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PAPER

GEOLOGICAL STRUCTURE AND STRATIGRAPHY OF THE KOGNISOY FIELD

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Abstract

The stratigraphic column, summarizing the geological structure of the Kognisai area, includes layers from the Lower-Middle Jurassic period to the Quaternary period. They are mainly composed of continental, terrigenous, and carbonate sedimentary deposits.

Key words: sandstone, tuff, kellovey-oxford, quartz, alloyed color, sedimentary cover, marl, gaurdak.

The assessment of prospective oil and gas fields of the Surkhandarya megasyncline began in the 1930s with the initiation of systematic exploration in the Surkhandarya depression. During 1931–1938, geological mapping led to the identification and study of surface structures at a scale of 1:84,000. During this period, the following industrial-scale oil and gas structures were discovered: Khaudak, Uchqizil, Kokayti, and Lalmikor. Geological mapping at a scale of 1:100,000, starting from 1943, was carried out for oil and gas exploration purposes. This work focused on prospective structures, surface indications of oil and gas presence, as well as the study of tectonics, lithology, stratigraphy, and subsurface layers of the exploration areas.

From 1950 onward, geological investigations began in the central and southeastern parts of the Surkhandarya depression.

At present, 86 structures have been identified in the Surkhandarya depression using geological and geophysical methods. However, only seven small fields have been discovered. Hydrocarbon accumulations have been identified within Paleogene deposits. The Cretaceous and Jurassic deposits have not yet been fully studied through drilling. To date, the conducted exploration work remains insufficient.

By the present time, the entire eastern part of the Surkhandarya oil and gas province, including previously explored areas, has been covered by integrated geological and hydrographic surveys

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at a scale of 1:200,000 (V.G. Garkovets; Kh.T. Tōlaganov, 1955–1960). In the Kelif–Sarykamish ridge, surveys at scales of 1:100,000 to 1:84,000 and even larger were carried out. These studies revealed surface outcrops of the Meso-Cenozoic sedimentary complex and the presence of local anticlinal uplifts within the Surkhandarya depression.

Under existing conditions, drilling data were used as the primary source for studying the lithological and stratigraphic characteristics of the geological section. The most effective structural drilling was conducted at more than 30 sites—including Gajak, Bayangara, Uchqizil, Khaudag, Oqtog‘, Lalmikor, Mirshodi, Qoshcheka, Qoshtor, and other anticlines—aimed at examining and deeply studying their geological structure and preparing them for deep drilling (I.I. Podolskaya, E.A. Goltman, M.M. Mirasrorov, S.I. Musayev, Kim Ben-Chan, T.K. Ro‘ziyev et al., 1952–1970).

A total of 365 deep exploratory wells were drilled across 45 areas of the Surkhandarya depression. Stratigraphic analysis showed that oil and gas fields were identified in Paleogene (P) deposits in 11 of these areas. In many other areas, oil and gas indications were observed during drilling or reservoir testing.

Exploration, appraisal, and parametric drilling wells penetrated Meso-Cenozoic deposits down to Upper Jurassic carbonates. Industrial-scale oil-bearing structures such as Uchqizil, Khaudag, Kokayti, and Lalmikor were discovered.

The Qoshcheka structure was identified. Within the anticlinal zone, structural profile drilling and geological mapping at a scale of 1:100,000 were carried out. A geological map at the same scale was compiled, and preparations were made for deep drilling of the Oqtog‘ structure along the Cenomanian clay cap layer.

Thus, geological exploration conducted to date in the studied areas has not been highly effective. This is due to objective geological factors, including extremely complex tectonic structures, widespread deformations, inconsistencies in structural plans of deposits of the same age, and other factors.

The widespread occurrence of thick (over 5,000 m) Neogene deposits significantly complicates the study of deep structural features of megasynclines using structural drilling and geological mapping methods. When studying the geological structure of the research area, it is evident that both basement rocks and sedimentary cover deposits belonging to different geological periods are present.

The stratigraphic column compiled for the geological structure of the Kognisoy area includes layers ranging from the Lower–Middle Jurassic deposits to Quaternary deposits. These deposits mainly consist of continental, terrigenous, and carbonate sedimentary formations. The stratigraphic column has a scale of 1:10,000 and was compiled by A.P. Yugay in 1991, in which stages and horizons were distinguished.

Below, a general description of the geological structure of the area is presented. Paleozoic (Pz). The geological structure of the folded basement includes Middle and Upper Paleozoic rocks.

The Middle Paleozoic complex is subdivided into two groups: a sedimentary-volcanogenic group consisting of marbles with thicknesses up to 150 m, schists up to 900 m thick, and volcanogenic rocks with thicknesses of 1600–2000 m; and an intrusive group composed of quartz diorite and granodiorite. The Upper Paleozoic complex includes volcanogenic Middle Carboniferous deposits up to 2000 m thick; Upper Carboniferous deposits with a total thickness of up to 1000 m composed of schists, sandstones, tuffogenic conglomerates, limestones, marl interbeds with tuff layers, and effusive rocks; Lower Permian deposits up to 1000 m thick consisting of acidic effusive rocks; and Upper Permian sands and conglomerates derived from erosion products of volcanogenic sequences. The weathering zone on the surface of the folded basement does not exceed several tens of meters in thickness (V.I. Troitsky, 1967).

Mesozoic (Mz). Mesozoic deposits include the Triassic, Jurassic, and Cretaceous systems.

Triassic (T) deposits overlie the eroded surface of the Paleozoic basement and fill ancient relief depressions. They consist of conglomerates, gravelites, argillites, poorly sorted rocks, and redeposited products of weathering crusts. In exposed areas, the thickness of Triassic deposits is relatively small (1–60 m). However, according to several researchers (P.K. Azimov, 1971; B.B. Tal-Virsky, 1972; and others), in subsided areas these deposits may reach significantly greater thicknesses and, together with Permian rocks, form a separate intermediate structural stage (PSE) with a thickness

of 2500 m or more.

The Jurassic (J) system is divided into three subdivisions corresponding to continental, continental–marine, and lagoonal formation complexes.

Jurassic deposits consist of basaltic coarse clastic rocks, sandstones, coal interlayers, and in some places marly siltstones. In subsided areas of the studied region, the total thickness of the Lower and Middle Jurassic (J1+2) deposits may reach up to 1500 m (Tal-Virsky, 1972).

The Upper Jurassic (J3) includes the Callovian–Oxfordian (Hisor Formation) and Kimmeridgian–Tithonian (Gaurdak Formation) stages. Callovian–Oxfordian deposits (J3 k+o) are represented by limestones up to 800 m thick (Termez area). Kimmeridgian–Tithonian deposits (J3 km+t) consist of anhydrites and gypsum up to 400 m thick, with reworked pelitomorphic limestone lenses in the lower part, as well as rock salt with thicknesses up to 400 m. According to some researchers (Egamberdiev, 1966; Bratash et al., 1969), the thickness of the Gaurdak Formation in the southern part of the area may reach 1000 m or more.

Cretaceous deposits (Lalmikor, Qushtor, Kokayti, Oqtog, and others) have been penetrated by drilling wells.

Lower Cretaceous (K1) deposits consist of sedimentary formations subdivided into three major complexes: continental red-bed formations; complex transitional (continental) and lagoonal–marine formations; and gray marine formations. In the studied area, the thickness of Lower Cretaceous deposits reaches 1150 m.

Upper Cretaceous (K2) deposits consist of marine and lagoonal sediments of the Cenomanian (Cm), Turonian (T), and Senonian (Sn) stages. Cenomanian deposits are composed of clays with interlayers of sandstones, siltstones, limestones, and gypsum beds in the lower and upper parts of the section. Their thickness ranges from 110 m (Sangardak) to 378 m (Qoraqurt). Turonian deposits are lithologically simpler and consist of two main components: the lower part is mainly marly clays with minor limestone and marl interbeds, while carbonate content increases upward. The total thickness of the Turonian ranges from 260 to 617 m. In the Senonian stage, terrigenous sandstone–siltstone rocks with thicknesses of 311–580 m are widely developed.

Paleogene deposits are represented at the base by the carbonate Oqjar Formation (Pak). Up-section, Lower Bukhara sandstones and clayey fractions are present, overlain by the Upper Bukhara gypsum–carbonate sequence. The Bukhara overlying complex (P2–3) consists of variegated clays with thin marl interlayers, with total thickness ranging from 452 m (Oqtog area) to 623 m (Qoshcheka area), as well as limestone units of the Sck, Aloy, and Turkiston (t-hn-sm) formations. Neogene (N) and Quaternary (Q) deposits form molasse formations. The uppermost horizon, including soil layers and recent unconsolidated deposits (loess-like soils, sands, clays, and conglomerates), has been penetrated by drilling wells from depths of zero to several tens of meters.

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