian Sea and is known as the Kura Depression. It is composed of thick sediments of Meso-Cenozoic age, predominantly of terrigenous composition (Uspenskaya and Towson 1972).

The eastern periclinal part of the South Caspian oil and gas province is distinguished as the West-Turkmen depression. Here, the geological section is close to the western part of the province with

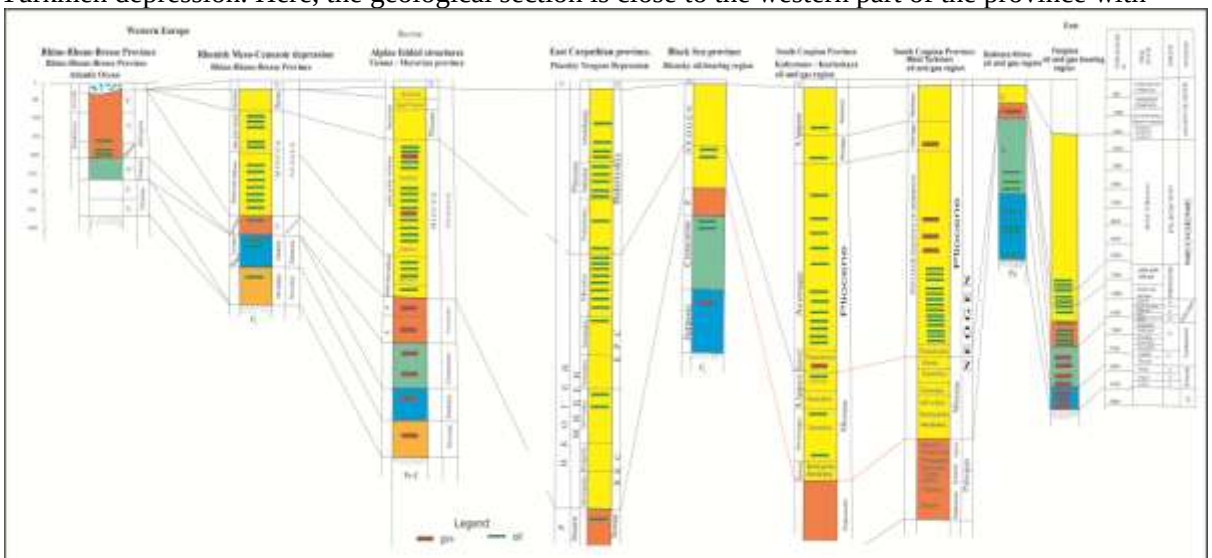

Fig. 3. Stratigraphic distribution of oil and gas deposits in various basins of the world (Compiled by Urmonov A.Kh. 2022)

lower thickness. In the Pliocene part of the section, an analogue of the productive stratum, called the red-colored stratum, is distinguished. It is characterized by interbedded sands, sandstones and clays up to 3000 m thick. In the lower part, rocks of the Pontic Stage, represented mainly by clays up to 3,800 m thick, are deposited. The Miocene part of the section is represented by sandy-clay deposits (analog of the

brick-red formation of the Miocene of Central Fergana) up to 400 m thick (Uspenskaya and Towson 1972).

In Kobystan-Kurinsk and West-Turkmen oil-and-gas bearing regions the field structures are of the same type and represented by anticlines and brachyanticlines, complicated in the vault by intrusion of saline sediments and strongly complicated by tectonic faults of dump and upsweep type. The stratigraphic positions of productive deposits are predominantly Pliocene and Miocene, sometimes Oligocene. Types of deposits are vaulted reservoirs, stratigraphically screened vaulted reservoirs, lithologically screened vaulted reservoirs, tectonically screened reservoirs. The lithological composition of productive horizons are sands, sandstones, siltstones, siltstones, etc (Uspenskaya and Towson 1972).

The Miocene sediments of the Neogene of the Kobystano-Kurinskaya depression contain up to 3-4 oil-bearing strata (Ferganskaya-3) and Pliocene up to 15-16 (Ferganskaya-2); Pliocene of the West-Turkmen depression contains 15-16 oil-bearing horizons and up to 4 gas-bearing (Fig. 3). The same result was obtained in the comparative analysis of the Fergana oil and gas bearing area with other Cenozoic basins of the same type.

For this purpose, apart from the above mentioned, the following oil-and-gas bearing basins were considered: Rocky Mountains; Assam; San Joaquin; Maracaib; Pannonian; Pasco; Fraser; Japanese Islands; Iranian Highlands; Indonesian and many others.

In all the basins considered, all stratigraphic divisions of the Cenozoic, from the Paleocene to the Quaternary, are oil and gas bearing. In the Paleogene part of the section, more deposits, as in Fergana, are confined to the Eocene sediments, after to the Oligocene and a relatively smaller number to the Paleocene.

In the Neogene part of the section, more deposits are concentrated in the Miocene (brick-red and pale pink suite of Neogene Fergana) sediments, relatively less in the Pliocene and the least in the Quaternary sediments.

In many basins, the Miocene and Pliocene part of the section, with the same lithological composition of the section as the Fergana basin, contains more oil and gas deposits. For example: Precarpathian-Balkhan NGB in Pliocene-16 and Miocene-25; Transylvanian NGB in Pliocene-4 and Miocene-19; Pannonian in Pliocene-21 and Miocene-2; Vienna NGB in Pliocene-1 and Miocene-46; Adriatic NGB in Pleistocene-2, Pliocene-2 and Miocene-2 oil and gas deposits, etc. In almost all oil and gas bearing basins, the lithological composition of Neogene reservoirs is similar to that of the Fergana oil and gas bearing basin, represented by sands and sandstones, interbedded with clays, mudstones, etc.

In the Central submerged zone of Fergana oil-and-gas bearing basin in many areas such as Varyk-II, Kum, Kokand, Yaypan, Atamtay, Sarykurgan, Gumkhana, South Gumkhana, Karajida, East Karajida, Mingbulak, Chust-pap, Kassansay, North Khakkulabad the Neogene part of Cenozoic deposits is revealed by deep exploration and prospecting wells at most. It is most fully uncovered on the East Karajid area and amounts to almost 6000m. In some areas, such as Gumkhana, Mingbulak, Kassansay, oil and gas occurrences were noted in the Miocene and bottom part of Pliocene. In the peripheral side parts of the basin of many fields such as Zap. Palvantash, Andijan, South Alamyshik and others of these sediments oil and gas have been extracted for a long time (Abdullaev *et al.*, 2021).

Based on the results of the performed comparative analysis of the Cenozoic oil-and-gas bearing basins, we can note that in the conditions of the Fergana oil-and-gas bearing basin in the central part in the Neogene sediments of the Cenozoic, we can additionally identify potentially oil-and-gas bearing strata of Miocene-Pliocene sediments.

CONCLUSIONS

In spite of the performed numerous studies on geosynclinal movable belts, epochs of development and age of folding, geological and tectonic conditions of location of intermountain (including Fergana depression) and piedmont depressions, many questions have debatable character and require unambiguous interpretation in the future.

Thus, the results of the studies allow us to draw the following conclusions:
-neogene part of the Cenozoic deposits of the Fergana oil-and-gas bearing region by the number of identified deposits and their types is strongly inferior to other similar oil-and-gas bearing basins of the world;
-in many basins, the Miocene and Pliocene parts of the section, with the same lithological composition of the section as in the Fergana basin, contain a greater number of oil and gas deposits;
-the Neogene part of the geological section of the Cenozoic deposits of the Fergana basin, especially in its Central deep-submerged zone, is characterized by low exploration and weak oil and gas prospecting;
-results of comparison and comparative analysis of single-type Cenozoic basins allow to suppose, that in conditions of Fergana oil-gas bearing basin, in the central part in Neogene deposits of Cenozoic, it is possible to reveal additionally potentially oil-gas bearing strata of Miocene-Pliocene sediments;
-it is recommended to test all kinds of reservoirs inside brick-red, pale pink formations of Massagetian stage and Bactrian strata of Neogene part of Cenozoic deposits in areas of central submerged part of Fergana basin, such as Mingbulak, Gumkhana and Karadzhida.

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