ANNOTATION
of the thesis for the degree of Doctor of Philosophy (PhD) in the specialty "6B070600 - Geology and Exploration of Mineral Deposits"
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Geological structure and prospects of oil and gas content of the Jurassic deposits of the North Ustyurt depression according to geological and geophysical data

Relevance - the need to increase the resource base of the Republic of Kazakhstan through the discovery of new oil and gas fields in the North Ustyurt region by reinterpreting complex geological and geophysical data and quantitative model building in modern softwares.

The object of research is geophysical fields, the history of geological development and the geological structure of the North Ustyurt region at the regional and local levels.

Methodology - a systematic analysis of geological and geophysical data obtained in different years and by various organizations / companies at all stages of geological exploration using modern softwares.

Research tools - Geosoft (USA, Geosoft Inc.), ArcGIS (USA, Esri), Coscad 3D, Surfer, Didger (USA, Golden Software), Petrel (Schlumberger), Interactive Petrophysics, etc.

The goal is to clarify the geological structure by constructing quantitative correlations between the distributions of the anomaly of potential geophysical fields and the structural features of the Moho surfaces, basement, and reference horizons of the sedimentary cover.

Scientific novelty - for the first time for the North Ustyurt region, using modern software, quantitative correlations between potential geophysical fields and deep structure have been revealed.

Practical significance - oil and gas geological zoning with the involvement of deep structure factors at a quantitative level. Identification of new oil and gas promising objects.

Geological tasks:

- Zoning of gravitational and geomagnetic fields, solution of inverse problems (determination of Euler points) and identification of the correlation coefficients between the anomalies of these fields;
- Structural analysis of the supporting boundaries of the sedimentary cover and consolidated crust;
- Revealing correlations between the reference boundaries of the earth's crust and anomalous gravitational, geomagnetic and thermal fields;
- History of geological development in the Paleozoic and Triassic-Jurassic times;
- Oil and gas geological zoning for deposits of the Upper Paleozoic, Triassic and Jurassic;

- Geological and geophysical exploration, tectonics, lithology and oil content of the Arystan oil field;
- Application of a complex of well logging methods, petrophysical analysis (in Interactive Petrophysics software) to identify productive horizons of the Lower-Middle Jurassic deposits;
- Methodology for constructing 3D geological models of productive horizons in Petrel software;
- Structural analysis of productive horizons. Distribution of reservoir properties of sandy-silty reservoirs of Jurassic deposits;
- Correlation analysis of local and regional structures on the example of the Arystan field.

Scientific positions and results presented for defense:

1. The inner regions of the Northern Ustyurt differ sharply from the linear folded systems in its framing, in the depth of the foundation immersion and fault tectonics, in the nature of the manifestation in the geophysical potential fields, and in the correlation of gravitational and magnetic anomalies with each other and with the foundation surface.

2. The results of calculating the deconvolution of Euler points make it possible to determine the interval of transition from Cretaceous to Jurassic sediments in geodensity models as a sharp gravitational perturbing boundary, in geomagnetic fields - the upper edge of magnetically perturbing masses confined to volcanogenic-sedimentary deposits of the Permian-Triassic. Application of the Euler method can help to adjust plans for further exploration work.

3. In the interior (depressions) In the North-Ustyurt region, high values of the correlation coefficients of the basement surface and the Paleozoic, the foot of the Jurassic and Cretaceous are observed.

For some tectonic elements in linear folded systems along the Northern Ustyurt border and in mobile incoming angles, the correlation of the basement surface and Paleozoic formations, the base of Jurassic and Cretaceous sediments is observed, for others-the correlation coefficients are weak or do not appear at all.

4. Throughout most of the Jurassic, Triassic, and Late Paleozoic, the distribution boundaries of the North-Ustyurt paleosedimentation basin were clearly delineated by mobile folded belts, which were areas of erosion from which terrigenous material entered the adjacent sedimentation areas.

The interior areas of the North-Ustyurt region-invariably appeared as a curved zone, which served as a natural place for the development of transgressions, the placement of the inner outer shelf with a general increase in sea level, and the long-term preservation of lagoon conditions during regressions.

5. The local structural plan of the Jurassic productive horizons is determined by the features of the regional boundaries: the surfaces and soles of the Jurassic sediments, the Paleozoic and the basement.

Publications - according to the results of research on the topic of dissertation work, 13 articles were published, including 3 in journals included in the Scopus database; 4 articles in publications recommended by the Committee for Control in

Education and the Ministry of Education and Science of the Republic of Kazakhstan; 6 articles in international conferences and other publications.

Factographic base - stock reports up to 1991 and after 1991 (including modern complex geophysical surveys carried out in different years «SPC «Geoken» LLP), information drawn from the published domestic and foreign literature.

The structure and volume of the thesis: the thesis consists of an introduction, 5 chapters, a conclusion, a list of used literature of 89 titles. The work is presented on 203 pages of typewritten text, contains 83 figures, 6 tables.

Chapter 1. Along the framing of Northern Ustyurt and in separate mobile zones (inner corners), linear folded dislocations of an inversion nature and deep faults, systems of linearly elongated maxima of the gravitational field and magnetic extrema with a differentiated nature of intensity, with different depths of submergence of the basement and different directions of geological evolution, development basic and ultrabasic types of magmatic formations.

The correlation coefficients of the anomalies of the gravitational and magnetic fields with the basement surface are anomalously increased, while the correlation of the anomalies of the gravitational and magnetic fields is reduced.

The inner regions of Northern Ustyurt are characterized by the presence of subisometric and polygonal anomalies of the geomagnetic field, a mosaic weakly negative field of polygonal gravity anomalies, confined to blocks with an Early Paleozoic or Precambrian age of consolidation, with an increased depth of basement subsidence.

These massive, stable blocks are characterized by an increase in the thickness of almost all rock complexes, deep subsidence of the basement and its specific composition. They are distinguished by steep plunge of the sides, graben-like structure and clear fault limits.

This conclusion is indirectly confirmed by the extremely high for the North Ustyurt region values of the correlation of the intensity of gravitational and magnetic anomalies, the intensity of gravity anomalies and the depth of the basement, the intensity of the anomalies of the geomagnetic field and the basement surface.

Calculations of Euler's deconvolution for 3D geodensity and geomagnetic models of Northern Ustyurt have shown their efficiency and geological significance. In the sedimentary cover of the North Ustyurt region, modeling of Euler points in geodensity and geomagnetic models showed their sharp differentiation in number at different depth sections.

In geodensity models, almost everywhere, the main gravitational perturbing boundary is the zone of transition from Cretaceous to Jurassic sediments at depths of 1000-1500 m, which corresponds to the transition zone from weakly consolidated and not consolidated Cretaceous-Neogene sediments to more compacted Upper Jurassic sediments.

The distribution of Euler points in the geomagnetic field showed the maximum concentration in the depth range of 3000-3500 m in the inner regions of Northern Ustyurt, and in the foredeeps at depths of 1000-1500 m.

In geomagnetic fields, the upper edge of magnetically disturbing masses is presumably confined to the volcanogenic-sedimentary deposits of the Permian-

Triassic. In the geological sections of the Northern Ustyurt, at these depths, there is a transition zone from Jurassic deposits to Permian-Triassic formations.

Consequently, it can be assumed that in the North Ustyurt region, in an integrated form, the upper edges of magnetically disturbing masses do not coincide with the "geopoddensity maxima".

The next level of concentration of Euler points falls on the depth range 5500-6000 m, where the gradients of the curves of the Euler points for the magnetic field (step dependence) and gravitational field (quasi-linear dependence) are practically leveled.

In the geological sections of the elevated blocks of Northern Ustyurt, these depths correspond to the formation of the basement.

Deeper, the nature of the distribution of Euler points in the gravitational and geomagnetic fields takes on close values and at depths of 10500 m and more, the corresponding curves practically do not differ from each other. In the inner regions of Northern Ustyurt, they correlate with the basement surface.

Chapter 2. In the South Emba uplift, the Central Ustyurt dislocation system, Mountain Mangyshlak, the basement and the Moho surface are everywhere conformally with a high correlation coefficient with the minimum subsidence of the Moho surface.

North Ustyurt system of troughs, conformal bedding of the Moho surface and basement, where the Moho surface takes intermediate values in depth.

There is a correlation between the basement and the Moho within the Aktumsuk system of dislocations, the Baichagyr-Yarkimbay uplift, the Kosbulak and Kultuk depressions.

In the territories of the Aral-Kyzylkum swell, Buzachi arch, Chelkar trough, Kuanysh-Koskala swell, the surfaces of the basement and Moho are antiformal and do not correlate with each other.

In linearly elongated mobile systems and mobile angles, the correlability of the basement surface and Paleozoic formations, the base of the Jurassic and Cretaceous deposits is weakly or not at all. Here, these interfaces are often antiform.

The conformal bedding of the basement and Paleozoic surface and the base of the Jurassic deposits in the form of protrusions was revealed in the Central Ustyurt dislocation system, the central part of Gorny Mangyshlak. The bottom of the Cretaceous deposits is not or weakly correlated with the interfaces described above.

The exceptions are the Buzachi uplift, the Aktumsuk uplift, the Kuanysh-Koskala swell and the Baichagyr-Yarkimbay arch, which are characterized by extremely high values of the correlation coefficients, and manifest themselves as large positive structures along all analyzed boundaries.

In the inner regions of the North Ustyurt region (North Ustyurt system of troughs, Chelkar and Barsakelmes depressions), they are characterized by a long and inherited trough in the Phanerozoic, a bowed position of the basement and Paleozoic surface, the Jurassic and Cretaceous base with high values of the correlation coefficient is observed.

Chapter 3. The separation of the North Ustyurt sedimentation basin presumably took place in the Early Ordovician. Throughout most of the Ordovician and Silurian, sedimentary complexes of rocks, first of the inner and then of the outer shelf, accumulated here.

In the Devonian, throughout most of the Carboniferous and early Permian, the North Ustyurt region developed in the mode of inherited subsidence with the formation of marine terrigenous-carbonate deposits (with thin layers of effusive rocks).

Since the Kungurian time, the entire territory of Northern Ustyurt has become an arena of continental sedimentation.

In the Late Permian and Triassic, postcollisional processes give rise to the general subsidence of the Northern Ustyurt.

An island arc was formed in the mobile zones at the site of the South Emba uplift, Akkul ledge, Chelkar trough, Mugodzhar in the Ordovician-Silurian time. To the south of the Central Ustyurt dislocation system - Mountain Mangyshlak, areas of coninental sedimentation were located.

Along the framing of the North Ustyurt region, in the Famennian-Early visa, rifts were formed (at the site of the South Emba uplift, Mountain Mangyshlak and the Central Ustyurt system of dislocations), the formation of which is associated with ancient faults.

At the end of the Carboniferous period or the beginning of the Early Permian, in the Late Permian and Triassic, intensive processes took place in the South Emba, Mountain Mangyshlak, Buzachi, Central Ustyurt uplifts, which led to the formation of significant large uplifts.

From here, coarse detrital material was transported to the adjacent areas of the North Ustyurt region.

In the regions adjacent to the Northern Ustyurt, the character of sedimentation was different.

In the Early and Late Triassic, the boundaries of the distribution of the Early Triassic North Ustyurt sedimentary basin were clearly outlined along the South Emba, Aral-Kyzylkum and Central Ustyurt uplifts, Gorny Mangyshlak, which at that time were an area of erosion and from where the terrigenous material entered the adjoining areas, siltstones, sands).

In these tectonic elements at the end of the Olenek Stage, in the Middle and Late Triassic, acidic ground volcanism was activated, with the ejection of significant masses of pyroclastic rocks.

In the Indian time, in the inner regions of the North Ustyurt sedimentation basin (Buzachi arch, Samsk-Kultuk depression), a thick stratum of monotonic red-colored, often finely dispersed clays accumulated, which were replaced up the section by interlayers of marls or strongly carbonate rocks.

In the Olenek Age, the transgression from the Tethys region captured the western part of the North Ustyurt region, including the Buzachinsky arch and almost the entire Mangyshlak, where marine dark brown, dark gray, sometimes with a violet tint mudstones with rare interlayers of siltstones and fine-grained sandstones accumulated.

In its eastern part in the Olenek Age and in the Middle Triassic, a low-lying accumulative plain was located, where terrigenous sediments accumulated in typical continental alluvial-lacustrine conditions - variegated mudstones, siltstones and sandstones, often red-colored, forming plumes of deluvial submontane-proluvial sediments.

The Middle Triassic epoch is characterized by the maximum transgression.

In the western part of the North Ustyurt region, organogenic detrital, chemogenic limestones and, finally, black bituminous, relatively deep-water clays accumulated.

In the Late Triassic, most of the North Ustyurt sedimentation basin was an arena of moderate subsidence, where, in the setting of a typically continental alluvial-lacustrine plain, predominantly sandy-clayey rocks accumulated.

In the early Jurassic and Bathonian time, in the mobile framing of the North Ustyurt region, the denudation areas were located in the southeast (Aral-Kyzylkum upland, southwestern part of the Aral Sea region) and northeast (Ural upland) of the study region, as well as within the Karabogaz and Aktumsuk uplifts, the eastern part of the Karabaur swell, from where relatively coarse-grained material was periodically removed.

In the Callovian, the area of demolition is inherited, located where they were in the Middle Jurassic, from where mainly fine-grained material was carried out by rivers.

Mountain Mangyshlak and the eastern continuation of the Buzachi, as well as the South Emben zone, lagged noticeably behind the general subsidence of the territory, and within them, a small thickness of terrigenous and terrigenous-carbonate formations was formed.

In Oxford (the central part of the South Emba uplift, Mountain Mangyshlak, the Central Ustyurt deployment system, the Aral Sea). there was an accumulation of sandy-argillaceous sediments with interlayers of limestone, indicating the periodic flow of sea waters into this lowland.

The structural plan of the Kimmeridgian time remains the same as in Oxford. The most curved sections, as before, are Yuzhno-Mangyshlak-Ustyurt and Yuzhno-Emben; the most elevated is the zone of the Central Ustyurt dislocation.

Revitalization of tectonic movements, the uplift of individual blocks and some restructuring of the structural plan of the considered territory, and regional erosion took place at the boundary of the Early and Middle Jurassic, at the end of the Bathonian, Callovian and Tithonian.

In the Early Jurassic, alluvial sediments accumulated in the North Ustyurt sedimentary basin, carried by rivers from the inherited uplifts along the framing of the North Ustyurt.

In the Aalen and Bajocian, most of the Northern Ustyurt turned into a vast low-lying accumulative plain with a stable subsidence regime with a cage of powerful rhythmically interbedded sediments formed by alluvial, lacustrine, boggy sediments.

In the Bathonian and Callovian times, the general subsidence of the North Ustyurt region continued. From west to east, there is a change in facies-paleogeographic settings from a shallow sea, coastal plain to a continental low-lying accumulative plain with the accumulation of lacustrine predominantly clayey sediments, when in a calm environment, clays, marls, limestones began to be deposited. The sea basin was framed in the east by a vast coastal plain.

In Oxford and Kimmeridgian, in the inner regions of North Ustyurt, there was a relatively deep sea (outer shelf), where a predominantly limestone lithological-facies complex accumulated.

From the southeast, the shallow carbonate sea was bordered by a rather extensive lagoon adjacent to the Karabogaz low-lying hilly plain.

The North Ustyurt massif invariably appeared in the form of a relatively bent zone, which served as a natural place for the development of transgressions, the location of zones of uncompensated subsidence with a general rise in sea level and long-term preservation of lagoon conditions during regressions.

Chapter 4. Along the Upper Paleozoic sediments, the North Ustyurt region is characterized by a fairly clear structural differentiation, dividing into a system of large positive and negative structures, which can be considered as oil and gas gathering and oil and gas generation.

The North Ustyurt region is characterized by favorable parameters of the geological section, including the regional development of rock complexes that are promising in terms of oil and gas content, the presence of reservoir strata in them with satisfactory and high capacity-filtration properties, as well as a set of fairly reliable regional, zonal and local seals.

Hydrogeological parameters should also be classified as favorable, the main of which is the absence of an active hydrodynamic regime, i.e. the relatively stagnant nature of the formation waters and their associated hydrochemical composition.

In general, the geochemical parameters of the section are also favorable, which indicate the presence of probable generation complexes in the section. At the same time, according to the available data on the concentrations of organic matter in these complexes, we can talk about the limited hydrocarbon potential of the region under consideration and the greatest probability of discovering small and medium-sized gas and oil deposits here.

Paleotemperature data make it possible to classify areas of the near-zone zones of deep troughs in the Northern Ustyurt: Samsk, Kosbulak and Kultuk, as well as the western slopes of the Aral-Kyzylkum system of uplifts as favorable for oil and gas accumulation.

It should be noted that the Upper - Lower Triassic terrigenous strata, due to the rhythm of their structure, are characterized by a favorable combination of a reservoir-cap pair of a local type.

The reservoir rocks of the Lower Triassic sediments are uneven-grained, well-sorted coastal-marine sandstones.

In general, in the North Ustyurt region, throughout the Triassic period, there was a repeated change in paleogeographic settings - from continental at the beginning of the Indian Age to marine in the Olenek Age and the Middle Triassic and again continental in the Late Triassic.

The climate changed gradually - from relatively dry, hot (desert) in the Indus. At the end of the Olenek Age and in the Middle Triassic, it becomes less hot, more humid with a transition to a typically humid warm, humid subtropical in the Late Triassic.

In terms of geochemical parameters and facies-paleogeographic settings in the North Ustyurt sedimentation basin, the most favorable for the generation of hydrocarbons are marine terrigenous-carbonate and terrigenous (mainly clayey) relatively deep-water facies of the Olenek Stage and Middle Triassic, as well as coastal marine sediments of the Upper Triassic.

These sediments were formed under reducing or sharply reducing geochemical conditions (low values of iron content, predominance of ferrous forms over oxide ones, the presence of sulfide iron), which contributed to the accumulation and preservation of huge masses of organic matter - a source of oil and gas generation with an organic carbon content of up to 3-5% in some samples.

Jurassic terrigenous strata of the North Ustyurt region, due to the rhythm of interbedding, are characterized by favorable conditions for the development of reservoir rocks and cap rocks.

The reservoir rocks in the Jurassic deposits are mainly sandy-silty sediments of various genesis.

Three large troughs should be considered the most likely sources of hydrocarbon generation, mainly gaseous ones: Kosbulak, Samsk and Kultuk, western slopes of the Aral-Kyzylkum uplift system.

A decrease in the thickness of predicted generation complexes with an increase in sandy-siltstone rocks within the uplifts and steps makes it possible to reasonably speak about the localization of these generation complexes in stably developing depressions. In paleogeographic terms, the latter could correspond to semi-isolated lacustrine-type reservoirs, favorable for the accumulation of organic remains.

The source of hydrocarbons for the Jurassic deposits can be gray-colored continental and coastal-marine (in the west) rocks of the Upper Triassic up to 1500 m thick, as well as deposits of the Upper Paleozoic.

In the Early Jurassic, a warm and humid climate favored the enrichment of Bajocian sediments with scattered organic matter of both humic and sapropel composition, and the reducing geochemical conditions of sedimentation contributed to its mass burial, which later became a source of hydrocarbon generation.

Formed at the end of the Lias (in the Toarcian age), an almost 100-meter stratum of monotonic clayey sediments with insignificant interlayers of sandstones can serve as a regional seal for hydrocarbon deposits in the latter.

In the Aalen sediments (with a thickness of 60-80 to 350 m and more), the coal content and the number of coal seams and interlayers are highly developed, which increases in an eastern direction.

The warm and humid climate favored the enrichment of the Bajocian sediments with dispersed organic matter of both humic and sapropel composition, and the reducing geochemical conditions of sedimentation contributed to its mass burial, which later became a source of hydrocarbon generation.

The climate of the Bathonian age, judging by the color of the rocks, the abundance of organic matter, coal beds and carbonaceous rocks, was warm and humid. Only at the end of the Bathonian century, apparently, there was a short-term aridization of the climate.

The climate of the Callovian time was at first warm, humid, which contributed to the lush flourishing of plant organic matter and peat accumulation (coal seams in the areas of Baiterek, Terenkuduk); at the end of the century it becomes arid.

Sandy-clayey sediments of alluvial-lacustrine genesis accumulated here, often colored brown, purple, lilac, light gray and gray, emphasizing their formation in a drier climate and oxidative geochemical environment.

Chapter 5. The results of geological modeling of the Lower-Middle Jurassic horizons of the Arystan oil field explored at the stage of the same name are considered.

The modelling is done using modern software such as Interactive Petrophysics and Petrel.

The objects of research were the structural characteristics and filtration capacitive properties of productive horizons, identifying correlations between regional and local factors.

The methodology of dissertation research involves a systematic analysis of the results obtained using the accumulated databases.

At the beginning of the final chapter, general information about the field, geological and geophysical knowledge, lithological and stratigraphic outline, tectonics, oil and gas content of the Lower-Middle Jurassic deposits (oil flow rates, depth of water-oil contacts, perforation results, structural characteristics of productive horizons, etc.) are presented.

Based on the data on laboratory analyzes of core samples, the lithological and petrographic characteristics of productive horizons and the physical and lithological properties of reservoir rocks, including mineralogical and volumetric density, residual water saturation, capillary pressure curves were studied, the boundary values of reservoir rocks were substantiated, and estimates of the coefficient oil saturation and characteristics of reservoir properties of productive horizons.

In the section of borehole geophysical studies, the analysis of the applied complex of geophysical studies of wells was carried out, the method of interpretation of well logging data was considered, the geophysical characteristics of the productive section were studied, a petrophysical model was built in the Interactive Petrophysics program, and the coefficients of volumetric clay content, porosity and oil saturation were determined.

According to the results of structural modeling in the Petrel * software (2014), the following features were identified for nine productive horizons (from J-III to J-XI):

- The dimensions of the structure vary with depth. Structural plans for the horizons J-V, J-VIII, J-X are characterized by the minimum sizes. Structural plans for horizons J-III, J-VII, J-IX, J-XI are characterized by the maximum sizes.
- The structure along the horizons J-VI, J-VII, J-VIII flattens out (with its height up to 40 m). For the rest of the horizons, it varies within 75-100 m.
- The amplitude of faults in all productive horizons varies within 15-30 m.
- The structural plan and differentiation of the structure according to the Lower-Middle Jurassic sediments becomes more complicated with depth due to the appearance of the eastern vault at the beginning, and subsequently the dissection of the western and eastern vaults into a number of local domes.
- On the southern flank of the Arystan structure along all productive horizons, the gradient of depth change changes quite sharply.

- On the northern wing of the structure - the deepening occurs more smoothly and with a smaller gradient of depth variation. In this case, the height and steepness of the western arch of the wing of the structure along all productive horizons are manifested to a greater extent than in the eastern wing of this structure.

Based on the materials of the petrophysical interpretation in the Interactive Petreophysics software and the subsequent distribution of reservoir properties in the Petrel software for the productive horizons J-IX, J-X, J-XI, the following conclusions were obtained:

- All three horizons show a trend, according to which areas with improved reservoir properties were developed on the slopes of the Arystan structure. which indicates that the structural factor does not control the placement of areas and areas with improved porosity values.
- The distributions of areas with normal and increased open porosity are controlled by elements of fault tectonics. Sequentially from the J-IX horizon to the J-XI horizon, an improvement in the reservoir properties of reservoir rocks is recorded.
- The oil saturation parameter does not correlate with the contours of areas with normal or increased porosity values. Areas with minimum oil saturation were maximally developed along the J-X productive horizon. The maximum values of this parameter were identified along the J-XI productive horizon. Intermediate oil saturation values are established in the J-IX productive horizon.

Correlation analysis of local and regional structures in the Arystan field

The local structural plan of the productive horizons determines the features of the regionally consistent boundaries: the surface of the Jurassic deposits, the Paleozoic and the basement, the base of the Jurassic deposits.

The sharp gradient of depth changes on the southern flank of the Arystanovskaya fold corresponds to a high correlation coefficient of regionally consistent boundaries.

Smooth deepening of the northern limb of the Arystan fold corresponds to a decrease in the correlation of the supporting boundaries of the sedimentary cover.

Recommendations. The main areas of work for oil and gas in the North-Ustyurt oil and gas region are associated with the continuation of the search for deposits in the Jurassic and Pre-Jurassic sediments in the side zones of large depressions.

To study the Jurassic oil and gas complex, it is necessary to conduct exploratory and detailed geological and geophysical work in order to identify local uplifts and study the patterns of changes in the reservoir properties of productive horizons.

To assess the prospects of oil and gas potential of the Pre-Jurassic deposits, it is necessary to carry out regional and detailed studies in order to identify objects for exploration drilling.

Primary tasks in the search for hydrocarbon accumulations in the Jurassic and Pre-Jurassic rock complexes:

- Application of digital technologies in the acquisition, processing, interpretation and modeling of geophysical data.
- Use of innovative approaches and methods in conducting predictive search operations.

- Application of a systematic approach and quantitative calculations in interpreting the obtained data and substantiating new theories (concepts) of oil and gas formation;

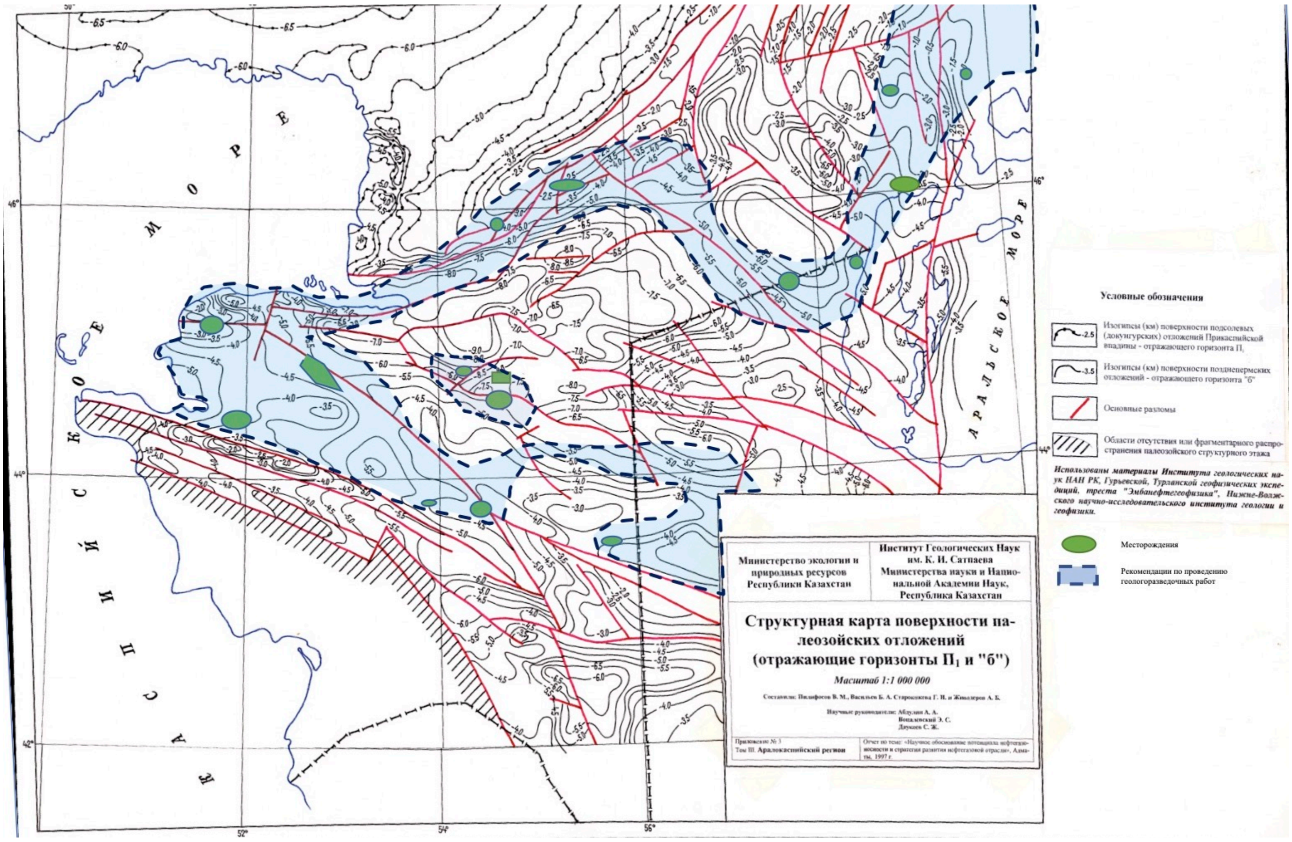

Figure 1- Recommendations for exploration work on Jurassic deposits in the North Ustyurt region [75]

The methodology, technology, hardware and software of geological exploration involves the use of:

- New methods of remote sensing of the Earth (aerogammasrectrometry, etc.),
- Advanced seismic survey technologies, technologies and algorithms for processing seismic data,
- Effective methods of interpretation of seismic data, new approaches to geological and hydrodynamic modeling.
- Improved methods of interpretation of downhole data, new methods of downhole monitoring to track fluid dynamics in reservoirs.
- Advanced methods of special studies of core material and reservoir fluid samples
- Testing and development of new high-efficiency and high-speed methods of drilling, well construction.
- Comprehensive geological and economic assessment of hydrocarbon deposits based on the achievements of geotechnology and modern methods of computer modeling.

- The latest methods of geophysical research of hydrocarbon deposits and modern mathematical methods in the processing of geological and geophysical research data for the assessment, re-evaluation, ranking and monitoring of hydrocarbon reserves.

The obtained information about the Jurassic and Pre-Jurassic will allow us to solve the problems of forecasting the development of structures in these deposits and the prospects for detecting hydrocarbon accumulations.

Conclusion

Based on the completed dissertation research, the following conclusions are justified:

1. For the first time in the North-Ustyurt region, the roof and the bottom of the Jurassic sediments were identified on the basis of quantitative calculations in the Geosoft software for deconvolution of Euler points for three-dimensional geodensity and geomagnetic models. In the sedimentary cover of this region, the zone of transition from Cretaceous to Jurassic sediments almost everywhere acts as a gravimetric boundary, and in geomagnetic models – the upper edges of magnetically disturbing objects of volcanogenic-sedimentary deposits of the Permo-Triassic.

2. For the first time, the correlation coefficients of the roof and sole of Jurassic sediments, Paleozoic surfaces, and basement were quantified in the Coscad 3D software for the depressions of the North-Ustyurt region. The increased values of these coefficients indicate the conformality of the occurrence of the main boundaries of the sedimentary cover.

In linear-elongated mobile systems and mobile angles, the correlability of the roof and sole of Jurassic sediments, Paleozoic surfaces, and basement formations is sometimes weak or not at all apparent. In terms of tectonic elements, there is a correlation between these boundaries.

3. According to the thickness and completeness of the development of Jurassic sediments, Paleozoic and Permo-Triassic formations, the depth of the basement sinking, the directions of geological evolution, the nature of the development of fault tectonics, and the method of manifestation in the geophysical potential fields, the depressions of the North-Ustyurt region are sharply differentiated from the folded systems by the framing and individual mobile incoming angles of this region.

4. During the Jurassic and Triassic periods, during most of the Paleozoic, stable blocks lying at the base of depressions in the interior of the North-Ustyurt region developed in the mode of inherited deflections with the accumulation of thick layers of deposits of the inner outer shelf, zones of uncompensated bending with a general increase in sea level and long-term preservation of lagoon conditions during regressions.

Throughout most of the Jurassic, Triassic, and Late Paleozoic, the distribution boundaries of the North-Ustyurt paleosedimentation basin were clearly delineated by mobile folded belts that represented areas of erosion at that time and from which terrigenous material entered the adjacent sedimentation areas.

5. Jurassic sediments of lateral trough zones The North-Ustyurt region is characterized by a clear structural differentiation with the allocation of systems of large positive structures that are considered as oil and gas catchment areas. A similar structural factor is observed in the Triassic and Upper Paleozoic formations.

The favorable factors also include the close proximity to large centers of hydrocarbon generation, favorable paleogeochemical and paleotemperature data, the absence of an active hydrodynamic regime, the widespread development of reservoir strata with satisfactory and high reservoir-filtration properties, as well as a set of sufficiently reliable zonal and local tires.

6. The local structural plan of Jurassic productive horizons is determined by the features of regionally sustained boundaries: the surface of Jurassic sediments, Paleozoic and basement, the sole of Jurassic sediments.

The sharp gradient of depth changes on the southern wing of the Arystanov fold corresponds to a high correlation coefficient of regionally consistent boundaries. The gradual deepening of the northern wing of the Arystanov fold corresponds to a decrease in the correlability of the reference boundaries of the sedimentary cover.