

ANNOTATION

dissertation work of Zhiyenbayeva Gulbanu on the topic: «Structure, Depositional Conditions, Reservoir Distribution Patterns, and the Petroleum Potential of the Triassic Deposits of the Karagiye Saddle and Adjacent Territories», submitted for the degree of Doctor of Philosophy (PhD) in the specialty 8D07208(6D070600)-Geology and exploration of mineral deposits

Assessment of the current state of the scientific problem. Southern Mangyshlak is one of the main oil and gas bearing regions of Western Kazakhstan. Oil and gas fields have been discovered within its boundaries, with productivity linked to various stratigraphic complexes. Triassic deposits occupy a special place among them, being distinguished by a complex structure, significant variability of rock composition and heterogeneous reservoir properties.

The Karagiinsky saddle and adjacent territories are located within a complex system of structures of Southern Mangyshlak. A significant contribution to the study of the geological structure, stratigraphy and oil and gas potential of pre-Jurassic and Triassic deposits of the region was made by K.Kh. Boranbayev, A.K. Boranbayev, N.D. Nurabayev, D.K. Azhgaliyev, K.Zh. Markabayev, D.S. Orudzheva, B.I. Titov, V.I. Popkov, Yu.A. Volozh and other researchers. Their work formed the fundamental understanding of the structure and oil and gas potential of the Triassic complex of Southern Mangyshlak. At the same time, the Triassic deposits have been studied unevenly, and a significant part of the available information has been obtained from individual wells and local structures.

A distinctive feature of the Triassic complex is that the Lower, Middle and Upper Triassic differ significantly in composition and formation conditions. The Lower Triassic deposits are represented mainly by terrigenous rocks. Volcanogenic-carbonate formations are widely developed in the Middle Triassic. The Upper Triassic is again characterized by the predominance of terrigenous material. Reservoir types also differ: sandy and sandy-silty rocks are of primary importance for the Upper Triassic, whereas in the Middle Triassic the prospects are mainly associated with carbonate reservoirs, whose properties largely depend on subsequent rock alterations.

Relevance of the topic. The relevance of the dissertation work is determined by the need for a more detailed study of the Triassic deposits of the Karagiinsky saddle and adjacent territories, as well as clarification of their oil and gas potential prospects.

Despite the availability of a significant volume of geological and geophysical materials, many questions concerning the structure of the Triassic remain insufficiently studied. This is related to the complexity of the section, variation of thickness and rock composition across the area, varying degrees of study of individual structures, and differing conditions of reservoir formation.

The study of the Upper Triassic deposits of the Segendyk depression and the North-Karagiinsky zone is of particular importance: correlation of well sections makes it possible to clarify their lithostratigraphic structure and determine the position of the most prospective reservoir intervals. No less important is the study of Middle Triassic carbonate rocks, whose reservoir properties depend not only on the original composition but also on secondary alterations - dolomitization, fracturing,

cavernosity and recrystallization. For the Lower Triassic deposits, a relevant task remains the clarification of the distribution of sandy and coarser-grained rocks against the background of a predominantly siltstone-argillite section.

Thus, the relevance of the study lies in the need to integrate the available geological, geophysical, lithological and petrophysical materials, to clarify the structure of the Triassic deposits and to establish the main patterns of reservoir distribution.

Aim and objectives of the study. The aim of the dissertation is to study the structure and conditions of formation of the Triassic deposits of the Karagiinsky saddle and adjacent territories, to establish the patterns of reservoir distribution and to assess the prospects of their oil and gas potential.

To achieve this aim, the following objectives were addressed in the dissertation:

1. study of the geological and tectonic structure of the study area;
2. analysis of the Lower, Middle and Upper Triassic deposits using drilling, well-logging (GIS) and core materials;
3. correlation of well sections and study of the reservoir properties of the main Triassic horizons;
4. lithostratigraphic subdivision and correlation of the Upper Triassic deposits of the Segendyk depression and the North-Karagiinsky zone;
5. study of the lithological and petrographic features of the Middle Triassic carbonate rocks and the influence of secondary processes on their reservoir properties;
6. construction of lithofacies reconstructions of the Lower, Middle and Upper Triassic and delineation of zones of predominant development of potential reservoirs.

Object of the study. The object of the study is the Triassic deposits of the Karagiinsky saddle and adjacent territories of Southern Mangyshlak.

Subject of the study. The subject of the study is the features of the geological and lithostratigraphic structure of the Triassic deposits, their lithological composition, formation conditions, reservoir properties and the patterns of spatial distribution of prospective reservoirs.

Research tools. AutoCAD, Surfer and Solver software were used for processing, analysis and graphical presentation of the obtained materials. Surfer was used in the preparation and editing of geological schemes, cross-sections and other graphical materials. Solver was used for processing and quantitative interpretation of well-logging (GIS) data.

Research methodology. The dissertation is based on a complex of geological and geophysical materials on the Karagiinsky saddle and adjacent territories. Published and archival materials, deep drilling data, well-logging (GIS) data, core descriptions and laboratory studies, as well as lithological-petrographic, petrophysical, seismic and geochemical data were used.

In the course of the work, lithological subdivision and correlation of well sections were carried out. Well-logging (GIS) data were used to identify reservoirs, assess their properties and trace changes in individual intervals across the section and area. In studying the Middle Triassic carbonate rocks, features of their composition and secondary alterations were taken into account. In studying the Upper Triassic, particular attention was paid to changes in grain-size composition, the position of sandy and coarse-grained intervals, and the cyclic structure of the section.

At the final stage, all obtained materials were generalized and used in compiling lithofacies maps of the Lower, Middle and Upper Triassic.

Scientific novelty. The scientific novelty of the study lies in the comprehensive study of the Triassic deposits of the Karagiinsky saddle and adjacent territories, taking into account their lithostratigraphic structure, lithological composition, formation conditions and reservoir properties.

- The lithostratigraphic structure of the Upper Triassic deposits of the Segendyk depression and the North-Karagiinsky zone has been clarified. Correlation of well sections has been carried out, the cyclic structure of the Upper Triassic sequence has been established, and the position of the main reservoir intervals has been determined.

- The lithological and petrographic features of the Middle Triassic carbonate rocks have been clarified, and the role of secondary processes in the formation of their reservoir properties has been shown.

- Based on the generalization of geological and geophysical data, lithofacies maps of the Lower, Middle and Upper Triassic have been compiled, which make it possible to trace the change in sedimentation conditions and show the spatial position of zones of predominant development of different reservoir types.

- It has been established that the most favorable zones of reservoir development in the Lower, Middle and Upper Triassic do not fully coincide in area. This is related to changes in sedimentation conditions and reservoir types during the Triassic period.

Practical significance of the work. The practical significance of the work lies in the possibility of using the obtained results for further study of the Triassic deposits of Southern Mangyshlak.

The completed correlation of the Upper Triassic deposits can be used in correlating sections of new wells and refining the position of prospective intervals. The results of the study of the Middle Triassic carbonate rocks make it possible to more reliably assess the influence of secondary processes on reservoir quality. The compiled lithofacies maps can be used in refining geological models, forecasting reservoir distribution and selecting directions for further exploration work.

Reliability of the obtained results. The reliability of the study results is ensured by the use of a complex of factual materials and the comparison of various types of geological information. The main conclusions were obtained on the basis of a joint analysis of drilling, well-logging (GIS), core, lithological-petrographic, petrophysical, seismic and geochemical data.

The obtained results were compared between individual wells and structures, which made it possible to establish general patterns while taking into account differences in the structure of individual parts of the study area.

Personal contribution of the author. The personal contribution of the author consists in the collection, systematization, processing and generalization of geological and geophysical materials on the Triassic deposits of the Karagiinsky saddle and adjacent territories.

Analysis and correlation of well sections were carried out, well-logging (GIS), core, petrophysical and lithological-petrographic data were generalized. Correlation

of the Upper Triassic deposits of the North-Karagiinsky zone and the Segendyk depression was performed.

An analysis of the lithological composition and reservoir properties of the Middle Triassic carbonate rocks was carried out. Based on the generalization of the obtained results, lithofacies reconstructions of the Lower, Middle and Upper Triassic were performed, and the main patterns of distribution of potential reservoirs were determined.

Scientific statements submitted for defense

1. The Upper Triassic deposits of the Karagiinsky saddle and adjacent territory have a cyclic structure, with the most favorable terrigenous reservoirs predominantly associated with sandy and coarse-grained intervals of the lower parts of sedimentation cycles.

2. The reservoir properties of the Middle Triassic carbonate rocks are determined both by the initial conditions of their formation and by subsequent alterations. Dolomitization, fracturing, cavernosity and other secondary processes play an important role in the formation of pore space.

3. Changes in sedimentation conditions in the Early, Middle and Late Triassic led to a change in reservoir types and a different spatial position of prospective zones of the Lower, Middle and Upper Triassic.

Connection with programmatic scientific research. The dissertation was carried out within the framework of the program-targeted funding BR24992964 “Development of integrated energy-saving technologies to improve the efficiency and environmental sustainability of offshore operations in the Kazakhstani sector of the Caspian Sea”, implemented with the support of the Ministry of Science and Higher Education of the Republic of Kazakhstan in 2024-2026.

The Karagiinsky saddle and adjacent territories of Southern Mangyshlak studied in the dissertation are considered within the framework of this regional direction. The conducted studies of the structure and formation conditions of the Triassic deposits, the patterns of reservoir distribution and the prospects of their oil and gas potential complement the geological basis of the complex research carried out under the BR24992964 program.

Approbation of results and publications. The main results of the dissertation research have been published in domestic and foreign scientific journals and presented at scientific conferences.

The main results of the dissertation research are presented in six scientific publications, including two articles in journals indexed in the Scopus database, two articles in publications recommended by the CQAEHE MSHE RK, as well as two articles in proceedings of scientific-practical conferences.

As part of her scientific and professional training, the author completed an online internship at the Department of Paleontology of the Faculty of Geology of Lomonosov Moscow State University under the program “Modern Methods of Stratigraphy” from 7 to 20 April 2021, in the amount of 73 hours.

During her stay at the National University of Uzbekistan named after Mirzo Ulugbek, the author took part in the Republican Scientific and Technical Conference “Actual Problems of Earth Sciences”, held in Tashkent on 26 April 2024.

The results of the dissertation research have been implemented in the scientific and production activities of the KazNIPImunaigaz branch of KMG Engineering LLP, as well as in the educational process of the Yessenov Caspian University of Technology and Engineering under the educational program 6B07208 “Geology and Exploration of Mineral Deposits”.

Structure and scope of the dissertation

The dissertation, with a volume of 136 pages of typewritten text, includes an introduction, five chapters, a conclusion and a list of references containing 128 titles. The work is illustrated with 26 figures.

Factual database

The factual database of the dissertation research is based on the materials of the author's own research, published articles and monographs in domestic and foreign publications (128 in total), as well as on archival reports related to the topic of the dissertation.