

ABSTRACT

of the dissertation work by Elmira Merekeeva on the topic: «Structure, conditions of sediment formation, patterns of reservoir placement and oil and gas content of the Lower Jurassic and Triassic deposits of the Zhazgurlinsky depression», submitted for the degree of Doctor of Philosophy (PhD) under the educational program 8D07208 – Geology and exploration of mineral deposits

Relevance of the study

The potential of Kazakhstan's oil and gas industry is determined by proven oil and gas reserves, as well as their prospective and forecast resources. The previous ones are related to deposits that were discovered earlier and, thus, are currently being developed or are in development, otherwise temporarily preserved. Prospective and predictive resources are insufficiently scientifically substantiated in terms of local seizures of various types (prospective and consolidated predictive resources) or from the point of view of large and large structural elements of the massif and lithological-stratigraphic complexes. Work is being carried out on an ongoing basis to assess the reserves of deposits discovered in Kazakhstan, as well as measures for a comprehensive assessment of promising and prospective resources, which is a sufficient basis for differentiating the current state and prospects for the future development of the oil and gas industry of the Republic of Kazakhstan.

The real possibility of increasing the proven reserves of autonomous gas is associated with the discovery of new fields in the Kazakh sector of the Caspian Sea, including large ones. Both deposits and deposits associated with Mesozoic complexes, which are productive here, do not contain hydrogen sulfide, which allows them to quickly begin development.

Justification of the need for this scientific research work

Jurassic-Triassic deposits are of considerable interest in the territory of the Zhazgurlinsky depression, as they are widespread and have great power and are an integral part of the Mesozoic period. According to the data of field and geophysical studies on the territory of the Zhazgurlinsky depression, reservoirs of various capacities and varying lithological composition are distinguished by the section of the Triassic complex, not fully uncovered in all areas and deposits, in all uncovered areas of the Triassic that overlap to a certain extent in the studied areas, with special attention being paid to their study in the instrument parts of the lowlands, in order to identify large traps of a non-anticline type.

The purpose of the dissertation work

The purpose of the dissertation is to study the detailed geological structure of the identified seismics, it provides for the processing and interpretation of seismic surveys for a detailed study of the section in order to identify promising oil and gas objects of Jurassic and Triassic deposits within the Zhazgurlinsky depression.

Research objectives:

- clarification of the geological structure of the Triassic, Jurassic deposits;
- to prepare a correlation scheme of the stratigraphy of the Meso-Cenozoic deposits of the Zhazgurlinsky depression;
- isolation of reservoir layers and fluid seals in the section being opened;

- according to the geological and structural position, to find out the patterns of distribution of oil and gas accumulations of Mesocainozoic deposits of the region;
- study of the physical properties of reservoirs based on laboratory core analysis and GIS data.

The object of the study

The object of the study is the Zhazgurlinsky depression of Southern Mangyshlak, administratively the territory belongs to the Karakiyansky district of the Mangystau region of the Republic of Kazakhstan.

The subject of the study

The results of seismic studies of the common deep point method (MOGT3D).

Working methods

The choice of a quantitative assessment technique was determined by the degree of study of the geological structure of the region by deep drilling and seismic exploration, which allowed one of the modifications of the method of comparative geological analogies to be used as the most reliable method.

The main provisions submitted for protection

The author proposes to defend the following provisions of his dissertation:

- lithological and mineralogical study of rocks of the Lower Mesozoic of the Zhazgurla depression is an important stage in the study of the geological history of this territory, the results will be useful for understanding the geological history of the Zhazgurla depression and adjacent territories in the Lower Mesozoic period. They can also be used for prospecting and mining, as well as for planning construction and infrastructure projects in a certain area;

- the zone of deflection of the Zhazgurla depression is an important geological object associated with the Meso-Cenozoic folding and also contains secondary structural elements, which are an important object for geological research. The field-geophysical study provides valuable information about the geological history of this territory, about the composition and structure of these rocks, their age, genesis and conditions of formation, as well as about potential mineral deposits;

- Jurassic-Triassic deposits are of considerable interest in the territory of the Zhazgurlinsky depression, as they are widespread and have great power and are an integral part of the Mesozoic period. According to the data of field and geophysical studies on the territory of the Zhazgurlinsky depression, reservoirs of various capacities and varying lithological composition are distinguished by the section of the Triassic complex, not fully uncovered in all areas and deposits, in all uncovered areas of the Triassic that overlap to a certain extent in the studied areas, with special attention being paid to their study in the instrument parts of the lowlands, in order to identify large traps of a non-anticline type

Scientific novelty of the work

For the first time, the applied technique of processing and interpreting 3D seismic data provided detailed information about the structure of the section of promising intervals of Cretaceous and Jurassic sediments, as well as reliable data on the structure of the Triassic section.

The analysis of the stratigraphy and lithology of the region is carried out. New research results for the stratigraphy and oil and gas potential of the Zhazgurlinsky depression are:

- obtaining new information about the structure of deeper regionally promising Triassic deposits;
- reliable study of the geological structure of the productive Triassic and Jurassic sections within the study area;
- the use of modern technologies for in-depth analysis of seismic attributes has made it possible to obtain detailed data on the structure of productive horizons, which is an important factor in planning exploratory drilling;
- clarification of the boundaries of tectonic and structural shielding, wedging;
- based on the analysis and generalization of geological and geophysical materials and the manifestation of oil and gas potential, a scheme of prospects for oil and gas potential of Mesocainozoic deposits of the Zhazgurlinsky depression has been compiled.

The practical significance of the work

The regional seismic studies carried out in the Caspian Sea made it possible to carry out tectonic zoning of the Mangyshlak sedimentary basin as a whole within Kazakhstan, covering the marine part of its territory. The obtained scientific results will be applied to the implementation of exploration projects for oil and gas. The target consumers of the obtained results are scientific institutes of the Republic of Kazakhstan.

Compliance with the directions of scientific development or government programs

The dissertation work was carried out within the framework of the state grant of the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan "Young Scientist" 2022-2024 No.AR15473398 within the framework of the project "Detailed study of the geological structure of productive horizons and searches for oil and gas promising objects of the Zhazgurlinsky depression".

Author's contribution

The dissertation is the result of research by Merekeeva E.K. The author personally carried out the interpretation after linking the logging of all wells with the seismic data of MOGT3D. This made it possible to stratify the section of Jurassic and Triassic sediments, identify 5 and 4 horizons in it, respectively, and correlate them. Along with this, great attention was paid to the identification and tracing of tectonic disturbances using all the capabilities available at PGS LLP, including coherence cubes, various seismic attributes.

As a result, horizons in Jurassic (III, Jk, Jbt, Jb, J1), Jurassic-Triassic (V) and Triassic (V2, V2- 2, V3) sediments were reliably traced and correlated. Isochron maps were constructed for all horizons, which were recalculated into deep structural ones using the constructed depth-velocity model based on the depth-velocity dependence obtained with the participation of existing wells. Horizons of Jurassic and Triassic sediments have been correlated based on 3D seismic data. Upon receipt of the results, the applicant published scientific publications and participated in the discussion of the research results at scientific conferences, the formulation of the questions posed and the discussion of their results.

The reliability of the research results.

The reliability and validity of the scientific provisions, conclusions and recommendations of the dissertation work is confirmed by the analysis and generalization of literary data, using materials from the Mangistaumunaigas Foundation, OPTIMUM Design Institute LLP.

Description of the main research results

As a result of processing and interpretation of MOGT-3D and GIS data of the Zhazgurlinsky depression in the Ulkendale, Tuchusken, Kurganbai, Bayram-Kyzyladyr, Demal, Kumak, Alak, Mahat-Riparian areas, the following conclusions can be drawn:

1. The used methodology of field seismic surveys provided a reliable study of the geological structure of the productive Triassic and Jurassic sections, as well as allowing Lila was able to obtain new information about the structure of deeper regionally promising Triassic deposits.

2. The applied methodology for processing and interpreting 3D seismic data provided detailed information on the structure of the section of the perspective intervals of Cretaceous and Jurassic sediments, as well as reliable data on the structure of the Triassic section.

3. The use of modern technologies for in-depth analysis of seismic attributes has made it possible to obtain detailed data on the structure of productive horizons, which is an important factor in planning exploratory drilling. In conclusion, it should be noted that the results obtained confirmed the economic effectiveness of the exploration strategy and 3D seismic exploration based on advanced exploration drilling, which significantly reduces exploration risks and saves significant funds spent on drilling "dry" wells.

In general, the conducted seismic surveys of MOGT 3D made it possible to study the geological structure and assess the prospects for oil and gas potential at priority sites and recommend drilling wells.

Thus, the set geological tasks at this stage of research can be considered fully completed. Within the limits of the Zhazgurlinsky depression, one can expect the discovery of oil deposits within local uplifts Mahat, Kurganbai, Bayram - Kyzyladyr in the Jurassic stratum, where minor oil inflows from Jurassic sediments were noted during drilling.

The section of sedimentary formations of the Mesozoic-Cenozoic age of the Zhazgurlinsky depression and the Great Mangyshlak flexure is illuminated by a significant volume of geophysical and deep exploratory drilling.

According to the results of drilling 42 wells in the considered areas, three gas fields were discovered, five structures with direct signs of oil and gas potential were identified. In the Lower Triassic complex, structural elements are characterized by high amplitude and size, but a complete absence of reservoir rocks capable of accumulating hydrocarbons due to their lithological and facies features.

Thus, the prospects for the oil and gas potential of the Lower Triassic complex of the territories under consideration are estimated extremely low. Therefore, there is no reason to quantify the prospects of these deposits.

In the area of direct investigation, when drilling deep wells in these and Kurganbai structures, gas manifestations in Jurassic and Triassic sediments were observed, as well as very high indicators for accounting for gas.

Approbation of work and publications

The main provisions of the dissertation work have been published in 9 scientific papers, including 2 articles published in journals included in the Scopus and Clarivate Analytics database, 3 articles recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Education and Science of the Republic of Kazakhstan "Oil and Gas", 3 articles published in journals of the international scientific and practical conference. In the period 07.04-04.20.2021, from April 7 to April 20, 2021, a scientific internship was completed (Appendix A). According to the results of the report, a certificate was obtained (Appendix B), 1 the article was published in the scientific journal Bulletin of Technical Sciences of the Kostanay Socio-Technical University named after academician Zulkharnai Aldamzhar.

The volume and structure of the dissertation work

The dissertation consists of an introduction, 4 sections, general conclusions and recommendations, contains 99 figures, 5 tables, 5 appendices, a list of references from 100 sources.

Gratitude

In conclusion, I consider it my duty to express my gratitude to the scientific consultant for constructive and valuable professional advice and recommendations, Associate Professor Kozhakhmet K.A. of the Caspian University of Technology and Engineering named after Sh. Yesenov, as well as to the foreign consultant Alekseev A.S., Professor of the Geological Faculty of Lomonosov Moscow State University.

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