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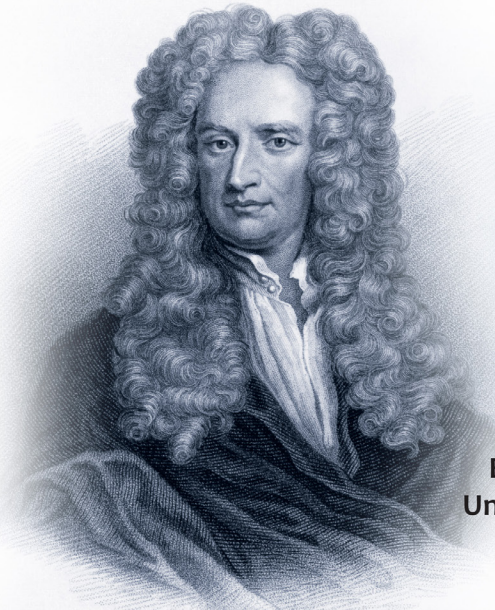

Birmingham
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# CONTENTS

# FORMATION PROCESS OF INNOVATIVE MODERNIZATION OF THE ECONOMY IN THE CONTEXT OF GLOBAL INSTABILITY

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**Abstract.** The relevance of the proposed article is due to the relevancy for innovative modernization of the Russian Federation national economy. The analysis of conceptual views on this issue points to many arguments, which indicates a divergence of theoretical positions. The widespread introduction at the world level of new information technologies leads to the gradual erasure of rigid national borders and an increase in transparency in foreign state interaction. It should be noted, that the specific structure of the Russian economy determines in almost all sectors of the economy the dominant position of state-owned corporations. Together with their special financial capabilities and the large available scientific potential, they determine their special place in the innovative, scientific and technological development of the country. In this regard, the formation of conditions for the success of the process of innovative modernization of the economy acquires significant importance. These circumstances determine the relevance of the topic of this study.

**Keywords:** innovation, innovative development, innovative modernization, factor-target management, strategic management, national economy.

Innovative modernization of the national economy presupposes the existence of prerequisites and conditions, based on which a transformation base is formed. Obviously, such transformations can be carried out in different ways.

First of all, they can be carried out taking into account situational and tactical features, when the emphasis is on solving current problems.

To a significant degree, the changes have taken place were made according to the scenario of the formation of the system in the context of the situational and tactical features which have been formed at the time of several transformations.

The imperative of the national economic system development on course to its innovative modernization is the inertial-imitation movement, given by similar processes in world space[1].

Each national economy as a kind of systemic formation contains a special potential, characterized by a set of conditions and factors used to produce a product in the form of a product or service with a set of properties with a definite level of competitiveness with varying degrees of productivity. This level can both meet the relevant world criteria and not reach the established competitiveness indicators. This is largely influenced by the forms and methods of organizing one or another activity, the area of use and inclusion of existing factors in the circulation, the technologies used to create the product.

Using the inertial imitation imperative right from the beginning of the movement in the line of intensification starves the intended acceleration.

At the same time, with a successful launch of the system, it is possible, subsequently, with an increase in the necessary potential, conditions and factors for overcoming the bar of competitiveness of economic partners in the market can be formed.

In our opinion, in such a scenario, it is important to ensure the stability of movement in a given direction, as well as the solidity and high quality of work.

In social production, there are such ideas, according to which the quality parameters are determined with the restriction of wear, temporary operation characteristics and much more, and performance indicators are evaluated from the standpoint of economic and social performance and environmental safety of the processes of creating a product in the form of a product or service intended for production or consumer use [2].

Innovative modernization involves the inclusion of parameters for the formation of the most effective and resulting factors that make up the potential of the national economy.

Moreover, its development is possible according to a scenario that does not give high returns in the near future, but in the strategic future very significant results can be expected.

That is why the choice of priority areas focused on achieving the intended goal is important.

This is seen as the task of strategic management of the national economy.

Obviously, the achievement of high parameters of the national economy requires the formation of prerequisites and their building, which would ensure the presence and interaction of factors of the adapted functioning of the economy, which sets the impetus for building a new economy.

Among the prerequisites for the implementation of innovative modernization of the national economic system, we distinguish such as:

– the degree of readiness of the entire national economy to implement innovative modernization. It is obvious that all elements of the national system, including macro-, meso- and micro-levels, should be prepared for the implementation of a phased sequential implementation of transformations. First of all, this involves determining the purpose of each level that makes up an element of the system, the time of implementation of the general target setting. Such a scheme can be checked by forecasting, showing both the result for each level and the overall result of the entire system when implementing a specific scheme. Since forecasting is based on several options, it is obvious that at least three reform scenarios will be formed, including optimistic, pessimistic and close to real ones. In our opinion, development scenarios can be calculated according to a small number of options;

– the formation of the necessary infrastructure, which allows for the process of gradual innovative transformation of the Russian economy. Such an infrastructure promotes the movement of information, investment and cash flows both within the national economy and in the space of economic interaction with partners, makes it possible to obtain the necessary information from the global information network, and track global innovation processes. The level of development of the market production and social infrastructure should be adapted to the level of problems to be solved so that the modernization process is accompanied by information mobility, transparency, continuity and constancy;

– the implementation of innovative modernization of the national economy requires the development of modern schemes and models for its implementation. In this case, the hierarchical peculiarity of building the country's economy with the elaboration of the contribution of each level, each enterprise and organization.

Strategic planning of innovative modernization of the national economy involves the coordination of the entire resource potential, including indicators of the labor potential involved in the process, calculations on its availability, assessment of quantity, quality and qualifications.

In addition, an important characteristic of the resource potential is the determination of the parameters of the proposed technological level, the determination of the prerequisites [3].

Fulfillment of innovative modernization is attributed to the development of conceptual basis for strategic management of the process of the Russian economy innovative modernization.

Much attention is paid to defining fundamental provisions such as:

- target settings for carrying out transformations;
- tasks that are solved to achieve the intended goals;
- the principles and criteria underlying the taken decisions, by which the results of the ongoing changes are evaluated;
- forms and methods of managing the processes of innovative industrialization, including system-wide, applied in management, and specific, aimed at solving the problems of industrialization;
- organization of the process, characterized by the presence of structural components involved in the industrialization;
- mechanisms for implementing the process, ensuring the implementation of the process in a constant mode, activating movement in a positive direction and neutralizing the negative impact of internal and external conditions.

The goals of implementing innovative modernization characterize the ultimate purpose of the transformation, it contains targets that are aimed at improving the welfare of citizens of the country, at creating the necessary conditions that make it possible to improve the quality and standard of living of the population through the provision of socio-economic development and the preservation of ecological balance [4].

Achieving the goals of modernization is achieved by solving problems that are focused on key, most important and significant directions of development of an innovative economy.

First of all, it is necessary to focus on the modernization of the managing and managed subsystems.

The managed subsystem in the overall innovation modernization management system includes:

- innovative and technological sphere;
- an educational complex that forms the potential of skilled workers serving the innovative economy;
- innovative construction complex;
- infrastructure complex (social, industrial, informational, financial infrastructure).

Innovative modernization presupposes the presence of basic conditions that form the basis of the upcoming transformations.

At the second stage, it is supposed to evaluate a special mesoclimat, which involves an analysis of spatial economic dynamics by assessing industry specialization [5].

The following complementary indices can be used as methodological tools for assessing industry specialization:

1) *Krugman index* is determined by the formula (5):

$$I_{KSI} = V_{ITJ} / V_{IT} \quad (1)$$

where J – region of the country;

$V_{ITJ}$ – gross added value of IT industry in the region;

$V_{IT}$ – gross added value of IT industry in the country.

$I_{KSI}$ – modified index KSI

2) *Herfindahl-Hirschman Index* is determined by the formulas (2) and (3):

$$IJ_{HHI} = (V_{IT}/V_{GRP} * 100\%)^2 \quad (2)$$

where J – region of the country;

$V_{IT}$ – gross added value of IT industry in the region;

$V_{GRP}$ – region gross added value;

$IJ_{HHI}$ – HHI index for the J-th region in the IT industry.

The final aggregated Herfendal-Hirschman index ($I_{HHI}$) for the IT industry will be the arithmetic average of the individual indices ($IJ_{HHI}$) of each region:

$$I_{HHI} = \sum^{n} (IJ_{HHI})^2 \quad (3)$$

where n – number of regions;

$IJ_{HHI}$ – HHI index for the J-th region in the IT industry;

$I_{HHI}$ – aggregated HHI index.

At the third stage, an assessment of the special microclimate is expected, which involves an analysis of the capabilities of the FEZ (free economic zone) and infrastructure facilities.

The result of the research will be a study of the organizational and economic opportunities for the formation of free economic zones and infrastructure sites (innovation, information and communication).The successful launch of innovative modernization is largely determined by the choice of directions of transformation parameters [6].

The stages of the study require the development of theoretical aspects of managing the process of modernization of the national economy.

Each stage of development of the economic system is based on an assessment of what has been achieved and determining the prospects for its adaptation with a new solution.

From these positions, it becomes necessary to identify the main prerequisites and conditions for innovative modernization, based on assessing the potential for transformation, choosing development directions and priorities taking into account the resource potential, determining the scale and volume of necessary investments, depending on the chosen path, timing and stages of successive changes.

In developing the theoretical principles of process control, it is necessary to proceed from an assessment of the prevailing conditions in the national economy.

The most important point is the choice of approaches in the implementation of innovative improvement of the Russian economy [7].

Through the lack of availability of resources for the modernization process, there is a need to highlight the key elements, models of innovative modernization.

First of all, the choice of development scenarios with the subsequent development of the model, its main system components, is determined.

Innovative modernization of the national economy has a complex structured solution, since the national economy is formed as an ambiguous multilevel hierarchical organization consisting of macro, meso and micro levels.

Moreover, each of the levels is aimed at solving multifunctional problems. If we consider the national system from the standpoint of sustainability, then its transformation should be administered bearing in mind the social, economic and environmental components, each of which can be evaluated by a set of characteristics [8].

Sustainable development involves a conjugate combination of selected subgoals. The path to the goal depends on the complex interweaving of various factors.

The development of a scenario for moving towards the most advanced management organization will allow the formation of a national system corresponding to the innovation economy, which is the most important task of applying the factor-target management methodology. The definition of such a scenario involves the use of strategic management mechanisms.

The need for structural reorientation of the economic complex to more advanced ones should be read from the perspective of innovativeness of the development direction.

From these positions, a reorientation towards an increase in the share of those areas of activity that are associated with the formation of industries corresponding to higher technological structures, representing the current level of scientific and technological progress and requiring the use of innovative technologies, can become promising [9].

An important factor in the formation of an innovative management system, in our opinion, is the organization of production infrastructure that serves the basic specialization of the entire economy.

The stability and continuity of interaction in the economic functioning and provision of basic industries and fields of activity depends on it.

In the economic organization of innovativeness of the country's economic complex, it is necessary to highlight the advancement of social infrastructure, which determines the provision of the sphere serving the country's population. It forms the human capital involved in the functioning of the national economic system.

Obviously, the direct increase in innovation activity is associated with the possibility of the participation of one of the most important economic factors, such as human capital, in the country's innovative transformation, which requires an increase in the level of innovation in the environment where this factor arises and forms.

With the accumulation of the innovative potential of social infrastructure, there is simultaneously a corresponding development of human resources in the form of increasing the physical, intellectual, labor capabilities of a person who is ready to create innovative products.

Throughout the economic complex, there is a need for the formation and development of innovative market infrastructure, which, in particular, ensures the movement of goods and cash flows[10].

In modern conditions, it seems insufficient to participate in the country's innovation process of banking, insurance and other areas. In fact, all sorts of projects that have innovative characteristics have an increased risk of not getting a predicted result. This restrains the process of innovative development of the national economy, which cannot be carried out without adapted, gradual, interested participation in it of the market infrastructure of the country's economy.

Noting the low positions of innovation both in the Russian Federation as a whole and in the context of individual regions by type of business operations, it should be pointed out that the level of innovativeness in the operation of the domestic economy depends largely on the advanced management system building, which is characterized by the use of productive methodological approaches of the relevant organization, and the ability to neutralize the impact negative external and internal factors and prerequisites, the ability to focus available resources to ensure the effective effectiveness of economic processes.

This largely depends on the formation of the economic structure of the economy, on how rationally it is organized. Economic efficiency is undoubtedly influenced by the degree of innovation of the basic sectors of the national economy.

To adapt to the new paradigm of knowledge, developing systems will have to become an institutionally transforming economy.

The current modernization of the national economy needs to be systematic.

The factor-targeted approach is touted as an intrinsic part of the concept of factor-targeting of the innovation-driven development of the economy, where the set of core drivers can vary exponentially with the targeting of specific stages of development.

At the same time, the starting point in the development of the factor-target regulatory model is a conceptual idea that reflects the most important qualitative and quantitative characteristics of specific areas of development.

The occurrence of new information and communication technologies, new more advanced production technologies led to the development of new organizational forms of production and management, which significantly reduced the demand for both obsolete technologies and the corresponding forms of organization and management [11].

The innovative situational approach has been developed in the global economy.

The *systemic heuristic* approach, which reflects the latest research in the field of management organization, is among the systemic approaches that are most consistent with the innovative type of economic development.

Its supporters are trying to find the optimal, balanced unity of various organizational structures located at different stages of the life cycle (nuclear-organic network of organizational structures), and also involve various management mechanisms, including factor-targeted for each unit, block of a complex production system [12].

Basically, researchers of the system-heuristic approach are working on creating projects of "companies of the future".

The conceptual idea will be embodied in the current system of economic regulation through the development of the following measures:

- statement of the general goal or task;
- evaluation of the country's economic situation, diagnosis of key problems and forecasting the results of the application of certain regulatory measures;
- planning regulatory activities and developing programs and plans for their application, as well as planning structural changes in the current regulatory system;
- implementation of the developed approaches and regulatory methods based on their implementation in the economic policy of the state.

Based on the study, the following conclusions and suggestions are made:

Achievement of the goals of modernization is provided by solving problems that are focused on key, most important and significant directions of development of an innovative economy. First of all, it is necessary to focus on the modernization of the managing and managed subsystems. The first is related to the adaptation of public administration to solve innovative problems. It is obvious that public administration is building a promising model that will act in a strategic perspective with the definition of stages in the short and medium term.

Thus, the combination of strategic and tactical approaches of the modernization process is carried out. In the implementation and solution of public administration tasks, an important role is played by the formation of structures that provide guidance to the movement towards modernization.

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# THE CALCULATION OF 3D GRAPHS OF THE X2SU VARIABLE FOR THE SSU PARAMETER

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**Abstract.** Here is reviewed a practical issue of making calculations to obtain a value of the X2su variable, to which end are used X1, X3, X4 variables and the Ssu parameter. The values of the X2su variable obtained allow to identify limits within which they can exist.

**Keywords:** X2su calculated variable, GDP-defining Ssu parameter, 3D graphs, Excel.

The author had previously carried out calculations of the volume of the economic shell Ssu (GDP), described in the older articles. The article below shows how the values of three variables X1, X3 and X4 and of the parameter Ssu (GDP) affect calculations of the variable X2su and plotting of 3D graphs. In this case, the values of the variables may remain constant, increase or decrease by a factor of 10. That is to say the changes of X2su = f(X1, X3, X4, Ssu) are being evaluated. This article addresses only 34 out of 83 options of 3D graphs.

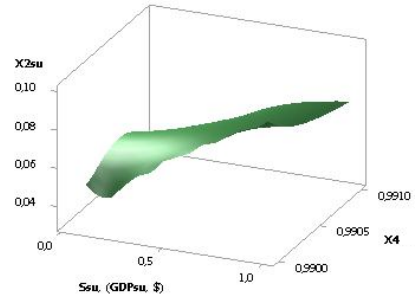


**Рис. 1. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = X4 = 1, Ssu = 0,1..1**

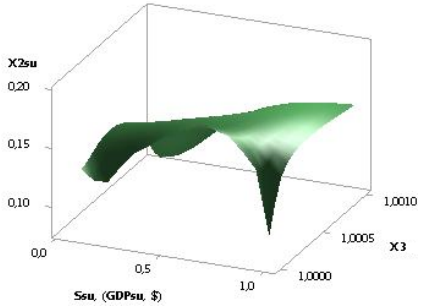


**Рис. 2. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1, X4 = Ssu = 0,1..1**

Thus, Figure 1 shows a 3D graph of the X2su dependence, with the variables having the following values X1 = X3 = X4 = 1, Ssu = 0.1..1. As seen in this figure, the X2su values increase by a factor of 3.16. The next Figure 2 shows a 3D graph for X2su, with variables X1 = X3 = 1, X4 = Ssu = 0,1..1, where we see its maximum of 0.19 in point 7.

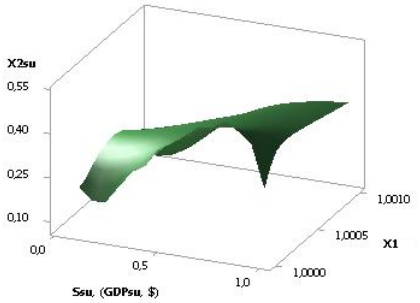


**Рис. 3. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = 1..10, X4 = Ssu = 0,1..1**

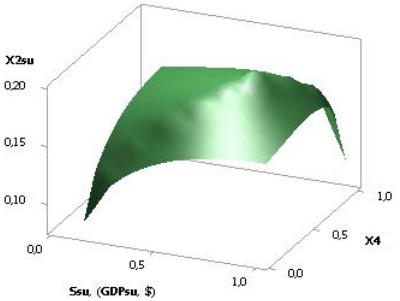


**Рис. 4. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..10, X4 = Ssu = 0,1..1**

Two Figures 3 and 4 represent two 3D graphs for X2su, with the variables X1 = 1, X3 = 1..10, X4 = Ssu = 0,1..1 and X1 = X3 = 1..10, X4 = Ssu = 0,1..1 respectively. As seen in Figure 3, the plotted X2su dependence reaches its maximum of 0.52 in point 8. The 3D graph in Figure 4 reaches its maximum of 0.19 in point 7 as well.

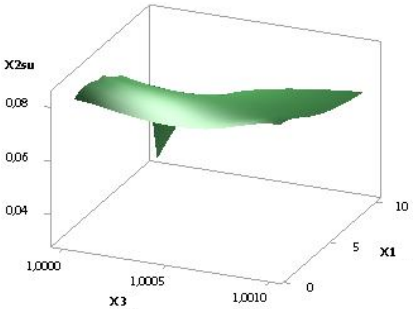


**Рис. 5. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..10, X3 = 1, X4 = Ssu = 0,1..1**

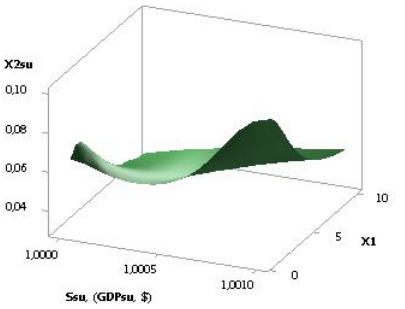


**Рис. 6. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..10, X3 = 1, X4 = Ssu = 0,1..1**

The values calculated for the X2su dependence in Figure 5 with the variables X1 = 1..10, X3 = 1, X4 = Ssu = 0,1..1 decreases by a factor of 2.6. In Figure 6 the values of X2su for the 3D graph with X1 = 1..10, X3 = 1, X4 = Ssu = 0,1..1 decrease by a factor of 3.16.

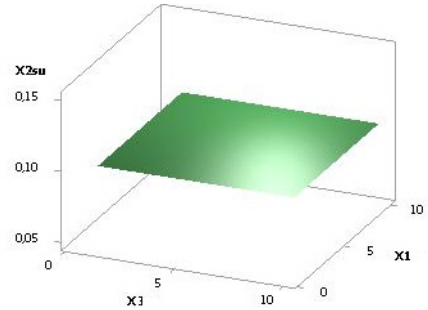


**Рис. 7. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..10, X4 = Ssu = 1**

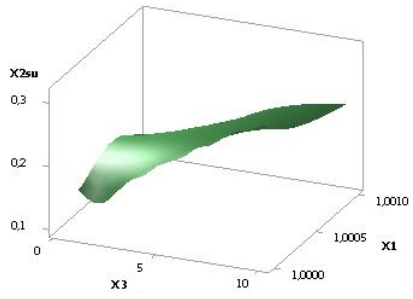


**Рис. 8. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..10, X4 = Ssu = 1**

The 3D graphs in Figures 7 and 8 were plotted with X1 = X3 = 1..10, X4 = Ssu = 1 and X1 = X3 = 1..10, X4 = Ssu = 1 respectively. Here, in Figure 7, the values of the variable X2su remain constant and in Figure 8 they increase by a factor of 3.16.

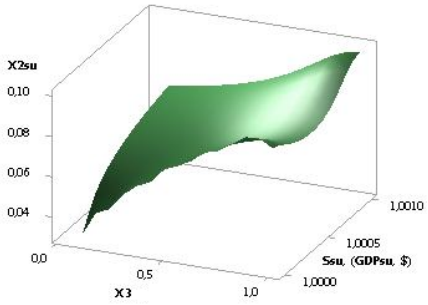


**Рис. 9. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = 1..0,1, X4 = Ssu = 1**

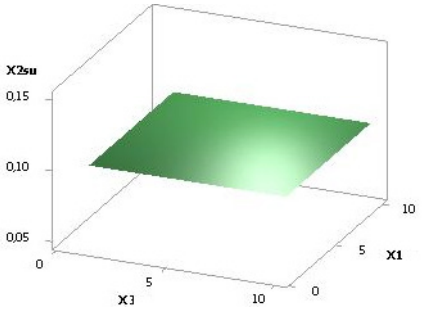


**Рис. 10. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..0,1, X4 = Ssu = 1**

The next 3D graphs in Figures 9 and 10 were plotted with X1 = 1, X3 = 1..0,1, X4 = Ssu = 1 and X2 = 1..0,1, X3 = Ssu = 1 respectively. Here, in Figure 9, X2su decreases by a factor of 3.16. In Figure 10 the values of X2su remain constant.

Figures 11 and 12 demonstrate that two plotted 3D graphs for X2su with X1 = 1..0,1, X3 = X4 = Ssu = 1 and X1 = X3 = 1, X4 = 1..0,1, Ssu = 0,1..1 increase by a factor of 3.16 and 8.4 respectively.

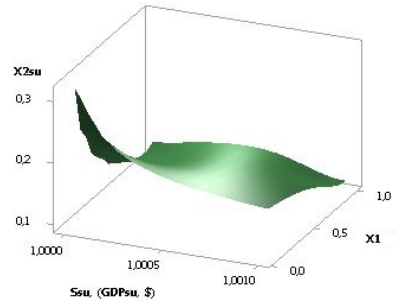


**Рис. 11. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..0,1, X3 = X4 = Ssu = 1**

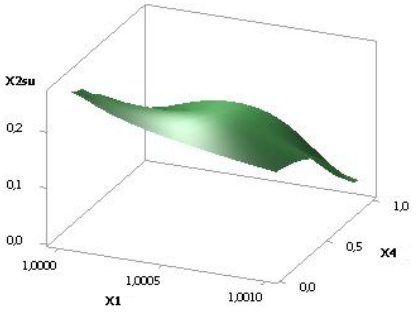


**Рис. 12. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1, X4 = 1..0,1, Ssu = 0,1..1**

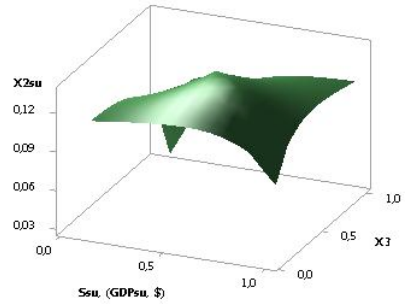


**Рис. 13. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = X4 = 1..0,1, Ssu = 0,1..1**

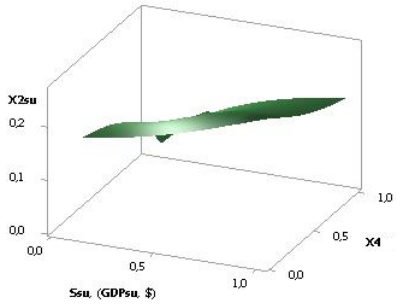


**Рис. 14. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1, X4 = 1..0,1, Ssu = 0,1..1**

In Figure 13 the 3D graph reaches its maximum 0.134 in point 6, and in Figure 14 the values of X2su increase by a factor of 8.4. These Figures were plotted with X1 = 1, X3 = X4 = 1..0,1, Ssu = 0,1..1 and X1 = X3 = 1, X4 = 1..0,1, Ssu = 0,1..1 respectively.

Figure 15 shows that the 3D graph for X2su with the variables X1 = X4 = 1..0,1, X3 = 1, Ssu = 0,1..1 increases by a factor of 26.56. In Figure 16 the 3D graph for X2su and X1 = 1, X3 = 1..0.1, X4 = 1, Ssu = 0,1..1 reaches its maximum 0.134 in point 5.

The 3D graph for X2su, depicted in Figure 17, apparently reaches its maximum 0.19 in point 7. This graph was plotted with the following values of variables X1 = X3 = 1..0,1, X4 = 1, Ssu = 0,1..1. The next 3D graph in Figure 18 was plotted with variables X1 = 1..0,1, X3 = 1, X4 = Ssu = 0,1..1. Here, the 3D graph for X2su reaches its maximum 0.38 in point 9.

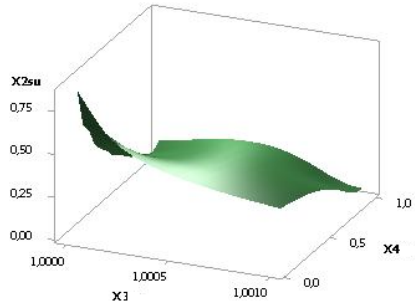


**Рис. 15. X2su = f(X1, X3, X4, Ssu)**
**X1 = X4 = 1..0,1, X3 = 1, Ssu = 0,1..1**

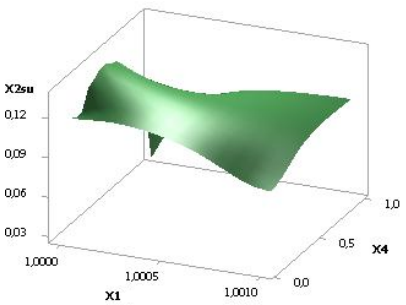


**Рис. 16. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = 1..0,1,**
**X4 = 1, Ssu = 0,1..1**

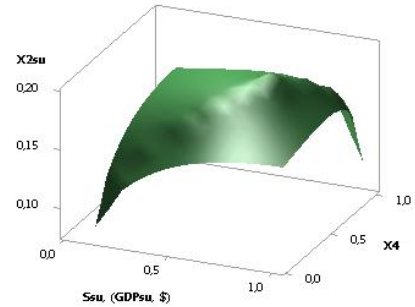


**Рис. 17. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..0,1, X4 = 1, Ssu = 0,1..1**

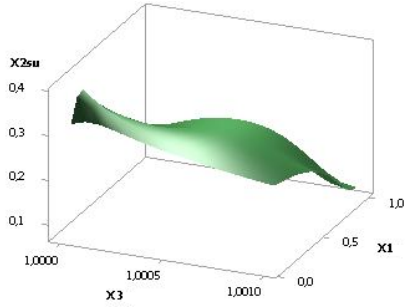


**Рис. 18. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..0,1, X3 = 1, X4 = Ssu = 0,1..1**

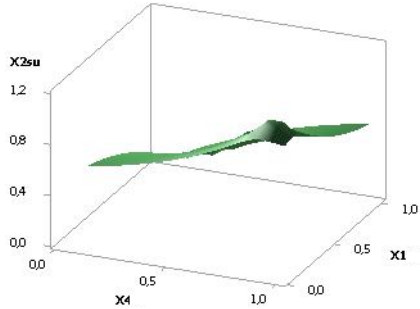


**Рис. 19. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..0,1, X3 = 1..10,**
**X4 = Ssu = 0,1..1**

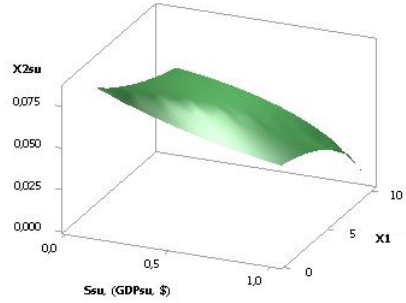


**Рис. 20. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..10, X3 = 1..0,1,**
**X4 = Ssu = 0,1..1**

The following variables X1 = 1..0,1, X3 = 1..10, X4 = Ssu = 0,1..1 were used to plot a 3D graph in Figure 19. The obtained 3D graph for X2su reaches its maximum 1.13 in point 9. Figure 20 shows a 3D graph for X2su with X1 = 1..10, X3 = 1..0,1, X4 = Ssu = 0,1..1, where we see that X2su decreases by a factor of 8.4.

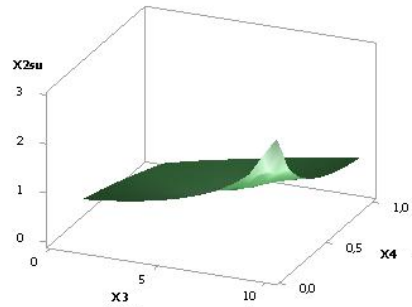


**Рис. 21. X2su = f(X1, X3, X4, Ssu) X1 = 1..0,1, X3 = 1..10, X4 = 1..0,1, Ssu = 0,1..1**

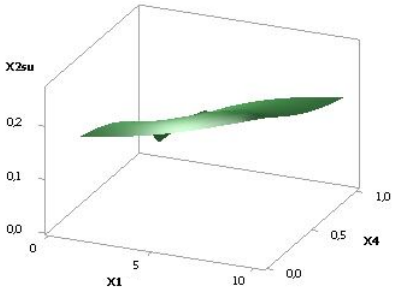


**Рис. 22. X2su = f(X1, X3, X4, Ssu) X1 = 1..0,1, X3 = 1..10, X4 = 1..0,1, Ssu = 0,1..1**

In Figure 21, the 3D graph for X2su with variables X1 = 1..0,1, X3 = 1..10, X4 = 1..0,1, Ssu = 0,1..1 increases by a factor of 83.99. In Figure 22 the plotted 3D graph X2su increases by a factor of 8.4 with variables X1 = 1..0,1, X3 = 1..10, X4 = 1..0,1, Ssu = 0,1..1.

The 3D graphs for X2su, represented in Figures 23 and 24, in both cases reach their maximum 0.059 in point 4 and 0.164 in point 3 respectively. Here, the values of variables X1 = 1..10, X3 = X4 = 1..0,1, Ssu = 0,1..1 and X1 = 1, X3 = X4 = Ssu = 1..0,1 were used to plot the 3D graphs for X2su.

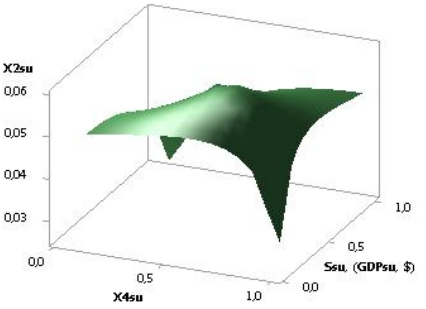


**Рис. 23. X2su = f(X1, X3, X4, Ssu) X1 = 1..10, X3 = X4 = 1..0,1, Ssu = 0,1..1**

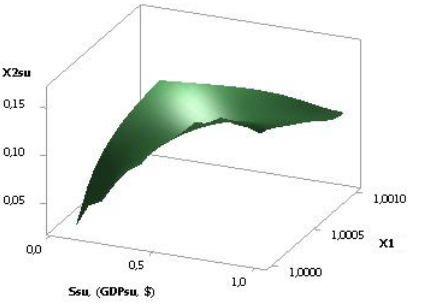


**Рис. 24. X2su = f(X1, X3, X4, Ssu) X1 = 1, X3 = X4 = Ssu = 1..0,1**

As seen in Figure 25, the 3D graph for X2su reaches its maximum 0.19 in point 4 with variables X1 = X3 = X4 = Ssu = 1..0,1 and the plotted 3D graph for X2su with X1=1 increases by a factor of 2.66 in Figure 26.

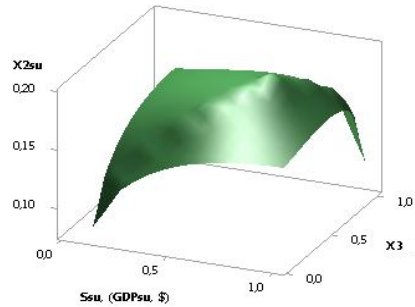


**Рис. 25. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = X4 = Ssu = 1..0,1**

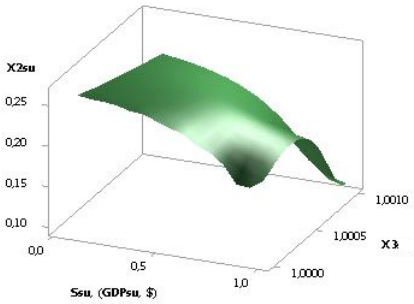


**Рис. 26. X2su = f(X1, X3, X4, Ssu)**
**X1 = X4 = Ssu = 1..0,1, X3 = 1**

In Figure 27, the X2su variable has its maximum 0.19 in point 4, while in Figure 28 its maximum 0.424 is in point 6. These 3D graphs were plotted with variables X1 = X3 = 1, X4 = Ssu = 1..0,1 and X1 = X3 = 1, X4 = 0,1..1, Ssu = 1..0,1..

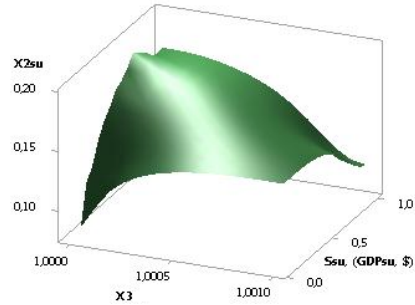


**Рис. 27. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1, X4 = Ssu = 1..0,1**

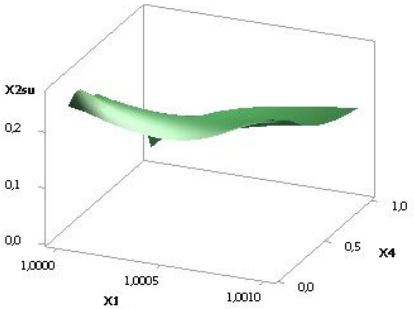


**Рис. 28. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3= 1, X4 = 0,1..1, Ssu = 1..0,1**

As seen in Figure 29, the 3D graph for X2su reaches its maximum 0.42 in point 5 with variables X1 = 1, X3 = 1..10, X4 = 0,1..1, Ssu = 1..0,1, and in Figure 30 the plotted 3D graph for X2su with X1 = 1, X3 = 1..10, X4 = 1..0,1, Ssu = 1..10 reaches its maximum 0.42 in point 6.

As seen in Figure 31, the variable X2su reaches its maximum 0.19 in point 4, while in Figure 32 its maximum 0.59 is in point 7. These 3D graphs were plotted with variables X1 = 1..10, X3 = 1..0,1, X4 = 1..0,1, Ssu = 1..10 and X1 = X3= 1..0,1, X4 = 0,1..1, Ssu = 1..10.

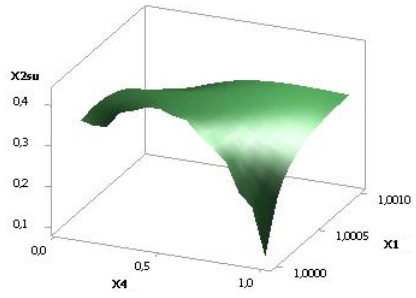


**Рис. 29. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = 1..10, X4 = 0,1..1,**
**Ssu = 1..0,1**

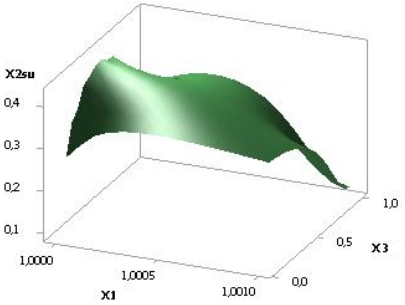


**Рис. 30. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1, X3 = 1..10, X4 = 1..0,1,**
**Ssu = 1..10**

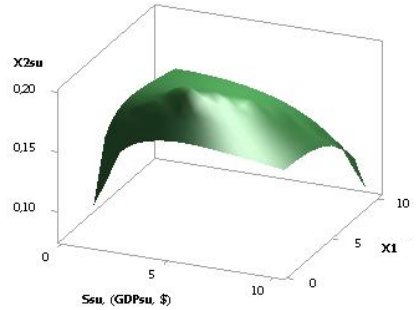


**Рис. 31. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..10, X3 = 1..0,1, X4 = 1..0,1,**
**Ssu = 1..10**

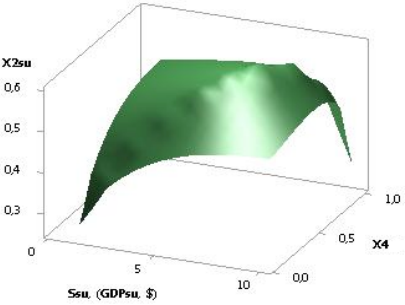


**Рис. 32. X2su = f(X1, X3, X4, Ssu)**
**X1 = X3 = 1..0,1, X4 = 0,1..1,**
**Ssu = 1..10**

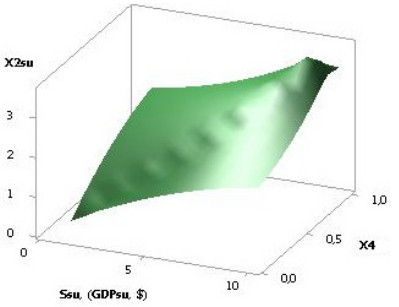


**Рис. 33. X2su = f(X1, X3, X4, Ssu)**
**X1 = 1..0,1, X3 = 1..10, X4 = 0,1..1,**
**Ssu = 1..10**

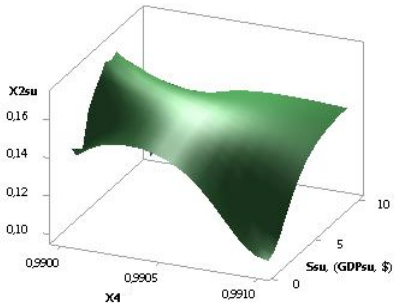


**Рис. 34. X2su = f(X1, X3, X4, Ssu)**
**X1 = X4 = 1, X3 = 1..0,1,**
**Ssu = 1..10**

In Figure 33, the X2su variable has its maximum 3.56 in point 9, and in Figure 34 its maximum 0.17 is in points 5 and 6. These 3D graphs were plotted with variables X1 = 1..0,1, X3 = 1..10,X4 = 0,1..1,Ssu = 1..10 и X1 = X4 = 1,X3= 1..0,1, Ssu = 1..10.

The obtained calculations were used as a basis for the combined Table 1 which included both the calculated values of the X2su variable and other values involved in the calculations. Here, the variables X2suf and X2suf signify the starting and final values of the X2su variable and indicate by which factor the X2su value did increase or decrease. This table includes calculations with X2suf / X2sub > 1.

**Table 1. Arranging the ratios of X2suf / X2suf parameters in descending order**

| № п/п | X1, ед. | X2su, ед. | X3, ед. | X4, ед. | Ssuf, ед.$^2$ (GDPsuf, $) | X2suf / X2sub |
|---|---|---|---|---|---|---|
| 1 | 1…0.1 | 0.03…2.62 | 1… 10 | 0.99…0.1 | 0.1…1 | 83.99 |
| 2 | 1…0.1 | 0.1…8.28 | 1… 10 | 0.99…0.1 | 1…10 | 83.99 |
| 3 | 1…0.1 | 0.03…0.83 | 1 | 0.99…0.1 | 0.1…1 | 26.56 |
| 4 | 1…0.1 | 0.1…2.62 | 1 | 0.99…0.1 | 1…10 | 26.56 |
| 5 | 1…0.1 | 0.1…2.62 | 1 | 0.99…0.1 | 1…10 | 26.56 |
| 6 | 1…0.2 | 0.13…0.99 | 1…9 | 0.1…0.89 | 0.1…0.9 | 13.59 |
| 7 | 1…0.2 | 0.26…3.56 | 1…9 | 0.1…0.89 | 1…9 | 13.59 |
| 8 | 1 | 0.1…0.99 | 1…10 | 0.99 | 1…10 | 10.00 |
| 9 | 1…0.1 | 0.1…0.99 | 1 | 0.99 | 1…10 | 10.00 |
| 10 | 1 | 0.03…0.26 | 1 | 0.99…0.1 | 0.1…1 | 8.40 |
| 11 | 1…0.1 | 0.03…0.26 | 1…0.1 | 0.99…0.1 | 0.1…1 | 8.40 |
| 12 | 1…10 | 0.03…0.26 | 1…10 | 0.99…0.1 | 0.1…1 | 8.40 |
| 13 | 1 | 0.1…0.83 | 1 | 0.99…0.1 | 1…10 | 8.40 |
| 14 | 1…0.1 | 0.1…0.83 | 1…0.1 | 0.99…0.1 | 1…10 | 8.40 |
| 15 | 1…10 | 0.1...0.83 | 1… 10 | 0.99…0.1 | 1…10 | 8.40 |
| 16 | 1…0.1 | 0.1…0.83 | 1…0.1 | 0.99…0.1 | 1…10 | 8.40 |
| 17 | 1 | 0.08…0.52 | 1…8 | 0.1…0.79 | 0.1…0.8 | 6.27 |
| 18 | 1 | 0.03…0.13 | 1…0.5 | 0.99…0.5 | 0.1…0.6 | 6.00 |
| 19 | 1…0.2 | 0.08…0.38 | 1 | 0.1…0.89 | 0.1…0.9 | 4.53 |
| 20 | 1…0.2 | 0.26…1.19 | 1 | 0.1…0.89 | 1…9 | 4.53 |
| 21 | 1 | 0.1…0.42 | 1…0.5 | 0.99…0.5 | 1…6 | 4.30 |
| 22 | 1 | 0.1…0.42 | 1…0.5 | 0.99…0.5 | 1…6 | 4.30 |
| 23 | 1 | 0.31…1.34 | 1…6 | 0.99…0.5 | 10…5 | 4.30 |
| 24 | 1 | 0.03…0.1 | 1 | 0.99 | 0.1…1 | 3.16 |
| 25 | 1 | 0.1…0.31 | 1…10 | 0.99 | 1 | 3.16 |
| 26 | 1 | 0.1…0.31 | 1 | 0.99 | 1 | 3.16 |
| 27 | 1…10 | 0.1…0.31 | 1…10 | 0.99 | 1…10 | 3.16 |

| № п/п | X1, ед. | X2su, ед. | X3, ед. | X4, ед. | Ssuf, ед.$^2$ (GDPsuf, $) | X2suf / X2sub |
|---|---|---|---|---|---|---|
| 28 | 1…0.1 | 0.1…0.31 | 1…0.1 | 0.99 | 1…10 | 3.16 |
| 29 | 1…0.1 | 0.1…0.26 | 1 | 0.99…0.1 | 1…0.1 | 2.66 |
| 30 | 10…1 | 0.1…0.26 | 1 | 0.99…0.1 | 10…1 | 2.66 |
| 31 | 1…0.1 | 0.31…0.83 | 1 | 0.99…0.1 | 10…1 | 2.66 |
| 32 | 1 | 0.08…0.19 | 1 | 0.1…0.69 | 0.1…0.7 | 2.25 |
| 33 | 1…7 | 0.08…0.19 | 1…7 | 0.1…0.69 | 0.1…0.7 | 2.25 |
| 34 | 1…0.4 | 0.26…0.59 | 1…0.4 | 0.1…0.69 | 1…7 | 2.25 |
| 35 | 1…4 | 0.03…0.06 | 1…0.7 | 0.99…0.69 | 0.1…0.4 | 1.89 |
| 36 | 1…0.7 | 0.1…0.19 | 1…0.7 | 0.99…0.69 | 1…0.7 | 1.89 |
| 37 | 1 | 0.1…0.19 | 1 | 0.99…0.69 | 1…0.7 | 1.89 |
| 38 | 4…10 | 0.19…0.08 | 0.7…0.1 | 0.69…0.1 | 4…10 | 1.89 |
| 39 | 1…4 | 0.31…0.59 | 1…4 | 0.99…0.69 | 10…7 | 1.89 |
| 40 | 10…7 | 0.31…0.59 | 10…7 | 0.99…0.59 | 10…7 | 1.89 |
| 41 | 1…0.7 | 0.31…0.59 | 1…0.7 | 0.99…0.69 | 10…7 | 1.89 |
| 42 | 1 | 0.1…0.17 | 1…0.6 | 0.99 | 1…5 | 1.73 |
| 43 | 1 | 0.31…0.54 | 1…5 | 0.99 | 10…6 | 1.73 |
| 44 | 1 | 0.13…0.08 | 0.5…0.1 | 0.5…0.1 | 0.6…1 | 1.67 |

Table 1 was used as a basis for Table 2, in which all the values of the X2suf / X2sub ratios are sorted in descending order. This allowed for the selection of the required X2su value depending on the number of variables considered.

**Table 2. Statistics of variables for X2suf / X2sub in descending order by groups**

| № п/п | X1, ед. | X2su, ед. | X3, ед. | X4, ед. | Ssuf, ед.$^2$ (GDPsuf, $) | X2suf / X2sub |
|---|---|---|---|---|---|---|
| **All remain constant** | | | | | | |
| 1 | 1 | 0.1…0.31 | 1 | 0.99 | 1 | 3.16 |
| **1 variable** | | | | | | |
| 2 | 1 | 0.03…0.1 | 1 | 0.99 | 0.1…1 | 3.16 |
| 3 | 1 | 0.1…0.31 | 1…10 | 0.99 | 1 | 3.16 |
| **2 variables** | | | | | | |
| 4 | 1 | 0.1…0.99 | 1…10 | 0.99 | 1…10 | 10.00 |
| 5 | 1…0.1 | 0.1…0.99 | 1 | 0.99 | 1…10 | 10.00 |
| 6 | 1 | 0.03…0.26 | 1 | 0.99…0.1 | 0.1…1 | 8.40 |
| 7 | 1 | 0.1…0.83 | 1 | 0.99…0.1 | 1…10 | 8.40 |
| 8 | 1 | 0.08…0.19 | 1 | 0.1…0.69 | 0.1…0.7 | 2.25 |
| 9 | 1 | 0.1…0.19 | 1 | 0.99…0.69 | 1…0.7 | 1.89 |

| № п/п | X1, ед. | X2su, ед. | X3, ед. | X4, ед. | Ssuf, ед.$^2$ (GDPsuf, $) | X2suf / X2sub |
|---|---|---|---|---|---|---|
| **3 variables** | | | | | | |
| 10 | 1…0.1 | 0.03…0.83 | 1 | 0.99…0.1 | 0.1…1 | 26.56 |
| 11 | 1…0.1 | 0.1…2.62 | 1 | 0.99…0.1 | 1…10 | 26.56 |
| 12 | 1…0.1 | 0.1…2.62 | 1 | 0.99…0.1 | 1…10 | 26.56 |
| 13 | 1 | 0.08…0.52 | 1…8 | 0.1…0.79 | 0.1…0.8 | 6.27 |
| 14 | 1 | 0.03…0.13 | 1…0.5 | 0.99…0.5 | 0.1…0.6 | 6.00 |
| 15 | 1…0.2 | 0.08…0.38 | 1 | 0.1…0.89 | 0.1…0.9 | 4.53 |
| 16 | 1…0.2 | 0.26…1.19 | 1 | 0.1…0.89 | 1…9 | 4.53 |
| 17 | 1 | 0.1…0.42 | 1…0.5 | 0.99…0.5 | 1…6 | 4.30 |
| 18 | 1 | 0.1…0.42 | 1…0.5 | 0.99…0.5 | 1…6 | 4.30 |
| 19 | 1 | 0.31…1.34 | 1…6 | 0.99…0.5 | 10…5 | 4.30 |
| 20 | 1…10 | 0.1…0.31 | 1…10 | 0.99 | 1…10 | 3.16 |
| 21 | 1…0.1 | 0.1…0.31 | 1…0.1 | 0.99 | 1…10 | 3.16 |
| 22 | 1…0.1 | 0.1…0.26 | 1 | 0.99…0.1 | 1…0.1 | 2.66 |
| 23 | 10…1 | 0.1…0.26 | 1 | 0.99…0.1 | 10…1 | 2.66 |
| 24 | 1…0.1 | 0.31…0.83 | 1 | 0.99…0.1 | 10…1 | 2.66 |
| 25 | 1 | 0.1…0.17 | 1…0.6 | 0.99 | 1…5 | 1.73 |
| 26 | 1 | 0.31…0.54 | 1…5 | 0.99 | 10…6 | 1.73 |
| 27 | 1 | 0.13…0.08 | 0.5…0.1 | 0.5…0.1 | 0.6…1 | 1.67 |
| **All the variables** | | | | | | |
| 28 | 1…0.1 | 0.03…2.62 | 1… 10 | 0.99…0.1 | 0.1…1 | 83.99 |
| 29 | 1…0.1 | 0.1…8.28 | 1… 10 | 0.99…0.1 | 1…10 | 83.99 |
| 30 | 1…0.2 | 0.13…0.99 | 1…9 | 0.1…0.89 | 0.1…0.9 | 13.59 |
| 31 | 1…0.2 | 0.26…3.56 | 1…9 | 0.1…0.89 | 1…9 | 13.59 |
| 32 | 1…0.1 | 0.03…0.26 | 1…0.1 | 0.99…0.1 | 0.1…1 | 8.40 |
| 33 | 1…10 | 0.03…0.26 | 1…10 | 0.99…0.1 | 0.1…1 | 8.40 |
| 34 | 1…0.1 | 0.1…0.83 | 1…0.1 | 0.99…0.1 | 1…10 | 8.40 |
| 35 | 1…10 | 0.1…0.83 | 1… 10 | 0.99…0.1 | 1…10 | 8.40 |
| 36 | 1…0.1 | 0.1…0.83 | 1…0.1 | 0.99…0.1 | 1…10 | 8.40 |
| 37 | 1…7 | 0.08…0.19 | 1…7 | 0.1…0.69 | 0.1…0.7 | 2.25 |
| 38 | 1…0.4 | 0.26…0.59 | 1…0.4 | 0.1…0.69 | 1…7 | 2.25 |
| 39 | 1…4 | 0.03…0.06 | 1…0.7 | 0.99…0.69 | 0.1…0.4 | 1.89 |
| 40 | 1…0.7 | 0.1…0.19 | 1…0.7 | 0.99…0.69 | 1…0.7 | 1.89 |
| 41 | 4…10 | 0.19…0.08 | 0.7…0.1 | 0.69…0.1 | 4…10 | 1.89 |
| 42 | 1…4 | 0.31…0.59 | 1…4 | 0.99…0.69 | 10…7 | 1.89 |
| 43 | 10…7 | 0.31…0.59 | 10…7 | 0.99…0.59 | 10…7 | 1.89 |
| 44 | 1…0.7 | 0.31…0.59 | 1…0.7 | 0.99…0.69 | 10…7 | 1.89 |

# METHODOLOGICAL BASES OF UPDATING THE DIDACTIC SYSTEM OF HUMANISTIC ORIENTATION

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**Annotation.** The article deals with the problem field of education renewal in the context of humanistic paradigm. Highlights some of the methodological emphases of innovative reforms in teaching system today and updated the Toolkit successful implementation of the mentioned methodological perspectives in the didactic process.

**Keyword:** Educational process, didactic system, humanistic approach, methodological tools, didactic process, content-target priorities, moral values, teacher, information space.

The problem of human development and professional development in the information reality requires a new reading and rethinking of the target orientation of training. Widely discussed and debated today is not so much the issue of procedural and technological support of training of professionals and solving the problems of the learning process, as the question of content of the educational process in the creation of a new education for a complex society in a strategic instability. These and other issues, the nearest changes in the world educational policy were discussed by the International group of experts at the session of Global Education Futures in 2018 [6]. The researchers suggested what will be the form and content of education of the future. It was noted that the new reality gives rise to a new objective need for a shift in the understanding of the paradigm of education in the direction of the transition from the transfer of knowledge to the understanding of the individual's capabilities. In this regard, the question " why study?"more important than the question "what to learn?". In this regard, education needs new methodological accents in the development of didactic systems, new approaches to the construction of the content and level of knowledge, to the definition of individual capabilities, to the definition of new types of didactic forms, methods and means.

Deep, essential features of the didactic system can be considered conceptual approaches to goal-setting, content development, allocation of the fundamental principles of construction, definition of ways of realization of the purpose and content of education, identification of mechanisms of its correction, as well as evaluation and control of the success of the implementation of the built integrated didactic system.

In the construction of a modern didactic system should take into account a number of key methodological accents, reflecting the conceptual approaches to the development of content-oriented priorities of the learning process and providing a single internally integral structure of the didactic system [3].

Since the most important direction of the development of the world educational process today is the integration of educational systems, the uniting for the whole world community content-target priorities are humanistic, cultural ideas that reflect universal values: the idea of the need to achieve full self-realization of each individual; the idea of historical and moral foundations in the selection of priorities of personal development; the idea of reliance of the content of education on a new dominant paradigm-the unity of the foundations of nature, society and each person; the idea of ensuring the security and tolerance of the individual; the idea of implementing a new information and technological structure of the educational process is not to the detriment of the moral and psychological world of man.

The integrated unity of the above-mentioned cultural ideas in setting the goal of learning today, will help to build a didactic system that provides students with systematic, strong and at the same time operational knowledge, implements the most important didactic requirement: to learn on their own and to manage themselves through the search and selection of educational trajectories. Such an integrated approach to setting the learning goal motivates the individual to self-development, self-improvement and self-management, which is especially important in today's changing information society.

Humanistic approach, through the assertion of the rights of each individual to their own education throughout life, makes it possible to ensure the implementation of the expectations of the person, his family, school, University, region and the country as a whole from the education system today.

Let us analyze how the above-mentioned methodological accents "work" on the renewal of the education system, on the positive creative solution of the existing problems of goal-setting, on the development of didactic systems today. Let us briefly discuss each of the identified ideas that need to be used as a methodological tool for setting and implementing education goals today.

Essential in the implementation of these targets is the focus on the preservation of each individual and the achievement of a high level of education through the development of its motivation for self-improvement and increasing the level of self-government. The task, which comes to the fore today in specific pedagogical practices, is the formation of the student's self-education skills.

Methodological support for the formation and creative development of such a person is the idea of the need to achieve a full life self-realization, which is realized through the goal of becoming a self-forming, self-directed student, motivated to study, self-setting tasks and successfully solving them from the position of their value-semantic ideals.

Motivation of students to study is revealed only at the level of specific pedagogical work of the mentor and is filled with real content. It is only at the level of specific pedagogical practices that the consequences of various external influences are clarified: either contributing to the formation or destroying (displacing) the motivation of the student to study. The task of the teacher today is to carefully "listen" to assess these impacts on the student.

The idea of historical and moral grounds when choosing the priorities of personal development actualizes the approaches concerning the traditional-historical orientation of the educational process. These approaches make it possible to implement the most important methodological message of the development of Russian education, which consists in "objectivity, respect for the past" (V. V. Putin, 2014) and contributes to the search for basic historical and moral foundations for the renewal and stabilization of the country's education system. The root of the same, basis our morality lies in our history, religion, culture and pedagogical thought. The search for moral foundations of personality development today is on the way to their identification in the centuries-old traditions, in the wise commandments and in historical and pedagogical treatises.

Today it is important to implement within the framework of content-oriented priorities of building a didactic system the idea of supporting the content of education on a new emphasis of the paradigm of education - the unity of the foundations of nature, society and every person. This orientation of the learning process actualizes the idea of creative naturalness, the global idea of preserving nature, society and man in it. "All in one boat", and this understanding of reality is the key to the success of life, which must be brought to the consciousness of students.

Important and fruitful is the idea of ensuring the security and tolerance of the individual, suggesting the need to overcome the trend of dangerous

behavior of the subject, as a result of global turbulence and instability of society. The emerging alarming situation of negative socialization of young people leads today to a negative result [1; 5]: the fall of morals, the lack of motivation of the individual to self-improvement, the loss of vitality of the individual. When setting the goal of learning, an important methodological tool is the fact that the practice-oriented idea of self-realization of the individual through the definition of the individual educational trajectory of the student is closely integrated with the idea of forming a culture of security of the individual in terms of the formation of the viability of the individual. It is important to convey to students that today no social phenomenon can be considered in isolation from the cultural aspect of security. To do this, it is necessary not only to study the culture of safe life, but also to realize it as a constant need to consolidate and transfer the cumulative spiritual experience to ensure the safe life of man, society and humanity to future generations.

In addition, it is necessary, in our opinion, to finally "work", the most important methodological principle – the principle of safety of education. Namely: in the system of principles of modern education, along with the principles of humanization, democratization, continuity, openness of education today it is advisable to make the principle – the safety of education. The strategy of renewal and development of domestic education as one of the key links in the development of the country should be built, on the one hand, taking into account the needs of all subjects of education, taking into account all aspects of reality: both positively colored and negatively colored, very seriously threatening the life and vitality of the individual, society and state. In the realization of this principle, education in itself should not carry the charge of danger: neither through the goals, nor through the content, nor through technology, nor through the management of education.

Implementation of the most important methodological message - through safe education to a safe person is possible only through methodologically competent setting of educational goals and development of its content. And the second side of setting goals – the person in need of cultivation, their self-government and formation of personality safe type. In our opinion, the educational goal is to create conditions for the formation of a safe personality type, capable of self-government in an unstable reality and should be one of the system-forming ideas of renewal and development of education today. After all, the way out of the situation of degradation of personality, devaluation of its value orientations, is important and should be sought in the person, in his inner "I", the formation of which depends on the educational and educational space, which would direct

the person on the optimal trajectory of self-development, self-improvement and self-realization [1, p.8].

Finally, the idea of new target accents in the development of didactic systems, updated approaches to the definition of opportunities and needs of the individual - the idea of implementing a new information and technological way of educational process (distance, mobile learning, network forms) not to the detriment of the moral and psychological world of man.

Living in the age of information technology it is impossible not to notice that today there is a large digital divide between young and Mature generations. Under the influence of information and communication technologies, a new situation of personality development is revealed, which manifests itself in the change of higher mental functions (memory, thinking, attention), mechanisms of personality formation, forms of personality relationship, ways of behavior, etc. new psychological phenomena Arise: electronic dependence, multitasking, privacy, etc. We observe the fact that the younger generation is becoming more electronic, computer, Internet and mobile-dependent [2; 3; 4].

The development of personality in the conditions of information reality generates, among other things, breaking the usual processes of his mental activity (the development of the phenomenon of "transactive" memory, scattered attention, multitasking, limited development of sensory activity, etc.). This leads to a break in the established relationships, interdependence, intellectual, emotional, physical, psychological tension and instability, to problems in determining the status, reputation and self - identification (different) [7].

Responding to the new individual needs of the developing personality today, the needs of its self-development, it is necessary to use the information environment, the modern transition to the "figure" as a new tool not only intellectual but also moral and psychological development of the individual. On the one hand, it is important that the digital environment has become a factor in the development of higher mental functions of a particular person (thinking, memory, attention, etc.), on the other hand – has become a means of content filling the process of moral formation of the individual, creating the basis and forming the direction of life plans, strategies, attitudes, level of motivation and aspirations of the subject in educational activities). And at the same time, it is especially important that the formation of the student's motivated attitude to continuous learning, readiness to expand the sphere of knowledge, which becomes the main goal of the teacher's work in the new information reality.

Such transformations and changes in the didactic system are methodological in nature, because they make essential changes in the activities of teachers to change the personality, and in the building of the personality of its own meaning of its educational trajectory (the answer to the question "why learn?"), life strategy and behavior.

Thus, we examined an important methodological emphases related to humanistic, cultural ideas and human values and reflecting the content and target the development priorities of educational system today.

In conclusion, we note that the professional scientific and pedagogical community is now on the path of finding productive ideas and technologies to improve education. Today there is a demand for a new subject of knowledge, a new person, and he is not so often. Such a subject should be ready to act in a complex society, in conditions of high dynamics of the labor market, global turbulence and instability. To do this, you must be able to work with information flows, be able to analyze what is happening around, be dynamic, easy-going, sociable, etc. Only an updated education system will be able to form such a subject and reorient it to a new life and activity.

Worked out in a new way, in the conditions of the leading information influence, methodological accents of construction of didactic system, will help to provide target, informative and technological equipment of the training and educating space of each educational organization focused on: education of the citizen of the country possessing integral image of the world and the place in it; formation of the personality of the analyst-professional; spiritual formation and overcoming of moral degradation of the personality; the development of a viable personality with a high energy resource, finding ways to survive in a changing reality, professionally developing for the benefit of their country.

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# THE PROBLEM OF GENERAL UNDERDEVELOPMENT OF SPEECH IN CHILDREN OF PRESCHOOL AGE

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**Abstract.** Data from speech therapy and logopsychology in children with undeveloped speech indicate that there is a mutual relationship between speech and psychological disorders. Establishing a reliable link between low starting Apgar indicators and levels of verbal and non-verbal communication activity of preschool children makes it useful to use statistical analysis methods.

**Keywords:** speech therapy, logopsychology in children of preschool age, statistical analysis methods.

Over the past few decades, many researchers have contributed to the study of General speech underdevelopment in children. This issue was addressed by leading scientists in the field of speech therapy: L. N.Efimenkova, N. S. Zhukova, R. E. Levina, S. A. Mironova, S. F. Spirova, and others [1]. The last time ODO with the Kazakh language of instruction deals with the peculiarities of speech in children, some aspects of correction work Umurbekova G. B., Ibatova G. B., Tulebyeva GN [2].

Children with an undeveloped language of speech need earlier application of complex corrective work. Preschool age is the most favorable stage for the formation and development of speech in children with an undeveloped General language of speech.

In speech therapy, the underdevelopment of General speech skills is considered as a complex speech defect caused by a violation of the formation of the system of all components of the speech language in relation to the sound and semantic sides of children with normal hearing and intelligence. In addition, there may be: late speech, a small number of vocabulary, agrammatism, speech defects. The General underdevelopment of speech has different degrees. In this case, there may be a complete ab-

sence of speech means in communication or their minimal development, compared with normally developed children. General underdevelopment of speech can manifest itself in the form of complex speech pathologies, such as alalia, aphasia, rhinolalia, dysarthria. The causes of General underdevelopment of speech, that is, the etiology may be different.

The reasons for the underdevelopment of speech are largely due to the weakness of acoustic-Gnostic processes. In such cases, while maintaining hearing, there is a low ability to perceive speech sounds. The causes of General underdevelopment of speech, that is, the etiology may be different. The reasons for the underdevelopment of speech are largely due to the weakness of acoustic-Gnostic processes. In such cases, while maintaining hearing, there is a low ability to perceive speech sounds. The result of violations of auditory perception are: first, the wrong distinction of acoustic features characteristic of the phoneme, and secondly, violations of sound pronunciation and errors in repeating the syllabic composition of speech. The delay or General underdevelopment of speech occurs as a result of a lesion associated with organic damage or imperfection of certain parts of the Central nervous system. Underdevelopment of speech can occur both for social reasons (bilingualism, multilingualism, education in deaf parents), premature birth (miscarriage) and due to General weakness and frequent chronic diseases of the child, lagging physical development. In this case, we are talking about a delay (delay in speech development). In other cases, General underdevelopment of speech is a sign of organic damage to the Central nervous system.

According to a study by E. M. Mastyukova (1991), children with speech retardation can be divided into three main groups [3]:

- children with motor alalia;
- children with speech delay and underdevelopment with cerebral organic Genesis;
- children with complicated speech development.

In motor alalia, the speech areas of the brain in the left hemisphere are damaged, primarily the Broca's area – the motor center of speech. In motor alalia, there are difficulties in forming the syllabic composition of speech, the relationship between phonemic and lexical disorders, and difficulties in the development of phrasal speech. Secondary defects-psychological origin, due to negativism in the child's behavior, General underdevelopment of speech in the motor alalia can occur in a severe form, since the child can not speak independently, in the lexical and grammatical structure of speech there are difficulties. Problems are especially pronounced in the formation of coherent speech, manifested by psychomotor disorders and

shifts in the emotional and volitional sphere. In sensory alalia, the speech zone of the brain in the left hemisphere, the Wernicke zone, is affected. With sensory alalia, the child does not understand the speech of others, and does not speak himself. This disorder is often found individually, sometimes it is difficult to distinguish between speech defects and hearing loss. In the mild form of sensory alalia, it is a sign of underdevelopment of the General speech language-it is manifested by the difficulty of understanding the speech of others. The content of the speech language of a child with sensory alalia in independent speech is characterized by a paucity of vocabulary, is full of errors and is expressed by an abundance of gestures modulated by intonation [3].

In most cases, alalia is combined with dysarthria. The main signs of dysarthria are manifested in articulations of sounds, violations of breathing and volume, and changes in the tempo, rhythm, and intonation of speech. Violations can be of different combinations and at different levels depending on the concentration of damage, the severity of the violation, and the time of its occurrence.

Defects in the sound of speech make it difficult to speak, violations of articulation and phonation can lead to secondary signs that mask the primary defect and complicate the structure.

Speech disorders are characterized as follows:

1). they appear independently, are not lost, and are fixed.

2). does not match the age of the child.

3). depending on its specifics, clear speech therapy is required.

4). often has a negative impact on the further development of the child.

5). in connection with malfunctions of the psychophysiological mechanism of speech language

6). it is not a language defect, but a manifestation of dialecticism [2].

Disadvantages common to all children with General speech disabilities:

1).later development of speech;

2). limit your understanding;

3). limited vocabulary, grammatical side of speech;

4). disadvantages of pronunciation of sounds;

5). underdevelopment of phonemic hearing.

General underdevelopment of speech occurs at different levels. Initially, R. E. Levina [1] was divided into three levels of General underdevelopment of speech. Subsequently, the 4th level was described [4].

In General, at the first level of underdevelopment of speech, there is not formed speech at all. But these are the words of children who suffer from speech defects: swallowing, imitating individual sounds, us-

ing separate nouns, verbs used in everyday life, expressing sentences, interrupts and interrupts completely incomprehensible, in the sentence sounds are indistinctly pronounced, unstable, changing. They are trying to unravel the movements of the hands, try to use non-verbal techniques (gestures).

Such speech defects can also occur in children with intellectual disabilities. But the consciousness of children with an undeveloped language of speech can be easily distinguished from children with intellectual disabilities (oligophrenic). The former have a more extensive vocabulary used in conversation. And children with intellectual disabilities, with a weak General development of speech, often use non-verbal gestures and expressiveness of the body organs to convey the meaning of speech to the listener. Children with speech disorders are characterized by critical views on the shortcomings of their speech and there is a desire to correct them. Thus, despite similar speech defects, the Outlook on speech development distinguishes these two groups from each other.

The first level of weak speech development of the language can be described as follows:

1). poor vocabulary.

2). the child has significantly more phrases that use passive vocabulary, but the phrases are too brief.

3). not developed the ability to repeat, while maintaining the composition of speech, sounds, syllables.

At the second level, common words are added. But they don't come clearly. At the same time, children have a broken structure of the hyoid joints ***os hyoideum***, and the ability to speak lags behind normal. Anthropologists have discovered the important role of this bone in the formation of speech in humans as a species [5].

Children of the second level of General speech development are characterized as follows:

1). active phrases of children are supplemented with words of a noun, verb, adjective, adverb.

2). despite this failure, children of this level start using case endings and suffixes.

3). at this level, children begin to speak by linking the word.

4). the understanding of speech is being improved, and active and passive vocabulary funds are being replenished.

5). still can't pronounce many sounds and some words correctly. There is a lack of readiness to master the methods of sound analysis and acquisition [2].

The third level of speech development is generally characterized by the following disadvantages:

1). when speaking, the child does not know and cannot use certain words correctly.

2). there is an underdevelopment of the grammatical side of the language. Children make mistakes in using case compounds and suffixes. The ability to change a word is not developed at all.

3). in speech, only simple sentences are often used, and complex sentences are rarely encountered.

4). many children of this level still have shortcomings in the incorrect pronunciation of speech links and find it difficult to master ways of generalizing analyses.

Characteristics of children of the fourth level of General speech development. As a rule, work on speech development with children continues in the following groups, due to the fact that the components of the speech language (phonetics, vocabulary, grammar) do not fall on the values set at this time, even if speech defects were eliminated in previous years.

This delay in speech language has hitherto been called an indefinite form of General speech development. This type of speech was studied by the Russian author and T. B. Filicheva and the Kazakh author M. S. Grushevskaya [4].Currently, such an undeveloped spoken language has been designated as the " 4th level of speech development.

Children of this level, first of all, are characterized by an inability to Express their thoughts. When composing stories on a given topic, a series of pictures, plot pictures, according to the scheme of the reference drawing, the direction of logical thoughts is systematically violated, stops in the center, does not mention the main nodes and repeats individual episodes. In conversation, children use simple and detailed sentences that provide little information. Children of level 4 can't plan their thoughts and find it difficult to select language tools.

The communication capabilities of children with General speech pathology are significantly limited and in all respects below the norm. In General, attention is paid to the low level of development of the game activity of preschool children with an undeveloped language of speech: the poverty of the plot, the procedural nature of the game, and low speech activity. Most of these children are characterized by high excitability associated with various neurological symptoms, as a result of which games that are not controlled by the teacher become disorganized.

Currently, the number of children with General speech disabilities is increasing every day. In General, the correction of underdevelopment of

speech, as well as measures for its prevention were not carried out in a timely manner, children study at school. As a result, the child's communication with other people becomes more complicated. Therefore, it is important to develop their communication skills, controlled by the teacher.

We conducted a pilot study of the relationship of criteria for assessing the state of a child after birth (Apgar scale) to the further development of verbal and non-verbal speech activity in young children, using statistical methods of material processing (STATISICA) [6]. Number of subjects (14 preschool children). Evaluation of performance verbal and non-verbal speech activity was made on a scale a teacher, assessment of the newborn Apgar scores (these metrics). The nonparametric method found that indicators of verbal and nonverbal speech activity significantly correlated with the Apgar criterion.

Moreover, the Gamma correlation coefficient of the verbal indicator r was more significant, equal to 0.8 (positive), and for the non - verbal one it was equal to 0.6 (positive) . Moreover, it should be noted that these correlation results were reliable ($p<0.05$).

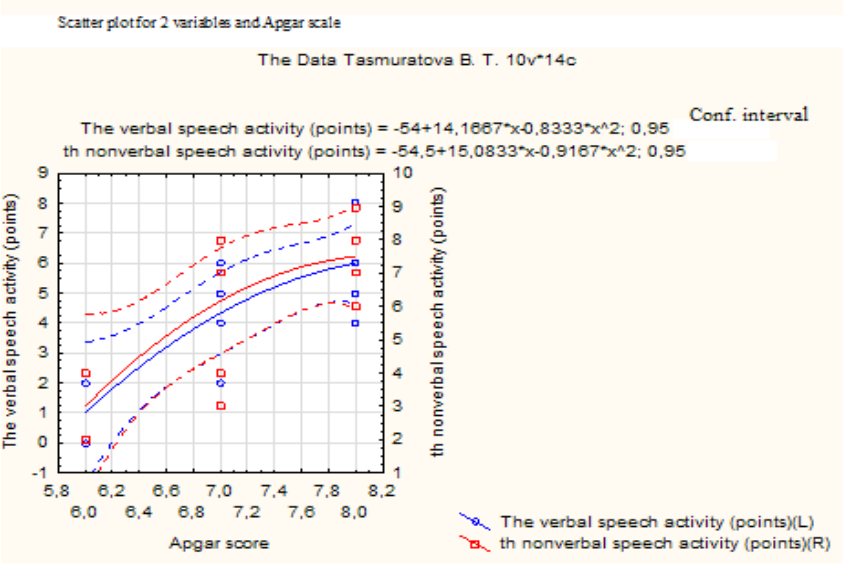


**Fig.1. Dynamics of the dependence of speech activity indicators on the Apgar indicator.**

Symbols on the scatter chart :***X***-Apgar indicator; nonverbal activity indicator (left ***Y1***) and verbal activity indicator (right ***Y2***),.

More significant is the visual demonstration of the dynamics of the relationship between these indicators, which is shown in Fig.1. From this figure, you can see that with the increase in the Apgar index, both verbal and nonverbal activity indicators increase. Moreover, you can see that their changes are described mathematically in the form of a polynomial:

***Y1*** (non-verbal) = -54.5+15.0833*x-0.9167*x2; Conf. interval of 0.95

***Y2*** (verbal) = -54.0+ 14.1667*x - 0.833*x2; Conf. interval of 0.95.

From these data, we can make a preliminary conclusion that a low starting Apgar indicator ( for example, x=6) is actually associated with low indicators of both verbal and non-verbal communication activity of children. Further research will allow us to objectively prove the correctness of the applied correction methods, which will be able to neutralize the impact of the starting level.

To sum up, in order to optimize speech therapy, it is necessary to know the psychological characteristics of children with undeveloped speech. Data from speech therapy and logopsychology indicate that due to the connections between systems in the presence of speech disorders, other psychological disorders can be observed. On the other hand, when forming a complex psychological profile of deviations in mental development, one of the leading syndromes of which may be a speech disorder. We think that the use of mathematical methods in biology, as well as in defectology, will be very useful and fruitful.

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# CONTENT-BASED ACTIVE SPEAKING TECHNOLOGY: AN EFFECTIVE MEANS OF ENHANCING COMMUNICATION SKILLS IN THE COLLEGE-LEVEL FOREIGN LANGUAGE CLASSROOM

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**Abstract. I**n the recent years, universities worldwide have faced the need to adjust their programmes to the growing demand for graduates in possession of a whole range of transferable skills. Reiterated in employer surveys and listed in higher-ranking job requirements, professional communication skills in a foreign language appear to be strongly linked to employability and career success.

Schools are attempting to improve their students' foreign language communication skills by turning to a variety of methods and approaches whereby a foreign language (predominantly English) is used to teach part of the curriculum, with varying results and more significant implementation challenges in tertiary education contexts.

This article describes an innovative Content-based Active Speaking Technology (CAST) of language teaching, which bypasses some of the common obstacles to teaching college-level academic courses in English, while effectively enhancing the motivational, cognitive and behavioural aspects of students' ability to communicate in English in relevant professional contexts.

**Keywords:** transferable skills, foreign language, CAST, communication skills, active speaking, content-based language learning

Communication skills have been listed among the key "soft" or transferable skills that graduates need to master in the course of their undergraduate studies in order to be successfully employed in the increasingly competitive job market (e.g. Idrus, 2018; Rhodes, Danaher and Ater Kranov, 2018)[1]. The importance of effective communication in the workplace and a lack of the corresponding skills in graduates is also highlighted (Morreale and Pearson, 2008 [2]; Kassim and Ali, 2010[3]; Stevens, 2016 [4]).

In many countries, employers increasingly look for candidates who are able to communicate professionally in a foreign language, predominantly English (Kaburise, 2016 [5]); Ting, Marzuki et al., 2017 [6]). In response to that demand, a considerable amount of research into ways of teaching English communication at tertiary level is being carried out worldwide. In their attempts to remodel English teaching to meet the stakeholders' demands, universities and colleges seem to adhere to one of three main trends, or tendencies, considered below.

Another tendency for colleges is to keep English teaching and course content instruction separate, but enhance the communicative aspect of the former through communication-oriented English teaching methodologies, such as project-based learning (Sultana, Zaki, 2015 [7]; Klyoster, Elkin and Melnikova, 2018 [8]) or task-based learning and teaching (TBLT) (Du, Zhao, et al. 2017 [9]). Alternatively, although non-specific to language instruction, such approaches as flipped classroom (Reddan, McNally and Chipperfield, 2016 [10]) are reported to have been successfully applied to English teaching in order to improve students' communication skills in English.

Overall, studies suggest that a significant improvement of graduates' communication skills in English is more likely to result from a combination of at least three factors, namely, a comprehensive institutional policy supported by adequate investments of research, funding, and time; a dedicated effort on the part of competent faculty, and motivated students. Even if all three factors are in place, communication skills acquisition seems to be highly sensitive to local conditions presenting a variety of unique challenges to all the participants.

In Russian tertiary education situations, foreign language teachers often emphasize reading and translation skills proceeding from the assumption that a professional would primarily use a foreign language as a means of obtaining job-relevant information from written texts. As practitioners in the field of teaching English as a foreign language, the authors of this article have noticed that oral communication skills in English are underdeveloped in most students. They show low motivation to communicate in the target language, admitting to a fear of errors when speaking in the

language they are learning. Exposed to traditional text-based memorization of speech forms and ready-made utterances, students have a limited range of self-expression, while also struggling with initiative and autonomy issues in target language communication.

Inspired by best practices of adapting teaching approaches to real-life situations (e.g. Ennis, 2015 [11]), the authors of this article developed a methodology, Content-based Active Speaking Technology (CAST), addressing the issues mentioned above. In order to ensure the growth of all three constituents of the communicative ability – motivational, cognitive and behavioural – CAST was designed as a three-component model. The implementation of CAST is based on the principles of communicative approach to teaching English in conjunction with a variety of active learning techniques, targeted at engaging students in a structured, personally and professionally relevant productive speaking activity pertaining to the qualification they are pursuing.

The present study was undertaken to look at how effective the use of CAST is to train undergraduate students to communicate in English in professional contexts.

Two main approaches to teaching English communication were used as a foundation for CAST: the communicative approach and the competence-based approach.

The communicative approach involves:

- communicative orientation of education, i.e. language serves as a means of communication in real life situations that require communication;
- integrated training in all forms of oral and written communication;
- the use of authentic teaching materials, original texts selected for learning without simplification or adaptation;
- situation-based learning and teaching (in the classroom, the teacher recreates situations that students may encounter in real life, for example, conversations in shops, on the street, discussions of current topics, daily situations at work or at university, etc., modelling of speech situations varies from day to day, creating new communicative tasks for students).

The competence-based approach involves:

- an ability to communicate fluently in various forms and on different topics, demonstrating a good command of appropriate vocabulary;
- unaided construction of utterances in accordance with the aims of communication;
- tolerant consciousness and behaviour, preparedness and ability to engage in a conversation with peers, to achieve mutual understanding in it, to find common goals;

• skills of cooperation with fellow students in the fields of education, training, research, design and in other activities;

• the leading role of hands-on experience and independent work in the learning process.

The complex nature of the ability to communicate in a foreign language is presented in this article as a three-component structure that comprises motivational, cognitive and behavioural components.

The latter provision has a direct bearing on students' feeling of success in the foreign language classroom. It helps them overcome language anxiety, the fear of errors, and promotes a free interaction with each other and with the teacher.

The cognitive component of communication skills is associated with the cognitive processes and the peculiarities of their development; the formation of specific and general cultural knowledge and communication abilities and skills. While communicating, students learn to use the target language to achieve a specific purpose, in other words, to perform a function, e.g., to refute something, to argue, to find out, to agree, etc. Performing a communicative function actively involves cognitive processes: students need to consider what to say, how to arrange a phrase, which lexical units and grammatical constructions to choose. Such a task requires both speaking and cognitive skills (Maiboroda, 2016 [12]).

Developing the cognitive component of communicative competence, therefore, presupposes:

• enabling students to learn in a conscious way, understanding what and why they are learning;

• developing students' thinking through problem-oriented communicative tasks, whereby they independently discover new knowledge

• using meaningful activities conductive to communication;

• a wide application of heuristic, creative tasks;

• arranging for students to practice various mental operations (analysis, synthesis, comparison, generalization, grouping) while communicating in the target language.

The behavioural component of communication skills is directly related to the actual use of a foreign language in accordance with the corresponding social and cultural norms. The essence of the behavioural component can be described in terms of the types of communicative tasks solved by students:

• in oral and written speech in the target language;

• in team work and cooperation;

• in non-verbal communication;

• in interpersonal perception.

Practitioners in the field of foreign language teaching (Nikitenko, Yanchenko et al., 2017 [13]) believe that students should be given plenty of opportunities to think over the solutions to communicative problems that, in their turn, generate thoughts; to discuss the possible ways of solving them, so that students focus on the meaning of what they want to say rather than on the form. This will likely encourage the use of the foreign language in its authentic function, which is to form and formulate ideas. A considerable creative and developmental potential is inherent to complex cognitive tasks, such as to participate in a discussion, to justify a judgment or a point of view, to expand a thesis into a speech, to write an essay, etc.).

The main difference between CAST and the traditional learning system is that the former encourages the use of the target language as a whole, without separating it into grammatical and lexical phenomena. Active speaking that occurs at a CAST-based lesson is prompted by search for solutions of a number of communicative tasks offered by the teacher. Students perform verbal actions trying to find the right ways to solve their communicative tasks. Due to this, immersion in the language environment occurs, and students begin to communicate in a foreign language for practical purposes. CAST tasks should be focused on the content rather than on the form, which, however, does not mean a complete disregard for accuracy of speech being produced.

The advantages of CAST technology:

• it enables students to overcome language barriers and language anxiety;

• it provides practice in spontaneous speaking in the foreign language without the fear of errors;

• it promotes fluency and motivated participation in communication both in the foreign language classroom and in real-life situations.

**Table 1**

**A comparison of the traditional approach to teaching foreign languages (TFL) and Content-based Active Speaking Technology (CAST)**

| Comparison criteria | Traditional approach to TFL | Content-based Active Speaking Technology (CAST) |
|---|---|---|
| Essence | Knowledge of rules and language units is transmitted in its finished form, through memorization | Ways of constructing knowledge are mastered: students learn to discover knowledge independently, through participation in problem-solving activities |
| Contents | Explanatory presentation of information and learning materials: explanation – practice – speech production | Active learning and teaching: using the language as a whole, without separating it into grammatical and lexical phenomena; content-focused rather than form-focused tasks |
| Forms | A combination of whole-class, individual and group work | A predominance of group work |
| Teacher's functions | A provider of information, a keeper of norms and traditions | A collaboration coordinator, a facilitator of problem-solving activities and communicative tasks |

**Table 2**

**Key features of CAST-based English teaching and learning**

| Students' actions | Teacher's actions |
|---|---|
| Students speak for the greater part of the lesson | The teacher directs and models various forms of speech interaction. He / She acts as an intermediary, i.e. an observer and assistant during the assignment and as a listener at the stage of presentation. |
| All students are equally engaged in communication | The teacher prevents stronger and uninhibited students from monopolizing study time and attention by involving shy and struggling students into class interaction |
| Students are motivated to speak | The level of motivation is high due to real-life communicative situations and the atmosphere of success created by the teacher |
| In the process of speaking students overcome language barriers and language anxiety | CAST provides free speaking practice, enabling students to speak spontaneously in the foreign language without the fear of errors |
| Language level corresponds to students' actual capabilities | The teacher focuses on the meaning of the task rather than the language needed to perform it. It does not mean disregard for accuracy, however, language-oriented tasks are only used to supplement communicative tasks. |

The results of the two-year experimental teaching suggest that Content-based Active Speaking Technology (CAST) is an effective means of enhancing English communication skills in the college-level foreign language classroom. CAST contributes to the sustained improvement of the motivational, cognitive and behavioral components of communication skills. Undeniably, this article is limited in evidence, the problem of improving college students' communication skills in English requiring further experimental work and research.

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# ANTHROPOLOGY OF MODERN PEDAGOGICAL EDUCATION

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**Abstract.** The article proves that pedagogy needs transformation and revival. The digitalization of higher pedagogical education due to the not very deliberate and verified inclusion of didactic and methodological content is still perceived by teachers as a negative trend. A study of organizational and pedagogical mechanisms at universities in Russia, Western and Eastern Europe, in the countries of Scandinavia shows that they have practically no anthropological approach, that is, an approach that takes into account the internal characteristics of preparing a person for the pedagogical profession. A promising trend can be considered the development of teacher education at Kazan Federal University, which examines the anthropology of modern teacher education, and anthropological models of teacher training are tested.

**Keywords**: trends, organizational and pedagogical mechanisms, functions, anthropological approach, teacher education, Kazan Federal University, models.

## Introduction

Regulatory documents of the Russian Federation (Letter, 2019; Order, 2014; Concept, 2012) place high demands on the teacher and his training. However, there are practically no measures for his social and professional protection. Therefore, a teacher in Russia is not protected from the arbitrariness of adolescents, nor from the rudeness of parents, nor from the punishments of Rosobrnadzor or the incitement of unfounded criticism in the media. In Germany, for example, a teacher is equated with civil servants (with all privileges available).

Hence the disrespect for pedagogical science in Russia and the high prestige of pedagogical knowledge in England, Germany, France, China and other countries. It is no coincidence that the British say that being a teacher is a privilege, and having a teacher is a blessing.

Everyone involved in teacher education, that is, the theory and practice of training teachers, noticed that during the modernization of higher education (the introduction of undergraduate and graduate programs, the destruction of specialties, the unification of universities, etc.), pedagogy as a science and as a discipline necessary for the training of teachers, began to fade. Now it is easy to find a university graduate who does not know anything about pedagogy (general pedagogy, preschool, elementary, pedagogy for secondary or higher school), does not know about didactics or the methods of teaching and upbringing. In some non-state universities, students are still asking what kind of teachers they will eventually be, that is, they know from school that there are primary school teachers, there are subject teachers related to teaching mathematics, physics, chemistry, literature, history, but what they will be (that is, what to teach) - they do not know, and often the university teachers themselves don't know.

Even at state universities, pedagogy has become the discipline of choice. It is difficult to imagine a teacher who does not know didactics (theory of building a lesson, theory of didactic methods and methods of teaching and learning), methods of teaching the subject (taxonomy of goals, theory of solving cognitive problems, stage-by-stage formation of mental actions, etc.). Therefore, graduates who wish to work at school must independently master the theory in everyday practice.

The hope that the magistracy will be a full-fledged step in higher education did not materialize: the magistracy everywhere has a narrowly focused (programmatic) character. Of course, this is also a negative trend. According to many teachers, higher education in modern Russia is more like a not very organized technical school. The level of higher education has clearly declined.

Pedagogy associated with such names as Yan Amos Komensky, K.D. Ushinsky, A.S. Makarenko, V.A. Sukhomlinsky and others, obviously needs a revival (Gabdulkhakov, 2017; Gabdulkhakov, 2018; Gabdulkhakov, 2019). Without reliance on the axioms of pedagogy, theoretical foundations, patterns, principles of training and education, it is impossible to build digital pedagogy. Filling of digital content with didactic and methodological content is still chaotic and unscientific. This is also a negative trend.

Modern education has entered a period of active transformation. Changes, updates coming in connection with the digitalization of school,

economics, social, cultural and personal life amaze not only ordinary people, but also people who, it would seem, are themselves carriers of the ideas of digitalization of education and upbringing of the younger generation. New generations of young people master digital technologies faster and deeper than their teachers in mathematics, computer science, and technology. And no one is surprised when a teacher of mathematics and computer science boasts to his colleagues (and students too) that his students taught him (teacher) this and that in the field of efficient use of digital resources. A generation of mentor students is being formed that can advise and help teachers in the use of digital technology. This is a new result of the transformation of education which modern didactics should consider (and not bashfully hush up).

However, the capabilities of mentor students are significantly limited: they can easily cope with the tasks of the communication plan (use different functions and capabilities of educational platforms, resources, accounts, etc.), but they do not have sufficiently deep basic subject knowledge in, for example, mathematics physics, history or literature.

It must be admitted that the digital sphere is now actively filled with informational content, but this does not mean that this sphere is also actively filled with methods and techniques of didactic or methodological interpretation of subject content. Moreover, applied sciences (methods of teaching mathematics, physics, chemistry, the Russian language, literature, etc.) are now relegated to the background: they are actively replaced by the so-called innovative content. A graduate of a pedagogical university, sometimes poorly knows the subject, didactics and methods of teaching it, but he is ready to make innovations and even thinks that he is already a mentor (this is the way they were brought up in leadership centers, popular among young people). As a result, children suffer, while school principals are reluctant to take young people, realizing that they need to work with them for a long time (retrain, re-educate) before they can be considered beginner teachers.

**The research methodology** is the theory of cognitive development of Jean Piaget (Piaget, 2004), the cultural and historical concept of L. S. Vygotsky (Vygotsky, 2012).

**Research results**

The studies we conducted in 2017-2020 in Russia, countries of Western and Eastern Europe (England, France, Germany, Poland, Belarus), in the countries of Scandinavia (Sweden, Norway), showed that the organi-

zational and pedagogical mechanisms of teacher training in universities not always positively affect the quality of teacher education.

In most modern universities, these mechanisms do not provide a sufficient level of technological updating of the content of teacher education: teacher training technologies do not always meet the requirements of the times.

In modern universities, the functional aspects of mechanisms (monitoring, prognostic, analytical, integrative, reflective, etc.) are not working effectively enough. The degree of manifestation of these functions is presented in diagram 1 (see diagram 1). The methodology for diagnosing functions was described in an article we published earlier (Gabdulkhakov, 2019).

**Diagram 1.**
**Results of diagnostics of the dominant functions of technological updating of teacher training in Russia, in the Eastern, Western European countries and Scandinavian countries (in %)**

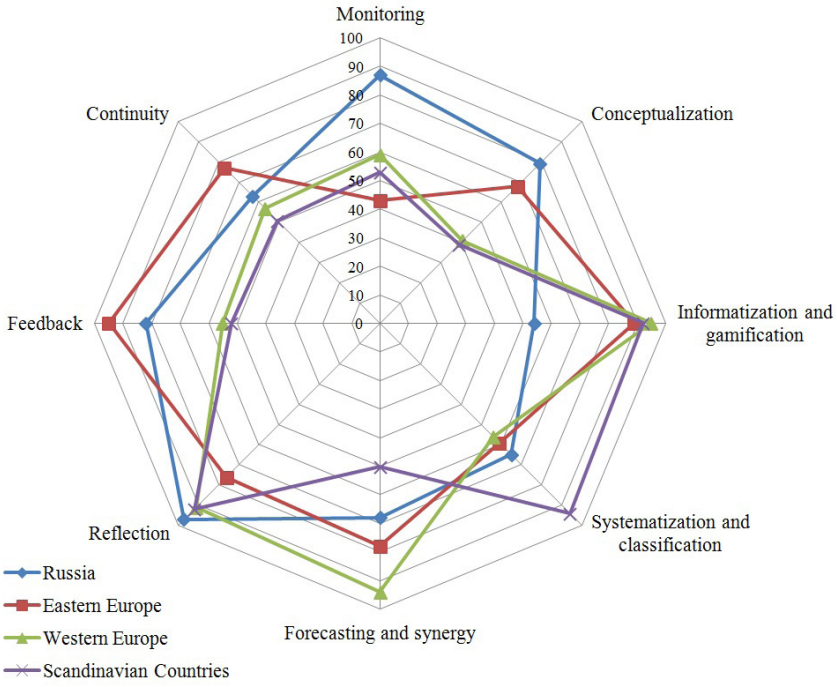

Diagram 1 shows that if in Russian universities reflective functions (functions of introspection, self-criticism - 95%), monitoring (measuring quality indicators of teacher training - 86%) prevail, in Eastern European countries - reflective - 82%, prognostic and synergetic - 95 %, in Western Europe - feedback functions, informatization, gamification - 95%, in the Scandinavian countries - systematization and classification, and also informatization and gamification - 92%.

The insufficient level of manifestation of reflective, prognostic, synergetic functions, feedback functions, systematization and classification, informatization and gamification in Russian universities negatively affects the quality of teacher training. We need a new - functional - mechanism for the technological update of teacher education at universities.

We call this mechanism anthropological, it should include all the functions indicated on the diagram and cover not only universities, but also the entire system of continuous education (from pre-school and primary school to university and postgraduate).

**Conclusions**

A promising trend can be considered the development of the anthropology of teacher education in Kazan Federal University and in universities with which this university has established partnerships (these are universities in the USA, Great Britain, Germany, etc.).

The Kazan experiment provides for several anthropological models for the organization of teacher education (traditional, integrated, network, etc.), various trajectories and training modules.

The positive side of this experiment is that the fundamental subject-oriented training of future teachers at the undergraduate level is combined with professional training (and retraining) at the level of the continuous teacher education system, since the university has its own Volga regional center for advanced training and professional HR retraining and students can be included in parallel educational process of this center.

The university relies on the pedagogical classes of specialized gymnasiums and pedagogical colleges, whose graduates are motivated to receive pedagogical specialties at the university.

Pedagogical magistracy also has a number of winning aspects: it is practice-oriented, has connections with basic university schools, and forms practical competencies.

All this allows us to build work with gifted students purposefully and systematically, combining the theoretical and practical training of teachers of the future into a single whole, developing their academic mobility in a

system of transnational educational platforms and research centers that improve the quality of teacher education.

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# ON THE ESSENCE OF SOCIAL STIGMA[1]

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**Abstract.** Based on the analysis of the theory of symbolic interactionism and publications of modern scientists, representing various scientific directions of social and humanitarian knowledge, the article actualizes the point of view according to which the processes of social stigmatization are desocializing. The purpose of the article is the justification of the ambivalence of the forms of the social identity process, the essence of which is most clearly manifested in the discrepancy between real and virtual identity. A person is in a situation of direct or indirect contradiction between the inner experience of his belonging to the corresponding social group, on the one hand, and the evaluation of his place and role by other participants in social interactions, on the other.

Using comparative methodology, the authors define the main criteria for comprehending and evaluating stigmatization processes. The article asserts the idea that symbolic interactionism, in fact, is a practical sociological tool that does not pretend to identify general tendencies and patterns.

**Keywords:** socialization, social identity, stigmatization, adaptation, symbolic interactionism.

The modern social world is characterized by extreme variability, rapid transformation of values, and large-scale civilizational challenges. This situation causes a split in the internal spiritual orientations of the individual, cognitive dissonance regarding the evaluation of one's own place and role in the rapidly changing world. Traditional mechanisms of socialization, understood as the process of learning the skills of social interaction and cultural adaptation, are currently ineffective and do not bring the expected

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results. In addition, this situation initiates the activity of factors opposing the normal socialization of individuals. In this regard, the problem of adequate self-determination of the individual becomes extremely relevant. It should be noted that the social identity of a person is one of the key topics in the social and human sciences and works of many modern scientists focus on its description.

The overall objective of this work is the analysis of stigmatization processes in the context of determining the essence of social identification of modern man on the basis of social and humanitarian studies. The purpose of the article is to justify the ambivalence of forms of the social identity process, the essence of which is most clearly manifested in the discrepancy between real and virtual identity.

Let us turn to the ideas of symbolic interactionism, which arose as an alternative to structural functionalism, a very common and influential trend in American sociology in the second half of the 20th century. While the supporters of structural-functional analysis (T. Parsons, R. Merton) positioned themselves as "theorists with a capital letter" seeking to create an objective sociological theory of macro-level, the advocates of symbolic interactionism (C. Cooley, D. Mead, G. Bloomer, G. Becker, E. Goffman) considered their task to describe the immediate social reality, which, from their point of view, in turn, is the product of role interactions between people.

One of the key concepts of the doctrine under consideration is deviation. It is asserted that deviation is a specific form of judgment about the actions of an individual on the part of various participants of social interaction, in the structure of which these actions are carried out. Deviation is not an individual property of a person, but a socially relational property. Deviation serves as a pointer, in other words, it highlights behavioral reactions unacceptable under the circumstances. This is a social "sticker" (or "label"). Thus, deviation is basically a necessary factor in the process of interaction of social groups which compete with each other in the nomination, substantiation and justification of certain social values. Competitiveness of the social environment is the basis which constantly provokes the phenomenon of deviation.

One of the most significant desocialisers is stigmatization. Modern researchers of the stigmatization processes take up the most common grounds for "labeling" such as: 1) non-standard appearance (overweight or obesity, mutilation); 2) mental illnesses, drug / alcohol addiction, other types of diseases or disorders; 3) different sexual orientation; 4) criminal past; 5) inconsistency with the established stereotypes of a "successful person"; 6) territory of residence, etc.

In order to comprehend the diversity of opinions, points of view and various procedures for describing the phenomenon of stigmatization that are presented in modern studies, we think it is necessary to use a systematic approach that implies a clear definition of the following fixed criteria for analysis: historical, substrate, value, and functional.

The historical criterion allows to determine the position of the author regarding solving the problem of origin, formation and prospects for the development of stigmatization procedures. In turn, the substrate criterion makes it possible to determine the substance of these phenomena in the research work of one or another author. The value criterion is aimed at revealing the well-founded values that are explicitly or implicitly attributed by a particular author to the stigmatization process itself, or to individual components of the process. The functional criterion is aimed at revealing the position of the author in relation to the function which is, from the researcher's point of view, performed by the stigmatization process in the social environment where it is directly carried out.

These criteria, of course, are not the utmost possible tools for analyzing the experience of stigmatization in the modern science. They can serve only as a working tool in the future development of this subject.

Let us turn to modern research, which provides analysis and assessment of stigmatization processes. We emphasize that the analyzed positions of scientists reflect the belonging to one of the above criteria for describing a stigmatization.

Claudia Sikorski, Melanie Luppa, Matthias C.Angermeyer, Georg Schomerus, Bruce Link, Steffi G. Riedel-Heller [1] focused their research on elucidating the prevalence of the phenomenon of social distance towards people suffering from obesity, as well as the identification of emotional reactions of participants in social interactions to this phenomenon. The authors believe that it is the change in the emotional responses of surrounding people to those who are obese (from lack of understanding to sympathy) that can be the starting point in activities aimed at overcoming the social distance towards them. This study expresses a value characteristic of the process of stigmatization.

Despite the fact that Stephen J. Mooney, Abdulrahman M. El-Sayed [2] view the problem of stigmatization from a different perspective, they also use the axiological principle. They analyze the etiology of depression in obese people. According to the authors, stereotyped ideas of so-called "body norm", such as a model of beauty and health, play their role here. The more distant the real proportions of the body from these imposed by the society models, the more dramatic and deep the depression can be.

The authors note that depression is more common among obese people when their percentage to the total number of the so-called "normal people" is rather small. Significantly, the authors define the risk of depression in obese people as a function of the obesity rate imitating the average statistical indicators for the entire population.

A number of studies are focused on the determinants of the "mental illness" stigma. In her research, Nana Tuntiya [3] analyzes the process of social stigmatization by the example of people with severe chronic mental illnesses integrated into small communities. The author shows that these patients usually tend to reject the stigmatized "status of the patient" imposed on them by the external environment. Using the data of several dozens of mentally ill patients, the author concludes that these people are not passive participants in the socialization process but rather functional members of the community in which they are needed. They make a certain contribution to the functioning of their group, influencing the structure and dynamics of intra-group interaction either explicitly or implicitly.

Tally Moses [4] conducts a study among adolescents who have undergone psychiatric hospitalization. The key factors here are: group identification of adolescents themselves, their social origin, efficiency (or inefficiency) of the functioning of school programs for the rehabilitation of adolescents. Moreover, the following dependence is observed: the higher the social status of a stigmatized teenager and the lower the level of general development of the members of the group they belong to, the higher the risk of being stigmatized by a "mental illness".

Japanese specialists Misa Kayama, Wendy Haight [5] elaborate on the adolescent emotional reactions to the assessment of others. In their study, they draw on the experience of parents in assessing the behavioral and cognitive disorders of their children in primary school. The authors note that the general high sensitivity of the population to the threat of stigmatization due to certain individual characteristics is traditional for Japanese culture. Not only real but even imaginary (possible or expected) negative reaction of surrounding people often leads to social isolation. On the basis of the collected empirical material, the authors state that this particular feature is most acute in the childhood period, i.e. primary school age. A special role in overcoming this tradition is played by the qualifications and experience of school teachers, employees, management staff, medical workers, who are called to help new generations in successful social adaptation together with their parents.

The content of the next study describes the functional criterion of the reflection of stigmatization to a certain extent. Henry J. Whittle, Kartika

Palar, Nikhil A.Ranadive, Janet M. Turan, Margot Kushel, Sheri D. Weiser [6] address the problem of stigmatization at the level of the government bureaucracy system. It is about the mechanism for issuing disability benefits in the United States. Based on the data obtained as a result of the ongoing neo-liberal reforms in the country's welfare, the authors come to the conclusion that the system itself, initially designed to help the destitute, provokes a process of negative stigmatization. Citizens who contact the relevant support agencies are labeled as "disability fraudsters", "lying malingerers", "unworthy poor" and other desocial subjects. The data obtained as a result of the research show a complex picture of the real situation when the inflexible and intricate bureaucratic management of the social security system for disabled people increasingly manifests its social dysfunctionality. The authors believe that their research reflects the real historical context of the ongoing neoliberal reforms.

Stigmatization based on belonging to sexual minorities is the subject of careful study of many sociologists, psychologists and representatives of other social and humanitarian sciences. This is a substrate criterion for describing stigmatization. Bethany G. Everett, Mark L. Hatzenbuehler, Tonda L. Hughes [7] set the objective to determine whether legislative initiatives (such as, for example, the legalization of civil marriage) affect the consciousness and health of sexual minorities (especially women). The authors consider the link between some social and demographic characteristics (race, ethnicity, education) and the processes of social and psychological discrimination of these groups, The authors also argue that the social policy supporting the civil rights of sexual minorities (especially women) improves their psychological state, contributes to the formation of a more responsible attitude towards their health. They also note that the most powerful effect of such a policy is observed among women of colour.

Studying interpersonal interactions involving people with a stigmatized identity (eg, sexual minorities, mental disability, etc.), Anna-Kaisa Newheiser, Manuela Barreto [8] note that individuals tend to hide their stigmatized identity from partners to avoid unnecessary bias on their part. Scientists have put forward a rather bold hypothesis: the concealment of one's stigmatized identity can help to reduce their personal dependence on this stigma, as well as to lead to a decrease in emotional dependence on it. And with the further development of interpersonal interactions (partner communications) this effect only increases.

The problem of social and psychological discrimination of transgender people is actively studied by modern researchers. Thus, Christian N.

Thoroughgood, Katina B. Sawyer, Jennica R. Webster [9] refer to cognitive processes forming paranoid perception of this contingent of persons (transgenders) by ordinary people in the process of fulfilling their professional work responsibilities. Scientists come to the conclusion that excessive suspicion of people to "transgender colleagues" is due to emotional exhaustion accumulated during their work duties. From this point of view, a paranoid and suspicious attitude provokes organizational transgender discrimination and complicates intra-group professional cooperation.

Continuing to discuss the problems of transgender discrimination, Jaclyn M. White Hughto, Sari L. Reisner, John E. Pachankis [10] argue that this stigma acts on several levels: individual, interpersonal, and social structural. Each of these levels has its specific causal relationships between the social conditions of the formation of the stigma itself, the medical parameters of the stigmatized transgender personality, and the intensity of group interactions in the communities of the transgender people themselves. The authors note that in order to prevent the negative consequences of "transgender stigma", we need an integrated approach which takes into account various determinants. In a certain sense, this position falls under the historical criterion of analyzing the problem of stigmatization. The authors give an overview of the determinants of origin and mechanisms for the implementation of "transgender stigma".

John E. Baur, Alison V. Hall, Shanna R. Daniels, M. Ronald Buckley, Heather J. Anderson [11] pay attention to a truly pressing social issue: the resocialization of so-called ex-offenders. These individuals convicted for their crimes have served their sentences and are trying to undergo a spontaneous social rehabilitation. They also play a specific and not always constructive social role in everyday social processes. Using an interdisciplinary approach, the authors point out that the following lines are intertwined in the process of stigmatization: general stereotypical portrayal of ex-offenders by the ordinary population (usually negative value characterization), the production and economic potential of this type of workers (which in turn affects labor productivity), civil initiatives of the society aimed at providing substantive assistance to ex-offenders in the process of their re-socialization. The authors propose to develop effective strategies that former criminals could use to overcome their own negative social experience.

Considering the specifics of the formation of urban marginal areas, Sune Qvotrup Jensen, Ann-Dorte Christensen [14] have noticed that the residents of these territories accept their marginal status as a matter of course, without any critical reflection. Moreover, such uncritical self-deter-

mination only strengthens the effect of territorial stigmatization. Residents of marginal territories are so used to their stigmatized position they are even subjectively happy with their status. The authors believe that state institutions and the development of the political culture of the whole society should play a certain role in overcoming this negative effect.

Simone Antonia, Luciavan de Wetering [15] analyze the process of stigmatization by analyzing the life of the youth in the suburbs of Paris (Bondi). They emphasize that the basis for constructing the stigmatized personality of a young person is the internalization of attributive identity. However, the process of transformation of external social norms and forms of communication into stable internal qualities of the personality itself is often indirect. One way of such indirect socialization is externalization acting as a mechanism for protecting one's own personal identity. In other words, from the authors' point of view, young people objectively differentiated according to the territorial and administrative basis (place of residence) subjectively exclude the discourse of stigmatization and deviance from their own self-identification. The authors believe that we should abandon the simplified approaches in describing this contingent of young people, and treat these groups of population more as "living together in diversity" capable of sufficient dynamic development in the social structures.

In turn, in analyzing the experience of stigmatization process research, the system and criterial approach presented above makes it possible to emphasize a certain ambivalence of the forms of the social identity process itself. The essence of ambivalence is most clearly manifested in the discrepancy between the real and the so-called virtual identity. In this case, a person is in a situation of direct or indirect contradiction between the inner experience of their belonging to the relevant social group, on the one hand, and the evaluation of their place and role by other representatives of this group, on the other.

Virtual social identity is an imaginary image that some participants of social interaction form in relation to other participants. Real social identity has a basis in objectified human attributes, such as skin color, race, gender, nationality. Any individual who has a certain gap between these identities is "labeled" (stigmatized) or subjected to discrimination. The stigma is not a substrate and objective difference, but rather it has a value origin reflecting the traditional differences in the society between "normal" and "abnormal".

In other words, the process of stigmatization serves only as a means of overcoming the specific ambivalence of social values of various social agents and participants of social interactions.

In attempts to explain the mechanism of stigmatization processes, supporters of symbolic interactionism do not analyze the essence of these processes and their impact on socialization and social identity of the individual. This sociological concept, in fact, is only a practical sociological tool, without claiming to identify certain patterns, trends, or generalizing empirical material.

Conclusion 1. In its essence, deviation is an indispensable factor in the interaction of social groups competing with each other in the nomination, substantiation and justification of certain social values. Competitiveness of the social environment is the basis which constantly provokes the phenomenon of deviation.

Conclusion 2. Deviation serves as a necessary social construct which inevitably ensures the unity and stability of society. It is the exclusion of deviants from the range of socially justified circumstances and conditions of existence that gives the legal majority of the society the right to justify their own norms and demonstrates the significance of the established rules.

Conclusion 3. Stigmatization is a necessary condition and at the same time the result of the social identity process characterized by a certain ambivalence, which is clearly expressed in the discrepancy between real and virtual identity.

Conclusion 4. The stigma is not a substrate and objective difference between people. Rather, it has a value origin reflecting the traditional differences in the society between "normal" and "abnormal". Stigma is a means of overcoming the existing ambivalence of social values of various social agents and participants of social interactions [16].

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# THE PREREQUISITES AND EARLY STAGES OF AMERICAN DETECTIVE LITERATURE'S EVOLUTION

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**Abstract.** The article analyses the causes and prerequisites for the birth of American detective literature, defines the early stages of detective genre's evolution and covers the ways of combining the realistic and the pragmatic aspects. It aims at generalizing and systematizing the theoretical material related to the evolution of the detective genre, appealing to the national literary tradition.

Edgar Allan Poe (1809 - 1849), the American poet and prose writer, literary critic and an outstanding representative of American romanticism is rightly considered to be the founder of the classical detective literature. The countdown in the evolution of the detective genre starts with the appearance of his novel "The Murders in the Rue Morgue" in the Graham's Magazine in 1841, which is based on one of the most intriguing plot elements of the detective story - the Secret of the Locked Room. The following short story, "The Mystery of Marie Roget" (1842–1843), affirms the high status of a sleuth armed with the clear logical tools of detective investigation and encourages the reader to take part in an intellectual competition with him. In "The Purloined Letter" (1844–1845), an incredible line of enquiry turns out to be the correct one. All these short stories together form a kind of trilogy of the "tales of ratiocination" featuring the romantic hero called Auguste Dupin.

The list of E. Poe's detective works includes the short stories "The Gold-Bug" (1843), which, and "Thou Art the Man" (1844). The former is based on the decryption of a cryptogram while the latter is interpreted within the frame of a biblical parable about a person's loss of sympathy and his willingness to commit a crime. Prophet Nathan's words addressed to King David became the symbolic name of the work. They remind us of the following: if not human judgment, then God's judgment will lead the criminal to repentance. E. Poe constructed the plot of his detective story

in such a way as to enable thoughtful readers to create a whole range of emotional and intellectual expectations and to propose their own ways of investigating the crime. The writer did not disguise the facts related to the investigation process, but at the same time he sought not only to surprise readers with a mysterious crime or an unexpected denouement (the suspect turned out to be innocent), but tried to change their conventional attitude to crime as a social phenomenon and encouraged them to find a balance between the "obvious" and the "unbelievable". According to the Bulgarian researcher Tsvetan Todorov, E. Poe's stories "obey the abstract principle, which generates both "ideas" and "writing techniques", "style" or "narration". In his creative writing, Edgar Poe opted for extreme and excessive situations and brought anything to its limits - and surpassed them, if possible. He was interested only in the greatest or the smallest: the point where this or that quality reached its highest degree, or (but it was often the same) the point where this quality could turn into its opposite. Everywhere the same principle defined various aspects of his work [4, 96]."

The appearance of the above-mentioned works featuring E. Poe's famous hero was predestined, to a certain extent, by the literary activity of the writer's famous predecessors. It is worth recalling the English philosopher-anarchist William Godwin (1756 - 1836), the author of the novel "Caleb Williams" (1794), in which the hero, driven by internal motives, solved the crime committed by his master. In his novel "Pelham, or The Adventures of a Gentleman" (1828), the English writer and politician E. Bulwer-Lytton (1803 - 1873) portrayed a hero saving a suspect who was innocent (the plot motif is similar to that in E. Poe's short story "Thou Art the Man"). Another impetus for the development of detective writing was also the well-known memoirs written by Eugene Francois Vidocq (1775 - 1857), who founded the French security police (la Sûreté) and the first known private detective agency. However, it was in the above-mentioned five short stories written by E. Poe that the fundamental principles of the classical detective story featuring the immanently logical and clear artistic structure were first laid down. According to the Hungarian researcher T. Keszthely, E. Poe's literary activity contributed to the evolution of not only the classical detective of the "intellectual type", but also to the detective works featuring certain elements of adventure fiction, melodrama and then the American "hard-boiled" detective literature [1, 50].

T. Keszthely pointed out that the word "detective" in the meaning of "a person conducting an investigation" was first used as early as in 1856 [73, 28]. Indeed, the activity of the legendary detective and abolitionist Allan Pinkerton (1819 - 1884) contributed to the popularization and devel-

opment of detective writing. In 1850, he founded the Pinkerton National Detective Agency in Chicago. A. Pinkerton is also considered the founder of the American intelligence service. Following President Abraham Lincoln's instructions during the Civil War between the North and the South, he organized an intelligence and counterintelligence service. In 1861, his agency averted A. Lincoln's assassination. The Pinkertonites successfully fought with the Irish terrorist group Molly Maguires (1877). A. Pinkerton's organization not only specialized in solving criminal cases, but also functioned as a private security agency, and he himself became the prototype of the famous hero Nat Pinkerton in his literary works.

It is no coincidence that it was A. Pinkerton who widely introduced the term "detective" into his works in the mid-1870s: "The Expressman and the Detective" (1874), "Claude Melnotte as a Detective and Other Stories" (1875), "The Somnambulist and the Detective", "The Murderer and the Fortune Teller" (1875), "The Spiritualists and the Detectives" (1876), "The Molly Maguires and the Detectives" (1877), "Strikers, Communists, Tramps and Detectives" (1878), "Criminal Reminiscences and Detective Sketches" (1878), "A Double Life and the Detectives" (1884), "Thirty Years a Detective" (1900), etc. It is noteworthy that the most famous representative of "hard-boiled detective" Samuel Dashiell Hammett (1894 - 1961) began his career as an employee at the Pinkerton Agency. Also note that in the title of the article "Criminal Reminiscences and Detective Sketches" the concepts "criminal" and "detective" are already distinguished. Moreover, the latter term acquires a figurative meaning: the type of narration, not a sleuth.

In 1878, Anna Katharine Green (1846 - 1935), the author of the famous literary works "A Strange Disappearance" (1880), "Behind Closed Doors" (1888), "The House in the Mist" (1905), etc., was the first to use the phrase "detective story" instead of the term "detective" in her first novel "The Leavenworth Case" (1878). It should be emphasized that the terms "criminal story", "mysterious story", and "police novel" peacefully coexisted in the English language of the late 19th century with the term "detective story".

It is essential to accept the opinion of the Bulgarian writer B. Raynov, the author of the research "The Noir Novel" (1970), as well as the famous detective works "Mr. Nobody" (1967), "What Could Be Better Than Bad Weather" (1968), "Big Boredom" (1971), "Requiem" (1973), "Dying As a Last Resort" (1976), "Typhoons with Affectionate Names" (1977), that creating a literary hero with a low level of artistic ambitions is much easier than raising the level of the wide readership's tastes [178, 58]. Therefore, it was precisely the principle of "creative inertia" that helped the little-known

writer John Russell Coryell (1848–1924) create a very popular hero Nick Carter in 1886, whose acts of bravery, according to B. Raynov, present a “criminal-urban variety of the old cowboy adventure mythology” [3, 59]. In the 1890s, John Russell Coryell’s "pulp" fiction legacy was continued by the American writer Frederick Van Rensselaer Dey (1861 - 1922) who wrote more than a thousand short stories featuring the main character Nick Carter. In 1908, he became the hero of the movie series produced by the French film director V. Jasset. Unlike B. Raynov, who considered brochures about Nick Carter to be an extremely negative phenomenon highlighting the establishment of the commercial essence of the detective genre, William Kittredge and Stephen M. Krauser, researchers of American detective literature, are convinced that “Nick Carter is a conscious embodiment of the American ideal of that period. He was a model for young people and an indisputable source of pleasure for the adult readership [2, 283]."

Naturally, one of the main internal literary factors influencing the formation of this image as well as many other images of “superman” detectives was the evolution of the traditions of adventure fiction presented in American culture primarily in the Fenimore Cooper’s literary heritage. First of all, one should recall his literary hero Natty Bumppo, known as Deerslayer, Hawkeye, Pathfinder, Leatherstocking, La Longe Carabine from “The Leather Stocking Pentology”, which included the novels “Pioneers” (1823), “The Last of the Mohicans” (1826), “The Prairie” (1827), “The Pathfinder, or The Inland Sea” (1840) and “The Deerslayer, or The First Warpath” (1841). Even before Nick Carter’s appearance as a literary character, Natty Bumppo had long been the personification of the American patriot and citizen. He remained faithful to the laws of nature, the sense of national and human dignity throughout his literary life, and F. Cooper became the first American writer to reproduce the upheavals of the national history and the period when the first stages of the complex and controversial formation of the young American nation’s mentality took place.

Discussing the predecessors of the popular Nick Carter, William Kittredge and Stephen M. Krauser constructed a typological series. Along with Natty Bumppo, they included Deadwood Dick, Annie Oakley, Buffalo Bill and unnamed heroes of cheap (so-called "five-cent" or "ten-cent") novels, motivating this by the fact that they shared one common feature - they all chose a way of life contrary to the civilizing processes and outside cities whose role in these processes grew steadily [2, 283-284]. In the footnotes to the article written by the abovesaid authors, Deadwood Dick, Annie Oakley and Buffalo Bill are called characters of American folklore. It

should be noted that they were real historical characters. Besides, Deadwood Dick is the hero of a number of novels written by Edward Wheeler, the first of which was published in 1880. Buffalo Bill is the stage name of William Frederick Cody, a former ranger, hunter, and horse-riding master. The writer Ned Buntline (Edward Zane Carroll Judson) came up with this name, and Cody used it performing in the circus troupe since 1883. The performances included demonstrating sniper skills, hunting for buffaloes and armed clashes between cowboy units and Indian tribes. Buffalo Bill also became the hero of Ned Buntline's novels. Annie Oakley (Phoebe Ann Moses) graced the Buffalo Bill troupe and was the best rifle master.

All these facts indicate that a characteristic feature of literary heroes in "five-cent" novels ("mass" literature, according to modern terminology) was a combination of ideal and romantic features with the features of their real prototypes. However, this feature, which was presumably supposed to ensure the realism of such literary works, was only a weak support for reproducing the “local color”. The hero’s oversimplified character highlighting only his great ability to go on horseback and shoot, the superficial copying of adventure literature’s characters (Fenimore Cooper’s characters, first and foremost) without psychological motivation, the repetition of plot lines (for example, episodes describing how fragile beautiful girls were released from atrocious Indians’ captivity) emphasized the conditionality of the Western narrative.

Taking the above-mentioned into account, it is not entirely correct to compare Natty Bumppo with the characters of literary westerns. All the features of F. Cooper’s adventure fiction – the dynamic plot based on a sharp contrast between good and evil which bristles with exciting adventures, love and hatred, the main and secondary characters’ disposition towards a certain type of actions – serve the purpose of depicting the tragic nature of his epoch. In his novels, the tragedy is shown not only through the outward confrontation between Americans assisted by Delaware Indians and the French assisted by Iroquois Indians combined with the intertribal warfare between Hurons and Mohicans, Pouni and Sioux, etc. It is also revealed by the ambivalent image of the supposedly refined “civilizing mission”, against which Natty Bumppo fought, as it destroyed the harmony between man and nature. This hero will always remain at a considerable aesthetic distance from the Western heroes with their eternal festive mood. It must be remembered that the Western genre frequently changed its attitude to the previous periods in the process of its evolution, thus denying the unimpaired functioning of the cultural traditions of a free society.

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# PAREMIOLOGY AS SECTION OF LINGUISTICS: DIACHRONIC AND SYNCHRONOUS APPROACHES

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**Abstract.** At the present stage, the problem of the study of paremias in foreign languages is very relevant among linguistic scholars. Philological studies of paremias are becoming more popular in connection with the development of humanitarian knowledge, the development and formation of new branches of linguistics.

**Keywords:** paremias, cognitive linguistics, paremiology, linguistic culture, aphorism, idiom.

Since ancient times, the Paremiological Foundation has been of interest to scientists. The first to classify and introduce proverbs and sayings (paremias) into the system was Aristotle (384-322 BC). He noted that paremias are elements of the old philosophy that survived due to their brevity. Paremias were used in their poems by the ancient poets Homer and Hesiod (VIII century BC), as well as Aristophanes and Menander.

In 1929, G.L. Apperson published a historical dictionary of English paremias and paremi expressions ”English Proverbs and Proverbial Phrases: A Historical Dictionary”. It contains paremias and paremiic expressions translated from Greek or Latin, as well as borrowings from other languages. In 1931, the first fundamental work on the study of English proverbs and sayings “The Proverb” by A. Taylor on the types, origin and structure of paremias appeared.

At the beginning of the XVIII century, a small selection of proverbs began to appear in various print media. The first, relatively large, publication of proverbs in Russian was carried out by N.G. Kurganov in his book "Russian Universal Grammar, or Universal Writing" (1769). For the first time, Russian proverbs are printed in a separate book in the collection of the professor of Moscow University Barsov “Collection of 4291 ancient Russian proverbs” (1770). The classic edition of V. Dahl's "Proverbs of the

Russian people" (1861) includes proverbs, sayings, apt words and other texts related to the field of paremiology.

Modern paremiology is developing as a system of interrelated socio-humanitarian paradigms that demonstrate, on the one hand, a variety of approaches and methods for studying paremias, and on the other, a general methodological foundation that allows interdisciplinary research. Modern tasks of studying paremias are posed as problem-oriented, that is, focused not on one specific approach, but on a problem requiring the integration of several areas of knowledge at once. In this vein, for example, studies have been carried out of proverbs quoted by well-known politicians and statesmen [17; 303]

The social aspects of the functioning of proverbs have also become the subject of interdisciplinary study. The combination of cognitive and cultural approaches is used to study the picture of the world, national and ethnic values, reflected in proverbs and sayings [18; 339]

Cognitive linguistics, one of the new and relevant areas of linguistics, turned its attention to how language and consciousness correlate, because language is a sign system in which the experience of mankind is fixed, which encodes it [7; 33]. Thus, language describes the world through its perception by man. So, we can talk about such a thing as a "linguistic picture of the world."

The linguistic picture of the world is a collection of people's representations of reality a at a certain stage of development of the people, the idea of reality reflected in linguistic signs and their meanings - linguistic division of the world, linguistic ordering of objects and phenomena, information about the world embedded in the system meanings of words [15; 38]. The national picture of the world is understood as something general, stable, repeated in the pictures of the world of individual representatives of the people [15; 37].

The linguistic picture of the world in the minds of native speakers is a combination of concepts and values. This is one of the components of the cognitive level of a linguistic personality, which is very closely related to culture [18; 10].

Thus, it is impossible not to correlate the concept of a linguistic picture of the world with a slightly narrower concept of “linguistic culture”, which in turn is a culture reflected, reproduced in linguistic signs [8, 10]. The linguistic picture of the world considers linguistic signs as carriers of a special form, which make it possible to analyze the language from the point of view of its influence on the consciousness of its speakers and its mediation, it includes both reality and individual features inherent in separate speakers of the language.

By the term "paremia", most modern scholars understand aphorisms of national origin, primarily proverbs and sayings. Folklore aphorisms along with aphorisms of non-folklore origin form a whole layer of linguistic expressions, which is included in the phraseological fund of the language [1; 240].

The question regarding the attribution of proverbs and sayings to phraseology remains open, since paramia have the characteristics of phraseological units, sentences and free combinations. In addition, proverbs and sayings are correlated separately with phraseological units for various reasons, and the reason for the difference lies in the unequal syntactic nature of these paremias.

In addition to the problem of correlating phraseology and paremiology, the separation of the concepts of “proverb” and “saying”, modern linguistics deals with the issue of distinguishing between paremias and aphorisms. The aphorism is considered a book stable expression, which briefly and originally sets forth the author's opinion regarding a life phenomenon or philosophical concept. Paremias are also aphorisms, but they have a folk origin, are characterized by laconic form, reproducibility of meaning and have, as a rule, an edifying meaning. They have an estimated orientation to all aspects of human life (from character to activity). Summarizing the concepts delimited above, one can say the following: phraseological units, paremias and aphorisms are varieties of stable expressions, each of which is characterized by its own set of structural, semantic and functional features. In the narrow sense of the word, only proverbs and sayings are considered paremias, since it is they who fulfill the function of moralizing and can claim the status of spokesmen for folk wisdom [1; 240].

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Speaking about the semantic content of the term paremia, L.B. Katsyuba considers paremia as a proverb, defined as a folk speech, and also as a short, stable expression that is used in a figurative meaning, in the form of a simple or complex sentence that describes a life situation, 16 while reflecting an important judgment, teaching, rules of conduct moral laws

created on the basis of rich everyday experience [8; 6]. Since paremias are not able to create units of speech, they relate to units of the language, similar to phraseological units, which gives reason to attribute them to the phraseological level of the language.

I.E. Anichkov considered the issue of the idiom of paremias, which is relevant and debatable in the linguistics of the 20th century. The scientist pointed out the need to study the structural and grammatical component of paremias, suggesting to designate proverbs and sayings that are stable combinations, the term "idiom" [3; 89]. However, we note that the issues of classifying paremias as phraseological units and the idiomatic sphere of language are relevant and not yet fully resolved for researchers in the field of phraseology and paremiology.

Thus, consideration of various interpretations of the concept of paremia allows us to conclude that this linguistic phenomenon has a complex nature and initiates controversy in modern linguistics. The interdisciplinarity of modern paremiology is to a large extent connected with the development of the communicative-pragmatic paradigm in linguistics, which has shifted the research focus towards speech activity and communication problems. In the framework of paremiology, this contributed to the study of the functional and pragmatic aspects of the proverbs and sayings used in speech, the analysis of the areas of their use and the related linguistic, cognitive, social, cultural and other features of paremias.

Monographic classification combines paremias depending on the place and time of their collection, with the aim of studying the historical component of proverbs and sayings, as well as considering them in chronological order. Genetic classification is the division of paremias into specific languages and ethnic groups. Thematic - consists in the distribution of proverbs and sayings on certain topics of the popular dictum, their semantic structure and content. Thematic classification used in their dictionaries and collections V.I. Dahl, M.A. Rybnikova, A.N. Martynova and V.V. Mitrofanova, V.P. Felitsin, Yu.E. Prokhorov, V.I. Zimin, A.S. Spirin, V.I. Zimin and most other domestic paremiologists.

It should be noted that the metaphorical nature of certain words of paremias does not change the meaning of a whole utterance, without creating, thereby, a figurative meaning.

Any classification of paremic units is conditional. Its existing principles have advantages and disadvantages. So, at first glance, a user-friendly dictionary classification by alphabet or reference word in some cases complicates the search itself and is not always related to the content of the paremic unit [16; 151].

The main and often used method of transformation of paremias is associated with syntactic changes in the structure. That is, we can distinguish types of transformation that are formed by lengthening, shortening, or otherwise changing the syntactic structure of paremias:

1) replacing the negative form with an affirmative. A lexical-grammatical transformation in which the negative form of the original is replaced by an affirmative in translation;

2) replacing the affirmative form with a negative one. The syntactic technique allows you to enhance the pragmatic effect;

3) changes in the communicative type of sentence.

The most characteristic type of transformation is the transition of narrative forms into interrogative ones, among which two types of question can be distinguished - general and separation. The occasional use of paremias in interrogative form transforms them into a rhetorical question.

Syntactic transformation leads to pragmatic modifications. The function of an occasional proverb, used in the form of a rhetorical question, is not only to communicate one's own opinion, but also to enhance the impression of what is said or written.

Distant arrangement of components (gap). The result of this transformation is the speech separation of paremia with a word, phrase, or graphic means to create a certain stylistic effect (semantic highlighting or isolation of any element of paremias) with an unknown component composition. At the same time, the disconnecting elements are not included in the structure of the paremias and do not fit into the image underlying it.

Knowledge and active possession of phraseological wealth not only decorates speech, but also contributes to a better understanding of the mentality of the people of the language being studied. This is all the more important because the problems of communication between cultures and peoples are being intensively studied in connection with the increasing importance of knowledge of foreign languages. Proverbs, sayings, phraseological units are original exhibitors of cultural knowledge, where there is an interaction of linguistic and cultural semantics.

That is why the study of phraseological units contributes to the knowledge of the entire history of the development of human society, from the origin of traditions and customs to the achievements of science and technology, helps to compare the peculiarity of the evolution of two or more individual communities [14; 3].

Thus, the research of V.P. Felitsyna, Yu.E. Prokhorova, O.A. Dmitrieva, M.L. Kovshova, F.F. Farkhutdinova, I.V. Privalova, I.V. Siglyuk and other scientists allow us to talk about the special linguoculturological status of

paremias, since in these units the synthesis of linguistic and linguocultural meanings is most clearly represented.

Summarizing the foregoing, it should be noted that proverbs and sayings most clearly reflect interpersonal relationships, which, being a "mirror" of culture, complexly and repeatedly reflect the people's identity, their mentality and vision of the world; it is the product of lively speech, the cultural creativity of the people, whose purpose extends far beyond the scope of a statement of instructive quality. The proverb contains a practical, creative and philosophical view of the world, which gives it the status of a valuable tool of knowledge.

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# LONG-TERM RESULTS OF CONSERVATIVE TREATMENT AND QUALITY OF LIFE IN CHILDREN AND ADOLESCENTS WITH PERTHES DISEASE (CLINICAL AND FUNCTIONAL RESEARCH)

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**Introduction.** The cause of Legg-calve-pertes disease (bLCPd) is not fully understood. In our opinion, long-term results and changes in the quality of life of most young people and middle-aged patients depend on the methods of conservative treatment. We believe that their increase is the most important task of an orthopedic doctor.

**Objective.** The goal is to evaluate the indicators of long-term results and identify changes in the quality of life in patients with Perthes disease 15 to 20 years after conservative treatment.

**Material and methods**. We examined 65 patients, aged 20-40 years, who were divided into two groups, depending on the proposed method of conservative treatment with various orthopedic techniques and pharmacological therapy. Group I was 30 people (46.1%), and group II was 35 patients (53.9%). We evaluated and compared the effectiveness of the treatment based on changes in the main static-dynamic, radiological, and Doppler parameters with results in the opposite hip joint (TBS). We also measured their quality of life on the Harris scale.

**Results.** Persistent asymmetric changes in the main static-dynamic parameters in the affected lower limb, pelvis, and vertebral column were found in all 65 (100%) of the examined patients ($p < 0.5$). In group I patients, the difference in leg length was 1.5-2.0 cm, the pelvic tilt was 10º, with the formation of a static deformation of the vertebral column of the

first degree. Whereas, identical linear and angular indicators in 35 people of group II significantly deteriorated ($p < 0.01$). Comparative radiometry, regardless of the method of conservative treatment, showed not only the formation of coxarthrosis (CA) in 40 patients (61.5%) of I – II degree, but also a violation of the spatial geometry of the proximal femur (POB) due to an increase in the Viberg angle (UV) and the Shenton line on the affected side. Evaluating the main hemodynamic parameters, we registered significant changes in the arteries that encircle the femoral neck. Their diameter on the affected side in all 65 (100%) patients was smaller, compared with the indicators of healthy TBS ($p < 0.5$). The average blood flow rate in them decreased on the sick side in 55 patients (84.6%) and was less than 30-50 %. The coefficient of blood flow asymmetry (AS) changed and was significantly lower on the affected side by 50-75 % ($p < 0.5$). The long-term results of their quality of life can only be considered satisfactory.

**Conclusion.** Thus, it can be considered that the improvement of methods of conservative treatment in patients with bLCPd is the most priority in the practice of children's orthopedist. Its qualitative revision should be recommended to ensure that their quality of life is improved.

**Keyword.** children; hip diseases; Perthes ' disease; conservative treatment; long-term results

**Introduction**

Legg-calve-pertes disease (bLCPd) is one of the most common osteochondropathies of childhood and adolescence. Its etiopathogenesis is not fully understood. Therefore, the proposed methods of conservative treatment are far from perfect. All 65 patients were divided into two groups, depending on the proposed treatment with different orthopedic techniques and pharmacological therapy, and their age at the time of treatment was the same. Group I in stages II – IV of the disease was performed unloading of the affected lower limb with skeletal and cuff traction. Non – steroidal anti-inflammatory drugs (NSAIDs) - Ibuprofen and Ibuklin-were used to reduce aseptic inflammation. Improving the metabolism of articular cartilage in TBS was achieved by intramuscular and periarticular administration of biogenic stimulants (phibs, Aloe, Vitreous), and hemodynamics by prescribing antispasmodics (Dibazol) and antiplatelet agents (Aspirin). Physical therapy, massage, and therapeutic gymnastics were used at each stage of bLCPd [1-6]. Whereas, in group II patients, Lange plaster immobilization and Mirzoeva splint were used to maintain the correct center of the femoral head in the cavity. The elimination of aseptic necrosis was facilitated by the use of NSAIDs (Nurofen and Nise). To stimulate

osteoarthritis, Osteogenon was prescribed, and the improvement of hemodynamic disorders was restored using angioprotectors and venotonics (trental, no-shpa, Detralex). Physiotherapy in various modifications (potassium iodide, calcium chloride, phosphorus, and sulfur), massage, and physical therapy were also used [6-9]. However, despite the variety of conservative treatment methods used, their result did not allow to improve the rate of osteoarthritis of the femoral head and hemodynamic parameters in the arteries that encircle the femoral neck. The duration of the disease was not significantly reduced, and structural and spatial disorders of the SBC were the main ones for the formation of CA in young and middle age. The quality of life gradually deteriorated. There are very few publications devoted to this problem [9-12]

**Material and methods**

We examined 65 patients aged 20-40 years who received conservative treatment in the departments of children's orthopedics in the Ivanovo region of the Russian Federation from 1988 to 2002.there were 60 Young people and middle – aged men (88.8%), and 5 women (11.2%). The defeat of the right TBS was 47.7% (31 cases), the left – 44.6% (29 cases), and both TBS – 7.7% (5 cases). The clinical examination included the study of the main static-dynamic indicators of the orthopedic status of the lower extremities, pelvis and vertebral column. Static values: the relative length of both lower limbs, the absolute length of the thighs and shins, and their circumference were measured in centimeters, and dynamic changes: movement in the affected TBS compared to healthy ones, the spatial position of the pelvic bones and the vertebral column in degrees, using the nomenclature protractor (SFTR). To identify radiological parameters of the SPACECRAFT, the classification according To N. S. Kosinskaya (1961) was used [11]. The change in the width of the articular gap of the affected TBS and its unevenness was detected using a line connecting the articular surface of the proximal epiphysis of the femoral head with the acetabulum in mm. in a healthy TBS, it was equal to 3.0 mm. its reduction over 1.5 mm in the medial, apical or lateral part was considered the most reliable. The radiological classification of Stulberg et al was used to determine the sphericity of the femoral head at the Exodus stage. (1981) as modified by Neyt et al. (1999), where A is the spherical shape of the femoral head; B is mushroom-shaped; and C is flat [9]. The violation of the spatial geometry of the POB to the acetabulum (VV) was judged by the increase in the Viberg angle and the discontinuity of the Shenton line. The angle of the Viberg (UV) revealed the degree of immersion of the femoral head in the BB. in normal adults, it

is equal to between 26° and 35° and was drawn by connecting two lines. The first passes perpendicularly through the center of the femoral head to the transverse axis of the pelvis, and the second connects the center of the head with the top BB. Its increase over 40° allow the formation of decentration of POBK. The Shenton line is drawn relative to the lower surface of the upper branch of the pubic bone and the medial surface of the femoral neck and has an arcuate course. Its discontinuity of more than 1.0 cm indicates that the articular surfaces of the affected TBS are not congruent. Hemodynamic disorders in the vessels that encircle the femoral neck of the affected TBS were judged by changes in the main indicators of dopplerometry. Its triplex polypositional scanning and high-energy color mapping were performed on a Toshiba Japan device using a 3.5-7.5 MHz sensor. Violation of blood flow in the medial and lateral arteries that encircle the femoral neck was determined by a decrease in their diameter (in millimeters), a decrease in the linear velocity of blood flow (centimeters per second), and an increase in the blood flow asymmetry coefficient (as). It was measured in the following proportion:

$$AS = \frac{Ø\ b.\ a. - Ø\ m.\ a.}{Ø\ b.\ a.} \times 100\ \%$$

where, Ø (b. a) is the diameter of the larger (unaffected) femoral envelope artery; Ø ( m. a.) is the diameter of the narrowed (smaller) envelope artery according to the recommendations of the Association Society of Radiologists in ultrasound, 2002 [12]. A decrease of more than 50% was considered the most reliable. The Harris scale was used to determine the quality of life of patients with CA [6; 13].

**Results and discussion**

Analyzing the results of a clinical examination in all 65 patients with CA, pain in the groin area (100%) was detected, which constantly increased after increased physical activity. The peak of its intensity occurred in the age range of 35-40 years, which provoked a decrease in motor activity and a decrease in the quality of life. Evaluating and comparing the main static-dynamic indicators, we found their deterioration in all 65 (100%) subjects ($p < 0.5$). In 30 young patients (46.1%), there was a decrease in the leg length difference of 1.5 - 2.0 cm. Hypotrophy of the soft tissues of the hip was 2.0 cm. the Deficit of active movements in the affected TBS was 10º of retraction and 20º of internal rotation. The formation of shortening in the affected lower limb caused the pelvic tilt-10º. Support capacity was not impaired, but gait arrhythmia increased. The change in the spatial position of the pelvis revealed a violation of the axis

of the vertebral column in the frontal plane, in the form of a" C – shaped scoliosis " of the lumbar Department of the I degree. Among 35 middle-aged individuals (53.9%), there was an increase in the relative shortening of the affected lower limb, more than 2.5 cm. Although the hip soft tissue hypotrophy remained at the same level, however, the lack of movement in the affected TBS increased due to the formation of a persistent adductor - rotational contracture. The angular value of the pelvis on the affected side increased and was equal to 15º. The gait was arrhythmic. Most patients used a medical cane when moving. The axis of the vertebral column was broken due to the formation of S-shaped deformation of the I – II degree in the lumbar and thoracic regions.

Studying the x-ray picture and comparative analysis of indicators in all 65 (100%) patients, it was found that they corresponded to the formation of CA in THEM. In 30 young people, the x-ray criteria for the KA classification [10] were equal to stage I (figs 1 and 2). The width of the joint gap was significantly narrowed mainly in the lateral part by 1.0 mm, compared with the indicators of the healthy side. Its uniformity in this part was not uniformly observed. The shape of the femoral head was broken. It was fungal in 10 (33.3%) cases, coxa plana– 8 (26,7%), 7 (23,3%) – coxa magna and 5 (16.7%) – saddle-shaped. The structure of the proximal epiphysis practically retained its uniformity, except for the apical part of it. The affected area was a rarefaction of bone tissue. The articular cartilage of the femoral head was thinned. The VV had the correct shape, but its depth was increased due to edge overgrowth. X-ray congruence indicators between SBC and BB were violated mainly due to an increase in the value of UV-45º and a change in the correct course of the Shenton line-1.5 cm. Whereas, in all patients older than 30 years, the x-ray picture of CA was already equal to stage II, and x-ray indicators continued to deteriorate. The width of the joint gap of the affected TBS significantly decreased by 1.5 mm in the apical and lateral parts ($p < 0.01$).Its apparent uniformity changed dramatically in the area of the SBK dislocation. It was not clearly traced there. The sphericity of the femoral head was lost, and its structure was not uniform, due to the formation of areas of cyst-like rearrangement and pronounced sclerosis of the closure plates of the BC and BB, especially in the zone of their contact. The depth of the BB increased due to the formation of osteophytes. The progression of the main x-ray parameters of the discongruence of the affected TBS was revealed in comparison with the healthy one. The UV value was - 50º, and the Shenton line was interrupted by 2.0 cm ($p < 0.5$).

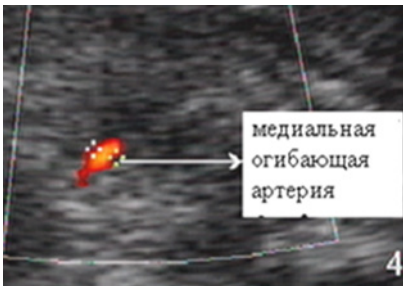
**Rice. 1**

**Rice. 2**

**Rice. 1.** X-ray of TBS in the anterior-posterior projection of the patient Yu. 24 years. Diagnosis: "Coxarthrosis of the right I degree". The change of the spatial geometry. Increasing the angle of the Viberg on the affected side and changing the size of the articular gap in the apical and lateral parts

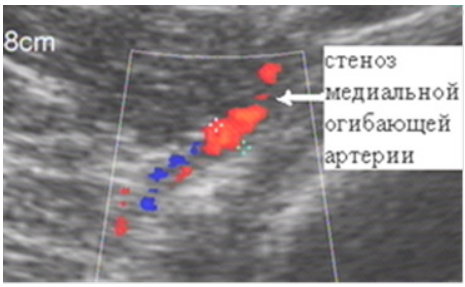
**Rice. 2.** X-ray of TBS in the anterior-posterior projection of the patient Yu. 36 years. Diagnosis: "Coxarthrosis of the right II degree". Narrowing of the joint gap, with an increase in the depth of the BB, due to the formation of osteophytes

Evaluating the main hemodynamic parameters, we found a decrease in blood flow in the arteries that encircle the femoral neck in all 65 (100%) patients. A comparative analysis of the main Doppler parameters revealed a decrease in the diameter of the arteries in all 30 young people on the affected side. It was 4.2 ± 0.18 mm, while on the healthy side its average values were -6.9 ± 0.26 mm ($p < 0.5$). Although the blood flow in them is set as the main one, but its average speed on the interested side was less by 30 % compared to the indicators of the contralateral joint, but with the same spectrum. However, AS sharply decreased and amounted to 50 % ($p < 0.5$). Whereas, in 35 middle-aged patients, dystrophic disorders of the SBC arteries progressed. Doppler monitoring revealed not only the deterioration of hemodynamics, but also the effect of stenosis in one of the arteries that encircle the femoral neck. The diameter of the medial and lateral envelope arteries in 25 (71.4%) subjects narrowed to 3.1 ± 0.04 mm. blood flow in them remained as the main One, but its average speed on the diseased side was > 50 % compared to the indicators of the contralateral joint, with the same spectrum. AS it decreased and was equal to -50 -75 %. The effect of stenosis was registered in 10 (28.6%) patients of the medial envelope artery. Its diameter was equal to 1.9 ± 0.12 mm, which led not only to the maximum decrease in the average speed (> 50%) and the lack of visualization of blood flow in them, but also changed the shape of its spectrum and sharp oppression AS 75-100 % (figs 3 and 4).




*the envelope of the medial artery

**Rice. 3**




** stenosis of the medial envelope artery

**Rice. 4**

**Rice. 3.** The dopplerogram of the patient is 24 years old. Diagnosis: "Coxarthrosis of the right I degree". Reducing the diameter of the medial envelope of the femoral neck artery. Violation AS more than 30 %

**Rice 4.** The dopplerogram of the patient is 36 years old. Diagnosis: "Coxarthrosis of the right II degree". Stenosis of the medial envelope of the femoral neck artery. Expressed violation AS 75%

Assessing the quality of life in all 65 patients with CA, the Harris scale was used. On the one hand, it was able to guarantee a higher quality of the proposed medical rehabilitation, and on the other hand, to ensure the main priorities of conservative treatment in children and adolescents with blcp. However, the terms of medical rehabilitation in all 65 patients were violated. We note that the quality of life improved in 10 patients (15.4%), did not change in 20 (30.8%), and worsened in 35 (53.8%).

When discussing the results obtained, we came to the conclusion that the long-term results and quality of life in patients with bLCPd depended not so much on the rate of reparative regeneration of the femoral head, but rather on the methods of conservative treatment [1-6]. Improvement of static-dynamic parameters in the affected lower limb, the structure of the femoral head and its spatial geometry with the acetabulum were not possible due to the inefficiency of the used pharmacological therapy and the proposed method of holding the femoral head in the center of the acetabulum (full immersion) [6-10]. Although, the doctrine of full immersion was the most important in comparing the correct geometry of the affected TBS since the 70 years of the last century [1-3; 6-7]. The use of the above-listed methods of conservative treatment was not enough to normalize x-ray and Doppler parameters. Therefore, the long-term results and quality of life of young and middle-aged people can be attributed to satisfactory. We believe that improving the quality of life in

children and adolescents is the main indicator in the treatment of such a complex orthopedic pathology.

**Conclusion**

Thus, the proposed methods of conservative treatment in children with bLCPd did not contribute to improving their quality of life. Clinical indicators in the affected lower limb caused persistent static-dynamic disorders, which led to changes in the linear and angular values of the pelvic girdle and vertebral column. Comparative x-ray analysis showed a significant deterioration of the main parameters under study with the formation of an early picture of the SC and violation of the spatial geometry of the BC and acetabulum. Dopplerometry of the arteries that encircle the femoral neck revealed significant hemodynamic abnormalities on the opposite side. The coefficient of blood flow asymmetry significantly showed impoverishment of blood flow FOR BC in middle-aged people. The terms of medical rehabilitation for young patients have not changed, but the average one has sharply decreased.

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# BILIARY ILEUS. OPPORTUNITIES FOR THE IMPROVEMENT OF DIAGNOSTICS AND SURGICAL TREATMENT RESULTS

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**Abstract.** The clinic operated on 51 patients with gallstone intestinal obstruction, which was diagnosed before surgery in 54.2% of cases. High obstruction prevailed - 77.1%. One-stage elimination of obstruction and radical debridement of extrahepatic bile ducts were performed in 81.3% of patients, in 5 cases laparoscopically. The conclusion is made about the prospects of mini-invasive methods of treating this pathology.

**Keywords:** biliodigestive fistula, intestinal obstruction, laparoscopy, acute pancreatitis

**Introduction**

An increase in the incidence of gallstone disease leads to an increase in its serious complications, such as internal biliodigestive fistulas and intestinal obstruction as a result of occlusion of the intestinal lumen with gallstones. Gallstone obstructive small bowel occlusion (GOSBO) is found in 3% of all patients operated on for acute intestinal obstruction or 0.2-0.6% of all operated on for gallstone disease and is a complex diagnostic and surgical problem [1].

There are various tactical approaches to treating biliary ileus. Most authors are inclined to two-stage treatment: at the first stage, it is proposed to eliminate intestinal obstruction, and with a favorable outcome and the absence of contraindications, perform cholecystectomy with the elimination of biliodigistinal fistula or be limited to enterolithotomy [2]. However, there is a point of view suggesting a radical treatment - the simultaneous elimination of intestinal obstruction and biliodigistinal fistula [3, 4]. In 1994, M.E.Franklin et al. First performed laparoscopic simultaneous surgery for

biliary ileus (BI), similar operations are rare to date. Laparoscopically assisted enterolithotomies are also performed a little more often [5]; Medline has information on only 30 such operations out of 400 with biliary ileus. The issues of minimally invasive treatment of this category of patients have not been studied in detail and there are only few results in a small number of patients, which dictates the need for studies to assess the capabilities of laparoscopic methods in the surgical treatment of patients, the development of diagnostic, tactical and surgical algorithms for BI.

**Purpose of work:** to evaluate the possibilities of diagnosing and improving the results of surgical treatment of gallstone small bowel obstruction.

**Material and methods**

Gallstone obstructive small bowel occlusion occurred in 48 patients admitted to surgical clinics of KubSMU on the basis of the city clinical emergency hospital. The diagnostic program for intestinal obstruction included: abdominal radiography (ARG), ultrasonography (US), computed tomography (CT), gastroduodenoscopy (GDDS), video laparoscopy (VLS).

**Results and discussion**

High obstruction was diagnosed in 37 patients (77.1%): at the level of the duodenum - in 3 patients (6.3%), with obstruction at 50-150 cm distal to the twelve duodenal-intestinal bend was detected in 34 patients (70,8%); low obstruction (at the level of the terminal ileum) was detected in 11 patients (22.9%), Fig. 1.

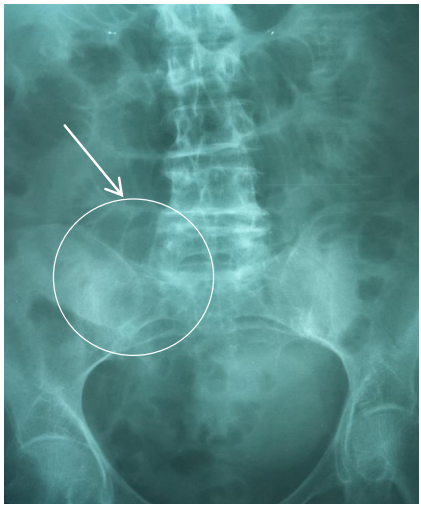
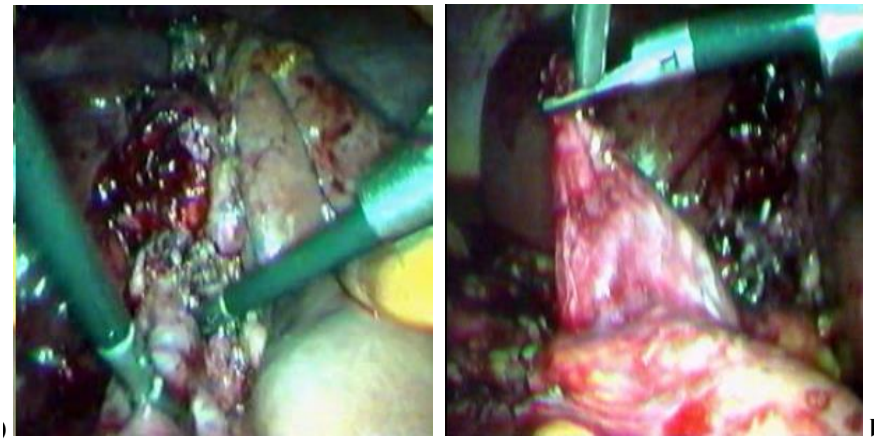


**Fig. 1. Abdominal ARG. OOCO, shadow of biliary enterolitis in the pelvic cavity (terminal ileum)**

GOSBO was diagnosed before surgery only in 26 patients (51%); in all other 25 patients, the cause of obstructive occlusion was determined intraoperatively.

In the surgical treatment of GOSBO, we used the following types of accesses: standard laparotomy, mini-access and laparoscopic. The goal of the operation has always been considered not only the elimination of small bowel obstruction, but also the radical rehabilitation of extrahepatic bile ducts. Dissociation of pathological biliodigestive anastomosis, duodenoraphy, cholecystectomy with revision of the bile ducts, enterolithotomy were performed in 38 patients (74.5%). In four cases, a small bowel resection was required, and in five patients it was possible to complete the full volume of the surgical aid in an endosurgical manner. In 12 patients, the complete radical volume of the operation was not performed due to the presence of severe concomitant somatic pathology - the operation is limited only by enterolithotomy (according to vital indications for eliminating small bowel obstruction). In 4 of these patients, in the postoperative period, choledocholithiasis was identified, which was eliminated by endoscopic papillosphincterotomy and lithoextraction.

Three patients died from extra-abdominal causes - mortality of 5.9%, which is a satisfactory result, given that in the vast majority of patients with gallstone obstructive small bowel occlusion- 74.5% of the surgical manual was performed radically, with the elimination of bilio-digestive fistula.

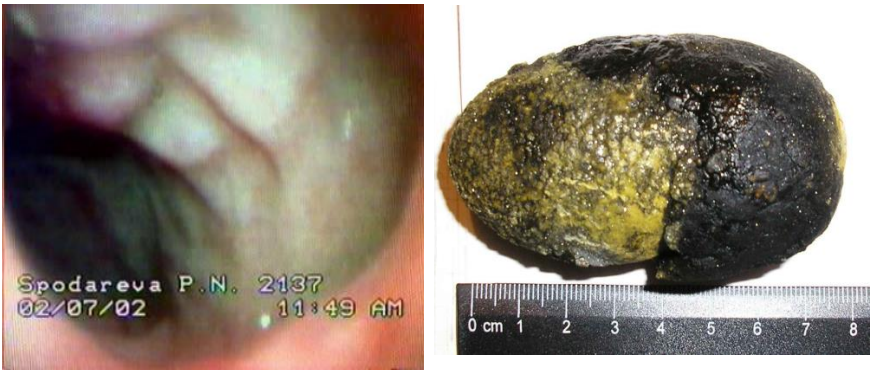


**a)** **b)**

**Fig. 2. VLS stages**
**a) cystic-duodenal fistula is set off, disconnected, cholecystectomy;**
**b) excision of the duodenal fistula, preparation for duodenoraphy**

The first experience of using video laparoscopy for the diagnosis and surgical correction of bilio-digestive fistulas against the background of the developed acute GOSBO showed the promise of using minimally invasive technologies for this complex pathology.

The stages of the full volume of VLS surgery for gallstone small intestinal obstruction: 1) the allocation of vesicouodenal fistula; 2) separation of the fistula; 3) cholecystectomy; 4) duodenraphy intracorporal; 5) enterolithotomy, enteroraphy intracorporal. Fig. 2.3.



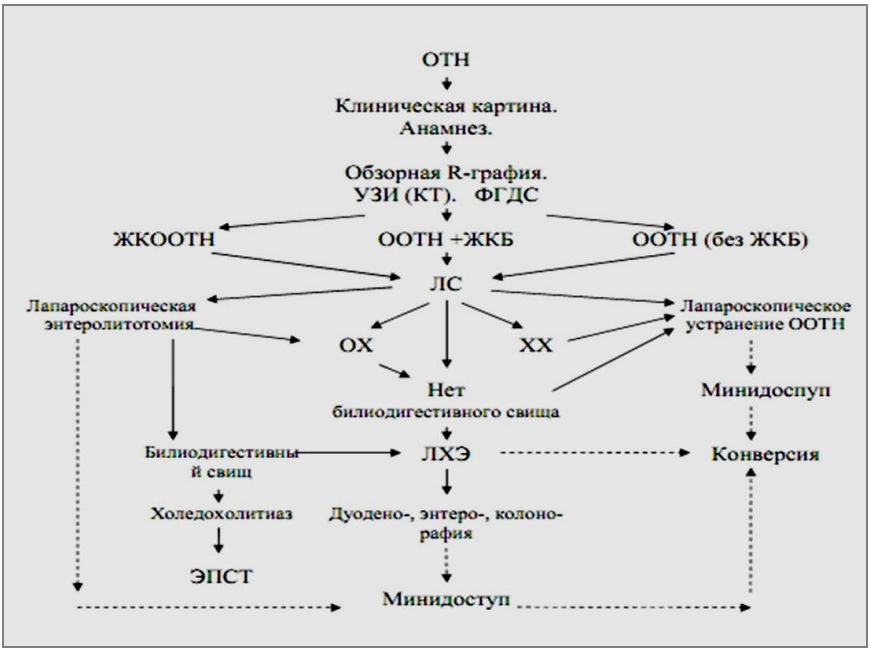

**a) b)**

**Fig. 3. VLS stages**
**a) intraluminal GDDS, control of duodenraphy from the mucosa of the duodenum; b) enterolithotomy, biliary enterolitis**

Further development of the diagnostic, tactical and surgical program will improve the results of treatment of pathology, which is a complication of acute cholecystitis. In this regard, a diagnostic and tactical algorithm for gallstone obstructive small bowel occlusion has been developed, which is shown schematically in Fig. 4.

Upon admission of a patient with acute small bowel occlusion, the medical history should be clarified in detail in order to identify the presence of gallstone disease, previous bouts of acute cholecystitis, data from possible previous US. It is necessary to perform a survey radiography of the abdominal cavity, a polyposition ultrasound examination of all areas of the abdomen. In some cases, the examination must be supplemented with computed tomography and firmogastroduodenoscopy (to identify or detail complex pathology options). At this stage of the examination of the patient, three clinical variants of OOCO can be identified (other options for small bowel occlusion are not considered in this algorithm): 1) gallstone OOCO

- the gallstone is clearly visualized in the lumen of the duodenum or small intestine, which is the cause of its obstruction; 2) obstructive OCO - signs of bowel obstruction, without a clear visualization of the biliary calculus in its lumen: at the same time signs of cholelithiasis are detected; 3) obstructive OCO - signs of bowel obstruction, without a clear visualization of the gallstone in its lumen and the absence of cholelithiasis.




*Abbreviations used in the algorithm scheme:*
OCO – obstructive colonic occlusion
OOCO – obstructive OCO
GOOCO – gallstone OOCO
LS – laparoscopy
AC (CC) – acute (chronic) cholecystitis
LCS – laparoscopic cholecystectomy
EPST – endoscopic papillosphincterotomy

**Fig. 4. Diagram of the algorithm for diagnosis and treatment of gallstone acute obstructive small bowel occlusion, gallstone disease and biliodigestive fistula**

According to our ideas and according to the current state of the issues of treatment of obstructive OCO, this pathology can be treated using minimally invasive video endoscopic techniques, therefore, for any of the revealed variants of intestinal occlusion, the next diagnostic and at the same time therapeutic stage should be video laparoscopy. The volume of the operation is determined based on the technical capabilities and the level of training of the operating team and combines the use of minimally invasive technologies in isolation laparoscopic or in combination with mini-access.

The following options are possible depending on the diagnosis: 1) with obstructive OCO without signs of cholelithiasis, an attempt is made to eliminate obstruction laparoscopically (enterolysis with adhesions of OOCO, enterotomy with removal of bezoar or foreign body, bowel resection with tumor obstruction; 2) with obstructive OCO (not gallstone) with the associated concomitant cholelithiasis, an attempt is also made to eliminate obstruction laparoscopically, and the simultaneous LCS is shown only in exceptional cases rays when the patient has signs of destructive cholecystitis; 3) with gallstone obstructive OCO, an attempt is made to eliminate obstruction laparoscopically - enterolithotomy; concomitant LCS in this case is performed only in acute destructive cholecystitis, which practically cannot be in the presence of a functioning vesicle intestinal fistula. In the case of the presence of such a fistula (which is very likely with gallstone OCO), tactics should be determined by the availability of technical capabilities and the readiness of the operating team to perform LCS with dissociation of the cystic-intestinal fistula and closure of the duodeno-, hero- or colonotomy opening, but mainly the severity of the patient's condition. In severe condition or in the absence of the possibility of minimally invasive performance of these stages of the operation should be limited to the elimination of OCO. The general position for all types of obstructive OCO is that if it is impossible to eliminate it by mini-invasive methods (laparoscopic and using mini-access), one should resort to conversion and perform the necessary amount of surgery with laparotomy access.

An extremely important aspect of minimally invasive surgery for obstructive OCO of any genesis is that the presence of complete obstruction with the expansion of the adducting small intestine and the accumulation of a large amount of intestinal contents in it creates unfavorable conditions for the evacuation of this content with minimal microbial contamination of the abdominal cavity with isolated laparoscopic access. Possible technical difficulties in performing laparoscopic surgery can be successfully resolved using a mini-approach, the projection of which onto the anterior abdominal wall is easier to determine with laparoscopy, as well as to ensure complete evacuation of intestinal contents and decompression of the small intestine

without the risk of massive microbial contamination of the abdominal cavity. In addition, the emerging need to perform closure of the enterotomy opening or resection of the small intestine with the formation of a small-intestinal anastomosis can also be successfully resolved through mini-access.

Separately, tactical and therapeutic issues should be addressed when identifying concomitant choledocholithiasis. The implementation of endoscopic papillosphincterotomy in the postoperative period seems to be an ideal approach; terms of its implementation should be determined by the condition of the patient, the presence of obstructive jaundice and cholangitis. In the presence of which EPST with lithoextraction or nasobiliary drainage should be performed according to urgent indications in a fairly short time after the main operation to eliminate small bowel obstruction, according to the generally accepted tactics of biliary decompression in this pathology. And only with asymptomatic choledocholithiasis, the issue of EPST and lithoextraction can be resolved in a longer time.

**Conclusion**

Minimally invasive methods of surgical treatment of gallstone intestinal obstruction are feasible both in two-stage and in one-stage variants, which is more preferable. Good results have been obtained for minimally invasive treatment of this rare and complex pathology. Our proposed tactical algorithm for choosing the methods of operation requires further clinical research in this direction.

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# THE NEW REFERENCE BOOKS OF NET ZOOPLANKTON OF THE FAR EAST SEAS AND ADJACENT PACIFIC WATERS

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**Abstract.** Using a unique database of zooplankton collected in the Chukchi and Bering seas, the Sea of Okhotsk, the Sea of Japan and the North Pacific Ocean, five reference books were created and printed containing the species composition, occurrence and abundance of zooplankton in the surveyed area, where the information is aggregated by species, developmental stages, size fractions, regions, vertical layers of water, light and dark time of day; seasons of the year and perennial periods. The substantial volume and high quality of the collated data gives hope that the information presented in reference books together with previously published data on macrofauna and data on the nutrition of common fish and squid will enable the next important steps to be taken in the understanding of the nature of the Far Eastern seas and the Pacific – one of the most productive and economically important regions of the world ocean.

**Keywords:** appraisal of waters; long-term monitoring; North Pacific and East Arctic; reference books; net zooplankton

## Introduction

Since the 1980s in the TINRO large-scale complex marine expeditions in the North Pacific and adjacent Arctic plankton is fished using a large Juday net made of kapron sieve No. 49 (0.168 mm mesh) with a 0.1 $m^2$ opening from a depth of 200 m to the surface, and where the depth is less than 200 m from the bottom to the surface. In the study of the upper pelagic zone additional plankton is fished in the 0-50 m water layer. If necessary, other depths are sampled layer-by-layer. Sample processing is carried out by the express method (Volkov 1984, 1996, 2008) with the division of their contents into 3 fractions: fine (length of 0.6-1.2 mm), medium (1.2-3.2 mm), large (> 3.2 mm), and the separate analysis of these fractions. Research groups at sea usually work in two shifts, so the collection of materials takes place both day and night in order to calculate the vertical diurnal migration of a number of dominant euphausiids species, some species of copepods,

and hyperiids that during the day descend into the deeper layers beyond the epipelagic zone. Surveys are performed, if possible, year round and every year with the sampling grid. They regularly cover the entire exclusive economic zone of Russia and sometimes the adjacent waters (Fig. 1).

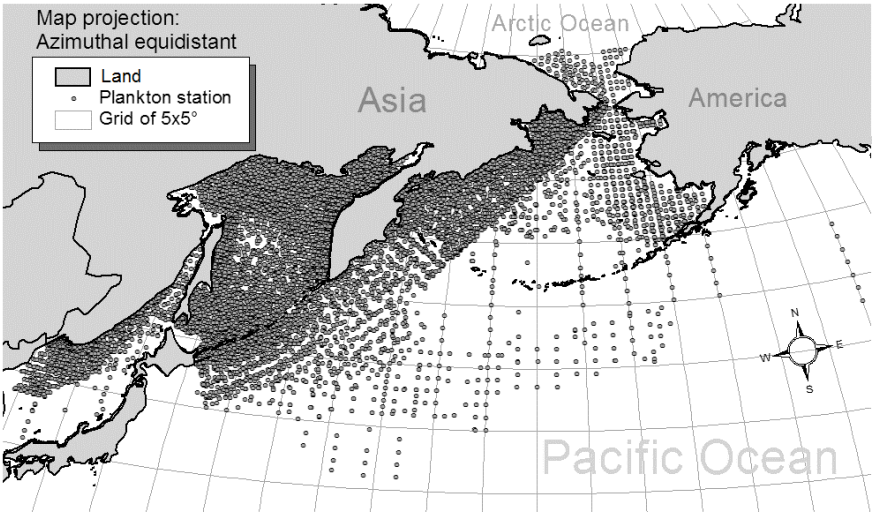


**Fig. 1. Spatial distribution across the surveyed waters of 25,512 plankton measurement stations, from which the data obtained, has been entered into the database and reference books**

During the implementation of the concept of information support for ecosystem research (Volvenko, 2015a-c, 2016) a large database "Net zooplankton in the North Pacific, 1984-2013" (Volvenko et al. 2016) was created in 2012-2014, put into trial operation 2015, and officially registered in the State Register of the Russian Federation in 2016. Based on it, GIS and other electronic information systems were prepared (see, for example, Volvenko 2019), and then the reference books on natural water resources that are described in this article. They are dated 2016, but only recently became available to the scientists.

**Materials and Methods**

Abundance *N* and biomass *M* of each taxonomic group of zooplankton at each stage of development or size group in each fraction per unit of the caught volume, the cubic meter (respectively in specimens/$m^3$, and mg/$m^3$), for each plankton sample (see Fig. 1) were recalculated according to the formulas:

$$N = \frac{n \cdot p}{v} = \frac{n \cdot p}{0.1 \cdot (h_1 - h_2)} \text{ and } M = \frac{m \cdot p}{v} = \frac{m \cdot p}{0.1 \cdot (h_1 - h_2)},$$

where: $n$ – number, $m$ – weight of this species/stage/group/fraction in the catch (specimen, mg); $v$ – volume of water, filtered by the plankton net ($m^3$); $h_1$ – initial, $h_2$ – final catch depth (m) determined while factoring in the angle of the cable (see, for example Volkov 2008). $h_1$–$h_2$ – net distance covered (m); $p$ – dimensionless correction of catch efficiency; constant 0.1 – area of the net opening ($m^2$).

This method of calculation differs from the standard ones by the introduction of correction $p$, compensating for the underestimation of aquatic organisms, due to the imperfection of the fishing gear. This correction (which many planktonologists recognize is needed, for example: Clutter & Anraku 1968, Kiselev 1969, Grese et al. 1975, Musaeva & Nezlin 1996, Gorbatenko & Dolganova 2006, 2007, Volkov 2008), is the inverse of the classic catch efficiency coefficient. According to the original definition (Baranov 1933), the catch efficiency coefficient is the ratio of the number of animals caught to the entire number of animals that were in the catch area. It introduces a multiplier in the denominator of the equation to calculate the density of aquatic organisms (see, for example: Shuntov & Bocharov 2003a, b, 2004a, b, 2005a, b, 2006a, b, 2012a-c, 2014a-e) and can vary from 0 to 1. Accordingly, the reciprocal value; the catch efficiency correction, typically used by TINRO planktonologists, $p \geq 1$ introduces a factor in the numerator. The correction values adopted by them, depending on the taxonomic affiliation, fraction, developmental stage or group size of zooplankton vary from 1 to 10 (see: Dolganova & Volvenko 2016a, b, Volkov & Volvenko 2016a-c). Comparisons of the catchability of the large Juday net with plankton nets of other constructions have been published earlier (Kiselev 1969, Timonin 1983, Musaeva & Nezlin 1996, Gorbatenko & Dolganova 2006, 2007).

Subsequently, the based on the relative values of $M$ the absolute abundance of thousands of tons of each species, the individual stages of their development, size classes, supraspecific taxonomic and ecological groups, fractions, the entire zooplankton for various layers of the pelagic zone and the time periods in the standard areas of biostatistical data averaging (Fig. 2) may be calculated.

**Results and Discussion**

Five tabular reference books (Dolganova & Volvenko 2016a, b, Volkov & Volvenko 2016a-c) of the species composition and abundance of zooplankton in a major fishing region of Russia (Fig. 3) were published. Three

of them are devoted to the Far Eastern seas: the western part of the Bering Sea, the north-west of the Sea of Japan and Okhotsk sea; one – the Northwestern part of the Pacific ocean. On the map (Fig. 1) the increased density of the measurements is clearly visible in these areas, as they were taken in the area of water which is constantly monitored by the TINRO, and studied much better than others. A separate volume is devoted to the Peter the Great Bay of the Sea of Japan. This is done while factoring in the uniqueness of the fauna of the bay, the fact that its coast contains much of the populace and industry of the Russian Far East, has a highly prospective aquaculture industry, and also the fact that unlike most other areas of the Far Eastern seas, the plankton in the neritic zone has only been adequately studied here. The new tabular directories contain a total of nearly 5 thousand pages.

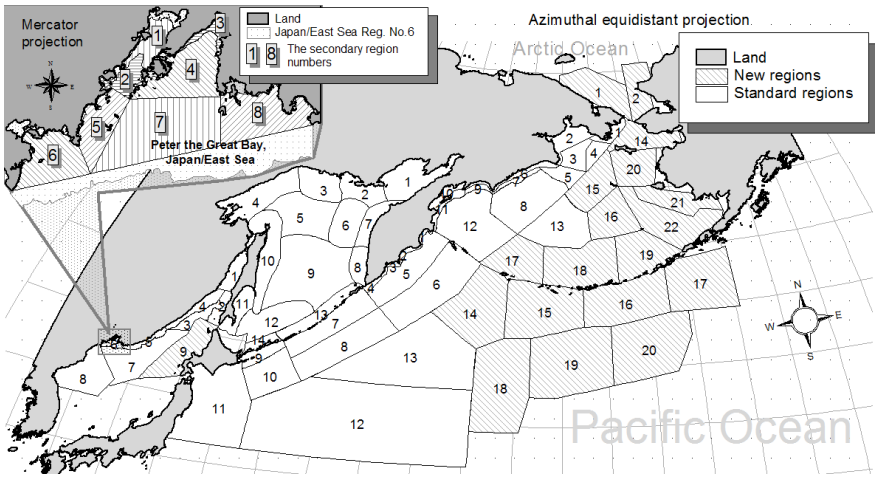


**Fig. 2. Standard regions in which averaging of biostatistical information in the waters of permanent (light) and periodic (shaded) monitoring is performed. In the upper left tab – secondary regions, which the 6th region of the Sea of Japan is divided into**

The tables contain information on the occurrence (number of samples in which this species/group of animals was found, and their share in percentage terms of the total number of measurements), the average abundance (specimens /$m^3$ and mg/$m^3$) and the standard error of mean with the Sheppard's correction. The species and other taxonomic groups of aquatic organisms are not sorted systematically but in alphabetical order, and then in ascending order of size by fraction, developmental stage

and/or size. The final rows of the tables – “Entire zooplankton”, “Meroplankton”, “Amphipods”, “Copepods”, “Euphausiids” etc. contain the corresponding total group means and standard errors calculated by the formula $m_{\sum x} = \sqrt{m_1^2 + m_2^2 + ... + m_n^2}$, where $m_{\sum x}$ is the sampling error of the sum *n* of the arithmetic means, following their errors $m_1 - m_n$.

In general the format of these tables is the same as in the previously published reference books on nekton published in 2003-2006 (Shuntov & Bocharov 2003b, 2004b, 2005b, 2006b) as tabular annexes to nekton atlases (Shuntov & Bocharov 2003a, 2004a, 2005a, 2006a), directories on the pelagic trawl macrofauna published in 2012 (Shuntov & Bocharov 2012a-c), and benthic macrofauna published in 2014 (Shuntov & Bocharov 2014a-e). Information in them is also grouped by: 56 standard biostatistical areas (see 48 light unshaded areas on the main map Fig. 2, and 8 areas in the insert in its upper left corner), which are natural systems characterized by relatively uniform waters that is due to the formation of their properties in specific local geographical, geomorphological, climatic and hydrological conditions. So there is now a certain standard for geo-referencing spatially distributed information, ensuring the comparability of diverse environmental information and the continuity of the long-term monitoring data on the state of the waters (Volvenko 2003d).

Besides the described zoning to identify the characteristics of the spatial and temporal distribution of plankton in the surveyed areas, the reference books contain four principles relating to grouping and the selection of raw data:

1) By fished layer, measurements are divided into:

epipelagic – final catch depth 0 m, and initial from 100 to 200 m (or the bottom, if depth is ≤ 300 m),

upper epipelagic – final catch depth 0 m, and initial from 25 to 50 m (or bottom, if depth is 70 ≤ m).

2) By time of day, to factor in the diurnal vertical migration of zooplankton, they are divided into:

day – obtained during daylight,

night – obtained in the dark or at dusk.

3) Seasonally (in this case this means not the calendar seasons but the biological seasons (see Shuntov 2001), the measurements are divided into:

summer – from 1 June to 15 September

autumn – from 16 September to 30 November,

winter – from 1 December to 31 March,

spring – made from 1 April to 31 May.

4) There are 4 long time periods:
1984 - 1990 – “Sardine and pollock fish abundance”,
1991 - 1995 – “Transitional period of sharp decline in abundance”,
1996 - 2005 – “Period of low-level new fish productivity growth”,
2006 - 2013 – “Salmon period”.

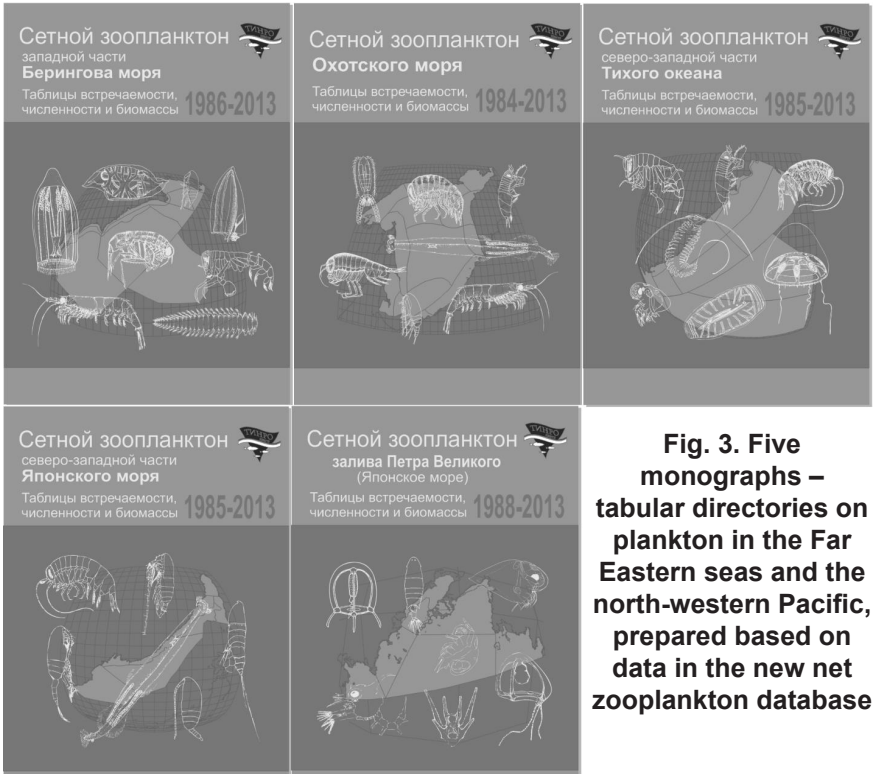


**Fig. 3. Five monographs – tabular directories on plankton in the Far Eastern seas and the north-western Pacific, prepared based on data in the new net zooplankton database**

These principles relating to the grouping, selection and averaging of data are partially or fully implemented in the majority of the TINRO ecosystem studies (see, for example: Shuntov & Bocharov 2003a-b, 2004a-b, 2005a-b, 2006a-b, 2012a-c, 2014a-e, Volvenko 2003a-c, 2004a-c, 2005a, b, 2007, 2014, 2015c, 2016, Shuntov et al. 2007, Shuntov & Temnykh 2008, Volkov 2014 and many others).

The data in these tables enable the total stock plankton biological resources of the Far Eastern seas of the North Pacific to be evaluated. With the use of the so-called volume method, the absolute abundance of aquatic organisms is calculated by multiplying their average density (specimens/

$m^3$ or $mg/m^3$) by the corresponding volume of water (thousand $km^3$). The result gives, respectively, trillions of specimens and thousands of tons. For this the standard morphometric characteristics of the areas listed in every reference book should be used. (Note that many opponents of applying corrections to catch efficiency can easily recalculate the data published in books in their own way, as in each row of the tables in them, the correction value is given. It is sufficient to divide any of the density parameters – abundance or biomass – by it. Those people who in principle do not deny the necessity to introduce such corrections, but are not in agreement with the specific values adopted by us, can also easily recalculate the density by dividing it by our correction, and then multiplying it by their own).

With these same tables it is easy to recalculate the volumetric characteristics of density into areal characteristics. To do this, multiply the average abundance or biomass by volume of water corresponding to the water area, and then divide it by its area. The result will be in the billions of specimens/$km^2$ or t/$km^2$. From the tables of these directories it is just as easy to calculate the plankton content in the middle and lower epipelagic, i.e. from 50-200 m (based on the difference of concentrations from 0-200 m and 0-50 m) and the average individual weight of animals (by dividing their biomass by number), and using previously published tables on calorific value and the chemical composition of zooplankton (for example Borisov et al. 2004), you can obtain its energy characteristics, etc.

In this way a significant contribution to the new quantitative inventory of aquatic biological resources and appraisal of the waters of the North Pacific has been made. A series of these monographs and catalogs is recommended to planktonologists, ichthyologists, hydrobiologists, ecologists, biogeographers, teachers and students in related disciplines. Their scope of application is fundamental and applied science, higher education, the management of living aquatic resources, aquaculture development, and nature conservation, and they can be used to assess the damage caused to nature by various anthropogenic factors, including pollution, the construction of hydraulic structures, oil and gas extractions, tanker accidents, nuclear reactors, etc.

**Conclusion**

The substantial volume and high quality of the collated data gives hope that the information presented in all five reference books together with previously published data on pelagic and benthic macrofauna and data on the nutrition of common fish and squid, which is now being compiled in the TINRO hydrobiology and applied biocenology laboratories, will enable the next important steps to be taken in the understanding of the nature of the Far Eastern seas and the Pacific.

The reference books contains information on the status and spatial-temporal dynamics of the planktonic part of the biotic community, which provides 90% of the Russian catch of fish and other aquatic organisms (Bocharov 2004, 2010) during a time period in which there were considerable transformations in the biota of the region caused by changes to global climate and oceanological and cosmic-geophysical factors since the early 1990s (see, for example: Shuntov et al. 1993, 1997; 2007, Shuntov 1994, 1998, Shuntov & Temnykh 2011). Therefore, it is difficult to overestimate its role in the ecosystem, biogeographic, trophological and biological resource studies of the Far Eastern seas of Russia and adjacent waters of the Pacific Ocean.

The author of this conference paper is the co-author of the table guides (Shuntov & Bocharov 2003b, 2004b, 2005b, 2006b, 2012a-c, 2014a-e, Dolganova & Volvenko 2016a, b, Volkov & Volvenko 2016a-c), atlases (Shuntov & Bocharov 2003a, 2004a, 2005a, 2006a) and databases (Volvenko & Kulik 2011, Volvenko et al. 2012, 2014a, b, 2016, Volvenko 2014, 2015b) mentioned above, but not the owner of the original data. On the use of the plankton database and for purchase hard copy of reference books one should contact the Directorate of the Pacific Branch of Russian Federal "Research Institute of Fisheries and Oceanography" at the address: TINRO, per. Shevchenko 4, 690091, Vladivostok, Russia. The electronic versions of five reference books discussed above are freely available in pdf format for public access through the ResearchGate website (see links in the list of references).

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# FAUNA AND ECOLOGICAL-TROPHIC RELATIONSHIPS OF LONGHORN BEETLES UNDER THE CONDITIONS OF SUBTAIGA ZONE OF THE TYUMEN REGION

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**Abstract.** On the territory of the taiga zone, with a variety of natural conditions, longhorn beetles are quite richly represented. Despite this, until now there has been no comprehensive analysis of the fauna of longhorn beetles. In this regard, we decided to conduct a comprehensive analysis of representatives of the longhorn beetles fauna.

As a result of our studies, we have identified potentially dangerous species of longhorn beetles of forests of the subtaiga zone of the Tyumen oblast. Most species are dangerous physiological pests, have wide environmental plasticity and are found in forests of various types. Their number is especially high in the northwestern part of the taiga zone, where a significant part of the forests is leased.

**Keywords:** Subtaiga zone, longhorn beetles, ecological-trophic groups, population density, control measures.

## Introduction

Forests of the subtaiga zone of the Tyumen region are in poor condition, especially pine forests. They are often "invaded" by tenants, fires and insects. Tenants are under state protection, and there is no way to deal with them. They have been quite successfully involved in firefighting in the regions of the region, and have not paid much attention to forest pests in recent years. Significant damage to tree species is caused by longhorn beetles, or longicorns (*Cerambycidae*), one of the most noticeable families in the order of beetles (*Coleoptera*). Representatives of this family are obligate phytophages found in a wide variety of stations.

When conducting a comprehensive analysis of the longicorns fauna, we established the habitat of 15 species of longhorn beetles, which are present in various phytocenoses of both natural and artificial origin. Naturally, the longhorn beetles fauna of this natural zone is by no means

limited to the species listed below. Analyzing the literary sources, we intend to detect several dozens of locally distributed and rare species of this family.

**Conditions, materials and methods**

Our research was conducted in the sub-taiga zone. This zone is located south of the southern taiga subzone. Its area is about 3 million hectares, which is 8% of the territory of the Tyumen region. Geomorphologically, the zone lies within the eastern margin of the Trans-Urals and the northern margin of the Ishim Plain.

During 2016-2019, we carried out observations of insects - longhorn beetles in the territory of the Tyumen region. Purpose of our research is the study of the ecological and biological characteristics of the species of longhorn beetles and their ecological and trophic relationships with plants in the subtaiga zone of the Tyumen region. Studies were carried out in all phytocenoses and in settlements.

For concomitant surveys and observations, generally accepted sources of literature were used [1, 2, 3, 4, 5, 7, 9].

**Research results and discussion**

In the study of biological features and species diversity, we described and determined 15 species of insects from 5 subfamilies. In order to describe and determine these species, we used various methods for catching insects [6, 8].

I. Subfamily *Prioninae*: 1) *Tragosoma depsarium* L.; 2) *Prionus coriarius* L.

II. Subfamily *Lepturinae*: 3) *Dinoptera collaris* L.; 4) *Stenurella melanura* L.

III. Subfamily *Aseminae*: 5) *Asemum striatum* L.; 6) *Arhopalus rusticus* L.; 7) *Spondylis buprestoides* L.

IV. Subfamily *Cerambycinae*: 8) *Aromia moschata* L.; 9) *Xylotrechus rusticus* L.; 10) *Cyrtoclytus capra* Germar; 11) *Monochamus galloprovincialis* Ol.; 12) *Acanthocinus aedilis* L.

V. Subfamily *Lamiinae*: 13) *Lamia textor* L.; 14) *Saperda populnea* L.; 15) *Saperda carcharias* L.

The composition of the entomocomplex in our conditions includes 4 ecological-trophic groups. All the 15 insect species defined by us and described above were distributed among trophic groups. Some longhorn beetles may come in several groups depending on age. For clarification, we have entered all the species we have identified in a special table, table. 1.

**Table 1.**

**Species diversity of ecotrophic groups of dendrophages.**

| Ecological-trophic group | Main species | At what stage of development is harmful |
|---|---|---|
| 1. Saproxylophages | *Tragosoma depsarium* L., *Prionus coriarius* L. | Benefit |
| 2. Antophages | *Dinoptera collaris* L., *Stenurella melanura* L., *Aromia moschata* L., *Cyrtoclytus capra* Germar. | Adult insect |
| 3. Xylophages | *Asemum striatum* L., *Arhopalus rusticus* L., *Aromia moschata* L., *Saperda carcharias* L. | Larval stage |
| | *Xylotrechus rusticus* L., *Spondylis buprestoides* L., *Monochamus galloprovincialis* Ol., *Acanthocinus aedilis* L., *Lamia textor* L., *Saperda populnea* L. | Adult insect and larvae of all ages |
| 4. Phyllophages | *Lamia textor* L., *Saperda carcharias* L. | Adult insect |

From the data of the table it follows that some species are included in various ecological and trophic groups, depending on the stages of development. Most species do harm to plant organisms in the larval stage, some species at a certain stage of development may not be pests, for example *Dinoptera collaris* L., *Stenurella melanura* L. and *Cyrtoclytus capra* Germar in the larval stage of development. Species from the subfamily Cerambycidae at all stages of development are useful.

In the ecology of insects, the central place is occupied by the dynamics of the number of populations. Knowing the type of distribution of individuals in a population is important when estimating its density by sampling. Depending on the year of research, some variation was observed. The data we have recorded in the pivot table.

**Table 2.**

**Fluctuation in abundance of longhorn beetles, their severity and frequency of occurrence.**

| Subfamilies and insect species | Population density in% | | | | | harm-fulness* | frequency of occur. points** |
|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | average | | |
| ***Prioninae*:** | 2 | ***3*** | ***2*** | ***1*** | ***2,0*** | | |
| 1. *Tragosoma depsarium* L. | 1 | 1 | 1 | - | 0,75 | U | 4 |

| Subfamilies and insect species | Population density in% | | | | | harm-fulness* | frequency of occur. points** |
|---|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2019 | average | | |
| 2. *Prionus coriarius* L. | 1 | 2 | 1 | 1 | 1,25 | U | 4 |
| ***Lepturinae*:** | ***4*** | ***4*** | ***3*** | ***3*** | ***3,5*** | | |
| 3. *Dinoptera collaris* L. | 4 | 3 | 3 | 3 | 3,25 | P/N | 3 |
| 4. *Stenurella melanura* L. | - | 1 | - | - | 0,25 | P/U | 4 |
| ***Aseminae*:** | ***17*** | ***16*** | ***15*** | ***14*** | ***15,5*** | | |
| 5. *Asemum striatum* L. | 3 | 2 | 2 | 2 | 2,25 | T | 3 |
| 6. *Arhopalus rusticus* L. | 6 | 5 | 4 | 5 | 5,0 | T | 3 |
| 7. *Spondylis buprestoides* L. | 8 | 9 | 9 | 7 | 8,25 | P/T | 2 |
| ***Cerambycinae*:** | 36 | 35 | 36 | 37 | ***36,0*** | | |
| 8. *Aromia moschata* L. | 2 | 3 | 2 | 2 | 2,25 | P | 3 |
| 9. *Xylotrechus rusticus* L. | 6 | 6 | 5 | 7 | 6,0 | P/T | 3 |
| 10. *Cyrtoclytus capra* Germar | 2 | 1 | 1 | 2 | 1,5 | P/T | 4 |
| 11. *Monochamus galloprovincialis* Ol. | 18 | 19 | 23 | 19 | 19,75 | P/T | 1 |
| 12. *Acanthocinus aedilis* L. | 8 | 6 | 5 | 7 | 6,5 | P/T | 3 |
| ***Lamiinae*:** | ***41*** | ***42*** | ***44*** | ***45*** | ***43,0*** | | |
| 13. *Lamia textor* L. | 3 | 4 | 3 | 2 | 3,0 | P/T | 3 |
| 14. *Saperda populnea* L. | 12 | 11 | 12 | 13 | 12,0 | P/T | 2 |
| 15. *Saperda carcharias* L. | 26 | 27 | 29 | 30 | 28,0 | P/T | 1 |
| Total: | 100 | 100 | 100 | 100 | 100 | | |

Legend: * - by harmfulness, the species of longhorn beetles are divided into: U - useful, populating rotten trees, accelerating their decomposition; P - physiologically dangerous; T - technically dangerous; P/N - physiologically neutral, not bringing any harm or benefit to plant organisms; P/U - physiologically useful, participate in the pollination of flowers and the decomposition of dead wood; P/T - species capable of attacking living trees and causing technical harm. ** - The frequency of occurrence of each species is indicated in points: 1 point - mass species, very common; 2 points - common species, often found; 3 points - the species is quite rare; 4 points - the species is very rare (isolated finds).

The data in the table show insignificant deviations in the number of insects depending on the year of research. The table also shows the harmfulness of each species separately and the frequency of occurrence in points.

Assessment of numerical abundance and determination of the degree of dominance of species in the entire fauna of longhorn beetles was carried out using the scale of abundance of O. Renkonen [11]. The abundance categories on this scale are estimated as follows: superdominants - make up more than 10% of the total number of collected material, dominants - 5-10%, subdominants - 2-5%, recedents (rare) –1–2%, subrecedents (very rare) - less than 1%. Based on the data in Table 2, all species identified by us were distributed according to the degree of dominance, Fig. 1.

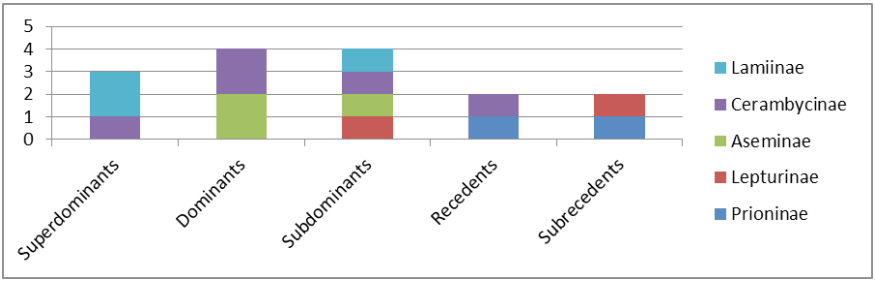


**Fig. 1. The species diversity of longhorn beetles, depending on the category of abundance**

The data of the figure showed the superiority of the categories of dominant and subdominant species diversity, represented by 4 species, respectively. Superdominant species are: *Monochamus galloprovincialis* Ol., *Saperda populnea* L. and *Saperda carcharias* L.. *Tragosoma depsarium* L. and *Stenurella melanura* L. are subrecedented species.

Despite the wide variety of species of longhorn beetles found in the subtaiga zone, only a few of them pose a real threat. To distribute the species according to their degree of danger, we used the technique from a scientific article [10]. We obtained the data we entered in the diagram (see Fig. 2), in the preparation of which we used the material of table 2.

To clarify the characteristics of the degrees of harmfulness, their detailed description is given below.

*Sporadic* – species present in plantations, but always in single copies and therefore not important in the weakening of trees.

*Harmful* – species are harmful, but due to the fact that they do not give outbreaks of mass reproduction, they are also not dangerous at present.

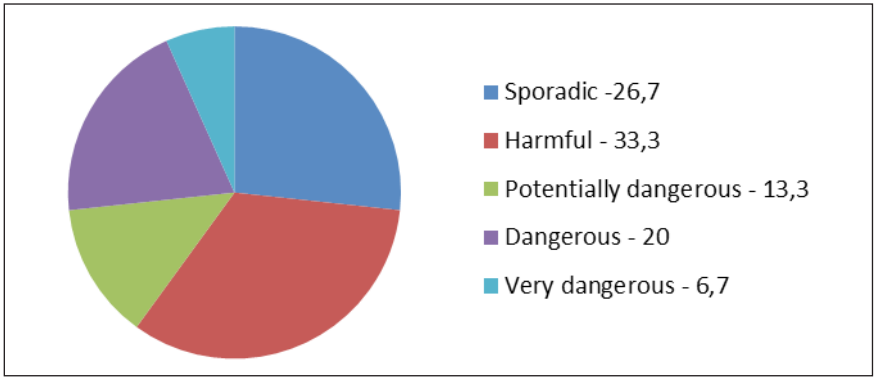


**Fig. 2. The distribution of insect pests by degree of harmfulness,%.**

*Potentially dangerous* – potentially dangerous species of dendrophages, which in the past could give outbreaks of mass reproduction and, under certain favorable conditions, can realize their numbers.

*Dangerous* – species dangerous to pine and small-leaved forests, requiring constant monitoring.

*Very dangerous* – especially dangerous species, giving periodic increases in numbers, significantly reducing the aesthetic appearance of the stand and can lead to drying out.

The diagram shows the percentages of the species representation of each degree of harmfulness. For potentially dangerous and very dangerous species, it is necessary to constantly monitor and actively combat them. Especially dangerous species of subtaiga forests in recent years are *Spondylis buprestoides* L. and *Saperda populnea* L., and according to our data *Saperda carcharias* L. is a very dangerous species.

The control of wood pests consists of the supervision of their mass appearance and distribution, the implementation of sanitary rules and the application of chemical control measures.

For detailed supervision, stationary test sites for 10 years of research were laid. At these sites, we conduct annual observations that will help us clarify the root cause of weakening of plantations, determine their condition, species composition and main groupings of wood pests, take into account indicators of their population dynamics. Based on the results of this forecast, pest control measures can be assigned.

Based on the studies performed in the processing of the obtained materials, all the results were summarized in table 3, which lists species that cause significant harm to the forest phytocenosis.

**Table 3.**
**Percentage of parasitic xylophagous insects on tree species and effective control measures.**

| Insect species | The object of parasitism | Percentage, ±m% | Effective control measures in forests of the taiga zone |
|---|---|---|---|
| *Dinoptera collaris* L. | Umbrella flowers, leaves and young shoots of trees and shrubs. | 3,25±0,8 | Sanitary felling. |
| *Asemum striatum* L. | Dead and fallen trees, unrooted timber, high unrooted stumps. | 2,25±0,5 | Felling of populated trees and debarking them before the larvae leave the wood. |
| Arhopalus *rusticus* L. | Dry pine wood, sleepers, wooden parts of buildings, timber. | 5,0±0,9 | Tree thinning, trap trees, chemotherapy. |
| *Aromia moschata* L. | Viable willows (larvae), plant flowers (beetles). | 2,25±1,0 | Tree thinning, trap trees. |
| Xylotrechus *rusticus* L. | Weakened and viable aspen, birch and willow trees of different ages. | 6,0±0,85 | Tree thinning, trap trees, chemotherapy, entomophage involvement. |
| *Monochamus galloprovincialis* Ol. | Weakened and even healthy trees, fresh unbroken timber and veiled. | 19,75± 0,9 | Systematic thinningof trees, cleaning windbreak, snowed. |
| *Acanthocinus aedilis* L. | Viable trees, timber. | 6,5±0,8 | Windfall and windbreak cleaning, debarking timber. |
| *Lamia textor* L. | Weakened small-leaved trees (larvae). Young shoots and leaves (beetles). | 3,0±1,1 | Tree thinning, trap trees, chemotherapy. |
| Saperda *populnea* L. | Young aspen and willow. | 12,0±0,8 | Tree thinning, trap trees, chemotherapy, entomophage involvement. |
| Saperda *carcharias* L. | Weakened and viable aspen. | 28,0±0,9 | Thinning of freshly populated trees (2 times), trap trees, chemotherapy, entomophage involvement. |

The data in the table shows the percentage of longhorn beetles conventionally per hectare of usable area (forest). According to the tabular data, we can determine which types of pests must be controlled in the first place, and which ones not to pay attention to at all. The most common for

subaiga forests are *Saperda carcharias L.* and *Monochamus galloprovincialis Ol.*, and the most dangerous are *Saperda carcharias L.* and *Saperda populnea L.*

When conducting pest control, we devoted more time to using trap trees and collecting eggs, larvae, pupae, adults and adult insects on weakened, but still living trees. Collection of insects at all stages of development was carried out periodically throughout the growing season. These measures allowed to heal several hectares of weakened pine and small-leaved forests.

The data obtained by us will help forestry experts to reasonably approach the implementation of the plan for forest production and forest protection in the subtaiga forests of the Tyumen oblast.

**Conclusions**: For four years of research in the subtaiga zone of the Tyumen region, 15 species of longhorn beetles from 5 subfamilies were identified and identified.

The structure of dendrophagous and phytophage of subtaiga includes 4 ecological and trophic groups. The most representative is the group of xylophages. Most species are harmed in the larval stage.

All certain species differ in the value and purity of occurrence, on the basis of this they were systematized into 6 groups (U - useful; P - physiologically dangerous; T - technically dangerous; P/N - physiologically neutral; P/U - physiologically useful; P/T - species capable of attacking living trees and causing technical harm). By the purity of occurrence of the studied insects, we divided them into a four-point system.

When assessing the numerical abundance and determining the degree of dominance of species in the entire fauna of longhorn beetles, we established the quantitative composition of the five categories of abundance. The dominant and subdominant species are most representative of species diversity.

Based on the methods of protection, we found that the most effective control measures for the species of the subfamilies *Cerambycinae* and *Lamiinae* are the harvesting of felling residues and the use of hunting belts, and for most longhorn beetles, the selection of freshly populated trees and the collection of insects at all stages of development.

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# ANALYSIS OF LEAVES OF *POLEMONIUM COERULEUM L.* BY SCANNING ELECTRON MICROSCOPY

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**Abstract.** In this study, we have conducted studies aimed at exploring the possibility of using the method of scanning electron microscopy to study the morphology of the leaf surface of Polemonium coeruleum and clarifying the morphological characteristics of this object, which is of practical importance for determining the indicator of "Authenticity" and the development of regulatory documentation for medicinal plant materials "Polemonium coeruleum herb". The object of the study was the leaves of Polemonium coeruleum harvested in the Voronezh Oblast from a cultivated plant. To study the morphology of the leaf surface, a scanning electron microscope JSM-6510LV (Japan) was used. As a result of the study, additional morphological characteristics of the leaf of Polemonium coeruleum, namely the structure of the stomatal apparatus and trichomes, were clarified, identified and visualized.

**Keywords.** Polemonium coeruleum, microscopic analysis, scanning electron microscopy

*Polemonium coeruleum L.* of the family *Polemoniaceae* is a widely known plant in the medical practice of Russia [1].

State Pharmacopoeia of the Russian Federation XIV ed. includes rhizomes with roots of Polemonium coeruleum, which are recommended for use as an expectorant and sedative [2, 3]. In addition to underground organs, the herb Polemonium coeruleum L is sold through the pharmacy network, which is in the status of a dietary supplement with a sedative effect [3, 4, 5].

A number of Russian and foreign works are devoted to the study of Polemonium coeruleum Studies mainly concern the study of the chemical composition of the plant, as well as the development of physico-chemical methods for assessing the quality and standardization of both medicinal plant materials of Polemonium coeruleum and herbal medicines based on it [5, 6, 7].

One of the important stages in the development of regulatory documentation and the assessment of the quality of plant objects is the determination of the "Authenticity" indicator, which is carried out using visual, stereomicroscopic and microscopic analysis. The description of external signs (established with the naked eye or with a magnifier) and the anatomical structure of the aerial part of Polemonium coeruleum (including leaves) are found in literary sources, however, information on the study of the morphological features of the leaf, established using microscopic methods, is limited [2, 8].

One of the promising methods for analyzing the surface morphology of plant objects is the method of scanning electron microscopy (SEM). This method is widely used both in solid state chemistry [9], aircraft engineering [10], materials science, archeology, biological sciences [11-15], and medicine (for analysis of the surface of bone tissue, tooth enamel, erythrocytes) [16] and pharmacy (surface analysis of tablets, etc. [17]).

Currently, the analysis of morphological features of plant objects is carried out using stereomicroscopy in reflected light, however, the SEM method has several advantages. First of all, this is the possibility of computer simulation of the resulting picture, using a larger magnification, obtaining a more contrast and clear image, reducing analysis time, the lack of the need for multi-stage sample preparation, etc.

The aim of the study was to examine the morphological structure of the leaves of Polemonium coeruleum by scanning electron microscopy.

**Materials and methods**

The objects of study were leaf samples of Polemonium coeruleum, independently harvested in the Voronezh region from cultivated plants during flowering and dried by the air-shadow method.

The study of samples by scanning electron microscopy involved the preliminary deposition of a thin metal film of carbon in a magnetron-type setup to ensure conductivity as a sample preparation. The samples were studied on a JSM-6510LV electron microscope (Japan) (Voronezh State University Center for Collective Use. URL: http://ckp.vsu.ru»).

**Results and discussion**

As a result of the analysis of the surface of a leaf of Polemonium coeruleum by scanning electron microscopy, the identification characteristics of the object were refined and supplemented, which correlate with some ana-

tomical features of the leaf that we previously established using classical microscopic analysis [8]. The epidermal cells of the upper and lower sides of the leaf have a different shape, from below they are very sinuous, elongated. The stomata are mainly on the lower side of the leaf, the stomata trailing cells are cuticular, the stomatal fissure is narrow, strongly elongated, surrounded by 4–5 epidermal cells. The edge of the leaf is wrapped on the underside. On the edge of the leaf, papillary outgrowths of epidermal cells are visualized, which are located in 3-5 rows. On the upper side of the leaf along the veins are rare simple multicellular hairs. On the lower side of the leaf along the veins in the apical part, simple hairs of small size, in the medial and lower parts they are long, hair cells are often twisted. Also, glandular hairs with a multicellular pedicle and a multicellular head are found along the veins. The same glandular trichomes are rarely found along the edge of young leaves. On the surface of the leaf blade there are also one and two-celled simple hairs.

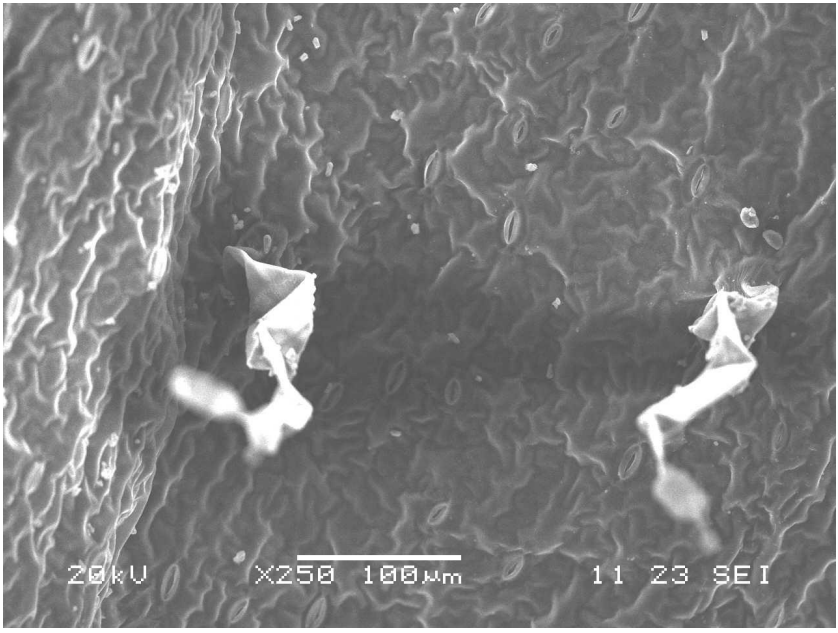


**Figure 1 – Polemonium coeruleum leaf underside view**

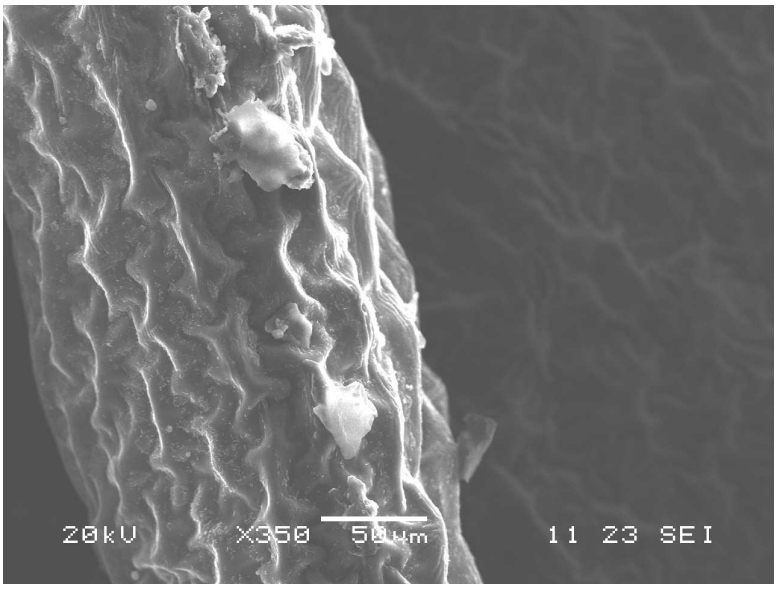


**Figure 2 – The edge of the Polemonium coeruleum leaf**

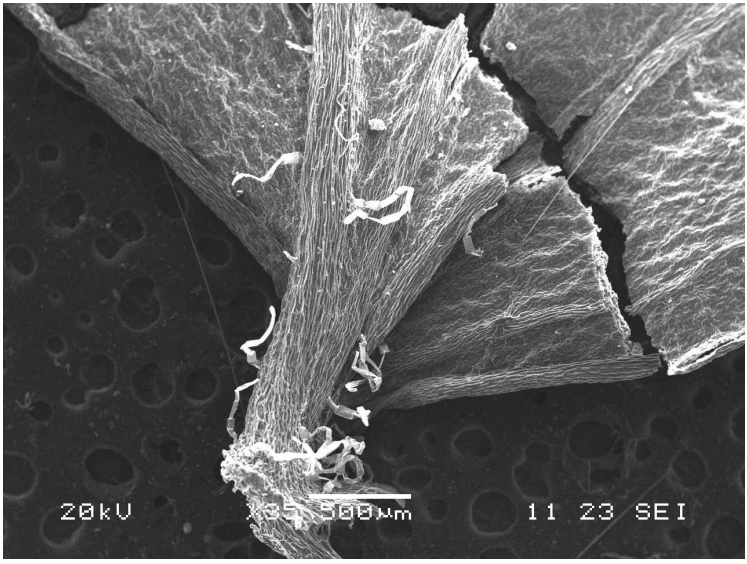


**Figure 3 – General view of the petiole and the main vein of the lower side of the Polemonium coeruleum leaf**

**Conclusion**

The prospects of using the method of scanning electron microscopy to study the surface morphology of plant objects using the example of Polemonium coeruleum leaves, which is relevant in pharmaceutical analysis and pharmacognosy, is of practical importance for determining the “Authenticity” indicator in the development of regulatory documentation for medicinal plant materials are shown.

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# HYDROCARBON POTENTIAL OF THE KOBLANDY-TAMDY UPFOLD OF THE NORTHERN EDGE OF PRICASPIAN BASIN

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**Abstract.** In the present article geological structure of Koblandy-Tamdy Paleozoic upfold of the Pricaspian basin is described, the upfold was discovered and delineated based on seismic exploration and drilling results. On the example of Koblandy area hydrocarbon potential of pre-salt complex of the conjunction of the Northen and Eastern edges of Pricaspian basin had been evaluated, resources were estimated. New prospective structures had been delineated within the Paleozoic sedimentary cover, which can be ranked as the first priority exploration drilling targets in the region.

**Keywords:** Pricaspian basin, Koblandy, Tamdy, pre-salt complex, seismic exploration, prospects, oil and gas.

The geological data of recent years, and these are the results of magnetometric, seismic, and deep drilling, allow us to make new constructions of the structural model of the Paleozoic sedimentary complex of the Caspian basin. The block character in the foundation structure of the Caspian Basin can be traced on seismic sections.

According to drilling data, the foundation of the Caspian basin was discovered by only a few wells in the northern side. The northern geoblock extends from the Mezhuzensky block in the west to the Novoalekseevsky block (trough) in the east. Large tectonic elements within this geoblock: Karpovsky, Fedorovsky, Aksaysky and Orenburg blocks. The surface of the foundation stepwise along the faults plunges into the depths from 4 - 5 km in the north of the side zones, to 22 km in the south of the tectonic blocks.

The results of seismic surveys and deep drilling data of the study area show that the ledges of the base correspond to elevations in subsalt deposits. However, the coincidence of the structural plan of the sedimentary complex with the surface of the foundation cannot be unambiguous. This is predetermined by multiple geotectonic collisions, which led to transgressions and regressions of the Paleo-Ocean, erosion of accumulated sedimentary strata and interruptions in sedimentation.

The Kobylandy-Tamda tectonic step belongs to the zone of the Middle Devonian side ledge and is located in the extreme eastern part of the tectonic step. In the south, it is bounded by the deepwater part of the Caspian depression, and in the southeast by the Novo-Alekseevsky trough. From the north, the Trinity deep fault and the narrow Linevo-Izobilnensky trough are separated from the Sol-Iletsky block (within which the ledges of the carbonic and Late Perm sedimentation stages are traced. The Tamdy and Bestau ledges are associated with the Novoalekseevsky trough, which is the southwestern extension of the Pre-Ural basin the basement surface is 10.0–12.0 km, in sub-salt deposits, as a rule, gentle uplifts and chains of local structures are distinguished (Fig. 1).

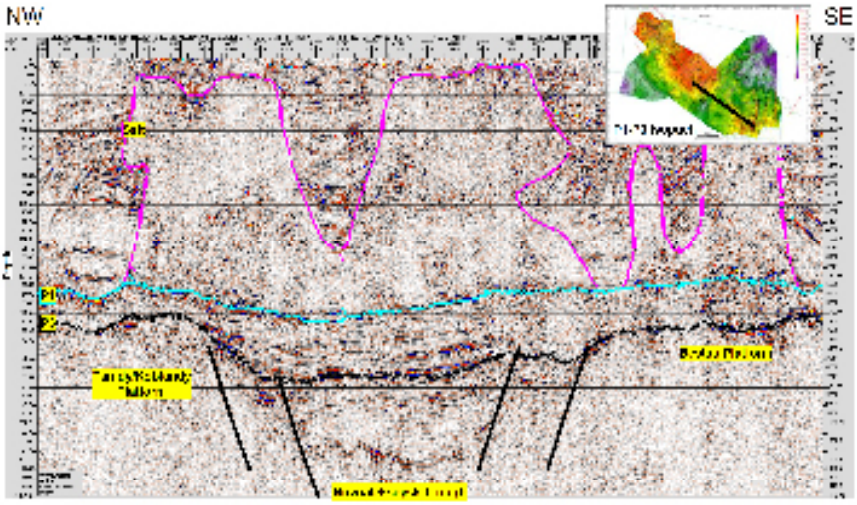



**Figure 1. Seismic profile along the OTG-06-20 line through the Kobylanda-Tamdy tectonic step - Novoalekseevsky trough - Bestau uplift**

In recent years, “Orenburggazprom” LLC has been actively searching for objects of the Karachaganak type in the Russian part of the internal borderline zone in the immediate vicinity of Kobylandy Square. Four wells were drilled - Kainsai: G-1 (6512 m), G-2 (6581 m), Burannaya G-1 (6504 m), Yuzhno-Linevskaya P-1 (6145 m), which uncovered subsalt deposits in the eastern borderline zone of the eastern sectors of the depression to a depth of 553, 731, and 312 m, respectively.

Well G-1 Kainsay discovered sub-salt deposits in the age range from the Lower Permian to the Eiffel layer, inclusive. An identical section was opened in well G-1 Burannaya, and its face is in French deposits. Well G-2, Kainsai revealed a section close in structure. The increase in the thickness of the coal-bearing part of the section is apparently less related to the plumes of shelf carbonate deposits, and more reflects the area of the onset of complex formation in shallow marine facies. The thickness of the subsalt complex within the Orenburg part of the inner borderline zone is much less than in the Kobylandy area. In Kaysai wells, the thickness of the subsalt complex is at the level of 700-750 m.

According to the data of Kobylandy-3 well drilling and 3D seismic exploration in the subsalt mid-Devonian section, a dolomite stratum with a thickness of 500 to 650 m (with an increase in thickness to the edges of the massif) is identified in the arch of the carbonate massif. In the study of core, the primary rock is limestones, fully dolomitized. In the upper part of the core, fragments of limestone “bandstones”, “packstones” and “orestones” are visible, from which it is concluded that sedimentation conditions relate to the slope of the carbonate platform.

In seismic sections in the Tamdinskaya area, the dolomite stratum in the Devonian sediments is also distinguished. According to 2D seismic data, the thickness of the Middle Upper Devonian sediments in the arch of the Tamdinsky subsalt uplift is 700-800 m (and in some areas up to 950 m).

Precipitation accumulated at an early stage in the formation of the sedimentary cover of the East European Platform. Where there are no such deposits within the outer borderline zone of the Caspian Depression (Rozhkovskaya Square, Sol-Iletsky Arch, Orenburg Arch), rocks of the crystalline basement were discovered under drilling in the Middle Devonian sediments. The section of the subsalt sedimentary cover of the northern side zone of the Caspian basin is represented by the following sedimentary complexes.

**Upper Vendian, Ordovician, Silurian, Lower Devonian.** Lower Devonian deposits in the Takatinsky, Vanyashsky and Elm horizons with stratigraphic disagreement lie on the deposits of the basement, Riphean, Ordovician and Silurian.

Terrigenous deposits of this complex were discovered by wells in the Sakmarsky graben, separating the Sol-Iletsky ledge of the foundation from the Orenburg, in the Ural trough and their presence in the Novo-Alekseevsky trough is possible. Lower Devonian sediments were discovered by the Kainsaiskaya G-2 well (int. 6562-6581m) and Chinarevskaya P-9 (int. 5168-5243m). The rocks are represented by interbedding of mudstones, sandstones, and gravelites).

**Eiffel-Artinsky complex** was discovered by wells in the areas of Chinarevskaya, Karachaganak, Kainsai, Nagumanovskaya, Vershinovskaya and Kobylandy. Carbonate formations are developed mainly on raised blocks and are represented by bioherms and biostromes (gravitating to the marginal parts of the massif). Depositional deposits form the bent zones of the basin, represented by the interbedding of terrigenous rocks and limestones. Eiffel deposits were discovered on the Koblanda structure by the KOB-3 well. These sediments are represented by a monolithic stratum of fractured, cavernous dolomites, which are identified in the seismic sections as a “bright spot”, without clearly defined stratification.

**Zhivetsko-Nizhnefransky complex ($D_2$gv-$D_2$1p-kn)** in the Vorobev, Ardat, and Mulla layers along the northeast side of the Caspian depression are represented by terrigenous and carbonate depressed rocks of reduced thickness (wells Nagumanovskaya-1, Vershinovskaya-501, Kaysayskaya G-1, Karachaganak D-5, Kobylandy Kob-3), possibly partially blurred in elevated areas.

**Deposits of the Nizhnefranian Stage $D_3fr_1$** as part of the Pashi and Kynov horizons, also of reduced thickness (11-89 m), are also represented by depositions - intercalation of limestone, mudstones, dolomites. In the Kob-3 well, deposits are represented by limestones, mudstones, dolomites and siliceous rocks.

North of the Linevsko-Izobilnevsky trough, which separates the Devonian Karachaganak-Kobylandinsky carbonate massif from the Orenburg and Sol-Iletsk system of arch elevations, the following are distinguished:

**Mid-French-Tournaisian complex ($D_2fr_2$-$C_1$t),** which composes the second step of the northern side ledge of the Caspian Basin, where barrier reefs are developed on the border of shelf carbonate and depression clay-carbonate deposits. The facies and thicknesses of the Famennian, Tournaisian, Visean, and Serpukhov tiers in the depression zone and in the airborne zone are different, which indicates the formation of an onboard ledge of the depression already in the Famennian time.

The Karachaganak Atoll, located at the base of the Upper Famennian deposits, is located somewhat separately. The strip of Carboniferous bar-

rier reefs is pushed to the north (Chinarevskaya area, Nagumanovskaya, Vershinovskaya), where the thickness of the reefogenic limestones of the complex reaches 700-340 m, and at a short distance to the interior of the basin, thick reefogenic limestones are replaced by a thin strata of depression deposits. In this case, in the Koblandy-Tamdinsky carbonate massif and northwest, in the Kainsai and Burannoy structures, the Middle Frans-Tournaisian complex is represented by low-power deep-sea sediments (limestones, mudstones, siliceous rocks, dolomites). Complex capacity in wells Kobylandy-3 is 58m, Kainsai G-1 - 182m., Burannoy P-1 - 197m, Kainsai G-2 - 270m.

**Visean-Bashkir complex**, including the Raspberry-Bobrikovsky terrigenous formation, it forms part of the barrier reefs, which south of the Visean-Bashkir ledge is represented by depressed clay-bituminous limestones, dolomites, and mudstones. The Karachaganak atoll has a thickness of Visean-Bashkir organogenic limestones - 778m, Vershinovskaya structure - 832m, Nagumanovskaya - 615m, Chinarevskaya - 300-500m. According to well drilling data (Kainsayskaya-2, Burannaya-1), the division of facies into deep-water and shallow-water begins from Famennian. In this zone, the Serpukhov-Bashkir carbonate platform is not traced. The thickness of depression deposits to the south beyond the Visean-Bashkir shelf carbonate ledge is insignificant - 55 m (well Kobylandy-3) and 15 m (well Kainsaiskaya -1).

**Kashira-Lower Perm Carbonate Complex** in the lower Permian side ledge zone is represented by organogenic, cavernous limestones, dolomites with a terrigenous horizon at the base (Verey terrigenous formation – $C_2m_1vr$). The capacity of the complex within the Lower Perm side ledge on the areas: Chinarevskaya 680-870m, Nagumanovskaya - 781m, Vershinovskaya - 462m. In the KOB-3 well, the Artinsky-Assel deposits are represented by interbedded limestones, mudstones, dolomites and siliceous rocks.

According to the results of 3D seismic surveys, the Kobylandy sub-salt elevation is distinguished in temporary and deep migrated sections as a massive carbonate formation with several peaks, such as a biostroma, of the Upper-Middle Devonian age, which arose on the arch of the eponymous ledge on the foundation.

As a result of the interpretation of the 3D seismic data cube, reflecting horizons were identified:

***$P_1$ (blurred surface of pre-Kungur deposits),***
***$C_3$ (coal deposit roofing),***
***$P_2d$ (eiffel tier $D_3ef$ dolomite roof),***

***Dolomites sole $D_2ef$,***
***$P_3$ (surface of terrigenous sediments of the Middle Devonian).***

An extensive structural wall is highlighted on the structural map along the reflecting horizon $P_1$ in the center of Kobylandy Square. In the center of the square, within this structural shaft, an isogypsum (-6150m) stands out with two peaks: to the west of the KOB-3 well and to the south. The dimensions of the isogypsum elevation (-6150m) are 17.0 x 8.0km, the amplitude is 200-250m, the area is 91.66 sq.km.

The uplift is represented by the northwestern brachianticline; the southwestern and western wings are complicated by tectonic disturbances.

The structural plan for the roof of carbon deposits is not presented over the entire area, since the thickness of these deposits is small and the traceability is not universal. The rise of Kobylanda in the coal-bearing complex of deposits is distinguished by isogypsum (-6100m), a complex shape, also has two peaks that are outlined by isogypses (-6050m). The western peak has an amplitude of 100m, the southern one - 50m. The thickness of the coal deposits within the arch of the uplift is 100-150 m, increasing in the south-western direction to 200 m, the area of the uplift is 22.28 km$^2$.

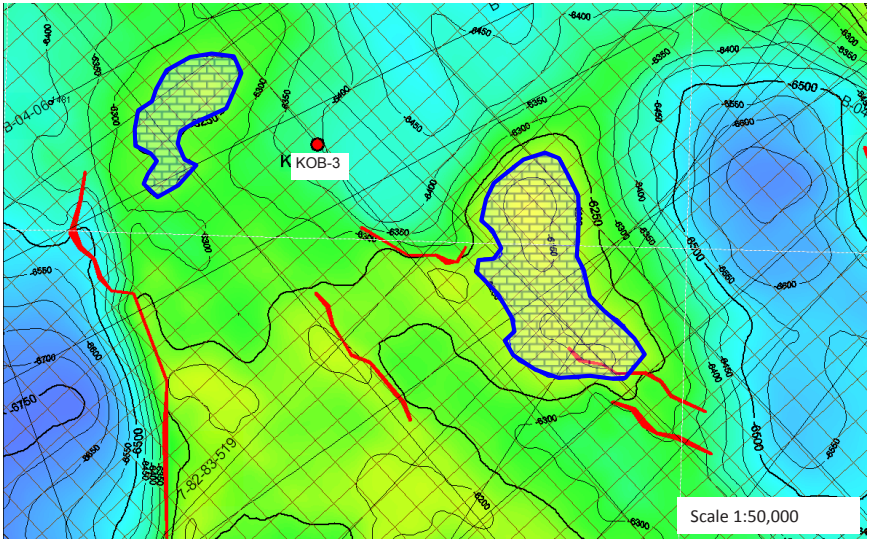



**Figure 2. Structural map of the conventional horizon below $P_1$ (Kobylandy area)**

Considering the main uplift of Kobylandy, it should be noted that the northern and southern parts of the structure are the most elevated parts. If we consider this structure is separate from the general elevation, then the elevation is fixed by the isoline -6200 m and the arch with the mark -6150 m (Fig. 2). The reliability of the structural formations of this section and the highlight of the uplift is high, since the knowledge is based on three-dimensional seismic data and the results of the technology “Deep migration before summation”.

Correspondence of the structural plans of the Lower Permian and Carboniferous deposits is noted, and the structural plan for the underlying Devonian deposits is markedly different in its location in the center of the uplift area and in the presence of structural forms within the side of the carbonate platform. It can be assumed that Carboniferous deposits (due to their uneven distribution over the area) were preserved as the remnants of filling the deflections and unevenness of the roof of the Upper Devonian relief and the underlying dolomite strata.

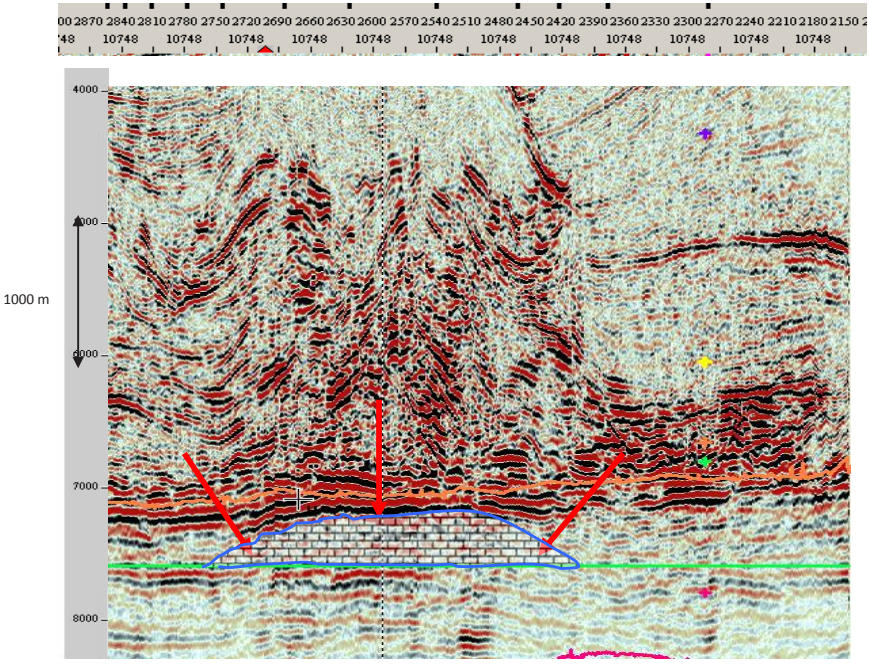



**Figure 3. The structure of Kobylandy. Crossline 10652 seismic section showing prospective reef construction**

According to the Devonian sedimentary complex (reflecting horizons: $P_{2d}$, the base of the dolomites $D_2$ef and $P_3$), the outlines of an extensive structural rampart are preserved in general terms, the western, southwestern and north-eastern slopes of which are complicated by deep tectonic disturbances associated with the movements of the Kobylandinsky basement block. In the center of the structural wall along all deep horizons, an uplift stands out, complicated by a series of local disturbances of the northwest direction.

According to the Devonian complex (within large ledges of a carbonate formation such as a biostroma), biogerm formations are identified in the form of separate peaks, identified and mapped during petrophysical studies, which may be of interest for subsequent exploration of the area by deep drilling.

On the roof of the dolomite stratum (reflecting the $P_2$d horizon), the Kobylanda uplift is separated in the elevated part of the carbonate platform along the isogypsum (-6250 m). In sloping areas, separate bioherm formations are distinguished. The steep ledges of the Devonian carbonate structure are complicated by a series of tectonic disturbances. The dimensions of the arch of the carbonate platform along isogypsum (-6250 m) are 12.5 x 4.0÷8.0 km. Within the arch, 6 separate peaks stand out, separated by shallow subsidence of the relief and in the eastern part are complicated by a series of tectonic disturbances. The amplitude of the peaks is from 50 to 100m.

At the bottom of the dolomite stratum, the uplift is distinguished by isogypsum (-6800 m), its dimensions are 17.0 x 8.0 km, the amplitude is 200 m and in the form of a directional brachyantline, it is complicated by individual peaks in the center and in the eastern part of the square. The most prominently distinguished is the uplift in the eastern part along isogypsum (-6750m), where the structural plan is complicated by a tectonic violation of the north-western direction. The size of the peak on the indicated isogypsum is 5.0 x 4.6 km, the amplitude is 150 m.

According to the results of the interpretation of 3D seismic data, the Upper Devonian part of the section on crossline 10652 corresponds to the greatest degree of organogenic construction according to morphological characteristics (Fig. 3).

The nature of the wave field and the morphology of the object with raised edge sections indicate possible reef bioherm constructions along the edges (wave field) and the inner lagoon (subhorizontal wave field).

The construction is located above the elevated areas of the underlying relief, while the amplitude of the proposed constructions is greater than

the amplitude of the rise in the underlying sediments. The wedge-shaped nature of its transition to brighter reflections from depositional deposits is visible in the marginal parts of the constructions.

The correlation with the host sediments indicates a gradual filling of the emerging topographic depression, apparently with terrigenous deposits of the “onlap” and “overlap” types. This object is important in that it indicates the possibility of the development of shallow marine carbonate accumulation here in the Upper Devonian sequence.

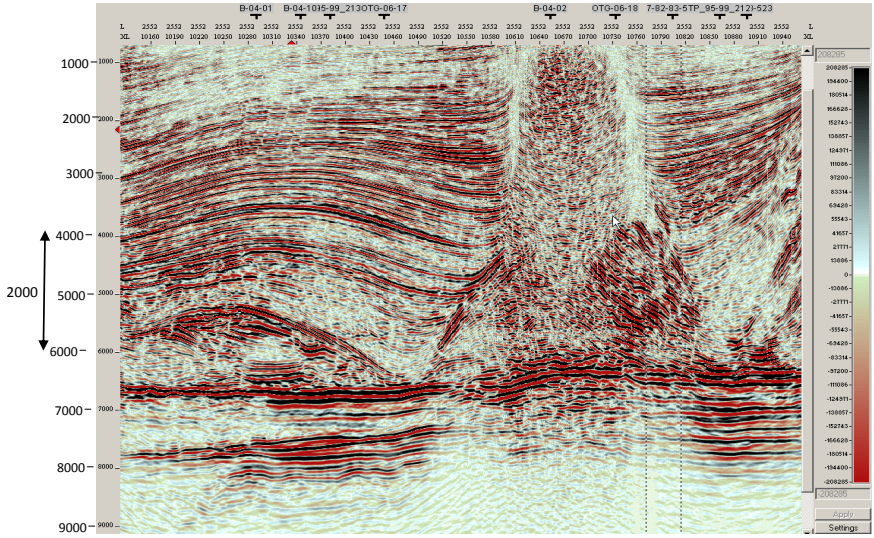



**Figure. 4 Structure of Kobylandy. Inline 2552 seismic section showing deposition of the Middle Devonian complex**

A characteristic feature of the subsalt Paleozoic sedimentation in the Koblanda area is the obvious progradational nature of the Middle Devonian and Upper Devonian complexes. The thickness of the Middle Devonian complex is halved from the northeast to the southwest from 1000-1200 m to 500-600 m. Moreover, in the southeastern part of the area in time sections, the transition of the Middle Devonian to deep-sea depressions is clearly observed (Fig. 4).

At the same time, the thickness of the Upper Devonian complex in this direction increases in thickness from 200-300 m to 800-900 m. Thus, this ratio reflects the shallowing of the Late Devonian sedimentation basin, which replaced the beginning of the formation of a deep-sea sedimentary basin.

The distribution of the thicknesses of the depression complex clearly indicates the leveling role of this complex with reduced thicknesses in the arch of the underlying structure (50-100 m) and their significant increase along its periphery (300-500 m and more). Since the zones of increased thicknesses of the depression complex (depocenters and their continuation) are linear and orthogonal to structural elements, this probably indicates the erosive (due to erosion by underwater currents) nature of the complication of the surface of the upper terrigenous sequence (horizons $D_3$ and $D_3c$).

The deep exploratory well KOB-3 with a design depth of 6,800 m was laid in the arch of the uplift (as presented by 2D SR) of Kobyland between the parametric wells P-1 and P-2 and completed at a depth of 6,737 m (bottom hole) in medium deposits Devon. The design depth was not reached due to technical reasons, due to the casing collapse in the intervals of 6120-6130 m and 6021-6041 m, caused by the fluidity of the salt layers in the lower salt mass.

Well KOB-3 revealed deposits of suprasalt, saline and subsalt complexes, detailed information about which is presented in table 1.

**Table 1. Actual uncovered section of the Kobylandy well 3**

| № | Open stratigraphic section | Depth Interval, m |
|---|---|---|
| 1 | Quaternary | 0-55 |
| 2 | Jurassic | 55-220 |
| 3 | Triassic | 220-2240 |
| 4 | Upper Perm, Tatar layer | 2240-2922 |
| 5 | Lower Perm, Kungur layer | 2922-6139 |
| 6 | Lower Perm, Artinsky-Assel layer | 6139-6240 |
| 7 | Unburnt coal deposits | 6240-6255 |
| 8 | Upper Devon, Famennian layer | 6255-6334 |
| 10 | Upper Devon, French layer | 6334-6376 |
| 11 | Middle Devon, Givetian layer | 6376-6430 |
| 13 | Middle Devon, Eiffel layer, Athos horizon | 6430 - 6527 |
| 14 | Middle Devon, Eiffel layer, Biysky horizon | 6527-6737 (stall) |

The section of coal and Devonian sediments is represented by carbonate rocks formed both in shallow and deep water conditions.

The interval of 6299.4-6303.5 m (the lower part of the Famennian stage of the Upper Devonian) is represented by mudstones of various colors: dark gray, black, dark brown, carbonate to varying degrees (10-30%), with rare layers (1-10 cm) mudstone, presumably with an admixture of pyro-

clastic material, fine-grained limestone and finely crystalline dolomite. Argillite is characterized by horizontal stratification, thinly horizontal (laminar) in sections, isolated skeletal grains represented by shells of gastropods and ammonoids are found, and also individual platform elements of Palmatolepis conodonts are found in sections.

Argillite is cut into sections by rare intermittent cracks (length 1-5 cm, width less than 0.05 mm), oriented at an angle of 0-10º to the core axis. Also, isolated sinuous cracks were found, 1-2 mm wide, oriented at an angle of 0-45° to the core axis, made by brownish-gray fine-grained calcite.

Argillite is non-porous, there is no luminescence under ultraviolet light, single layers up to 1 cm of gray luminescence are noted, which are lithologically associated with an admixture of thin pyroclastic material in mudstone.

In the interval of 6299.71-6300.36 m, the core is represented by acute-angled pieces 3-8 cm wide, 8-12 cm long, and the layering is oriented along the long side of the piece, that is, the pieces are larger than the core diameter, which is caused by the "collapse" of the rock, under pressure into the borehole space. It can be assumed that mudstones were accumulated in relatively deep water conditions.

The interval of 6421.4-6430.6 m (the Zhivsky layer of the Middle Devonian) is represented by Dolomites. The primary rock is completely dolomitized, relics of the primary rock (limestone) - skeletal grains and lithoclasts, according to the ratio of which the type of limestone according to the classification of Dunham (1961) are preserved. When the rock is cracked, dissolved in hydrochloric acid, the smell of hydrogen sulfide is released, which is probably located in the intergranular space of dolomite.

The rock is broken up to different degrees by cracks, by sections it is broken by single cracks, by sections - by a system of numerous cracks. Some of the cracks are intermittent, i.e. It does not cut the core completely, curving arcuate shape and is oriented at an angle of 90º to the core axis. A similar type of cracks can be attributed to cracks formed during drilling.

Other cracks have a more complex appearance, are presented, as a rule, in the form of a grid (system) and are oriented at different angles to the core axis, that is, randomly. Some of the cracks are open, some of the cracks are made mainly of gray fine-grained dolomite and light gray fine-grained anhydrite; cracks made by fine-grained gray calcite are less commonly encountered. In the case of a network of mineral cracks, the rock acquires a breccia-like character (the shape of the fragments is acute-angled).

The dolomite is finely crystalline, spotty, spotty-banded, due to the presence of the relict structure of the primary breed, brown-gray, brown-dark gray, dark gray, 100% composed of idiomorphic, often rhomboid-shaped dolomite grains, size 0.1 -0.3 mm, in sections 0.3-0.5 mm.

In the intergranular space of dolomite, mainly of a lighter color, black bitumen is found in sections (0.1-0.2 mm in size), rare cracks with an openness of less than 0.05 mm, also filled with bitumen, are noted.

The primary rock is limestone, which can be attributed to a packstone with lithoclasts or, possibly, to a orestone.

**Stromatoporoid** are presented in the form of shapeless angular fragments (1–10 cm in size, rarely up to 15 cm) and contain (1–5%) rounded precipitations of gray siliceous material (2–5 mm in size).

**Bryozoans** – in the form of elongated branches with a characteristic cellular structure, 3-5 cm long, 5 mm in diameter.

**Coral** – individual inclusions of a cylindrical shape with distinct septa, the void between the septa was filled with sparite, which was subsequently replaced by a light gray dolomite, which differs from the dolomite of the main mass with a lighter color.

**Brachiopods** – in the form of arched sections, in some cases with internal partitions, 1-3 cm in size.

Rocks in the sampling interval of 6421.4-6430.6 m were deposited on the slope of the carbonate platform, as indicated by the presence of acute-angled fragments of stromatoporoid up to 15 cm in size, which can be considered as fragments of boundstones (bioherm limestones). The conditions of the slope of the carbonate platform are most obvious in the upper part of the interval, the rocks of which before post-sedimentation processes were represented by limestones such as Paxtone or, possibly, Rudstone with lithoclasts.

According to the results of interpretation of geophysical well research data (hereinafter - GWD), two productive strata (lower and upper) were identified in the subsalt section.

The upper productive stratum in the KOB-3 well combines deposits of the French, Zhivsky and upper parts of the Athos above-horizon. The total horizon thickness is 130 m, the productive part is 38.4 m (Fig. 5). The total porosity of the reservoirs is, on average, 6.2%, and the oil and gas saturation coefficient is 73%.

The lower productive stratum includes deposits of the Biysk horizon and the lower part of the Mount Athos above horizon. The total thickness of the horizon is 203.3 m, the thickness of the productive part is 55.3 m. The total porosity of the reservoirs is, on average, 4.8%, Kng - 75%.

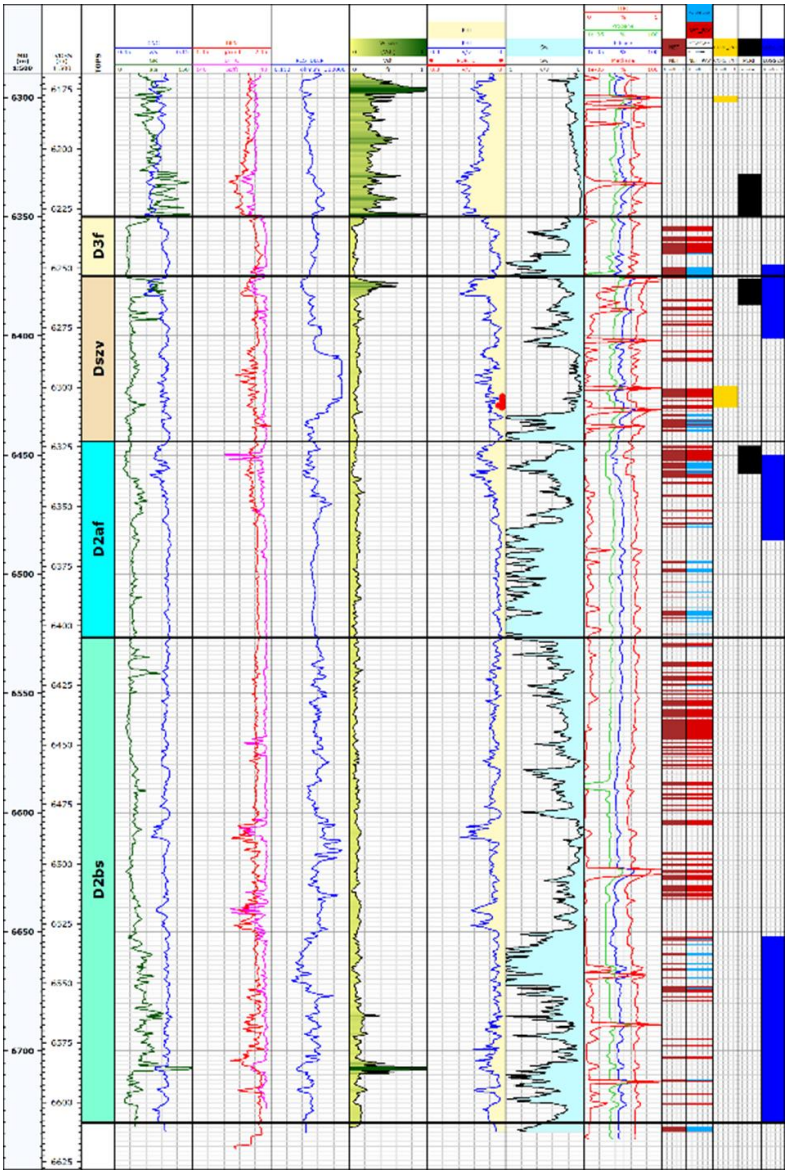



Figure 5. The results of the interpretation of GWD data of the KOB-3

**Predicted natural reservoir model.** To analyze the geological structure of the deposits in the Kobylanda structure, structural maps were used for the reflecting horizons $P_1$ (roof of subsalt deposits) and $P_2d$ (roof of Devonian deposits), interpretation data for GWD materials of drilled wells, as well as test data, gas readings and gas manifestations of subsalt deposits of KOB-3 wells.

An analysis of the data on the Kobylanda structure showed that the total thickness of the Devonian productive deposits is about 380 m. It is worth noting that, according to seismic data, the structure amplitude does not exceed 200 m. Moreover, the KOB-3 well is located on the side of the structure and most likely did not open directly the arched part of the structure (possibly a reef building). A detailed lithological analysis of spectral gamma-ray logging (hereinafter, GL) of the carbonate sequence helped to identify the high frequency of interbedding of porous dolomites (boundary value 3%) and non-collectors with an insoluble residue content> 10%. This probably means that the well uncovered the edge of the reef containing redeposited material. Therefore, the total amplitude of the structure in the area of the KOB-3 well (up to the closing isogypsum -6300 m) is not enough to accommodate the entire productive section of the well. Therefore, the assumption arose that Kobylandy is not a massive reservoir, but several conditionally reservoir deposits with different levels of fluid contacts. This model is confirmed by the presence of water-saturated reservoir intervals in the Afoninsky horizon of the Middle Devonian. This allowed us to divide the Devonian productive section of the well into two horizons: $D_2$bs and $D_2$-$_3$ (presumably including deposits $D_2$af, $D_2$gv and $D_3$f) (Fig. 6).

In accordance with the proposed model and based on the obtained data on the interpretation of GWD, fluid contacts were established at the following levels for two productive horizons:

Horizon $D_{2\text{-}3}$ – mark of conditional gas-water contact (GWC) is on a.o. -6360m, which is the lower mark of the productive interval of the gas-saturated reservoir and the upper mark of the water-saturated intervals, respectively. In the KOB-3 well, the subsalt part of the section was tested. The lower part of the Devonian sediments was not tested due to the obstruction of the column. Perforation of three intervals (6458-6446 m, 6387-6376 m, 6350-6332 m) in the upper part of the Devonian reservoir was manifested by the presence of gas readings, increased pressure and a significant loss of drilling fluid. Due to behind-the-casing flows, it was not possible to complete the well test. An attempt to isolate the intervals also failed, thereby it was decided to test Permian deposits (6236-6218 m, 6156-6138 m).

Horizon $D_2$bs – according to the interpretation of a clear fluid contact log, it is currently impossible to distinguish. Within the Biysk horizon, a decrease in the resistance curve, which may indicate an increase in the water saturation of the reservoir, is observed twice, at a depth of 6581 m (a.o. -6460 m) and 6651 m (a.o. -6530 m). The maximum possible level is comparable to the last trailing isogypsum (-6610 m). The level of -6530 m was used to calculate the resources of the deposit.

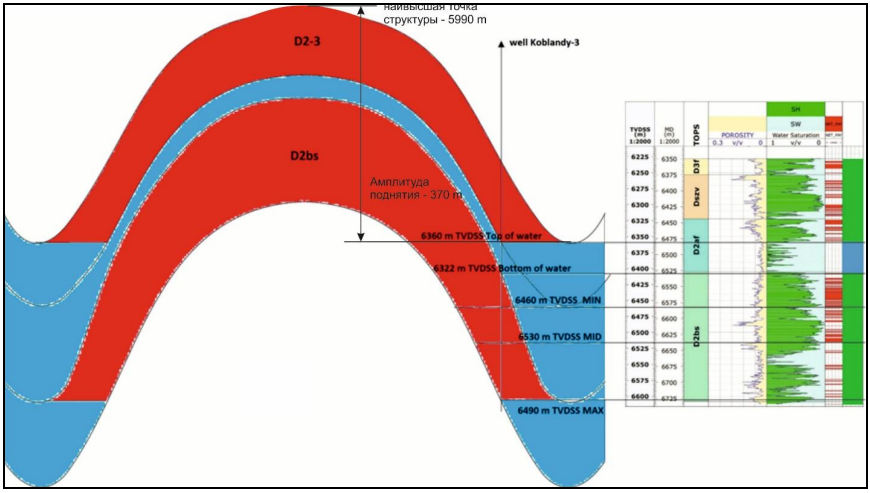



**Figure 6. The predicted model of the structure of deposits in Kobylandy square**

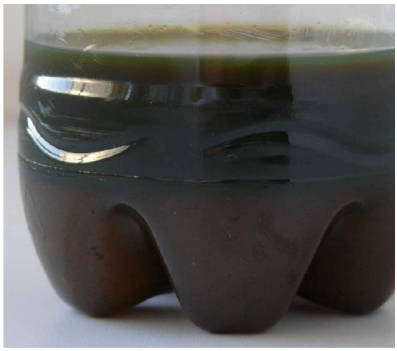
Due to the fact that during the drilling process at the Koblanda structures, as well as tests of subsalt deposits that are regionally productive within the Caspian Basin, no industrial hydrocarbon (HC) inflows were obtained, reserves were not calculated for these structures. Obtaining fluid influx (condensate and water) during testing of the KOB-3 well (Fig. 7), as well as gas manifestations and gas indications during drilling did not allow us to unambiguously identify HC deposits and give them a qualitative characteristic. On Kobylandy Square, it is conventionally assumed that there are two gas condensate deposits in the Middle Devonian section. Deposit of the French tier of the Upper Devonian, as well as a deposit of the Biian horizon of the Middle Devonian.

3D seismic data obtained as a result of reinterpretation are the basis for calculating prospective HC resources. The oil and gas contours for the above deposits are accepted in accordance with the model of their structure at the levels of –6360 m ($D_3$f horizon) and –6530 m ($D_2$bs horizon). The

calculated parameters of gas and condensate are taken by analogy with the Chinarevskoye field. The collectors in them are carbonate rocks. The type of reservoir is mixed: cavernous-pore, pore – fracture, and fracture.

According to experts, (PGS and OTG) the resources of the Kobylanda structure are estimated as very promising. **The total geological reserves of category C3 are 101.7 billion m³ of gas, and recoverable 77.3 billion m³. The total geological reserves of condensate - 62.9 million tons, recoverable - 20.4 million tons.**

GAS FLARING DURING K-3 KOBLANDY WELL TESTING



OIL TESTED IN K-3 KOBLANDY WELL

**Figure 7. The structure of Koblandy.**
**Testing the Devonian productive horizon.**

**Conclusions:**

1. An analysis of the results of geological exploration has shown that the Koblanda area, taking into account new 3D seismic structures, is not sufficiently studied by drilling.

2. The results of the interpretation of 3D seismic tomography (ST) have made significant amendments to the structural formations of the Kobylandy-Tamdinsky uplift. Well KOB-3 of Koblanda, laid down according to 2D ST data, revealed subsalt deposits in the slope part of the structure, which make it difficult to determine the true volume of reservoirs and their saturation.

3. The productivity of the Devonian deposits is confirmed by the selected core and increased gas readings during the drilling of the KOB-3 well.

4. When testing the Middle Devonian deposits in the well, an inflow of a gas-condensate mixture with water was obtained.

Despite the insufficient information obtained during the drilling of the deep well KOB-3, the studies carried out in this complex and poorly studied region inspire great promise for the discovery of a number of large fields. Figure 8 shows a structural map along the reflecting horizon $P_1$ highlighting the promising structures of the junction zone of the northern and eastern side zones of the Caspian Basin.

Within the northern onboard zone, in the Kobylandy-Tamdinsky zone, according to the results of geological and geophysical surveys carried out in recent years in the subsalt complex, a number of promising structures are distinguished: Ayganym, Syrgaly, Tamdy, Uttas, Zhelezny.

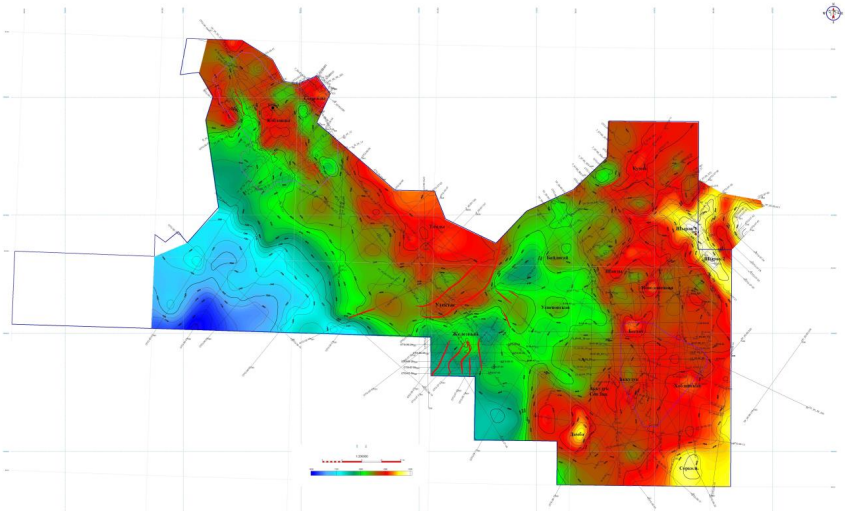


**Figure 8. Structural map of the reflecting horizon P1 with the identification of promising formations of the junction zone of the northern and eastern side zones of the Caspian depression**

No less promising objects were identified in the zone of the Novoalekseevsky trough: Aleksandrovskoe, Uspenovskoe, Karatayskoye, Bailisay.

Within the north-eastern zone of elevations of the Pre-Ural trough, the Shyrak structure is of particular interest where the deep exploration well Shirak-1 (actual bottomhole - 6597 m) with a design depth of 7000 m and a design horizon of Devon has already been drilled. According to GWD in the lower part of the section, There are 4 structural - formation strata that are of interest in the oil and gas bearing. Of the listed strata, the III and IV strata are distinguished, corresponding to intervals of 5887-6195 m with a thickness of 308 m and 6195-6597.1 m with a thickness of 302 m, respectively.

Three intervals are distinguished by gas logging (6026-6043m, 6100-6114m, 6170-6193m), where the total gas is 100%, and the proportion of methane is from 58 to 74% during drilling. After STR and pipe extension, large values of gas readings were constantly observed (total - 100%, methane - 70%).

SHYRAK-1 WELL GAS FLARING DURING DRILLING

SAMPLE OF CORE – SHYRAK RESERVOIR ROCK

**Fig. 9. The structure of Shyrak**
**A). Bleeding gas from the annulus of the well.**
**B). Sample of oil-saturated sandstone from the productive horizon.**

In sandstones, according to FMI and core analyzes, increased fracturing of rocks is noted. During drilling, they showed high gas readings (up to 100% of the total gas) (Fig. 9). The described sandstones are characterized by good reservoir properties: porosity - 4.25 - 10%, permeability - 0.017-0.43 x $10^{-3}$ μm$^2$, porosity in the fracture zones is 7.56 - 13.86%,

permeability 0.844 - 3.49 x $10^{-3}$ $\mu m^2$. According to the conclusion of the GWD, in this part of the section 13 perspective intervals were identified and recommended for column testing.

The following structures are distinguished in the Bestau zone of uplifts: Bestau, Sorkol, Dam, South-East Dam, Akkuduk and Akkuduk North-West, Khobdinskoye, Novodonetskoye.

***The primary objects that can confirm the oil and gas potential of this region are undoubtedly the structure of Kobylandy and Shirak, where horizons with oil and gas occurrences in subsalt deposits have already been identified, but have not yet been studied and are under testing.***

Further steps towards the discovery of new deposits within the above areas depend on successful drilling and testing of already identified objects in these structures.

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# AUTOMATED SYSTEM FOR DESIGNING THE TECHNOLOGICAL PROCESS OF FOUNDRY PRODUCTION

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**Abstract.** An automated system for selecting the optimal casting method has been developed, based on the characteristics of the design features of castings and solving the optimization problem.

**Keywords:** computer-aided design, optimization criteria, databases, editing results, casting methods, representative parts.

**Introduction**

The manufacture of castings is one of the most widely used technological processes for the formation of parts due to low cost and the possibility of its comprehensive application. This process can be applied in the manufacture of both small and large parts, both with simple and complex shapes, both for individual and mass production. For castings, various alloys can be used. In many cases, the cost of castings is less than the cost of similar parts obtained by other technological processes. The choice of the most appropriate technological process for manufacturing castings is often difficult, since it requires taking into account many different factors.

**Research objective**

The definition and assessment of the quality characteristics of various technological processes for the production of castings are the basis for choosing the best option at the design stage.

**Research methods and results**

When designing a technological process, it is necessary to establish such values of its parameters that provide for obtaining predetermined indicators of this process. In general, process optimization means choosing such process parameters and searching for the values of these parameters that, according to a certain optimization criterion, will be the best.

If there is a predetermined set of parameters (when considering a specific process), the process optimization will consist only in finding the best values of these parameters, which can be minimum, maximum, and in the general case optimal values.

Optimization criteria are divided into economic, characterizing the economic efficiency of the process, social, characterizing the intensity and working conditions of workers and technical, characterizing the quality indicators of the process, for example, alloy strength [1].

The ultimate goal of the choice is, as already mentioned above, the manufacture of the product in a given quantity and quality with minimal labor, materials, energy and minimally harmful effects on the environment.

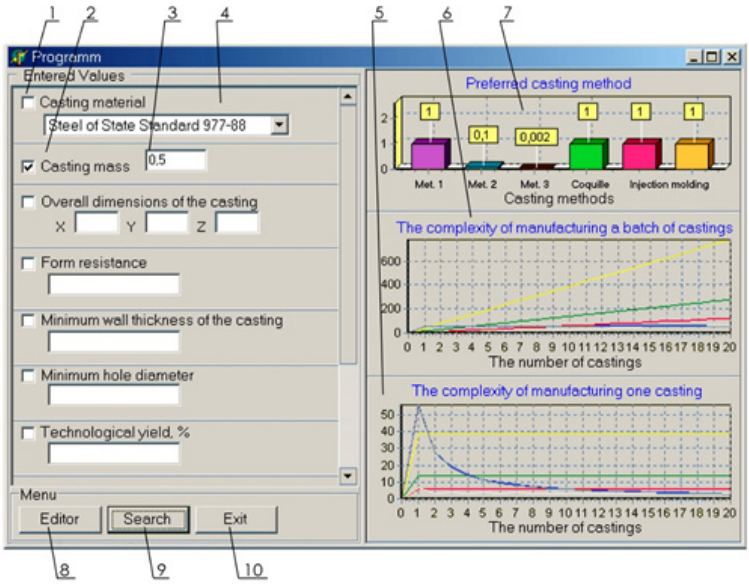


**Figure 1. Data entry window for analysis:**
1 is off selection bias; 2 is on selection bias; 3 is selection field for the selection bias; 4 is selection bias panel; 5 is the labor input of manufacturing one casting; 6 is the labor input of manufacturing a series of castings; 7 is casting method preference chart; 8 is button for launching the «Editor» module; 9 is calculation start button; 10 is shutdown button.

One of the solutions to this problem can be attributed to brief comparative characteristics of the design features of castings, manufacturing methods and scope. Comparative characteristics make it possible to approxi-

mately evaluate the possibility of obtaining a casting and its relative cost. In some cases, such reference data can serve as the basis for a decision about the choice, especially at an early stage of design.

The program for determining the optimality of the casting manufacturing method is intended to select the optimal casting method. The program consists of two main parts: a data input program for castings representative of casting methods and an analysis program [2].

Figure 1 shows the data analysis window. The initial data for analysis are entered into fields 3 presented on panel 4. The field is included in the calculation after setting the checkbox against the corresponding field to the included position 2. Fields with the checkboxes 1 off do not participate in the calculation. The calculation is performed by pressing the "Search" button 9. The calculation results are displayed in the form of graphs (preference for casting methods 7, the complexity of manufacturing a batch of castings 6, the complexity of manufacturing 1 casting, depending on series 5).

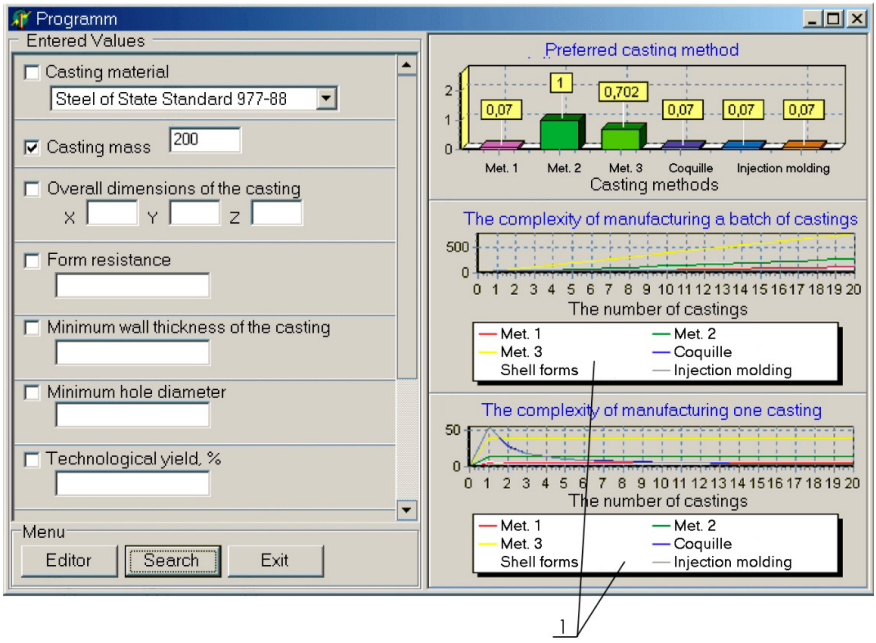


**Figure 2. Analysis input window with chart legend enabled where 1 is legend chart**

The legend is displayed in the field of the labor intensity determination diagrams (Fig.2). In accordance with the diagram of the complexity of manufacturing a batch of castings, an information window is called up indicating the name of the selected casting method, a batch of castings and the complexity of their manufacture (Fig. 3). According to the labor input diagram for manufacturing one casting, an information window is displayed indicating the name of the selected casting method, a batch of castings and the labor input for manufacturing one casting (Fig. 4).


**Figure 3. Dialog window**


**Figure 4. Dialog window**

In the start window, there are buttons for launching the “Editor” module 8 and completion of work with program 10.

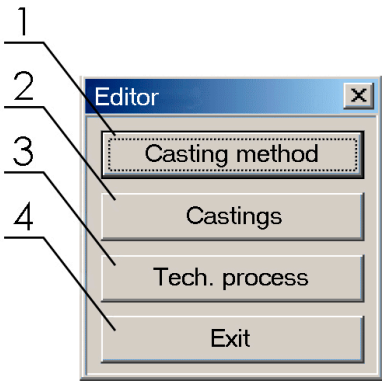


**Figure 5. Window "Editor":**
1 is button "Casting methods";
2 is button «Castings»;
3 is button « Technological process»;
4 is button «Exit»

The “Editor” module (see Fig. 5) is designed to populate the database.

The window shown in Figure 6 is intended for entering names of casting methods. The main elements of this window are: an input field for the name of the casting method 1, a navigation table 4, a button to close the window 5, and a table control panel consisting of buttons 2, 6-14. The table control panel provides the ability to move through the table using the buttons 2, 6, 7, 8, add 9, delete 10, edit 11 records, save 12 or refuse to change 13, as well as update table 14 (if used in multi-user mode) [3].

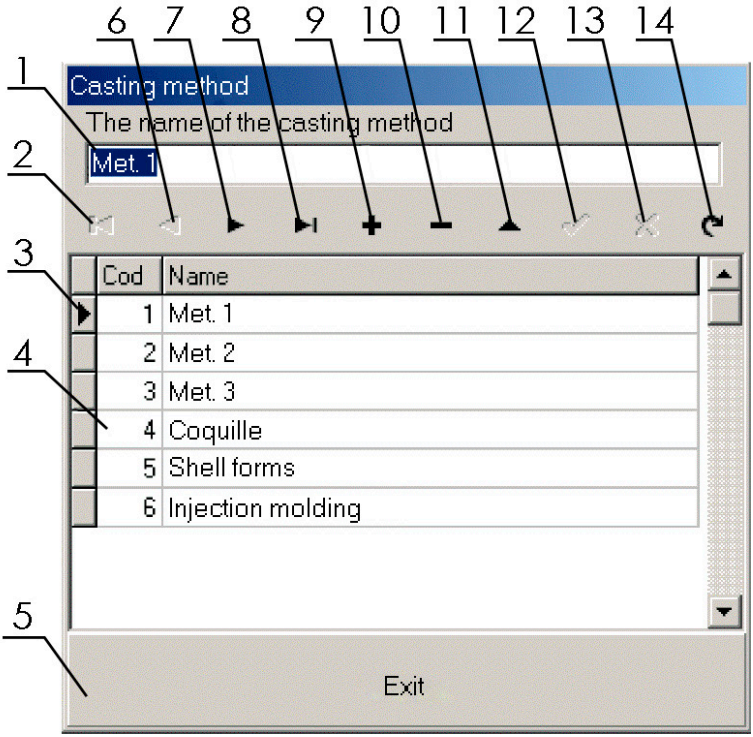


**Figure 6. Window "Casting methods":**

1 is input field for the name of the casting method; 2 is button «Go to first record»; 3 is current record pointer; 4 is table; 5 is button «Exit»; 6 is button «Previous note»; 7 is button «Next note»; 8 is button «Last record»; 9 is button «Add a note»; 10 is button «Delete note»; 11 is button «Edit note »; 12 is button «Save note»; 13 is button « Cancel editing »; 14 is button «Update database».

**Summary**

Thus, the automated system allows you to choose a casting method according to the specified criteria, such as surface roughness, casting material, number of rods, minimum hole diameter, product weight, etc. using the data available in the reference literature, and at the same time provides the user with the ability to edit data and selection criteria.

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# ON THE POSSIBILITY OF REINFORCEMENT OF ROCK CHUTES OF BATCHING CHAMBERS WITH COMPOSITE MATERIALS

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**Abstract.** Regularities are revealed in destruction of deformation of the rock bin chamber and the batching device chamber, the construction of the reinforced concrete batching chamber is proposed, the inner surface of which is faced with rails on the inclined part and lined with lining elements on the sides, composite materials are proposed for formation of the lining layer.

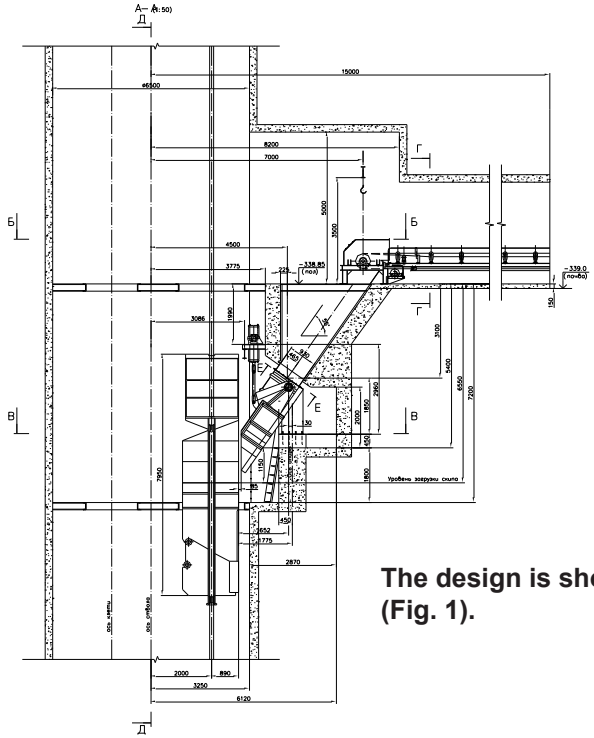
**Keywords:** batching chamber, rock chute, lining layer, composite material.

The batching chamber belongs to one of the main workings of the shaft bottom, the service life of the batching chamber is equal to the service life of the entire mine. And from all the chambers of the shaft bottom - the batching chamber is the most complicated engineering structure, taking into account its complicated configuration, and this correspondingly affects the complexity of the construction and fastening. The batching chamber usually consists of the unloading chamber for the carriages coming to the shaft; the storage hopper chamber used for temporary accumulation of rock and the chamber of the batching device for loading skips.

Batching chambers, depending on the properties of the intersected rocks, are constructed by different methods. In strong solid rocks the chambers can be constructed by longwall face, in less strong rocks, requiring application of temporary lining, the chambers are constructed by stepped face

Concrete is usually used for fixation of the batching chambers, and at depths of more than 400 m and in difficult mining and geological conditions reinforced concrete is used. The width of the batching chambers usually makes 6 m, length (from the shaft) - up to 7 m, height - 10-16 m. Usually batching chambers are made of an open type, where the batching equipment (metal hopper) is placed on specially installed metal beams.

One of the main factors affecting the stability of workings is the depth factor. Currently, the miners face the task of assurance of the quality and reliability of the batching chambers constructed at great depths operating in conditions of the limit state of rocks. In difficult mining and geological conditions, the opening of the camera to the full height is almost impossible. Therefore, it is required to replace the traditional metal design of the batching chambers with a completely new one, taking into account the revealed character of destruction of standard chambers [1].




**The design is shown in (Fig. 1).**

**Fig. 1 Layout of the mechanical equipment of the batching chamber with the reinforced concrete hopper according to a new variant (section on the chamber).**

For this purpose, the metal hopper, which was previously used in the chamber of the open type, is replaced with the reinforced concrete, the internal surface of which is faced with rails along the inclined part of the hopper and sheet steel on the sides. Hereby the batching chamber is constructed in three independent blocks, which are constructed sequentially with the shaft sinking and, the most important, at low height (6-7m) [1].

At great depths the structures of the chutes, trays and sides of the hopper should be accessible for repair, so it is recommended to line them with lining elements - FibARM Tape - 230/300 carbon fiber canvas, increasing the load-bearing capacity of reinforced concrete samples up to 120 kN (up to 205%).

The work [1] proposes a special design of the batching chamber, which takes into account the lack of thrust in the middle part of the batching chamber, leading to emergency situations. The design is shown in (Fig. 1).

Such a reinforced concrete hopper ensures the stability of the proposed closed structure by means of a rigid connection with the circular structure of the shaft part. The construction of the batching chamber is divided into three independent blocks, which are constructed sequentially with the shaft sinking and, the most important, at low height (6-7m). This ensures quick opening of the working, unlike the typical design, in which sinking is carried out to the full height of the chamber with temporary fixation of the walls and subsequent construction of a permanent lining from the bottom to the top.

First, the feeder chamber (by the drilling and casing technology) and the shaft part are constructed. Then a reinforced concrete hopper is constructed, which is connected to the bottom of the feeder chamber with the help of the fittings. (The hopper is a kind of suspended to the floor of the feeder chamber with the die-rolled section fittings with diameter of 20 mm in increments of 250 mm). Then the chamber of the closed type loading device with the shaft part is sunk, supporting the hopper from below. Thus a rigid structure is created, which is constructed from top to bottom.

The proposed variant allows to reduce the construction time of the chamber by 1.7 months in comparison with the basic variant and reduces the cost of its construction by 20% due to reduction of the weight of steel structures.

To enhance the reinforced concrete structure of the hopper, lining with FibARM Tape - 230/300 carbon fibers canvas and FibARM Lamel 14/100 [2] is proposed.

In this article we present the results of the strength test of the reinforced concrete structures enhanced with carbon fiber. Reinforced concrete samples with the total length of 1,550 mm, a rectangular cross-section with the width of 120 mm and the height of 220 mm were tested. The design rating of concrete of all beams - B30 by strength, F300 by frost resistance, W6 by water resistance. FibARM Tape-230/300 carbon fiber fabric and FibARM Lamel 14/100 carbon fiber lamels were used to strengthen the beams.

The reinforcement scheme of the beams and the reinforcements structure with FibARM Tape-230/300 composite materials is shown in Figure 2, a and b.

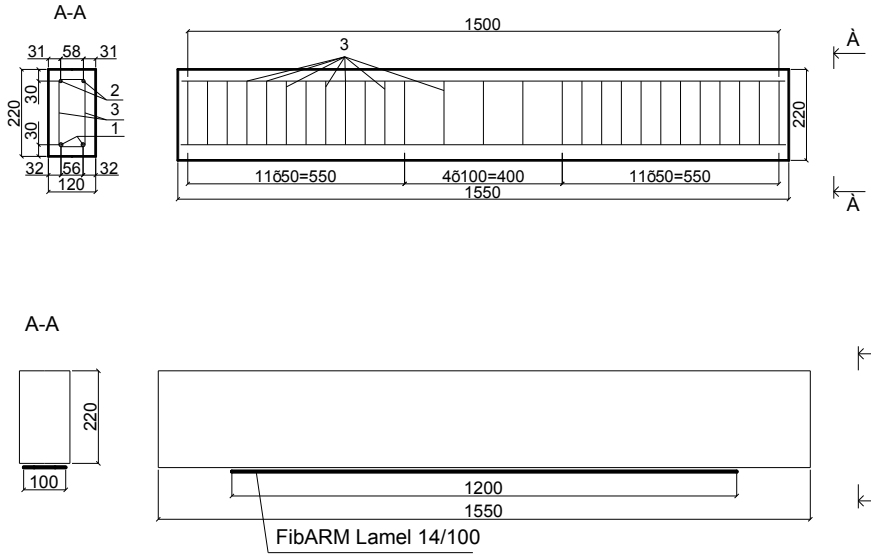



**Figure 2 — Beam structures**
**a) series “A”; b) series “B”; 1 — working reinforcement of class AIII Ø 10 mm; 2 — working reinforcement of class AIII Ø 8 mm; 3 — transverse reinforcement (clamps) of class AI Ø 6.5 mm**

The beam reinforcement structure with FibARM Lamel 14/100 is shown in Figure 3.

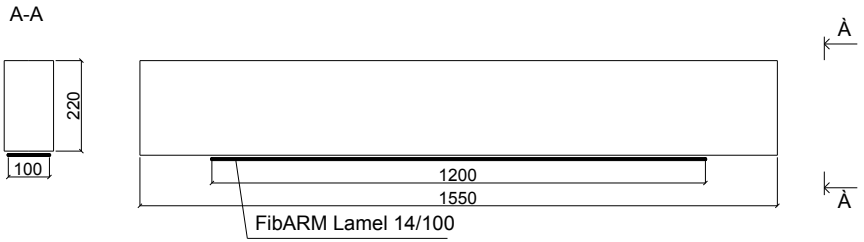



**Fig. 3 — Reinforcement structure of the reinforced concrete beam with FibARM Lamel 14/100**

Tests of the samples for strength were carried out according to the scheme of a single-span beam.

The deflection of the beam in the middle of the span was fixed at each stage of loading by means of a strain displacement gage. The load was applied step-by-step, 500 kg, with an average loading speed of 100 kg/min. The value of the test load on the beam was fixed by the strain dynamometer (pressure cell) of the small measuring complex "Tenzor-MS"

**Results of experimental studies**

Table 1 shows the results of the test of the samples for strength.

**Table 1 - Results of the test of the samples for strength**

| | Series | Sample number | Reinforcement material | Temperature, ° | P, kN | $P_{av}$, kN | Bearing capacity increase,% |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | A | 1 | - | + 15-22 | 60.4 | 64.3 | 96.5 |
| | | 2 | | | 65.5 | | |
| | | 3 | | | 68.4 | | |
| | B | 4 | FibARM Tape-230/300 | + 15-22 | 120.4 | 119.80 | 195.60 |
| | | 5 | | | 122.07 | | |
| | C | 12 | FibARM Lamel 14/100 | + 15-22 | 79.6 | 96.5 | 147.08 |
| | | 13 | | | 100.9 | | |
| | | 14 | | | 103.2 | | |

Note: $P$ — bearing capacity of the beams; $P_{av}$ — average strength.

The results of the tests showed that the reinforcement of bending reinforced concrete structures with FibARM Tape - 230/300 carbon fiber canvas leads to a significant increase of their bearing capacity from 96 to 165% in comparison with not reinforced specimens. Hereby application of FibARM Tape - 230/300 carbon fiber canvas is the most effective solution.

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# CALCULATION OF MELTING PARAMETERS OF WIRE AT SURFACING

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**Annotation.** In this paper, we examined an algorithm for numerical simulation of a plasma-arc surfacing process with transverse oscillations of a plasma torch for computer simulation. A typical technological problem (this is the determination of the melting parameters of the deposited alloy wire) is solved using this algorithm. It is shown that if the additional arc current is 140 A and 200 A, then the power that the copper wire absorbs from the torch depends almost linearly on the wire feed speed.

**Keywords:** laser powder surfacing, computer analysis, system of equations, modeling, engineering problem.

Often blanks for bimetallic structures are produced by surfacing. It is advisable to solve the main tasks of developing a technology for surfacing blanks using computer engineering analysis methods. It is based on numerical modeling of physical phenomena that are essential for the formation of a surfacing layer. When simulating surfacing, we solve the differential equations of heat and mass transfer and equilibrium of the surface of the surfacing bath. We do this taking into account the mass balance of the surfacing material. The results obtained determine the quality characteristics of surfacing.

In plasma-arc surfacing, molten metal is insert on the surface of the part. The main requirements for surfacing copper on steel are as follows. This is the absence of melting of the substrate metal, providing the specified dimensions of the deposited layer and its good adhesion to the substrate. These requirements are is ensured at certain values of surfacing parameters. Surfacing is carried out with significant heating of the deposited alloy wire [1, 2]. This fact makes it possible to regulate separately

melting of the deposited alloy and heating of the base metal. Usually two arcs are used, the first arc heats the substrate, and the second arc heats the wire. This is energetically advantageous when plasma-arc surfacing of large-width layers is performed with transverse vibrations of the arc and the filing material feed system is used [3].

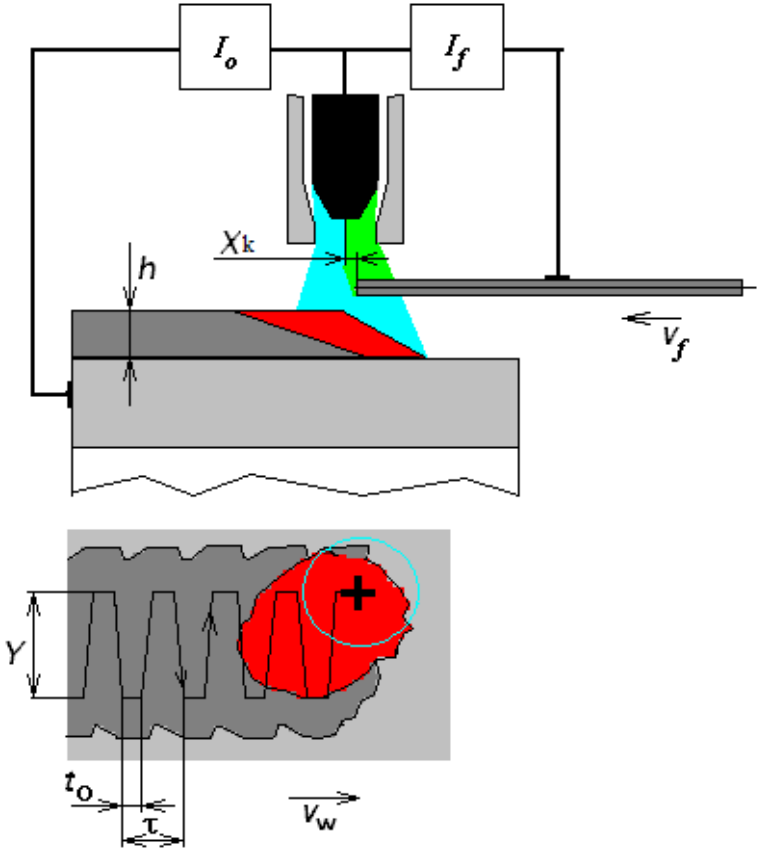


**Fig. 1. Diagram of the plasma-arc surfacing process with transverse oscillations of the welding torch [1]: IO is the current of the main arc, and If is the current of the additional arc, vw is the rotation speed of the workpiece, vf is the flow of the surfacing alloy, τ is the period, Y is the amplitude and to there is a form of transverse vibrations, Xk of the drop on the wire relative to the axis of the plasma torch on the wire feed speed, hare the height of the deposited layer.**

A diagram of the process of plasma-arc surfacing with transverse vibrations of the welding torch is shown in Figure 1.

Surfacing parameters change in time at the beginning and end of the process to ensure uniform formation and closure of the layer. It is difficult to determine the optimal parameter values empirically. Therefore, we use computer methods of engineering analysis. Moreover, the search for solutions is carried out on a virtual process model. A virtual model of the plasma-arc surfacing process with transverse oscillations of the plasma torch is known [4]. The system of equations of heat transfer and equilibrium of the surface of the surfacing bath is its basis. An algorithm for its numerical solution is shown in Fig. 2

| |
|---|
| **The cycle of periods of transverse oscillations of the plasmatron** |
| **The cycle inside the oscillation period with a small time step** |
| **Determining the position of the plasmatron and the boundary conditions of the heat equation.**<br>**Solving the heat equation and determining the current values of temperature, enthalpy and heat conductivity? Distribution in the substrate layer** |
| **Iterative cycle of solving the equation of the surface of the surfacing bath.** |
| **Determining the location of the boundaries of the bath by solving the heat equation, the distribution of the electrodynamic pressure of the arc on the surface of the bath. Calculation of the coordinates of the surface of the melt from the solution of the equilibrium equation of capillary, internal and electrodynamic pressures. Correction of internal pressure according to the condition of the mass balance of the deposited alloy** |
| **to achieve a mass balance of the weld alloy** |
| **Fixing the coordinates of the melt along the crystallization front and the formation of the weld surface. Correction of the structure of the modeling zone according to the results of solving the surface equation.** |
| **Conclusion of results: indicators of the quality of the formation of the roller** |

**Fig. 2. Algorithm for numerical simulation of the formation of a deposited layer [4].**

The wire feed speed vf is calculated when surfacing the deposition of copper wire on a steel substrate. The initial simulation parameters are a given cross-section of the deposited layer, a wire section and a given surfacing speed. In the simulation, we determine the approximate value of the current of the main arc, the melting parameters of the electrode wire and

the current of the additional arc If. The selection criteria for the current of the additional arc is the location Xk of the melting point of the wire in the plasma torch (see Fig. 1). It is optimal when this point is located on the axis of the plasma torch (Xk = 0). The location of the droplet on the wire in the torch is displayed on the screen immediately after starting the simulation program, as well as to confirm the continuation of the simulation or to adjust the current of the additional arc.

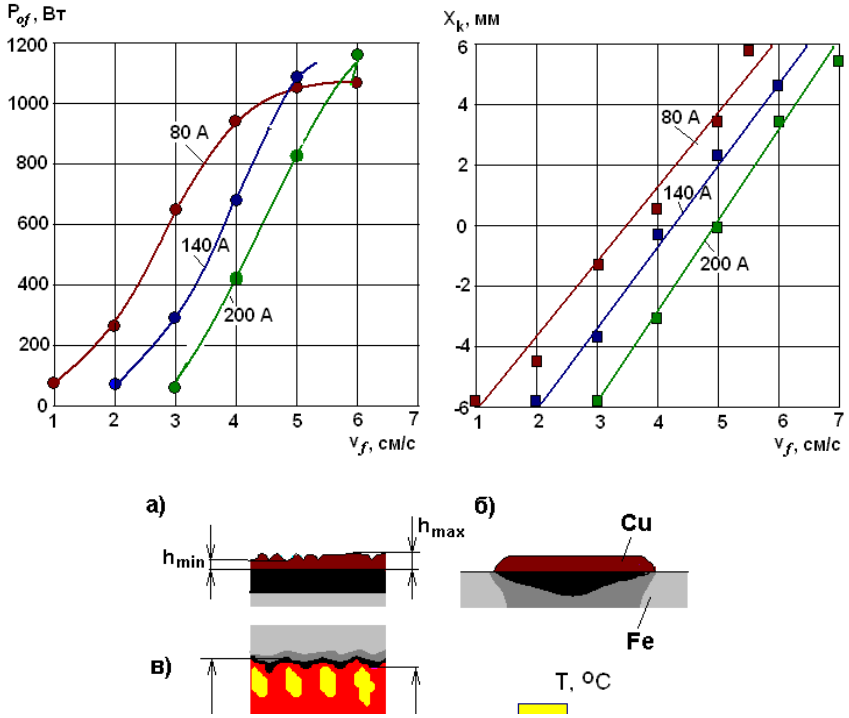


**Fig. 3. The dependence of the power Pof, absorbed by the wire from the plasma torch of the main arc (a) and the displacement Xk of the drop on the wire relative to the axis of the plasma torch on the wire feed speed vf for different values of the additional arc current (b) [1]: Bmax and Bmin are the maximum and minimum surfacing width ; hmax and hmin are the maximum and minimum height of the deposited layer.**

The dependences of the power $P_{of}$ absorbed by the wire from the plasma torch of the main arc (a) and the displacement $X_k$ of the drop on the wire relative to the axis of the plasma torch on the wire feed speed vf for different values of the additional arc current (b) are shown in Fig. 3

Fig. 3a shows that the power absorbed by the copper wire of their torch almost linearly depends on the wire feed speed, at additional arc currents of 140 A and 200 A, in contrast to the surfacing process, which is carried out at an additional arc current of 80 A.

The presented solution to the problem of determining the melting parameters of a wire from a deposited alloy shows that the main tasks of developing a technology for depositing workpieces can be effectively solved by computer engineering analysis, which is based on numerical modeling of physical phenomena that are essential for the formation of a deposited layer.

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