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# Assessment of the Tectonic Factors Influence on the Deep Oil and Gas Source Rocks Formation at the Upper-Pechora Depression

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# Оценка влияния тектонических факторов на формирование глубокопогруженных нефтегазоматеринских пород Верхнепечорской впадины

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Upper-Pechora depression, deep sediments, probabilistic-statistical methods, basin modeling, oil, gas, hydrocarbons, organic matter, organic carbon, oil and gas source rocks, concentration, tectonic characteristics, burial depth, statistical differences, forecast.

The relevance of the work is that in the coming years the oil and gas potential of deep deposits of the sedimentary cover, located at depths of more than 4 km, will have to be fully studied. One of the methods for solving the problem most effectively is the construction of probabilistic statistical models. In this case, a comparison of average values and distribution densities (statistics – t and $\chi^2$), correlation analysis, regression analysis, including stepwise, as well as discriminant analysis are used. As a result of the calculations, fundamental differences in the tectonic conditions formation of the organic carbon initial concentrations ($C_{org}$) before hydrocarbon (HC) generation processes were determined for the studied types of organic matter (OM) – sapropel, mixed and humus. Comparison of average $C_{org}$ values made it possible to establish the presence of statistical differences between types of OM in deep sediments at the Upper-Pechora depression. Since this structure had an asymmetrical structure typical to marginal troughs, a comparison was made of two tectonic zones – western and eastern, corresponding to its outer and inner sides. Correlation analysis showed that between the studied indicators there were connections of varying degrees of closeness and direction. Using linear discriminant analysis based on a set of tectonic indicators, differentiation by types of OM and tectonic zones was established. The performed stepwise regression analysis confirmed a significant difference in the processes of accumulation of OM of sapropel and humus types, as well as in the western and eastern regions. Thus, statistical analysis showed the decisive role of tectonic factors in the processes of $C_{org}$ concentrations formation. In addition, regression equations were constructed to describe the dependences on tectonic indicators that made it possible to forecast the most important characteristic of oil-gas source rocks.

*Ключевые слова:*
Верхнепечорская впадина, глубокопогруженные отложения, вероятностно-статистические методы, бассейновое моделирование, нефть, газ, углеводороды, органическое вещество, органический углерод, нефтегазоматеринские породы, концентрация, тектонические характеристики, глубина залегания, статистические различия, прогноз.

Актуальность работы обусловлена тем, что в ближайшие годы предстоит наиболее полно изучить нефтегазоносность глубокопогруженных отложений осадочного чехла, залегающих на глубинах более 4 км. Одним из методов, который позволяет решить данную задачу наиболее эффективно, является построение вероятностно-статистических моделей. При этом применяются сравнение средних значений и плотностей распределения (статистики – $t$ и $\chi^2$), корреляционный анализ, регрессионный анализ, в том числе пошаговый, а также дискриминантный анализ. В результате этих расчетов определены принципиальные различия в тектонических условиях формирования исходных концентраций органического углерода $\left(C^{н}_{орг}\right)$ до начала процессов генерации углеводородов (УВ) для изучаемых типов органического вещества (ОВ) – сапропелевого, смешанного и гумусового. Сравнение средних значений $C^{н}_{орг}$ позволило установить наличие статистических различий между типами ОВ в глубокопогруженных отложениях Верхнепечорской впадины. Поскольку данная структура имеет типичное для краевых прогибов асимметричное строение, проведено сравнение двух тектонических зон – западной и восточной, отвечающих внешнему и внутреннему ее бортам. Корреляционный анализ показал, что между изучаемыми показателями наблюдаются связи различной степени тесноты и направленности. С помощью линейного дискриминантного анализа по комплексу тектонических показателей установлена дифференциация по типам ОВ и тектоническим зонам. Выполненный пошаговый регрессионный анализ подтвердил существенное различие в процессах накопления ОВ сапропелевого и гумусового типов, а также в западных и восточных районах впадины. Таким образом, статистический анализ показал определяющую роль тектонических факторов в процессах формирования концентраций $C^{н}_{орг}$. Кроме того, были построены уравнения регрессии, описывающие зависимости $C^{н}_{орг}$ от тектонических показателей, позволяющих прогнозировать эту важнейшую характеристику нефтегазоматеринских пород.

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## Introduction

The Upper Pechora depression is one of the northern depressions of the Cis-Ural foredeep, a sedimentary basin of tectonic nature between the Urals and the Timan-Pechora plate orogen. The uppermost horizons structure of the sediment cover is well studied – hydrocarbon deposits have been developed since the 1960s, but deep sediments (more than 4 km, Middle Visean age) remain insufficiently examined. At the same time, more than 40 deep wells have been drilled within the Upper Pechora depression, most of which at the Vuktyl tectonic plate in the eastern part of the territory. Therefore, to model the formation of the oil and gas content at large depths using various methods is of great interest.

## Research Methods

Tectonic characteristics, such as immersion and sedimentation rates, affect the processes of oil and gas formation. Stable and intensive immersion over a significant area is not only a prerequisite for the formation of a sedimentary basin, but also an important criterion for zones of the highest hydrocarbon concentration.

The immersion and sedimentation rates of the Upper Pechora depression are obtained by means of one-dimensional basin modeling based on an extensive geological database. The basin modeling technique is considered in many Russian and foreign works [1–18]. The obtained values take into account the rocks compaction during geologic time, also the procedure of "decompaction" is applied.

Immersion is a prerequisite for the formation of sedimentary rocks, including oil and gas basins. In addition, this tectonic characteristic was previously mentioned to influence the formation of organic carbon concentrations ($C_{org}$) [19–21]. The regulating role of sedimentation rate in the balance of organic and mineral sediment components is described in the work of A.I. D'iakonov [19], but the regularities of changes in the organic matter content depending on the immersion rate are not described in detail.

Earlier, fundamental differences were established in the tectonic conditions for the formation of $C_{org}$ concentration for the selected types of organic matter [21]. But tectonic factors influence not only the current $C_{org}$ values, but also the initial $C_{org}$, before the start of HC generation, which are obtained using the formulas proposed by K.E. Peters, C.C. Walters, J.M. Moldowan [22].

The initial hydrogen index was first calculated using the formula:

$$HI^{и} = HI + \frac{HI(T_{max} - 435)}{30},$$

where $HI^{i}$ is the hydrogen index prior to the HC generation process, mg HC/g $C_{org}$; $H^{I}$ is the hydrogen index according to pyrolysis data, mg HC/g $C_{org}$; Tmax is the maximum output temperature for kerogen cracking, °C.

The transformation ratio is then calculated, i.e. the degree of the initial generation potential realization by the hydrocarbon source rock:

$$TR = \left[\frac{HI^{и} - HI}{HI^{и}} \cdot \frac{1200}{1200HI}\right] \cdot 100~\%,$$

where $TR$ is the transformation ratio, %; HIi is the initial hydrogen index, mg HC/g $C_{org}$; $HI$ is the hydrogen index based on pyrolysis data, mg HC/g Corg; 1200 is the coefficient with the amount of HC produced per mass unit of organic carbon, mg HC/g $C_{org}$.

Based on the previously obtained $HI^{i}$ and TR values, the initial organic carbon content of $C^{i}_{org}$ has been determined:

$$C^{и}_{орг} = \frac{83{,}33 HI^{и} \cdot C_{орг}}{HI^{и} \cdot (1 - TR) \cdot (83{,}33 - C_{орг}) + (HI \cdot C_{орг})},$$

where $C^{i}_{org}$ – initial organic carbon content before HC generation, %; $C_{org}$ – organic carbon content according to pyrolysis data, %; $HI^{i}$ – initial hydrogen index, mg HC/g $C_{org}$; HI – hydrogen index according to pyrolysis data, mg HC/g $C_{org}$; TR – transformation ratio, fractions; 83.33 – the average percentage of carbon in the generated hydrocarbons.

If the pyrolysis data or part of it (such as $T_{max}$) necessary to determine $C^{i}_{org}$ are not given, the modern $C_{org}$ values were used in the calculations.

Furthermore, tectonic zoning of the territory was not taken into account in the previous work [25]. As is known, the Upper Pechora depression has an asymmetrical structure typical for foredeep, so two tectonic zones – western (outer face) and eastern (inner face) were compared in the study [8, 9].

Probabilistic statistical method has been carried out to determine the prospects of using tectonic factors values for the evaluation of $C^{i}_{org}$ concentrations in sediments, including deep ones. The methods used are discussed in detail in numerous Russian and foreign research [23–52].

## Results

Descriptive statistics and a t-test are used to compare the average values of the $C^{i}_{org}$ generation potential (%), immersion rates $V_i$ (m/mln l) and sampling depth $H_i$ (m) for sapropel, mixed and humus organic matter of deep sediments in the western and eastern zones of the Upper Pechora depression. The average values by the type of OM are given in tables 1 and 2.

Data analysis showed:

– in terms of the $C^{i}_{org}$ parameter, statistical differences in average values were found in the eastern zone between sapropel and mixed, mixed and humus OM;

– average values do not differ statistically for $V_i$ parameter;

– according to $H_i$, a statistical difference in average values was obtained in both zones, in the west – between sapropel and mixed, as well as sapropel and humus OM, in the east – between all types of OM.

Correlation fields between the studied indicators within the western and eastern zones of the Upper Pechora depression were constructed to understand the process of $C^{i}_{org}$ value formation depending on $H_i$ and $V_i$. The analysis showed that the ratios and strength of correlation within the types of OM under consideration varied significantly.

To quantify the correlation, the values of the r correlation coefficients are calculated not only between $C^{i}_{org}$ value and the selected indicators, but also between the indicators themselves, which made it possible to quantify the impact of each on the $C^{i}_{org}$ value and to determine how statistically related the indicators that form the values $C^{i}_{org}$. The values of the r coefficients are given in table 3.

Table 1

Comparison of western zone averages

| Indicators, unit of measure | Averages $\left(\frac{x \pm \sigma}{\text{min} - \text{max}}\right)$ | | | Criteria $\frac{t}{p}$ |
|---|---|---|---|---|
| | OM type, number of observations | | | |
| | sapropel, 21 | mixed, 16 | humus, 31 | |
| $C^i_{org}$, % | 0,299 ± 0,322<br>0,01–1,23 | 0,611 ± 0,677<br>0,05–2,29 | | –1,85825<br>0,071561 |
| | 0,299 ± 0,322<br>0,01–1,23 | | 0,771 ± 1,71<br>0,007–6,45 | –1,2472<br>0,218134 |
| | | 0,611 ± 0,677<br>0,05–2,29 | 0,771 ± 1,71<br>0,007–6,45 | –0,35933<br>0,721026 |
| $V_i$, *m/mln l* | 51,24 ± 21,02<br>12,0–72,0 | 61,81 ± 49,91<br>15,0–170,0 | | –0,87709<br>0,386417 |
| | 51,24 ± 21,02<br>12,0–72,0 | | 74,87 ± 65,24<br>15,0–175,0 | –1,60026<br>0,115842 |
| | | 61,81 ± 49,91<br>15,0–170,0 | 74,87 ± 65,24<br>15,0–175,0 | –0,70045<br>0,487249 |
| $H_i$, м | 4803,52 ± 393,14<br>4385,5–5564,5 | 3783,81 ± 719,04<br>3047,0–5213,0 | | 5,519982<br>0,000003 |
| | 4803,52 ± 393,14<br>4385,5–5564,5 | | 3960,55 ± 702,29<br>2946,5–5258,5 | 4,986702<br>0,000008 |
| | | 3783,81 ± 719,04<br>3047,0–5213,0 | 3960,55 ± 702,29<br>2946,5–5258,5 | –0,811025<br>0,421620 |

Table 2

Comparison of eastern zone averages

| Indicators, unit of measure | Averages $\left(\frac{x \pm \sigma}{\text{min} - \text{max}}\right)$ | | | Criteria $\frac{t}{p}$ |
|---|---|---|---|---|
| | OM type, number of observations | | | |
| | sapropel, 6 | mixed, 24 | humus, 62 | |
| $C^i_{org}$,, % | 0,088 ± 0,094<br>0,011–0,266 | 0,407 ± 0,434<br>0,031–1,755 | | –1,76570<br>0,08835 |
| | 0,088 ± 0,094<br>0,011–0,266 | | 1,332 ± 1,37<br>0–6,47 | –2,208667<br>0,030675 |
| | | 0,407 ± 0,434<br>0,031–1,755 | 1,332 ± 1,37<br>0–6,47 | –3,23695<br>0,00173 |
| *Vi, m/mln l* | 60,00 ± 5,48<br>55,–65,0 | 43,67 ± 31,99<br>19,0–161,0 | | 1,230159<br>0,228873 |
| | 60,00 ± 5,48<br>55,–65,0 | | 55,50 ± 21,81<br>32,0–161,0 | 0,500705<br>0,618245 |
| | | 43,67 ± 31,99<br>19,0–161,0 | 55,50 ± 21,81<br>32,0–161,0 | -1,96782<br>0,052389 |
| $H_i$, м | 6409,58 ± 364,50<br>6071,5–6987,5 | 5397,40 ± 356,83<br>4726,5–6040,0 | | 6,190670<br>0,000001 |
| | 6409,58 ± 364,50<br>6071,5–6987,5 | | 4958,27 ± 326,77<br>4487,0–5800,0 | 10,293289<br>0,000000 |
| | | 5397,40 ± 356,83<br>4726,5–6040,0 | 4958,27 ± 326,77<br>4487,0–5800,0 | 5,448164<br>0,0000005 |

Table 3

Correlation matrix

| | General | | | Western zone | | | Eastern zone | | |
|---|---|---|---|---|---|---|---|---|---|
| | $C^i_{org}$ | $H_i$ | $V_i$ | $C^i_{org}$ | $H_i$ | $V_i$ | $C^i_{org}$, | $H_i$ | $V_i$ |
| Sapropel OM | | | | | | | | | |
| $C^i_{org}$ | 1 | | | 1 | | | 1 | | |
| $H_i$ | –0,44* | 1 | | –0,40* | 1 | | –0,36* | 1 | |
| $V_i$ | 0,40* | –0,26* | 1 | 0,48* | –0,94* | 1 | 0,49* | 0,86* | 1 |
| Mixed OM | | | | | | | | | |
| $C^i_{org}$ | 1 | | | 1 | | | 1 | | |
| $H_i$ | –0,30* | 1 | | –0,38* | 1 | | –0,02 | 1 | |
| $V_i$ | –0,12* | –0,03 | 1 | –0,30* | 0,63* | 1 | 0,06 | –0,39* | 1 |
| Humus OM | | | | | | | | | |
| $C^i_{org}$ | 1 | | | 1 | | | 1 | | |
| $H_i$ | –0,10 | 1 | | –0,43* | 1 | | –0,21* | 1 | |
| $V_i$ | –0,24* | 0,26* | 1 | –0,33* | 0,76* | 1 | –0,04 | 0,07 | 1 |

N o t e : * – statistically significant correlations.

Table 4

Regression equations

| OM type | Regression equations | $R$ | $p$ |
|---|---|---|---|
| Western zone | | | |
| Sapropel | $C^i_{org} = -0{,}0003H_i + 1{,}874$ | –0,3998 | 0,0725 |
| Mixed | $C^i_{org} = -0{,}00036H_i + 1{,}96$ | –0,3792 | 0,1474 |
| Humus | $C^i_{org} = -0{,}001H_i + 4{,}955$ | –0,4338 | 0,0148 |
| Sapropel | $C^i_{org} = 0{,}0074V_i - 0{,}0819$ | 0,4847 | 0,026 |
| Mixed | $C^i_{org} = -0{,}0041V_i + 0{,}864$ | –0,3019 | 0,2557 |
| Humus | $C^i_{org} = -0{,}0086V_i + 1{,}418$ | –0,3294 | 0,0704 |
| Eastern Zone | | | |
| Sapropel | $C^i_{org} = -0{,}00009H_i + 0{,}69$ | –0,363 | 0,4794 |
| Mixed | $C^i_{org} = -0{,}00002H_i + 0{,}54$ | –0,0201 | 0,9258 |
| Humus | $C^i_{org} = -0{,}0009H_i + 5{,}638$ | –0,207 | 0,1064 |
| Sapropel | $C^i_{org} = 0{,}0084V_i - 0{,}416$ | 0,4879 | 0,3263 |
| Mixed | $C^i_{org} = 0{,}0008V_i + 0{,}373$ | 0,0566 | 0,7926 |
| Humus | $C^i_{org} = -0{,}0026V_п + 1{,}476$ | –0,0413 | 0,75 |

The analysis of correlation coefficient values shows both positive and negative correlations of varying strength degrees between $C^i_{org}$ values and the selected indicators, as well as between the selected indicators themselves.

In the west, the $C^i_{org}$ of sapropel OM has a notable direct influence of $V_i$ and a weak influence of $H_i$ (negative correlation). In the east, there is also a moderate direct dependence on $V_i$, a weak inverse dependence on $H_i$. At the same time, within the Upper Pechora depression a noticeable inverse influence is exerted by the $H_i$, to a lesser extent by $V_i$ (direct correlation).

A weak inverse dependence on $H_i$ and $V_i$ was found for the $C^i_{org}$ of mixed OM in the west. To the east, no dependencies were found. In general, there occurred a weak negative relation with $H_i$, to a lesser extent – with $V_i$.

The $C^i_{org}$ of the humus OM in the western zone is markedly influenced by $H_i$ (inverse relation), and there is also a weak negative relation with $V_i$. In the east, a weak relation to $H_i$ is observed. In general, a weak correlation is found with $V_i$ (inverse relation), with $H_i$ it is defined at the boundary of statistical significance.

The regression equations describing the dependencies of the $C^i_{org}$ on the $H_i$ and $V_i$ values are given in table 4.

Table 4 shows that the values of r coefficients differ according to the type of OM and the tectonic structure, as well as the relations of studied indicators. It is evidenced from the intercept values of the regression equations and coefficient values of the studied indicators.

Geological structure of the Upper Pechora depression of the Cis-Ural foredeep and its asymmetry require consideration of $C^i_{org}$ formation regularities for each side. Therefore, linear discriminant analysis was carried out taking into account both the type of OM, and the tectonic structure. Thus, six groups have been distinguished.

As a result of linear discriminant analysis, the following linear discriminant functions have been constructed:

$$Z_1 = 0{,}184\,C^i_{org} - 0{,}014\,V_i + 0{,}0023H_i - 10{,}349$$

at $R = 0{,}85$, $\chi^2 = 220{,}5$, $p = 0{,}0000$;

$$Z_2 = -0{,}86\,C^i_{org} - 0{,}0076\,V_i - 0{,}0001H_i + 1{,}666$$

at $R = 0{,}36$, $\chi^2 = 25{,}85$, $p = 0{,}0011$.

$$Z_3 = 0{,}092\,C^i_{org} - 0{,}024\,V_i - 0{,}00028H_i + 2{,}616$$

at $R = 0{,}16$, $\chi^2 = 4{,}1$, $p = 0{,}2499$.

The linear discriminant functions $Z_1$ and $Z_2$ are statistically significant, $Z_3$ is not. The values of $Z_1$, $Z_2$ and $Z_3$ are calculated from these functions. Figure 1 shows that according to $Z_1$, $Z_2$ and $Z_3$ the sample is to some extent (58.7 %) divided into groups due to types of OM and tectonic zoning.

Stepwise regression analysis was also applied for the selected data of the western and eastern tectonic zones. As a result, 19 regression equations describing the dependencies of $C^i_{org}$ on $H_i$ and $V_i$ were constructed for the sapropel OM of western tectonic zone, and 4 for the eastern zone. Then 14 regression equations describing the dependencies of $C^i_{org}$ on $H_i$ and $V_i$ of the western regions were calculated for the mixed OM and 22 for the east, 29 and 60 regression equations for the humus OM, respectively.

From the graphs presented in figure 3 *a*, it can be seen that the changes in the free terms of the regression equations calculated for the western tectonic zone are quite similar for humus and mixed OM, while they differ significantly for sapropel OM. For sapropel OM, the $C^i_{org}$ values of the regression equations characteristic are corrected with the minus sign, while for humus and mixed OM – with the plus sign.

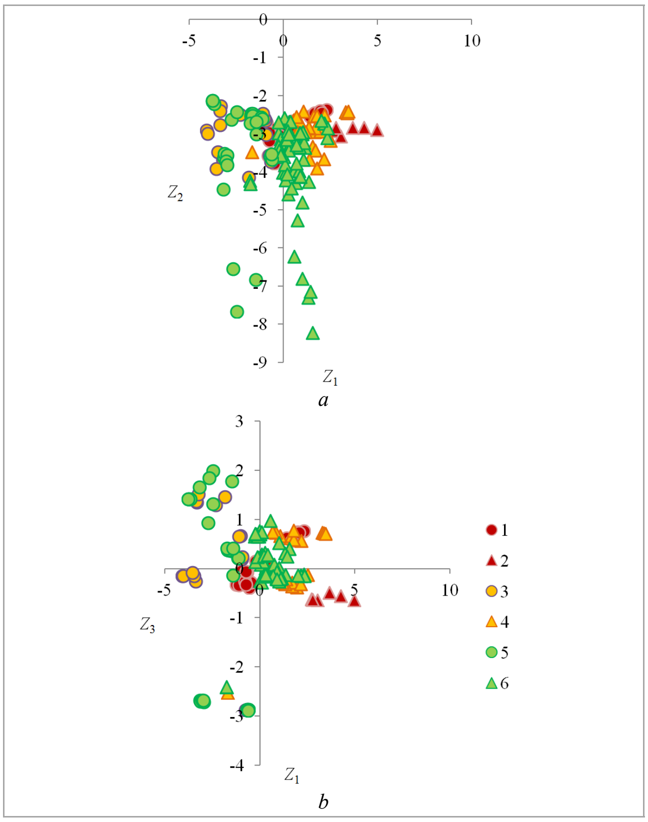


Fig. 1. The correlation between the values $Z_1$ and $Z_2$ (*a*), $Z_1$ and $Z_3$ (*b*) for the selected types and their distribution zones: *1* – western zone sapropel OM, *2* – eastern zone sapropel OM, *3* – western zone mixed OM, *4* – eastern zone mixed OM, *5* – western zone humus OM, *6* – eastern zone humus OM

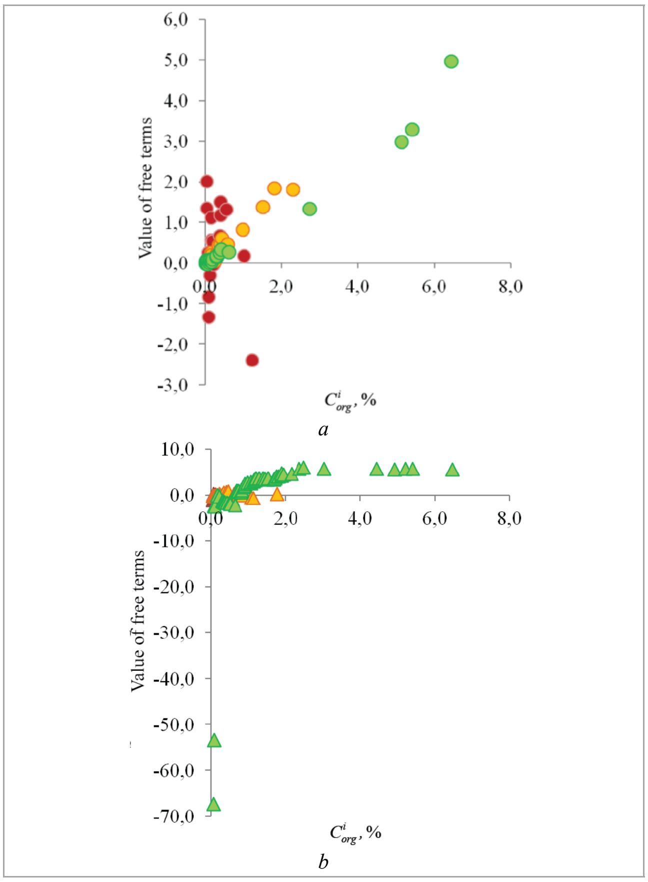


Fig. 2. Free terms changes of regression equations according to $C^i_{org}$ for different types of OM: *a* – western zone; *b* – eastern zone (see fig. 1 for conventional signs)

Graphs in Fig. 3, *b*, demonstrate that the free terms of the regression equations calculated for the eastern tectonic zone are significantly different for the sapropel and humus OM, and for the mixed OM are intermediate. The parameter values of the regression equations for the sapropel OM perform correction of $C^i_{org}$ values with the minus sign, while for humus – with the plus sign, and for the mixed OM practically have no influence.

The coefficient variations under $H_i$ of the regression equations in the west is close enough for humus and mixed OM and significantly different for sapropel OM. In the first case, the coefficient values under $H_i$ of regression equations adjust the $C^i_{org}$ values with the minus sign, while in the second case the value is corrected with the plus sign.

Within the eastern tectonic zone, the coefficient variations under $H_i$ of the regression equations also vary significantly between the sapropel and humus OM, and for the mixed OM it is intermediate. The analysis of the coefficient values under $H_i$ from Ciorg shows that for the sapropel and mixed OM the coefficient adjust $C^i_{org}$ values with the plus sign, while for the humus OM with the minus sign.

Changes in coefficients under $V_i$ of the regression equations calculated for the western regions differ for humus, mixed and sapropel OM. For all types of OM, the coefficient values under $V_i$ of the regression equations adjust the values with the plus sign, mainly for the sapropel OM. In the east, changes in coefficients under $V_i$ of regression equations differ significantly for humus OM, and are quite similar for mixed and sapropel OM. The analysis of the parameter values dependence of the regression equations on $C^i_{org}$, calculated for the eastern regions shows that for all types of OM coefficients under $V_i$ values of the regression equations perform adjustment of the $C^i_{org}$ values with the plus sign, first of all for sapropel OM.

The results of the stepwise regression analysis clearly show that $C^m_{org}$ model values are formed under fundamentally different conditions and depend both on the type of OM, and on the tectonic position.

When $C^i_{org}$ values are increased, the coefficients variation range of the R multiple correlation of the regression equations decreases significantly for all types of OM both in the western and eastern territory.

The changes analysis of the coefficients values and the level of statistical significance reached by *p* allowed to distinguish a certain trend of changes in the ratios *R* and *p* for the studied types of OM in both tectonic zones. This shows to some extent that the influence of $H_i$ and $V_i$ values on $C^i_{org}$ values is quite different.

In connection with the relations found and depicted above, the regression equations describing the dependencies of $C^i_{org}$ on $H_i$ and $V_i$ were calculated for the particular thicknesses, both for the whole studied area and the previously selected tectonic zones. The obtained regression equations were used to determine $C^i_{org}$ values based on tectonic characteristics. As a result, working maps of $C^i_{org}$ cal changes of selected deep sediments are constructed. Maps based on the calculations of regression equations for tectonic zones showed greater accuracy. Fig. 3 shows working maps of the $C^i_{org}$ cal and $C^i_{org}$ values changes in Lower Middle Visean deposits of the northeastern regions at the Upper Pechora depression.

## Conclusion

The application of probabilistic and statistical methods of analysis, one-dimensional and multidimensional modeling allowed to draw a number of conclusions.

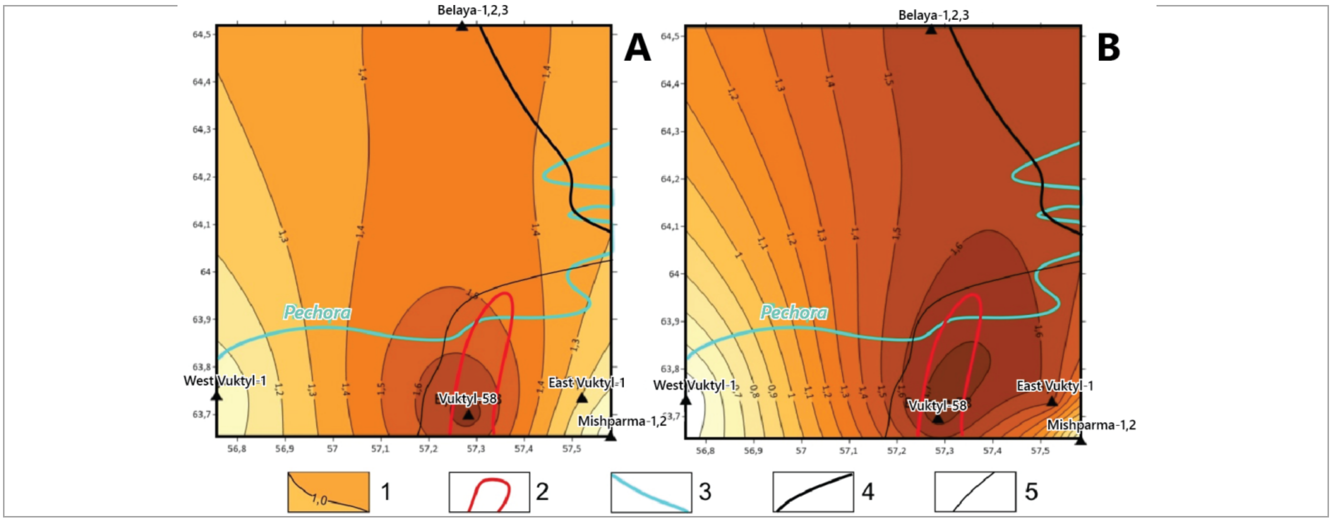


Fig. 3. Working maps of changes in $\dot{C}_{org}$ cal (*a*) and $\dot{C}_{org}$ (*b*) lower Middle Visean deposits of the northeastern regions of the Upper Pechora depression: *1* – isolines, *2* – contours of the Vuktyl oil - gas condensate field, *3* – river, *4* – border of the Upper Pechora depression, *5* – border of the Vuktyl thrust

The use of the t-criterion helped to determine the statistical differences in the average $\dot{C}_{org}$ values and the tectonic factors influencing it between the types of OM both for the Upper Pechora depression in the whole and within the tectonic zones in its sides.

Analysis of the correlation coefficient values showed that there are both positive and negative relation with varying degrees of strength between $\dot{C}_{org}$ and the selected indicators, as well as between the selected indicators themselves.

Discriminant analysis showed that the sample studied is divided into groups of both OM types and tectonic zones.

The analysis of the dependencies obtained as a result of the stepwise regression analysis revealed that in the change of regression equations parameters built for different OM types and tectonic zones there are noticeable inversions, which also shows the different conditions under which $\dot{C}_{org}$ values are formed.

From the ratios graph of *R* multiple correlation and the achieved level of statistical significance of *p* regression equations allowing to study the formation of $\dot{C}_{org}$, it is evident that there is a certain trend for the studied OM types (primarily humus OM) and tectonic zones. This shows that the influence of $H_i$ and $V_i$ values on $\dot{C}_{org}$ is quite different.

Thus, it is shown that the $\dot{C}_{org}$ value is influenced by $H_i$ and $V_i$ tectonic factors. It is worth noting that in the east of the territory their influence is less, due to the complex geological structure of the inner side of the Upper Pechora depression.

$H_i$ reflects the conditions of the appropriate stages of geological development, the features of which differed in the west and east of the territory, and $V_i$ also determines the balance of organic and mineral components of the sediment and geochemical facies in the sediment.

As a result, on the example of deep Lower Middle Visean deposits, it was shown that tectonic factors can be used to estimate the $\dot{C}_{org}$ initial concentration, valuable for this parameter being an important characteristic of oil-gas source rocks, though not always available.

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