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Research Article

EVALUATING THE POTENTIAL OF HYDROCARBON GENERATION OF THE EARTH CRUST WITHIN THE TERRITORY OF UZBEKISTAN

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ABSTRACT
The article used a complex of geological and geophysical data for the classification of the earth's crust. The methodology for classifying the earth's crust is based on cluster analysis, which allows for simultaneous and comprehensive analysis of a complex large amount of data. Correlation-statistical analysis of the (initial or primary) data was carried out, the problem of classification based on cluster analysis was solved. This study used methods that were completely different from the previous method for assessing the potential for oil and gas formation in the earth's crust. Are given predictions for similar types of the earth's crust based on an analysis of the relationship between the distinguished types of the earth's crust and hydrocarbon deposits, using as a standard the deposits determined to date. A stratified predictive map of hydrocarbon deposits in Uzbekistan has been developed.

Keywords*: Typification, Statistics, Cluster Analysis, Earth Crust, Anomaly, Classification, Frequency Histograms*

INTRODUCTION
To date, more than 450 oil and gas fields have been discovered in Uzbekistan, most of which are fully or almost fully mined, being mined or being prepared for industrial processing, while others are in various industrial exploration processes.
Due to the complex tectonic structure of the region, the genesis and accumulation of hydrocarbons (UV) are observed here. Hydrocarbon deposits are observed in sedimentary rocks, as well as in the rocks of the Upper Paleozoic (southern part of the Fergana Basin, Ustyurt). Their traps are also available in a variety of structural forms - anticlinal, tectonic shielded, noanticline, reef, and so on.
The prospects of oil and gas in the study area are very well studied by comparative geological analogues, volumetric genetic methods (Akramkhodjaev *et al.,* 1982) and geophysical methods ("Uzbekgeophysics).
This study used methods that were completely different from the previous method of estimating the potential for oil and gas formation in the earth's crust. In this method, the formation of oil and gas fields is assumed to occupy a definite place in the following system; endogenous regime (a set of magmatic, metamorphic and tectonic processes), tectonic process (vertical and horizontal, a set of fast and slow movements, torsion, etc.), oil and gas.

MATERIALS AND METHODS
The methodology of homogenization of the Earth's crust provides great opportunities for the study of endogenous processes. Its task is to determine the types of crust and the interrelationships between them, as well as their place in the overall system. If we choose isolated crustal species to reflect endogenous regimes, in this case we can study not only the modern structure of the crust, but also the laws of its development (Belousov 1978; Reysner *et al.*, 1986).
The methodology for the classification of the Earth's crust is based on cluster analysis (solution of a classification problem), which allows a complex analysis of data from a large array of different at the

same time. Information about this (Khusanbaev *et al.*, 2017, Tukhtasinov *et al.*, 2021) is detailed in the articles.

Modern endogenous regimes are associated with processes such as seismicity, magmatism, ore-generation, oil and gas accumulation in the earth's crust. Therefore, data on the modern structure and condition of the earth's crust are used to compare the processes of accumulation of hydrocarbons. In this case, the first step of cluster analysis, in the step with a very small "convergence norm" is selected (Reysner *et al.*, 1990).

Based on the parameters that determine the current structure and condition of the Earth's crust, it is possible to predict the oil and gas generation potential of the Earth's crust when the types of crust are "trained" with a standard hydrocarbon deposit. The cluster classification method was used in the study and the areas where oil, gas and condensate fields are located were used as a reference.

Processing of primary geological and geophysical materials was carried out using cluster analysis by the K-medium method. STATISTICA v 6.0 was used in this study. 339 cells across the region were allocated according to the proximity criterion to 200 clusters (classes). Based on this information, 200 different formalized (digital) maps of the territory of Uzbekistan were created using the computer program "program KA" (Tukhtasinov *et al.*, 2021).

The results of the cluster analysis and the data on the discovered oil, gas and condensate fields were considered together, and in the 1st stage a catalog of deposits by clusters was compiled. At the national level, hydrocarbon deposits in various clusters are located in 63 cells. These clusters are a benchmark in solving the problem of forecasting associated with the identification of promising areas for oil and gas fields.

RESULTS AND DISCUSSION

In this catalog, using the data of the nomenclature sheet, cluster type, the data of reference cells containing hydrocarbon deposits are distributed to 339 cells allocated on the territory of Uzbekistan. In this case, the reference cells are divided into three categories: oil, gas and condensate fields. Using the Image Recognition method, the data of the reference cells belonging to one cluster are distributed to the unexplored cell in the same cluster. As a result, a number of digital forecast maps (for individual oil, gas, condensate, and general) showing the potential of oil and gas generation classified by hydrocarbon categories were created.

Results of the study Forecast map of oil fields (Figure 1). 192, 189, 194, 186, 135, 66, 123, 98 crust types of oil deposits have been identified in the Fergana basin, of which there are two cells of the 192 crust type, both of which contain oil (on the nomenclature sheet K-42-108 (NV)). Shorbulak, Namangan, Maylisay, K-43-97 NV (Maylisu 4, Izbaskent) deposits have been identified. There are no other cells that belong to this shell type. Another similar type of shell is in the K-43-110 NV (Changyrtash, Northern Alamyshik, Southern Alamyshik, Changyrtash deposits) in the Fergana basin of the 186th type, and in three cells J-42-99 NV in the Surkhandarya basin (Jeyrankhana, Jeyrankhana-1) , J-42-88 NV (Kokayte, Aktau), J-42-76 NV (Jalair, Lyalmikar, Koshtar, Akdjarsay) also have oil deposits, and other cells of this type are not available in our region.

One of the three cells of the 122nd crust type, Fergana K-42-107 NV (Kasansay, Tergachi) and two Surkhandarya basins contain J-42-64 NV (Mirshadi), J-42-65 NV (Regar) oil fields. No other unwanted cells are encountered. In cells 66 and 123, one of the cells belonging to the type of shell, as well as cells belonging to this type of shell in which oil deposits have been identified, are no longer found.

There are three cells in cluster 189, which serves as a benchmark, two of which contain oil deposits in cell K-42-120 NV (Minbulak), cell K-43-109 NV (N-Khartoum, Khartoum East, Boston, Shakhrikhan-Khojiabad, Andijan) , and one cell is provided as a forecast. In the 194th cluster, there are two cells, one of which contains an oil field in cell K-42-132 NV (Gumkhana), and the other is forecasted. Similarly, in the 98th cluster there are oil fields in cell K-42-143 NV (Chongar-Galcha, Northern Sokh, Northern Rishtan, Chimion-Yarkutan), in cell 135-cluster type K-42-142 NV (Ravat, Nefteabad, Varik-1, Varik-2, Achisu,

Shorsu-4, Chongar-Galcha) oil fields have been identified, and these cells serve as a reference for cells 98, 135 of the same type as a reference.

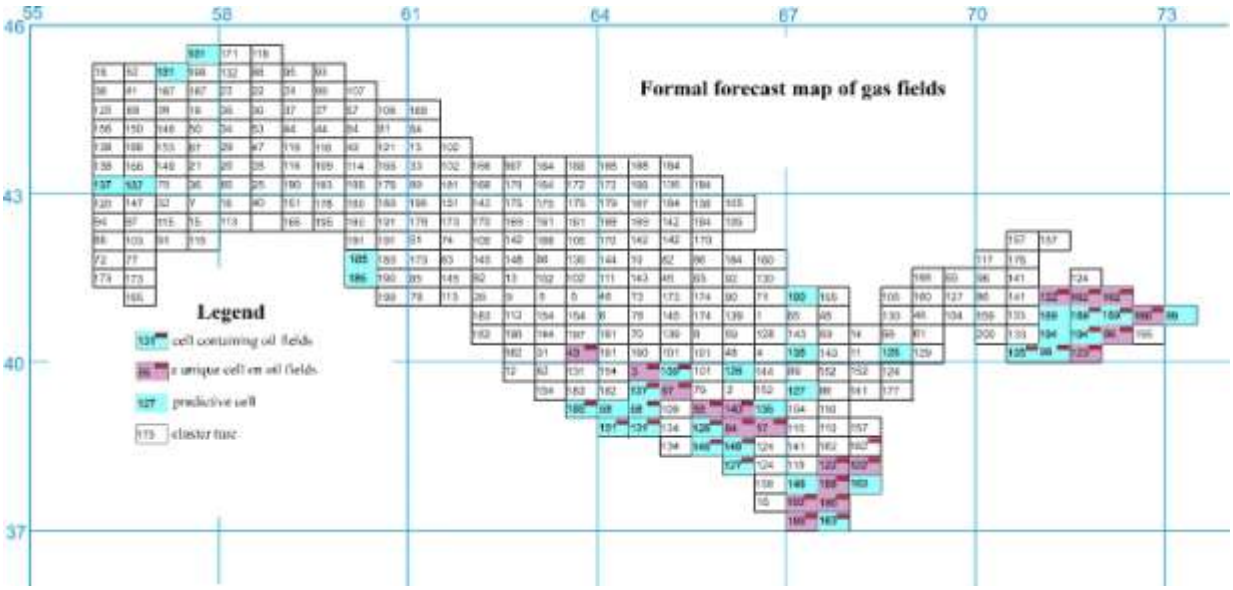

Figure 1: Formed forecast map of oil fields

There are oil fields in clusters 163, 146, 186, 122, 193 in the Surkhandarya basin. Of these, prognostic cells were not identified in clusters 122, 186, 193, and cluster 193 turned out to be a unique type of crust. Cluster 122 is found in two cells in the Surkhandarya basin and one cell in the Fergana basin, similar to cluster 186 in three cells in the Surkhandarya basin and one cell in the Fergana basin. In the cell J-42-100 NV of the cluster type 163 (Korsagli, Amudarinskaya) oil fields were used as a reference, and one forecast cell was identified.

Oil deposits have been identified in clusters 43, 3, 63, 55, 140, 64, 17 in the south-western Gissar and Bukhara-Khiva oil and gas regions, but no other cells belonging to these crust types have been found. Cell type 131 is of interest, two of which contain oil deposits, in cell J-41-45 NV (Akchopan, Western Border, Border), in cell J-41-46 NV (Sardob, Chiston, Western Alan, Uzurkuduk), Using the cells as a reference, two more such cells belonging to the 131st cluster were identified in the northern part of the Ustyurt oil and gas region. In the Bukhara-Khiva region, in one cell J-41-22 NV of the 137th cluster type (South-Western Yulduzkak, Shurchi deposits), in the 185th cluster type J-41-32 NV cell (Kishtiyan; Serpa, Kishtiyan-2 deposits) these cells are standard. Cell and two prognostic cells in the southern part of Ustyurt belonging to this type.

J-41-60 NV (Shurtan; Northern Shurtan, Nishan, Zafar), belonging to cluster 146 in the South-Western Gissar oil and gas region, in cell J-42-49 NV (Northern Shurtan, Southern Kyzyl Bayak, Pachkamar, Shakarbulak; K-Shurtan , Eastern Buzakhor, Buzakhor, Northern Shurtan, Northern Guzar, Eastern Karail, Amanota, Pachkamar, Adamtash, Gumbalak, Jarkuduk, Eastern Auzikent) deposits are available as a reference, which allows to predict a single cell in the Surkhandarya basin of this type.

Condensate deposits forecast map (Figure 2). In the forecasting of condensate deposits, a standard of currently identified condensate deposits was used. Condensate deposits (Eastert One, Western Palvantash, Western Khodjiosmon) in the crust of the Fergana Basin 123, 66, 155 have been found to contain condensate deposits, but the species belonging to this crust type is no longer found.

Cell K-42-142 NV (Kanibadam, Chongar-Galcha) belonging to cluster 135 has condensate deposits and a single forecast cell is presented in the Central Kyzylkum basin of the same crust type.
Three cells belonging to cluster 189 were identified, one of which is a cell with a standard deposit K-42-120 NV (Minbulak), and two are forecast cells.
There are a total of four cells in cluster 186, one of which is the K-43-110 NV cell in the Fergana Basin. There is a field in this cell (Southern Alamishik), the second is the J-42-76 NV (Lyalmikar) condensate field in the Surkhandarya oil and gas basin. Two J-42-73 and J-42-81 NV cells in the Surkhandarya basin are forecasted.
Description of the forecast areas of the map of condensate fields built on the types of crust of the Ustyurt oil and gas zone. Korachalak, Kukchalak, Akchalak), K-40-21 NV cell (Urga), K-40-10 NV sheet cell (Berdakh, Shagerlik), L-40-142 NV cell (Surgil, Northern Urga), condensate deposits identified but these cells are of the type of cells that are not unique to the area under study.
When studying the Bukhara-Khiva oil and gas region, we consider the types of reference and forecast shells. There are 12, 31, 62, 43, 67, 55 clusters of unique types in this area, in all of which condensate deposits have been discovered, in addition, three cells of cluster type 182 have been identified and K-41-125 NV (New Kazgan, Karomat, Bright), K-41-138 NV (Uchkir, Khatkul, Uchburgan, Western Kulbeshkak), J-41-21 NV (Chandyr, Western Kukchi, Kalandar, Jangul) cells, all of which contain condensate deposits. Another similar shell type is cluster 134, two of which are cells J-41-59 NV (Gersan, Aknazar, Kirkulach), J-41-47 NV (Kultak, New Alan, Pamuk, Central Pamuk, Kamashi). , both have condensate deposits. Both of these crustal types indicate that these crustal species have a geological environment conducive to condensate deposits.

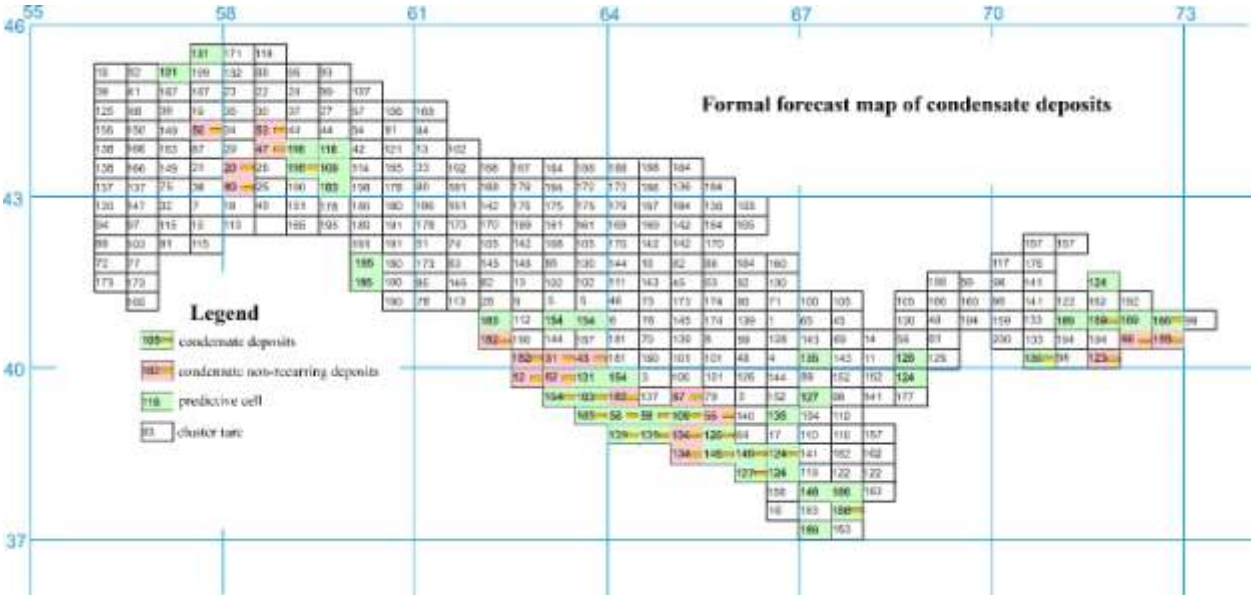

Figure 2: Formal forecast map of condensate deposits

The crust of cluster 183 is of interest, in one of the cells of this type of crust J-41-21 NV (Chandyr, Western Kukchi, Kalandar, Jangul) condensate deposits were discovered, which serve as a benchmark for two cells of this type in the Bukhara-Khiva oil and gas zone. .
There are three cells in the crust of cluster 154, one of which contains condensate deposits in J-41-19 NV (Kandym, Kumli), which serves as a benchmark for two cells of this type.
There are three cells in the crust of the 185th cluster, one of which contains cells J-41-32 NV (Samandepe, Alat, Tegermen, Western Tegermen, Khodjidavlot) and two cells of the same type.

There are five cells in the crust of the 131 cluster type, two of which are in cell J-41-58 NV (Yanguy, Chashguy, Uzunguy, Pirguy, Bereketli), in cell J-41-46 NV (Urtabulak, Kokdumalak, Southern Zevardy, Alak, (Alan, Berdykuduk, Darakhtli) condensate fields have been discovered, and these cells are used as a benchmark for two cells in the northern part of the Ustyurt oil and gas region, and one cell in the central part of the Bukhara-Khiva oil and gas region.

There are three cells in the 146th cluster type crust, two of which are located in the Bukhara-Khiva oil and gas zone J-41-60 NV (Shurtan, Northern Nishan, Zafar), J-42-49 NV (Shurtan, Eastern Buzakhor, Buzakhor, Northern Shurtan, Northern Guzar, Eastern Karail, Amanota, Pachkamar, Adamtash, Gumbalak, Jarkuduk, Eastern Auzikent)

In the South-West Gissar oil and gas region, there are two cells in the crust of the 124-cluster type, one of which is a standard J-42-50 NV (Auzikent) condensate field, and the other is forecasted to a neighboring cell in its southern part.

In total, 19 unique (unique), 15 reference and 23 forecast cells were identified for condensate deposits.

The forecast map for gas fields (Figure 3) used the currently available gas field standard in forecasting gas fields. We know that gas fields in our country have sufficient potential. However, a certain percentage of the currently identified gas fields have been mined, and a certain percentage is in the process of extraction, so it is necessary to apply new methods of prospecting for new fields. Therefore, the cluster method was used. Based on the results of the research, it was possible to make a forecast for gas fields.

The results of cluster analysis of gas fields identified in the Fergana oil and gas region corresponded to the following cluster types. K-42-143 NV (Sarykamysh, Sary-Tok, Southern Rishtan), K-42-144 NV (Khankiz, Northern Khankiz, Kashgarqir), K-43-121 NV , K-43-97 NV (Western Khodjiosmon) gas fields have been identified, but this type of crust belongs to a rare (unique) type.

The crust of the 192 cluster is observed in two cells in the Fergana basin. Of these, gas deposits have been identified in cell K-43-97 NV (Kizil-Alma, Maylisu, Maylisu 3), which allows us to forecast a neighboring cell of the same cluster type to the west.

A single K-43-110 NV cell (Suzak) in the Fergana Basin was discovered in a cell belonging to the 186th cluster type, which allowed to forecast this cell as a reference for three cells of the same shell type in the Surkhandarya basin.

The Bukhara-Khiva oil and gas region ranks first in the country in terms of the location of gas fields.

According to the cluster analysis, the rare (non-repetitive) types of crustal isolated species are clusters 1, 12, 31, 43, 67, 79, 55, 140, 64, 119, (J-41-6 Southern Kulbeshkak, Border Sand, Western Hakkul, Gakkakum, Murodtepa), (K-41-139 Tashkuduk), (K-41-140 Kaltakyr), (J-41-23 Karais, Akjar, Setalantepe, Yulduzkak, Shurtepe), (J-41-24 Kyzylrabat), (J-41-36 Karabair, Istiqlol-25), (J-42-25 Saricha), (J-42-37 Tursari, Namazbay,), (J-42-63 Gajak) are located in NV. The gas fields mentioned in all of these have been discovered, but no other crustal species of this type have been found in the study area. These include cluster 134, but there are two cells in this shell type (J-41-59 Nishan, Northern Aknazar, Chulkuvor, Nishan, Chigil, Nazarkuduk, Ernazar), (J-41-47 Northern Kultak, Kapali, Rubai) The gas fields mentioned in NV have been discovered in both of them.

Three cells were identified in cluster 154, one of which (J-41-19 Taylak, Eljik) was the reference, allowing a prediction for two crustal cells of this type.

In cluster 185, three cells were identified, one of which was a reference cell (J-41-32 Serpa, Kishtiyan) in which the gas fields indicated in NV were discovered. Reference cell 185 predicts two side-by-side cells in the western part of the Chorjoi step.

Cluster 131 is found in the Bukhara-Khiva oil and gas region in three cells, two of which have discovered gas fields (J-41-45 Metejan, Genjibek, Nerezin), gas fields specified in NV (J-41-46 Tanuguy). One of the remaining three such crusts is the Bukhara-Khiva oil and gas zone, and two more are located in the central part of the Bukhara stage, forecasting cells in the northern part of the Ustyurt oil and gas zone.

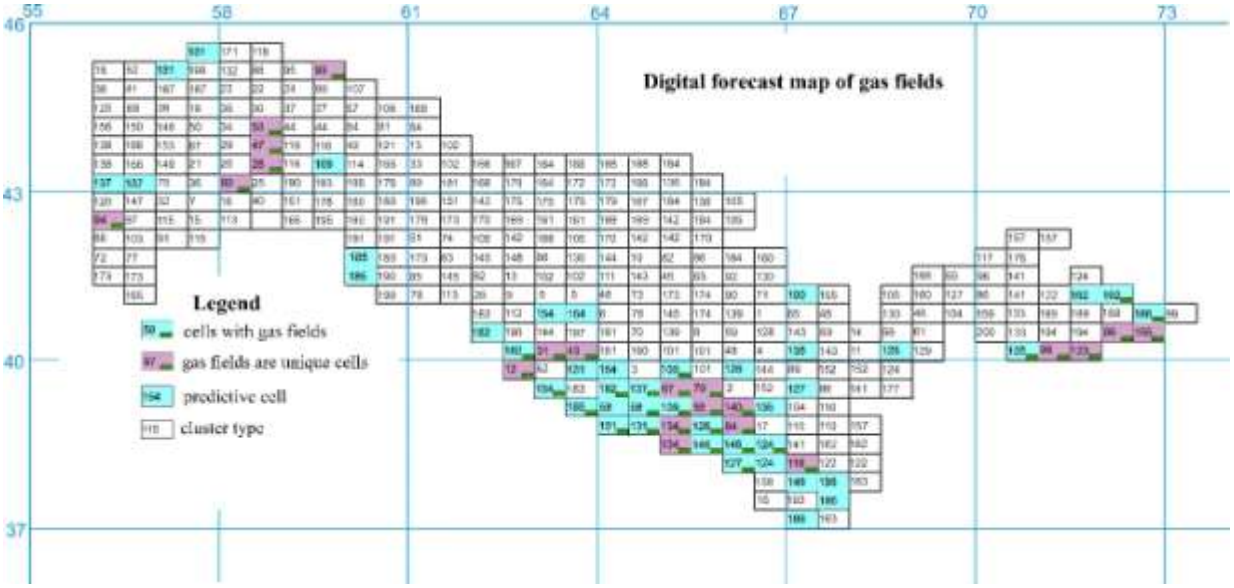

Figure 3: Formal forecast map of gas fields

Cluster 126 occurs in two cells in the region, one of which is a gas field (J-41-48 New Karatepa, Sherkent, Karatepa) NV discovered, the other is located in the Karadarya valley of the Zarafshan basin, and this cell is presented in the forecast. In the 127th cluster type crust (J-42-61 Siemochnaya, New Kyzylcha, Sagirtau) a gas field was discovered in NV, the second one is located in the valley of the Zarafshan river, and this cell is presented in the forecast.

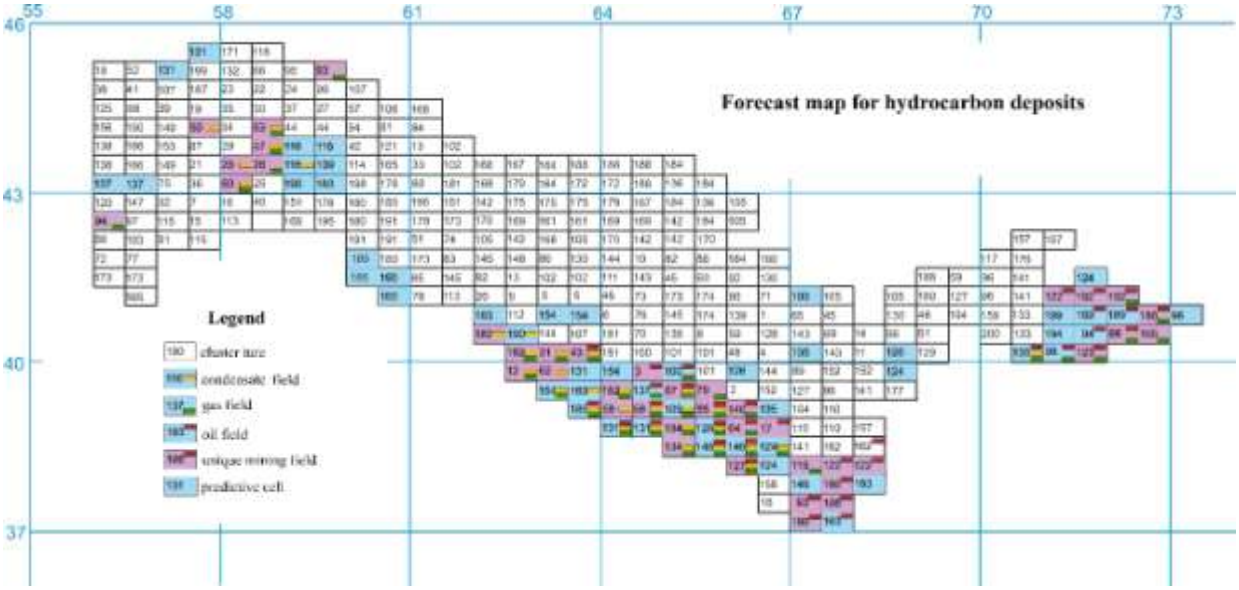

Figure 4: Formal map of oil, gas and condensate formation potentials in Uzbekistan (general)

There are a total of three cells in the 146-cluster type crust, two of which are in the standard (J-41-60 Allachigikuduk, Tavakkal, Ahirbulak), (J-42-49 Aydin, Shurdarya) NV, and one in the Surkhandarya oil and gas region. This cell is presented as a forecast cell.

There are three cells belonging to cluster 137, one of which is located in NV in Bukhara-Khiva region (J-41-22 Karaulbazar-Sarytash, Mamajurgaty, Urtarabad, Jayron, Kagan, Zirabod), the other two are prognostic for two cells in the western central part of Ustyurt oil and gas region gives
In total, 21 unique (unique), 18 reference and 24 forecast cells were identified for gas fields.
An integrated forecast map was created summarizing the results of research conducted in the forecasting of hydrocarbon deposits (Figure 4). This map shows the simultaneous analysis of unique (non-recurring), reference, forecast shell types for oil, gas and condensate fields.
There are 61 standard cells in Uzbekistan, including 40 unique cells. The number of forecast cells is 30 (total area 51,000 km^2), and the ratio of standards and forecast cells is almost 1: 1 (Fig. 4.). In other words, each reference cell predicts an average of about one cell, indicating that there are favorable conditions for the formation of oil and gas in the earth's crust.
There is some additional evidence to help assess its quality in determining how reliable a forecast is. Needless to say, the most effective shell types are the most reliable at the same time in solving the prognosis problem. For example, let's look at unique (unique) shell types that belong to the same shell type. There are four cells in cluster 186, three cells in cluster 122, three cells in cluster 182, two cells in clusters 92, 134, 58, 94, 93, 192, and the discovery of hydrocarbon deposits in all of them indicates the reliability of the study.
An example of the reliability of the cells presented as a forecast is the number of cells that serve as a benchmark.
Indeed, if cluster 131 consists of five cells and two of them are known to contain deposits, the prognosis in the remaining three cells will be more reliable. For example, in cluster 189, there are two benchmarks and one forecast cell, and so on.

CONCLUSION

If the proposed method of solving the problem of oil and gas forecasting was developed at a time when many fields have not yet been discovered, then the result can be said to be very good. This applies to some types of shell species with the high productivity mentioned above. Indeed, for type 131, there are two cells that contain oil and gas deposits, and 3 cells were sufficient to make an accurate prediction. Similarly, there is data on a single reference cell for shell types 137, 116, 190, 109, 183, 185, 154, 146, 126, 124, 135, 163, 98, each of which correctly predicts hydrocarbons in 2, 3 cells. allowed to do.
The forecast map of oil and gas generation potential of the Uzbek crust shows that the projected areas are associated with tectonic structures, but can be used only in general zoning.

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