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Research Article

REMOTE SENSING DATA FOR STRUCTURAL AND GEOLOGICAL RESEARCH OF THE REPUBLIC OF UZBEKISTAN

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ABSTRACT
In recent years, remote sensing data are increasingly used in the practice of oil and gas exploration. Space images record the integrated reflection in the landscape of various endogenous and exogenous processes and phenomena occurring in the earth's crust, affecting its formation, development and relationship, i.e. tectonic movements lead to the appearance of specific indicators in the landscape, reflecting the internal structural and tectonic element of the basement and sedimentary cover.

This article discusses the main methodological aspects of identifying oil and gas prospective structures through the use of space images interpretation data and a complex of geological and geophysical data, as well as the application of digital images interpretation data to clarify the tectonic structure (discontinuous tectonics) of the Aral (Aral Sea) depression of the Ustyurt region of the Republic of Uzbekistan.

Keywords*: *Lineament, ring structure, counter line (horizontal), oil, gas, hydrocarbons, anticlinal, syncline, fold, arch, sediment, micro assembly

INTRODUCTION
Much attention is paid to the issues related to the use of space survey materials for researching the oil and gas bearing and promising territories of Uzbekistan. In 1975, the first satellite images of the Aral-Caspian region were obtained from the cosmonauts P.I. Klimukom and V.I. Sevostyanov from the Salyut-4 orbital station. On the basis of the materials obtained, the Central Photogeodesic Enterprise compiled photo cards of scale 1: 2500000, which served as the basis for a comprehensive program for the study and analysis of the tectonics of the region, and for oil and gas geological zoning. Also, these materials were used in compiling a lineament and ring structure map of Central Asia on a scale of 1: 1000000; 1: 500000. In 1986 based on geological, geophysical and remote sensing materials, a map of the “Oil and gas potential of the Republic of Uzbekistan” was compiled at a scale of 1: 500000. The dynamic development in the search for anticline structures in the complex of geological and geophysical studies has been obtained from space surveys since the end of the 90s. In 1999, within East part of Ustyurt, work was carried out to identify oil and gas prospective objects based on a comprehensive interpretation of the materials of previous geological and geophysical work, interpretation of space images and analysis of topographic maps.As a result, a number of areal morpho - photoanomalies identified with oil and gas prospective traps were revealed. From 2005 to the present, the Institute of Geology and Research Prospecting for Oil and Gas deposits - Division of "Deciphering (interpretation) of remote sensing materials of space Survey and subsurface oil and gas potentials forecast” has been conducting remote studies of oil and gas territories of Uzbekistan. Over the years, remote studies have been carried out on separate tectonic zones of oil and gas territories of Uzbekistan. The results of studies of the northern part of Uzbekistan on the territory of the Aral depression are briefly covered in this article.

STUDY AREA
A distinctive feature of the Aral (Aral Sea) Depression as a research area is that a significant part of it only in recent years has been freed from the waters of the Aral Sea and turned into the earth (daytime) surface. As a result of such a transformation, the underwater relief, largely formed by endogenous move-

ments, passing into the category of surface relief, began to change rapidly under the influence of aeolian-deflation processes (Fig.1)

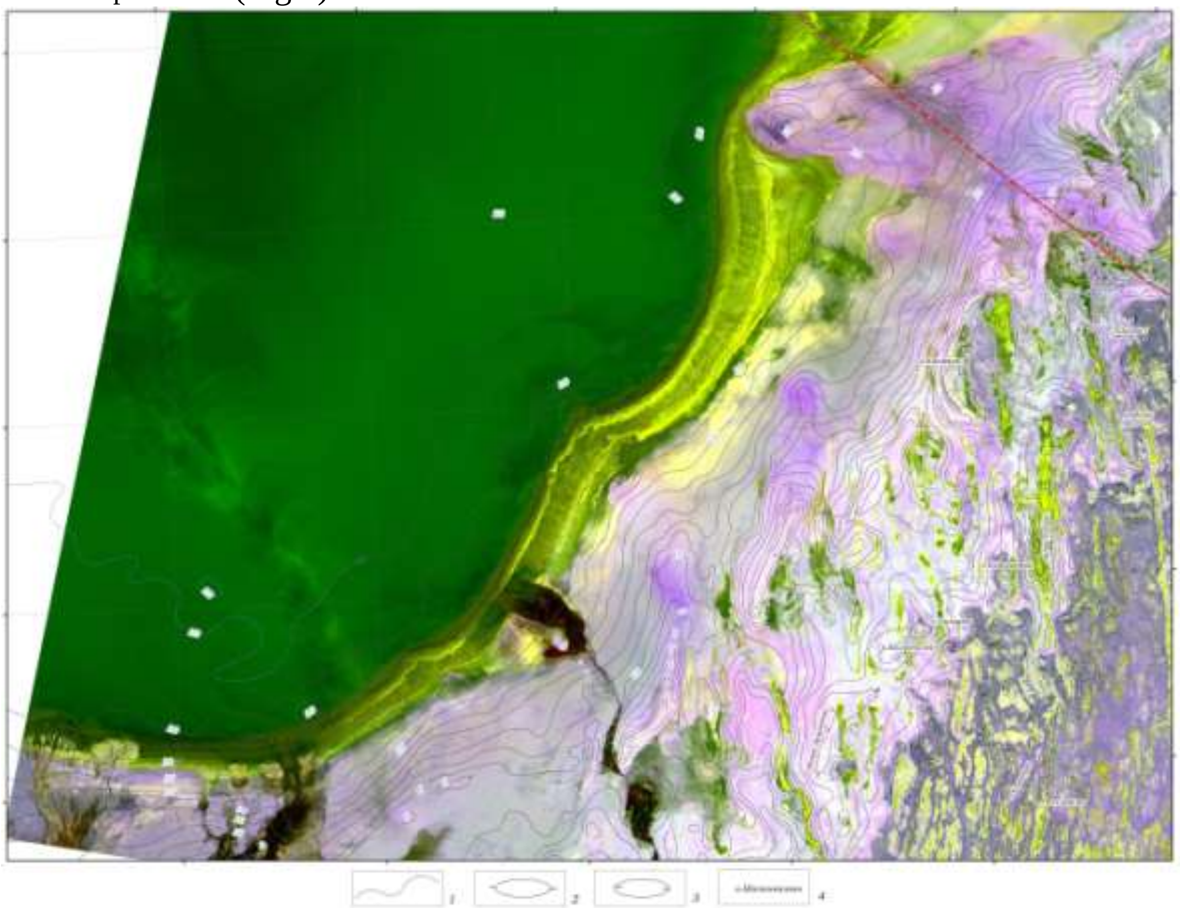

Figure 1: Landsat 7 ETM+ of East part of Aral Sea. Isobaths showing dynamic alteration deep sea. 1-isobaths showing relief sea, 2- island (raising) Aral Sea, 3-deflection expressed deep relief, 4 - name of Islands

To date, the relief of the Aral Depression is a sea gently inclined lowland plain (exposed young plain), occupying the lowest hypsometric position on land, which is represented by salty solonchaks with sparse vegetation. As the sea receded, the dynamics of landforms also changed, with an inherited geomorphological principle - banks turned into islands, islands into capes, capes into hills, bays and bays into lagoons, lagoons into shores.

The landscape was formed on the site of dried out lagoons and bays and at the moment is a naked seabed occupied by wet marshy sediment, sometimes alternating with deposits of salts, gypsum and their hummocks. In general, the shallowing of the sea and the associated changes in its morphometric characteristics, and most importantly, the catastrophic salinization of cover sediments, led to deep transformations of its physical and chemical regimes, and all the processes that determine its state and dynamics.

MATERIALS AND METHODS

Data Used and Methodology

The space satellite imagery materials used are Landsat 7 ETM, Landsat TM (USA), Aster TerraLook (stereo-sensor) (Japan), SRTM (radar-topographic satellite) (Canada), Sentinel 1 A / B (Europe). Erdas Imagine programs are used as the main tools for interpreting digital images, and ArcGIS is also used to compare deciphering data and previous geological and geophysical studies.

The main research methods used in this work are: structural interpretation of lineaments and ring structures; morphometric analysis of neotectonic movements (Edward A.Keller, V.P. Filosofov); morphotectonic analysis of the geodynamic block frame. The method of structural interpretation of remote sensing data allows you to: detail the internal structure of oil and gas regions; to reveal the position and features of the tectonic blocks forming them, structures of the second (arch, ramparts, hollows, etc.) and third (anticlines, synclines, monoclines, etc.) orders; identify major disruptive violations; identify chains of local structures; fix the transverse structural elements that determine tectonic (block) fragmentation, etc. By deciphering the space images, the distribution and nature of the lineament network marking disjunctive dislocations and zones of increased fracturing are revealed and analyzed, as well as ring structures are detected, which in most cases indicate local structures of the sedimentary cover at different depth sections. In the regions of distribution of buried structures, structural decoding of remote sensing data makes it possible to predict the location of local structures with a rather high degree of reliability, to predict the degree of disturbance (tectonic fracturing), to detect discontinuous disturbances that separate oil and gas deposits into separate blocks.

The results of deciphering space images allow not only more definitely and unambiguously to trace the position of faults identified by geophysical materials, supplement with information about their position and extent, but also highlight a large number of previously unknown faults, data on the presence of which from geophysical materials can be obtained only with an additional, targeted reinterpretation of them.

The main criteria for highlighting lineaments are as follows: rectilinear stripes occupied by salt marshes; straightened sections or sharp bends of thalwegs of temporary streams; contact along the same boundary of geological formations of different ages or linear sections of their development well expressed in horizontal lines. In the sedimentary cover, lineaments, or rather, structural and tectonic lines traced by them, are usually expressed by a wide range of disjunctive layer deformations — faults, flexures, and cracks. Structural interpretation also distinguishes elements characterizing folded tectonics, plicative deformation of layers — arc elements (ring structures). The criteria for identifying plicative structures (local uplifts) are as follows: the radial structure of the thalwegs paleolines; oval bends; positive and negative microforms; change of direction flowing around the rise.

RESULTS AND DISCUSSION

The Aral Sea depression is one of the most promising oil and gas regions of Uzbekistan, but it is a poorly studied territory compared to the southern Aral Sea. In recent years, one West Aral gas condensate field has been identified here; the remaining hydrocarbon deposits of the Ustyurt region are located in the southern border part of the basin. The task of deciphering the deep geological structure of the region was solved on the basis of the interpretation of space images, structural analysis of geological and geophysical materials. All selected linear elements are shown on the structural-tectonic diagram of the interpretation results.

The performed structural interpretation has analyzed the distribution and nature of the lineament network — disjunctive dislocations and zones of increased fracture. An analysis of the distribution of lineaments was carried out according to four schemes on each of which lineaments of one or close strike are plotted. The diagram clearly shows the difference in their distribution on different blocks and repeatability at equal distances. From the total number - 1954 selected linear elements (lineaments): 289 (14.8%) lineaments have meridional strike; latitudinal - 132 (6.7%) elements; northeast strike - 897 (46%) elements and northwest - 636 (32.5%) elements. On the whole, over the study area, the general direction of tectonic disturbances is northeastern (200 ° -260 °), which makes 46% of the total number of identified linear cosmophotogeological objects (lineaments) (Fig.2).

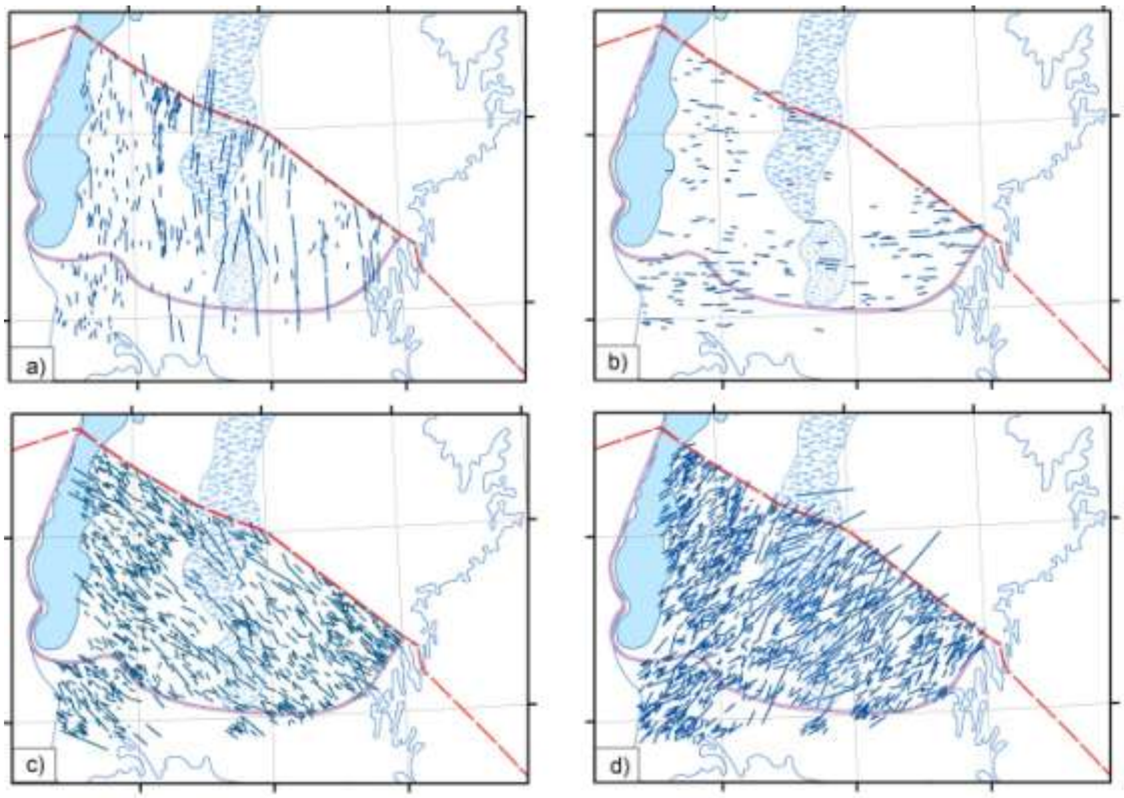

Figure 2: Dislocation arrangement and character linear disjunctive fracture territories Aral Sea (a-meridional, b-latitudinal, c-north-west, d-north-east)

When combining the data of the space image interpretation with the available geological and geophysical data, it was determined that these elements are involved in the formation of the modern structural tectonic plan of the Meso-Cenozoic deposits. Elements of plicative tectonics - ring structures are formed as a result of the appearance of tensile deformations during the uplift of the foundation blocks along the faults that limit them and are expressed in the formation and opening of arc cracks in the sedimentary cover, which, in turn, develop various plicative forms and elements of the geological structure. Structural uplifts within the Aral Sea Depression are morphologically expressed in both positive and negative relief forms. On salt marshes with heavy clay soils, a direct expression of structural uplifts in the relief is observed, when the uplift is emphasized by a system of small, indistinctly pronounced incisions of thalwegs radially diverging from its dome. At the same time, on the uplifts, which began their formation earlier, i.e. more ancient laying, the developed relief develops. In this case, a cup-shaped lowering occurs within the arch, and ridges surrounding it are formed on the periphery, on the slopes of which erosion incision systems are observed. The studies revealed a series of local brachiform morphostructures active in the Oligocene-Anthropogenic time, and their spatial relationship with the elements of the regional tectonic structure was previously established. For the majority of the distinguished ring structures, several concentrates are planned i.e. heterochronism is observed.

When combining the results of interpretation with structural maps compiled from seismic data, one of the indicators (signs) of the presence of local structures is the manifestation of structural units, such as structural noses (hemanticlines) or structural sites.

Figure 3: Map of the Aral Sea depression showing plutonic object with element field of gravitation 1-deposit for oil and gas, 2-drilling structure 3- prepare structure, 4-recognise structure, 5-recognize (Hegai D.R. and Yuldasheva M.G.), 6- recognize (Geideco G.V.), 7- deep drill, 8- contour plutonic object, 9-place of increased significance of gravity.

As a result, it was established that the decoding signs of the presence of the structure at a depth (Jurassic and intermediate structural geologic plane (stage) are:
- the presence of a ring anomaly or a combination of arc elements of the space image;
- the presence of a large horizontal uplift;
- an increase in the laying of contour lines, their tightening towards regional subsidence of the relief;
- on the geological map, such a sign is the development of more ancient deposits in comparison with the surrounding areas with the same hypsometric marks. One of the indispensable conditions is the limitedness of these sections with lineaments from several or all sides.

Highlighted promising objects were compared with the distribution scheme of magmatogenic objects with elements of gravitational and magnetic fields compiled by V. Bashayev. The most active volcanic activity took place in the Up-per Carboniferous - Lower Permian. The selected contours of magnetically active objects are concentrated within the central part of the Aral Sea depression in the area of the Renaissance islands, Belenghausen, the activity of the Aral-Kyzylkum seam zone affects (Fig.3). Only a small part of the objects identified by seismic exploration and interpretation of satellite imagery coincided with intrusive massifs, for example, Ulkemtumsuk, East Kosbulak, West Tumsuk, Northern Arman, partially Khazina, South Aktepe. I would like to draw attention to the fact that the only Western Aral field discovered to date is also located, if not over the intrusive massif, then in the immediate vicinity of it.

In the Middle and Late Triassic, the Upper Carboniferous - Lower Permian granite massifs were intensively denuded with the formation of arkose plumes around themselves, which led to the formation of layers with good reservoir properties (sandstones) adjacent to protrusions of the Jurassic relief and the formation of a series of successively wedged horizons. Overlapping them with younger clay sediments created favorable conditions for the formation of lithological-stratigraphic traps.

As a result of the studies, more than 30 objects for the development of structural-tectonic traps for geological exploration and a detailed study of the deep structure by geophysical methods were outlined.
The remote sensing data interpretation performed - the interpretation of space images and topographic maps of the research area are effective and consistent, taking into account the stages of geological exploration. This method is considered relatively material costs - economical. The method is the identification and tracing of different-rank faults and zones of increased fracturing and many other tasks, and it is especially important to identify structural traps, and such studies are, to a certain extent, a guide for further, primarily seismic, exploration.

REFERENCES

Abdullaev GS, Uyldashev JU (2006). Geological features of gas condensate deposits of the Aral-Ustyurt region and factors controlling the specifics of their development. *Actual problems of the integration of science, education and production in the oil and gas industry: Thesis of the Republican Scientific-Practical Conference*. Tashkent, 35-37 *(In Russian).*

Abidov AA, Dolgopolov FG (2004). Geodynamics of Central Asia and its role in the formation of oil and gas geostructures of the Aral-Ustyurt region. *Geology of the Caspian and Aral Sea regions. - Alma-Ata:“GasGEO”*,160-165 *(In Russian).*

Babadjanov TL and Kim GB (2004). Prospects for the oil and gas potential of the Aral basin. *Geology of the regions of the Caspian and Aral seas. - Alma-Ata: GasGEO”*, 282-289 *(In Russian).*

Bikeyeva LR and Usmanov PM (2015). The use of remote sensing data for research in structural traps in the poorly studied territories of the Ustyurt region . *Oil and gas and geological science of Uzbekistan and the role of young scientists in solving its problems: materials of a scientific and practical conference.-Tashkent*, 30-31. *(In Russian).*