DOI 10.52209/1609-1825_2021_3_124 UDC 553.98

Seismic Interpretation and Assessment of the Structural Factor on Example of the North Mangyshlak Basin

[1,2]**ZHUMABEKOV Arslan,** *doctoral student, zhak28@gmail.com,*
[1]***PORTNOV Vasily,** Dr. Tech. Sci., Professor, vs_portnov@mail.ru,*
[2]**LIU ZHEN,** *PhD, Professor, liuzhenjr@163.com,*
[1]*Karaganda Technical University, Kazakhstan, 100027, Karaganda, N. Nazarbayev Avenue, 56,*
[2]*China University of Petroleum, China, 102249, Beijing, 18 Fu Xue Road,*
**автор-корреспонденг.*

Abstract. *The article examines seismic data with subsequent interpretation and assessment of the structural factor, namely, on the example of the Mangyshlak basin. The purpose of this study is to carry out seismic interpretation, with which you can identify the structural type of the basin. This study can provide an enhancement in the development of oil reservoirs and the entire target area. Based on the previously studied data, it was revealed that tectonic elements are not developed. Archival materials of structural morphology show that the main target horizons in the Jurassic interval. The study area represents in the form of an anticline with a long axis in the sub-latitudinal direction. In addition, the morphology of all horizons is inherited. After analyzing the structural characteristics and signs of tectonic disturbances, the authors interpreted the seismic data.*

Keywords: *Mangyshlak Basin, seismic survey, interpretation, structure, horizon, tectonics, faults.*

Interpretation of the structure. Interpretation of horizons

The Mangyshlak basin is a typical Mesozoic-Cenozoic sedimentary basin. Deposits of the Upper Permian and Triassic, as well as deposits from the Jurassic to the Quaternary period [1] were deposited on the Paleozoic basement (Figure 1). The Jurassic deposits are the main objects of interpretation.

Among the sediments from the Paleozoic to the Triassic, the main objects are: V1-top of the Triassic; V2II-top of carbonate rocks of the Middle Triassic (top T2-A); V2IV-sole carbonate rocks of the Middle Triassic (bottom T2-B); V3-top of carbonate-detrital rocks of the Lower Triassic (top T1-G); VI1, the surface of unconformity of Paleozoic deposits. Based on seismic stratigraphic reference, the characteristic of reflection of all horizons is established. In this case, V2II and V2IV have a positive amplitude, the remaining reflecting horizons are characterized by negative amplitudes (Figure 2).

Within the Middle Jurassic [2], the main objects are reservoirs of the following ages: J2a, J2b, J2bt, J2k, and are divided into 13 sand packs J-I ~ J-XIII. Based on seismic stratigraphic reference, reflecting horizons of all complexes are established. In this case, JI, J-II, J-VI, J-IX, J-XII have a positive reflection amplitude, J-IV, J-VII, J-VIII have a wavelength reflection, the remaining reflecting horizons have a negative reflection amplitude (Figure 3). In accordance with the results of the binding. The work was done to interpret the target horizons, i.e. 13 horizons of the Middle Jurassic and Triassic objects.

Interpretation of tectonic faults

Based on the analysis of coherence, and using the technology of structure-oriented filtering (SOF), visualization of tectonic disturbances in the seismic section is enhanced and the additional work has been carried out to interpret tectonic disturbances. According to the analysis of coherence, it is obvious that in this region the main tectonic failtings are developed in deep deposits below the surface of the Triassic unconformity. In the Jurassic sediments, tectonic faults are not developed.

Using a cube of seismic data, the work has been done to interpret of tectonic movements. Discharges in the Triassic sediments are inclined located faults, which divided the structural plan into tectonically shielded elements (Figure 4).

In combination with the attribute of coherence, curvature, instantaneous phase and others, the work was done to interpret tectonic faults over the area. Typically, the coherence attribute is more sensitive to faults, and allows highlighting smaller faults. The curvature attribute is designed to analyze larger tectonic elements. The combination of these two attributes allows comprehensive analyzing the area faults.

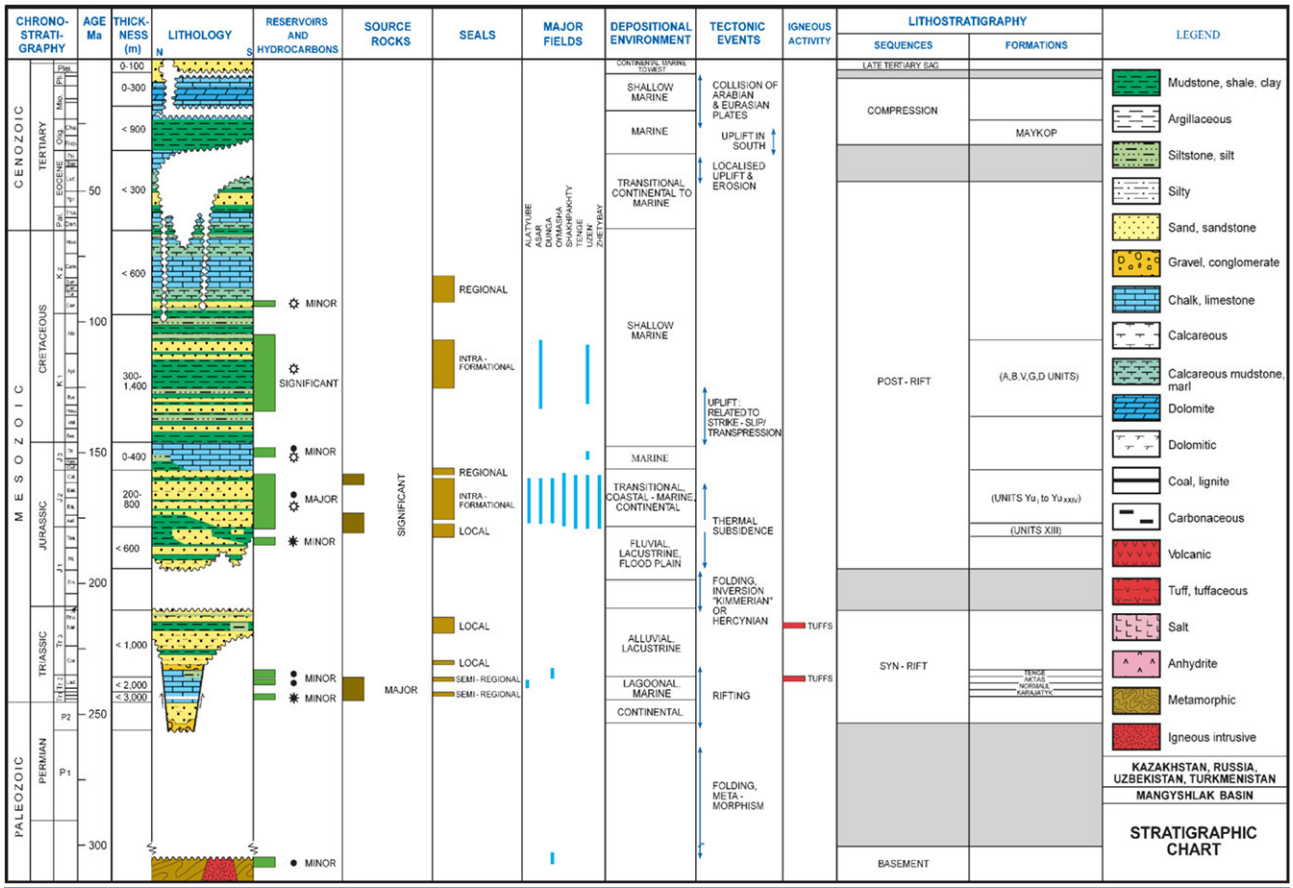

Figure 1 – Stratigraphic column of the cavity

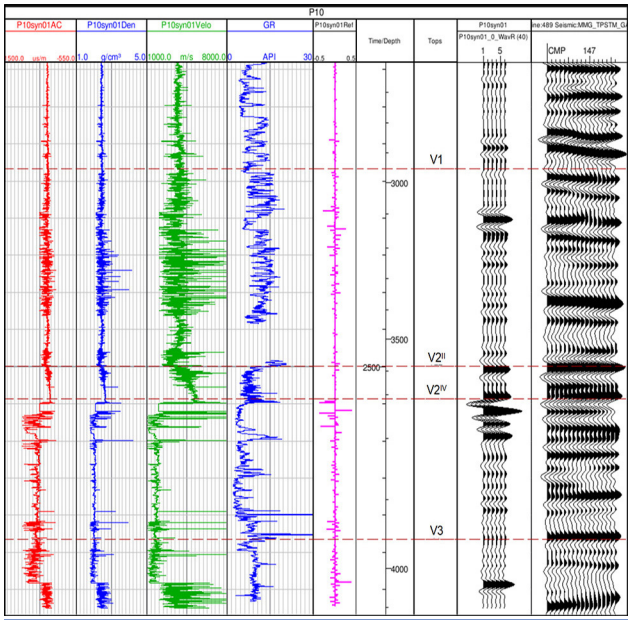

Figure 2 – Seismostratigraphic binding of Jurassic sediments

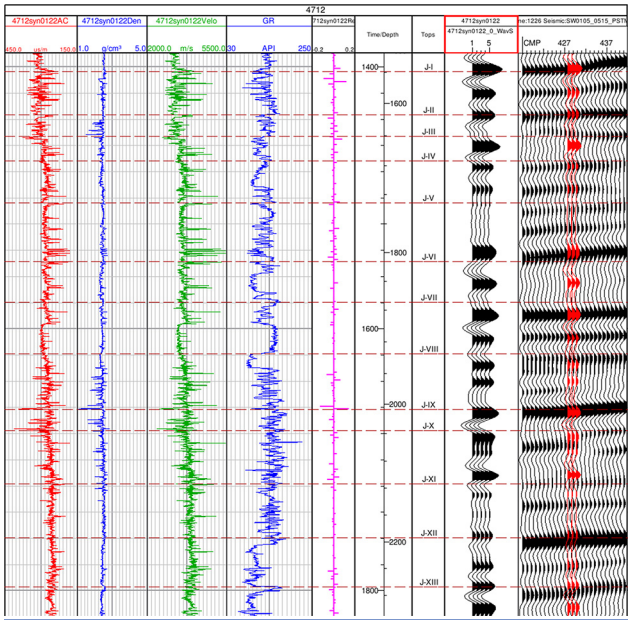

Figure 3 – Seismostratigraphic binding of Triassic sediments

The instant phase attribute is designed to analyze the area of wedging out of sediments, in combination [3] with an isochronous cut of sediments, which makes it possible to clarify the configuration characteristic of the wedging lines of all horizons under the surfaces of unconformities (Figure 5).

From the interpreted faults in the Jurassic sediments, it can be seen that no major faults were

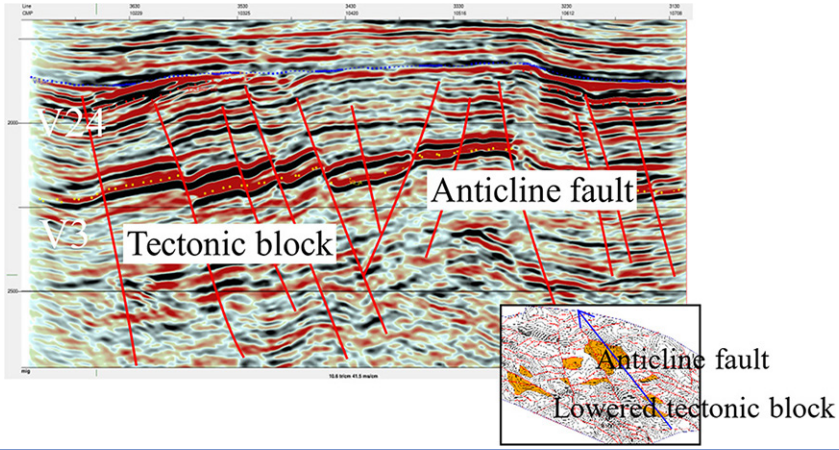

Figure 4 – Diagram of the configuration of tectonic faults in the Triassic deposits

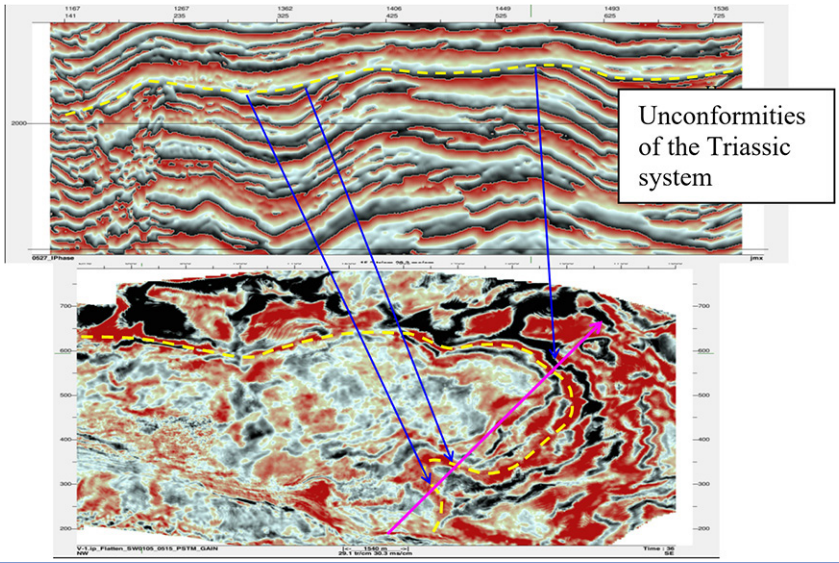

Figure 5 – Section of the instant phase and isochronous section of deposits in the survey area

noticed in the main part of the structure of the survey area, all tectonic faults are discharges of small sizes, according to which the amplitude of the discharges is about 10 m, the length is short. In the southern part of the survey area, thrust faults were observed that cut up and cut through the Triassic upwards, and their length was relatively large (Figure 6).

Faults in the Triassic sediments are more developed than in the Jurassic sediments. The area developed 4 types of faults. In this case, the main faults: large size, the main faults have a sub-latitudinal strike, the inclination is large, limit the breakdown of structural zones; branched faults have a submeridional strike, the inclination is large, the amplitude is small, and the zone of fault horsts of the structural base is cut off. Discharges accompanied by faults, the extension of which parallel to the shear zone limits the compressed anticline. Small faults which have a strike is perpendicular to the branched shifts, they limit the configuration of local structures.

Conclusion

Geophysical and geological studies of this area from the scientific point of view expand the understanding of extracting information of the detailed structure of the studied object with transition from the dynamic characteristics of the wave field to the geological characteristics of the object: facies composition, reservoir properties, HC content, etc. The combination of well data and the results of the kinematic and dynamic interpretation of seismic data makes it possible to construct a geological model of the studied object, which is not an integral part of the study in the geology of oil and gas.

Within the industrial framework, seismic data helped to detail the structural body and the tectonic model of the research area, which provides the basis for adjusting the approach to the development of the oil reservoir and assessing the exploration potential of the area in-depth. The main target horizons are a structural type reservoir that determines the

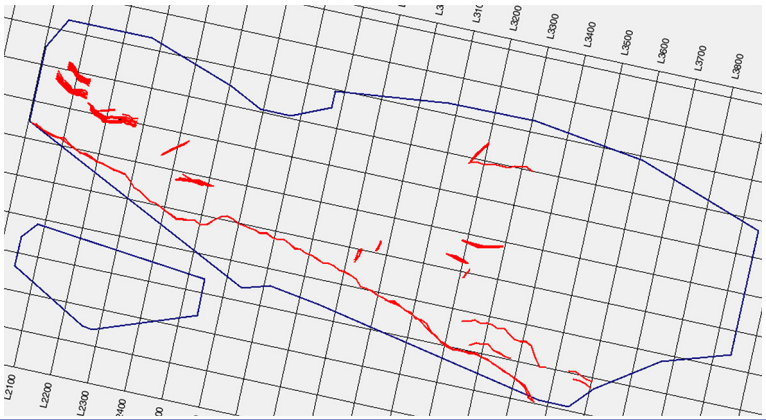

Figure 6 – Superposition of the fault system for the Jurassic interval

distribution of oil, water and gas. However, it is necessary to consider the influence of the reservoir on the prevalence of hydrocarbons and the production rate of each individual well.

It is proposed to carry out a comprehensive study of seismic, geological and dynamic data for each productive horizon, to make a detailed analysis and to assess the effectiveness of field development, and predict areas rich in residual oil. It is recommended to continue further geological research with the aim of identifying traps, understanding the formation of deposits, optimizing the development of facilities and locations for new wells.

REFERENCES

1. Geological structure and oil and gas potential of the platform part of the Caspian Sea. – 2017. – https://neftegaz.ru/science/development/331536-geologicheskoe-stroenie-i-neftegazonosnost-platformennoy-chasti-kaspiyskogo-morya/
2. Features of the geological structure and prospects for the exploration of new oil and gas deposits in the Mesozoic deposits of the Mangyshlak basin, KAZENERGY. – 2006. – No. 4.
3. Jing Wu, Donghong Zhou, Dingyou Lv, Chengmin Niu, Dianbo He, Guoying Li, and Xiaoyuan Wang. Structural interpretation of inner buried hill under restricted data availability – A case study in KL-X area, Bohai Bay Basin. – Technical program SEG Denver Expanded Abstracts. – 2014.

Сейсмикалық интерпретация және бағалау құрылымдық факторы. Маңғышлақ бассейні мысалында

[1,2]ЖУМАБЕКОВ Арслан Кайратович, *докторант, zhak28@gmail.com,*
[1]*ПОРТНОВ Василий Сергеевич, *т.ғ.д., профессор, vs_portnov@mail.ru,*
[2]ЛИУ ЧЖЭН, *PhD, профессор, liuzhenjr@163.com,*
[1]Қарағанды техникалық университеті, Қазақстан, 100027, Қарағанды, Н. Назарбаев даңғылы, 56,
[2]Қытай мұнай университеті, Қытай Халық Республикасы, 102249, Пекин, Фу Сюе Лу көшесі, 18,
**автор-корреспондент.*

Аңдатпа. *Мақалада құрылымдық факторды, атап айтқанда Маңғышлақ бассейні мысалында кейіннен интерпретация және бағалаумен сейсмикалық мәліметтер қарастырылған. Зерттеудің мақсаты – сейсмикалық интерпретация, оның көмегімен бассейннің құрылымдық түрін анықтауға болады. Бұл зерттеу мұнай қоймаларын және барлық мақсатты аймақты жақсартуды қамтамасыз ете алады. Бұрын зерттелген мәліметтер негізінде тектоникалық элементтердің дамымағаны анықталды. Құрылымдық морфологияның мұрағаттық материалдары зерттеу аймағының юра аралықтарындағы негізгі мақсаттық горизонттар кіші ендік бағытта ұзын осі бар антиклиналь түрінде ұсынылғанын көрсетті. Сондай-ақ құрылымдық жағынан барлық көкжиектің морфологиясы мұра болып табылады. Тектоникалық бұзылыстардың құрылымдық сипаттамалары мен белгілерін талдағаннан кейін авторлар сейсмикалық интерпретация мәліметтерді көрсетті.*

Кілт сөздер: *Маңғышлақ бассейні, сейсмикалық, интерпретация, құрылым, горизонттар, тектоникалық, бұзылыстар.*

Сейсмическая интерпретация и оценка структурного фактора на примере Мангышлакского бассейна

*[1,2]**ЖУМАБЕКОВ Арслан Кайратович,** докторант, zhak28@gmail.com,*
*[1]***ПОРТНОВ Василий Сергеевич,** д.т.н., профессор, vs_portnov@mail.ru,*
*[2]**ЛИУ ЧЖЭН,** PhD, профессор, liuzhenjr@163.com,*
[1]Карагандинский технический университет, Казахстан, 100027, Караганда, пр. Н. Назарбаева, 56,
[2]Китайский нефтяной университет, Китайская Народная Республика, 102249, Пекин, ул. Фу Сюе Лу, 18,
**автор-корреспондент.*

***Аннотация.** В статье рассмотрены сейсмические данные с последующей интерпретацией и оценкой структурного фактора, а именно на примере Мангышлакского бассейна. Целью исследования является проведение сейсмической интерпретации, с помощью которой можно выявить структурный тип бассейна. Данное изучение может обеспечить улучшение разработки нефтяных коллекторов и всего целевого участка. На основе раннее изученных данных выявлено, что тектонические элементы не развиты. Архивные материалы структурной морфологии показали, что основные целевые горизонты в юрском интервале исследуемого района представлены в форме антиклинали с длинной осью в субширотном направлении. Также в структурном отношении морфология по всем горизонтам имеет унаследованный характер. Анализ характеристик структуры и признаков тектонических нарушений позволил произвести интерпретацию сейсмических данных.*

***Ключевые слова:** Мангышлакский бассейн, сейсмика, интерпретация, структура, горизонт, тектоника, нарушения.*

REFERENCES

1. Geological structure and oil and gas potential of the platform part of the Caspian Sea. – 2017. – https://neftegaz.ru/science/development/331536-geologicheskoe-stroenie-i-neftegazonosnost-platformennoy-chasti-kaspiyskogo-morya/
2. Features of the geological structure and prospects for the exploration of new oil and gas deposits in the Mesozoic deposits of the Mangyshlak basin, KAZENERGY. – 2006. – No. 4.
3. Jing Wu, Donghong Zhou, Dingyou Lv, Chengmin Niu, Dianbo He, Guoying Li, and Xiaoyuan Wang. Structural interpretation of inner buried hill under restricted data availability – A case study in KL-X area, Bohai Bay Basin. – Technical program SEG Denver Expanded Abstracts. – 2014.