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Abstract. The article discusses the study of the behavior of reservoir fluids and the influence of the hydrodynamic situation on the accumulation and conservation of hydrocarbon deposits in the explored structures of the Beshkent trough. The main attention is paid to studying the value of the potential energy of fluids by mapping them at different points in the reservoir to determine the path of formation water and the possible hydrocarbon deposits associated with them. The places of their most probable accumulation are forecasted and recommendations are given for the implementation and adoption of optimal decisions on the targeted conduct of prospecting and exploration.

1. Introduction

The role of the hydrodynamic conditions in the formation of oil and gas deposits is examined. Attention should be paid on the so-called influence of groundwater during lithogenesis: sedimentation is characterized by the influence of lithosphere reservoir waters; during diagenesis hydrodynamic effects are exerted by silt aqueous solutions, in katagenesis - aqueous solutions, and in sub-mesocatagenetic it should be payed attention on the release of water from the state to the crystalline hydrate minerals, in sub-apokatagenesis previously regenerated water played a major role, which serve as transport and environment of oil and gas formation; in hypergenesis and metagenesis the process of infiltration is discussed. Relevance of hydrodynamic studies is associated with prospecting, exploration and directly oil and gas production. Attention is focused on the role of groundwater in the operation of oil and gas deposits and the influence of hydrodynamic conditions (positive and negative).

Hydrocarbon migration forms, release of oil and gas from fields to the header, the formation of oil and gas, the outflow of chemically and physically bound water, directly an increase of rock pressure should be specially emphasized [1].

Most researchers believe that groundwater plays an important role in the formation of oil and gas deposits and take part in the migration of hydrocarbons. One of the stated assumptions is that hydrocarbon deposits are formed by releasing gases from groundwater and allocation of oil droplets.

Studying the effect of hydrodynamic conditions on the formation of oil and gas takes a lot of time. Groundwater accompanies oil and gas, they can be often found in exploration, development and exploitation of oil and gas deposits.

Hydrogeological observations and studies in oil and gas areas are usually carried out in deep wells intended for prospecting, exploration and exploitation of oil and gas fields. Also, the issues of migration and hydrodynamic conditions for the formation of oil and gas deposits were not left without attention. The hydrodynamic conditions of water pressure systems significantly affect hydrocarbon deposits, subsequently directly affecting the formation of hydrodynamic traps and associated oil and gas deposits. Such traps are usually understood to mean deposits that are retained by the movement of water. Groundwater has both positive and negative effects on the formation of hydrocarbon deposits. [2, 3].

Hydrodynamic studies are widespread in the search, exploration and development of oil and gas deposits. Recently, a number of hydrodynamic works have helped in the discovery of structures (exploratory wells № 1 Tarmok and №. 2 Tuigu). According to the drilling data, advice and recommendations are given, according to which water halos are distinguished. Recommendations are announced that contribute to the completion of work due to the hopelessness of the region (Beshkent trough, etc.).

In the process of prospecting and exploration works, hydrodynamic studies are carried out in deep wells. Usually these are monitoring the quality and quantity of the drilling fluid, determining the static level and reservoir pressure, the productivity of aquifers, sampling groundwater, gas and brines for chemical analyzes, and determining the water temperature.

When the layers containing high-pressure water are opened, the latter begin to flow into the wellbore, influencing the mud that holds this pressure [4, 5, 6].

2. Methods

The hydrodynamic theory and its application in oil and gas exploration are based on a characteristic of the behavior of underground fluids, expressed in terms of their hydraulic potential. The successful application of the principles of hydrodynamics in the search and exploration of hydrocarbon (HC) raw materials depends on the accuracy of determining the hydrodynamic parameters inherent in the studied geological object.

The search for hydraulically shielded oil and gas deposits involves a detailed study of the water pressure system, knowledge of the position of the piezometric surface, which often has a very complex shape, the depth of the roof of the water pressure complex, its power and reservoir properties. Mapping of hydraulic traps in the general case consists in combining the structural map constructed for the formation roof and the hydroisopies map. The intersections of isogypsum and hydroisopies in the cartographic image represent a family of curves, sections of closure, which may indicate the presence of hydrocarbon traps formed under the corresponding hydrodynamic conditions [7,8].

The emergence of hydrodynamic traps is due to the dynamic state of the water pressure system. The formation of oil and gas deposits in shallow-seated formations may be associated with balancing the strength of hydrocarbon floatation, the difference in the pressure of the produced water, the change in the magnitude of this difference in the zones of a sharp change in reservoir properties and a decrease in reservoir capacity in some areas.

The study of the behavior of underground deep-seated fluids and the influence of the hydrodynamic situation on the formation and preservation of hydrocarbon deposits of raw materials is one of the important issues in oil and gas hydrogeology. The hydrodynamic engineering technique for oil, gas, and water provides the researcher with a simple method for assessing the productivity of potential hydrocarbon traps of raw materials within the study area. The corresponding parameters can be used to model various combinations of structural, lithological and hydrodynamic conditions. [9,10,11,12]

It should be noted that fluids make up only one part of the picture of underground conditions. The remaining necessary prerequisites for the formation of hydrocarbon deposits, such as traps, reservoirs,

source rocks, etc., should be taken into account for selecting recommendations for the most probable detection of oil and gas deposits within a given area.

The occurrence of fluid motion in underground conditions occurs as a result of the imbalance of forces between points of high or low potential energies. If the values of the potential energies of the fluids at different points in the reservoir are estimated and mapped on a regional scale, then it is possible to determine the paths of movement of water and associated hydrocarbons within the underground aquatic environment and based on this, to predict the places of their most likely accumulation.

At the same time, it must be borne in mind that within separate gas-water (GWC) and water-oil (WOC) deposits, the contacts may deviate from the horizontal position depending on the hydraulic slope of the formation water and the velocity of the fluid flow. With unidirectional tilt of the contact, the deposit can be shifted. The forecast of such a shift is very important for the rational search and exploration of hydrocarbon clusters [13,14,15,16].

3. Results and Discussions

In order to determine the hydrodynamic conditions for the location of reservoir fluids and assess their influence on the distribution of hydrocarbon accumulations in potential traps, schematic maps of the hydraulic head pressure of the reservoir waters of the Upper Jurassic water complex for the Tuigu, Avazchul and Fayzliv structures within the Beshkent trough have been compiled.

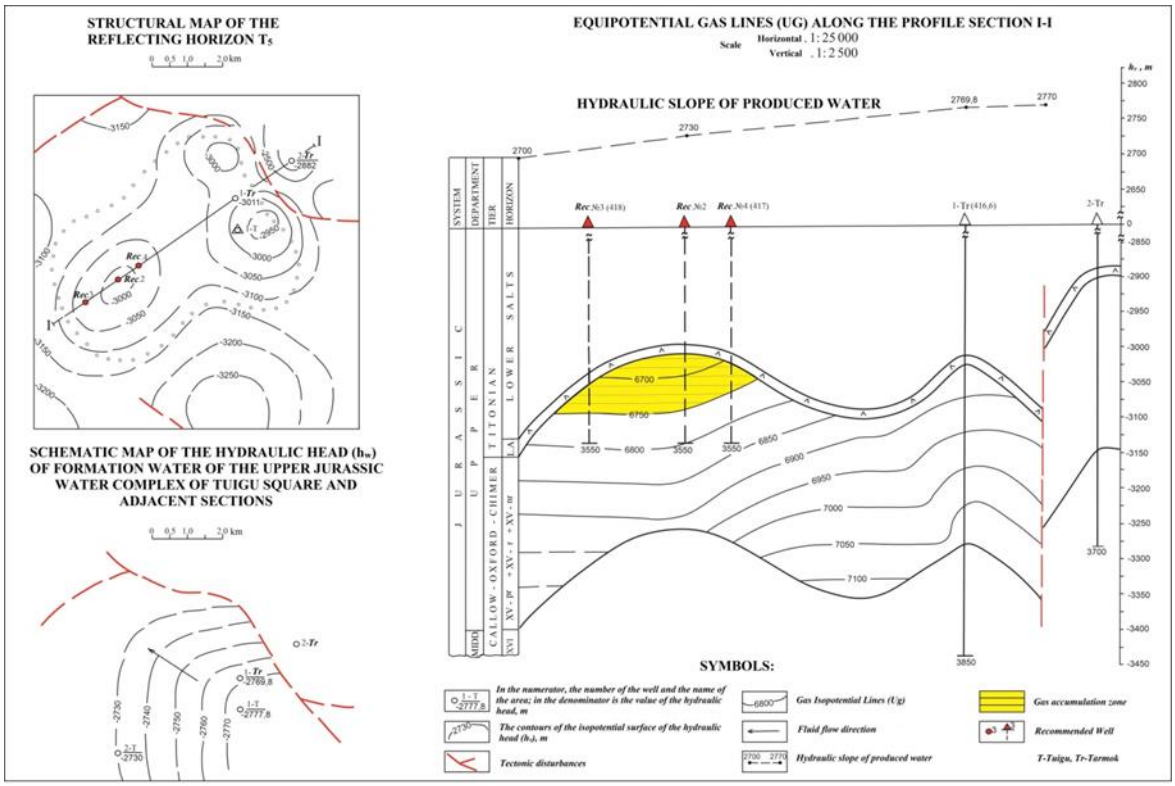

Figure 1. Hydrodynamic conditions of accumulation of hydrocarbon potential traps in Tuigu Square. (Based on the material of T.Kh.Shoymuratov), 2019.

Using the obtained data and compiled maps, specialized hydrodynamic models of equipotential lines for oil and gas for each of the selected objects were constructed. The hydrodynamic conditions that predetermined the accumulation of hydrocarbons within the studied structures are given below, and recommendations are given for the introduction of targeted exploration.

In order to study the structure of Tuigu, exploratory wells № 1 Tarmok and № 2 Tuigu were drilled, where, according to the results of the GIS interpretation (Golubev I.A., Mizik A.N.), pore reservoirs with high oil and gas saturation coefficients were identified in the section of the XV horizon. However, when testing the selected objects obtained formation water.

Given the heterogeneity of the results obtained, in order to clarify the hydrodynamic conditions of the structure under study, a schematic map of the hydraulic head (hb) of formation water of the Upper Jurassic water complex was compiled. Using the obtained data and the compiled map, a profile hydrodynamic model was constructed along the line I-I through the exploratory wells Tarmok-1 and Tuigu-2 (Figure. 1).

On the profile hydrodynamic model of the Tuigu structure, equipotential lines constructed for gas (Ug) in the southwestern dome in the area of the design well. № 2 Tuigu, an area of confined space with locally low potential energy is clearly distinguished, which indicates a high probability of hydrocarbon accumulation in this area, where it is advisable to drill regular exploration wells.

The identified area coincides with the anomalies predicted as hydrocarbon traps, obtained on the basis of neotectonic indicators and the results of interpretation of satellite images (P.M. .A.Dyrda, N.Yu. Bunyak) [17, 18, 19, 20]

In the hydrodynamic profile model of the Avazchul structure, equipotential lines constructed for gas (Ug) in the northwestern part of the structure, near a steeply falling sub-latitudinal fault, form a lenticular space of the probable accumulation of a small amount of fluids in this part of the section (figure. 2). However, according to hydrodynamic indicators, there is no element of a “castle” of traps on the slope steepness; therefore, the possibility of accumulation of hydrocarbon deposits here is very low. Given the above hydrodynamic situation and the ambiguity of the results of geophysical surveys of wells (GIS) and the lithological and physical properties of core samples until new data on the structure and adjacent territories are obtained, we believe that in order to avoid risk it is inappropriate to place another exploratory well on the structure under consideration.

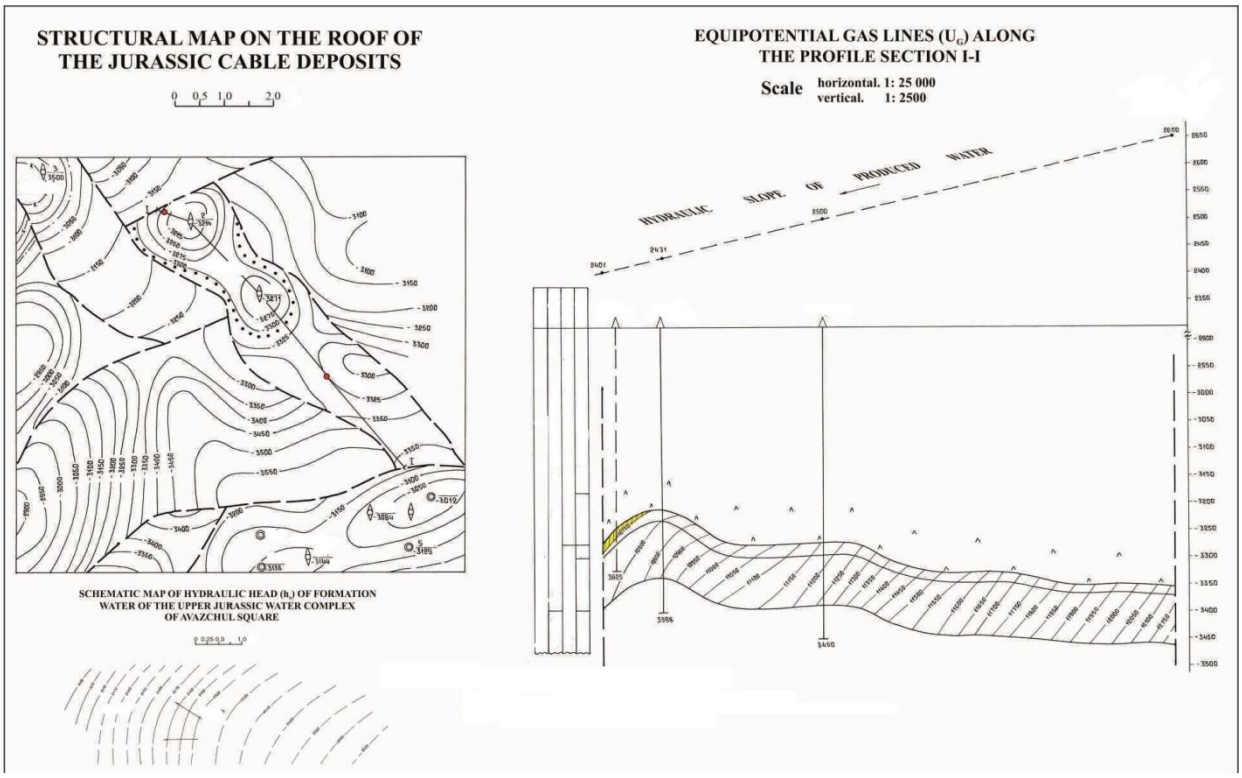

Figure 2. Hydrodynamic conditions of hydrocarbon accumulation in potential traps of Avazchul area. (Based on the material of T.Kh.Shoymuratov), 2019.

The hydrodynamic profile model of the Fayzli structure indicates that the southern flank of the structure is crossed by a steeply falling fault (Figure. 3). Possibly, due to a shift in the amplitude of the fault, a slightly raised structure was formed in the form of a brachianticlinal fold, where equipotential lines show a high probability of accumulation of hydrocarbons on the arch of the structure. At the closure of equipotential lines with a screening fault and a formation roof (a pack of lower anhydrites), a closed area with a minimum energy is formed, which contributes to the accumulation of hydrocarbon deposits. Identified area, i.e. the predicted hydrodynamic anomaly is located in the upper part of the section in the reef formations of the Jurassic carbonate formation of the XV-p, XV-HP horizons, which according to the core study also have the best properties. The rocks are porous, permeable, cavernous, oil-saturated [21, 22, 23, 24].

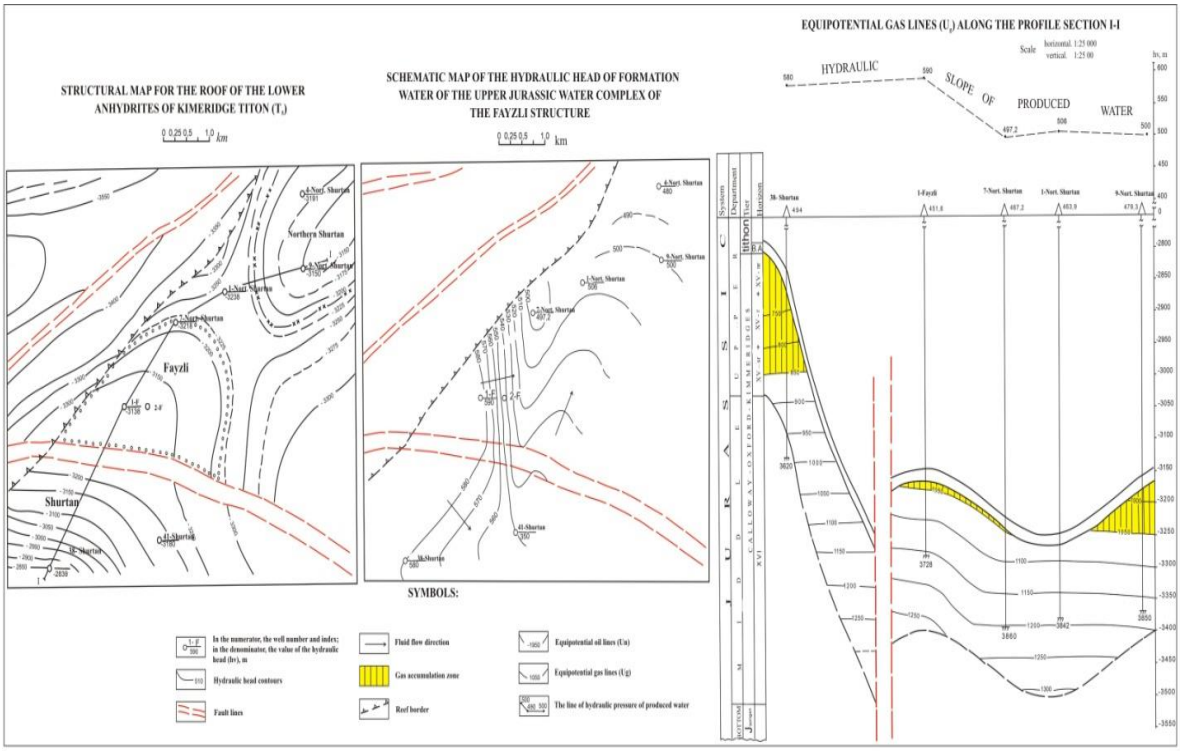

Figure 3. Hydrodynamic conditions of hydrocarbon accumulation in potential traps of the Fayzli area. (Based on the material of T.Kh.Shoymuratov), 2019.

4. Conclusions

According to the results of the study, in the hydrogeodynamic plan, the Fayzli structure is a tectonically shielded brachyanticline deposit with favorable hydrodynamic prerequisites for the accumulation and preservation of hydrocarbon deposits.

Consequently, an on-line analysis using the hydrodynamic method to assess the location of fluids within the studied structures allowed us to identify and correct the probable locations of the traps of hydrocarbon feedstocks. At the same time, the identified trap objects and their prospects based on the hydrodynamic method are confirmed by a complex of geological and geophysical data (well logging, gravity exploration, lithological and physical properties of core samples and laboratory studies, chemical analysis of water samples), as well as the use of neotectonic indicators using interpretation space photographs.

Thus, when searching for and prospecting for oil and gas, combining geological and geophysical work with hydrodynamic research can increase the likelihood of success in discovering hydrocarbon deposits, which contributes to the adoption of optimal decisions for further geological study and to increase the efficiency of prospecting and exploration work.

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