



# **SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION**

**上合组织国家的科学研究：协同和一体化**

**Materials of the  
International Conference**

**Date:  
March 25-26**

**Beijing, China 2019**



# 上合组织国家的科学研究：协同和一体化 国际会议

## 参与者的英文报告

### International Conference “Scientific research of the SCO countries: synergy and integration”

#### Part 4: Participants' reports in English

2019年3月26日。中国北京  
March 26, 2019. Beijing, PRC

ISBN 978-5-905695-99-5



Materials of the International Conference  
**“Scientific research of the SCO countries: synergy  
and integration”** - Reports in English. Part 4.

(March 26, 2019. Beijing, PRC)

ISBN 978-5-905695-99-5

这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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ISBN 978-5-905695-99-5

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## Foreword

*We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 56 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).*

*This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.*

*I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.*

**Fan Fukuan,**

*Chairman of the organizing committee of the conference*

*"Scientific research of the SCO countries: synergy and integration"*

*Full Professor, Doctor of Economic Sciences,*

*member of the Chinese Academy of Sciences*

## 前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，  
教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”

金融刺激教育的目的是增加劳动力资源的竞争

## **FINANCIAL STIMULATION OF EDUCATION FOR THE PURPOSE OF INCREASING THE COMPETITION OF LABOR RESOURCES**

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抽象。教育經費的籌措應以形成和發展能夠滿足國民經濟擴大再生產需求的優質勞動力資源為目標。

在沒有解決確保所有公民接受教育的任務的情況下，形成真正高質量的勞動力資源顯然是不可能的。教育系統各級教育過程的一致性（從學前教育到高等教育，包括地方法院和後續教育的水平）是提高學生對教育最終結果的興趣的基礎——獲得工作他們所選擇的職業。

該文件具有概覽性質，專門用於對俄羅斯聯邦和一些發達國家在廣泛參數方面的教育籌資進行比較分析。

作者的主要結論是需要結合教育方法的形成和聯邦州教育標準（FSES）的要求以及融入國際教育標準。

關鍵詞：政府支出，教育，教育經費，刺激勞動力資源的效率。

**Abstract.** *Financing of education should be aimed at the formation and development of high-quality labor resources capable of meeting the needs of expanded reproduction in the national economy.*

*Formation of really high-quality labor resources without solving the tasks of ensuring accessibility of education for all citizens is obviously impossible. The coherence of the educational process at all levels of the educational system (from preschool to higher education, including the level of the magistracy and subsequent ones) is the basis for increasing students' interest in the final results of their education - getting a job in their chosen professions.*

*The paper is of an overview nature and is devoted to a comparative analysis of the financing of education in the Russian Federation and a number of developed countries on a wide range of parameters.*



*The main conclusion of the authors is the need to combine in the formation of educational methods and requirements of the federal state educational standard (FSES) and integration into international educational standards.*

**Keywords:** *government spending, education, education funding, stimulating the efficiency of labor resources.*

The mechanisms and amounts of financing education at all levels are determined by a set of conditions that naturally develop in response to the state of macroeconomic parameters, the main of which should be recognized as demographic and socio-economic. Reforming the system of domestic higher education in accordance with international standards, enshrined in the Bologna provisions continues, but at the current stage it is advisable to analyze some, even intermediate results, in order to identify trends and trends emerging at all levels of education.

The needs of society are transformed and grow continuously: changing demands cover not only consumer goods, but also services that provide opportunities. This type of services primarily includes education. Narrowly professional competencies are traditionally in demand in the labor market, since specialists with skills and abilities are able to perform technically complex manipulations. However, changes in technology require educational programs of such characteristics (volume, content, planned learning outcomes) that allow people to be professionally adaptive throughout their working life.

The Russian education system is coordinated with the European principles of higher education proclaimed by the Bologna Declaration and enshrined in the UNESCO program document Reform and Development of Higher Education 1995.

Principles of development of the educational system form the legal framework for the construction of the educational process and streamline financial flows directed to the improvement of educational technologies. The leading role in the consistent implementation of the Federal Target Program for Education Development (FTPED) for 2016–2020, according to the authors, is reasonably assigned to the activities in clause 2.2. "Improving the quality of education in schools with poor learning outcomes and in schools operating in adverse social conditions." It is the quality of education that seems to be the most significant and still vulnerable component of the national educational system of Russia.

Aligning the conditions for all students in obtaining high-quality modern education in schools can become a platform for the integration of those educational institutions that currently do not provide sufficient results in mastering the educational program. Whether such equalization means creating real opportunities for all schoolchildren is a debatable question, since "opportunities" mean, in the opinion of the authors, not only the equipment of schools and teacher training, should take into account different abilities, inclinations, interests and just the level

of education and training children. Otherwise, it is futile to fight for the quality of education: in the conditions of filling classes, teachers will not be able to provide individual teaching methods for all students.

Further, there are other consequences of the lack of quality education at the school level, which reflect the unified state examinations (USE): students from socially disadvantaged regions and those who could not fully integrate into the educational process and master the program of disciplines, get non-competitive results compared to their peers from schools with high rates in educational activities and more capable. Overcoming the existing dissonance can contribute to the creation of a system of consulting support aimed at stimulating the professional growth of managerial and pedagogical personnel in socially disadvantaged regions; the use of state-public administration tools to stimulate the interaction of schools with different socio-economic conditions with the assistance of municipalities; development of the format of interschool partnership and network interaction of schools with different quality indicators of learning outcomes.

The authors are convinced that the result of reforming the domestic, first of all - higher education, should be a flexible financing system that can simultaneously provide equal opportunities for all students to receive quality education regardless of the region of residence and create conditions for attracting additional non-state funding for those training organizations that are able to effectively absorb such funding. But, at the same time, it is necessary to take into account the range of differences: and by region, and by categories of schools, and by the level of pre-school, and then - pre-university training. Only in this case, with a truly rational use of education financing, the state will be able to rely on high-quality labor resources, which can be included in all sectors of the national economy without additional costs from all stakeholders: the corporate sector, the state and the workers themselves to professional and preparation.

Education<sup>1</sup> in all civilized countries of the world is funded by the state, traditionally from budgetary funds within the framework of national programs. Other sources of funding, characteristic, to a greater degree, for higher education: grants from private companies and foundations, international and other organizations in the framework of this study were not taken into consideration due to their irregularity both in terms of volume and period. The dynamics and volumes of state financing of education in the Russian Federation are presented in the context of levels of education are presented in table 1.

---

<sup>1</sup>It is about education in general - all levels in accordance with the International Standard Classification of Education (ISCED) - from 0 to 8 levels.

**Table 1.** *State expenditures on education by subsection of the classification of expenditures of budgets, billion rubles*

Sources / Periods	2000	2005	2010	2015	2016
Consolidated budget of the Russian Federation and budgets of the WBGF	214,68	801,79	1893,88	3034,58	3130,09
Preschool education	31,92	113,06	321,29	692,12	678,98
General education	107,88	356,1	827,37	1405,84	1488,37
Initial vocational education <sup>2</sup>	13,38	39,39	61,66	-	-
Secondary vocational education	10,19	43,28	102,22	197,79	199,97
Higher and postgraduate professional education	24,38	125,86	377,79	517,23	505,31
Training, retraining and advanced training	1,38	6,66	13,19	19,48	21,11
Youth policy and children's health	—	24,96	49,61	58,38	65,22
Other educational issues	25,38	90,77	125,09	130,47	132,88

As can be seen, almost half (47.55%) is accounted for by general (school) education, due to the significantly larger proportion of students and the longest duration of this type of training. The total number of students in this category is primary, basic, secondary general education in Russia - 15,219 thousand people (48.3% of all students). In second place is the financing of pre-school education (21.7%), which covers 7,343,000 people (23.3% of all students). Higher and postgraduate education is in the third place.

The question of the quality of labor resources is difficult to do on the basis of the data presented. A more informative comparison of relative indicators (the share of GDP allocated to finance education) in countries that have achieved significant results in the quality of labor resources looks like. Table 2 shows that Russia ranks last among developed countries, sharing it with Italy (3.6%).

<sup>2</sup>Since 2014, accounted for in open source software

**Table 2.** *The share of expenditure on education in general government expenditures*

<b>Countries / Indicators</b>	<b>For all education, %</b>	<b>For higher, %</b>	<b>Expenditure on education, % of GDP</b>	<b>Expenditure on higher education, % of GDP</b>
South Korea	14,49	2,89	4,59	1,02
canada	13,41	3,02	4,48	1,31
The USA	11,81	3,48	4,21	0,89
Great Britain	12,52	3,02	4,77	0,59
Sweden	11,33	3,57	5,19	1,48
Russia	9,92	1,61	3,61	0,62
Germany	9,39	3,03	3,69	1,11
France	8,38	1,69	4,79	1,19
Japan	8,19	1,68	3,21	0,51
Italy	7,11	1,67	3,58	0,69

The presented structure of expenditures on education (by levels) is of particular importance for the development of the national economy - in fact, this is a potential whose financing has a multiplicative effect, reflecting on the possibilities of economic growth. South Korea has the largest share of education funding in all general government spending; by share of GDP attributable to education funding - Sweden. The results of such a properly oriented public policy are already visible. Sustainable development of the economies of these countries (in terms of economic growth, stability of national currencies, unemployment) is largely due to government investment in the education of the population.

Conducting a comprehensive study on the impact of education financing on the quality of labor resources should not be limited to the cost method. No matter how much money is spent, this does not mean achieving a real result. The question of how this result should be, what qualitative characteristics a modern worker should possess is the main goal of the authors' research.

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越南农业土地管理存在的问题及前景

## PROBLEMS AND PROSPECTS OF AGRICULTURAL LAND MANAGEMENT IN VIETNAM

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註解。 本文討論了越南農業土地管理的問題；突出農業土地管理的困難和國家農業土地管理機構的弱點； 建議在越南長期提高農業土地立法實施和農業土地管理的組織效率。

關鍵詞：問題，管理，土地資源，農業用地，土地利用。

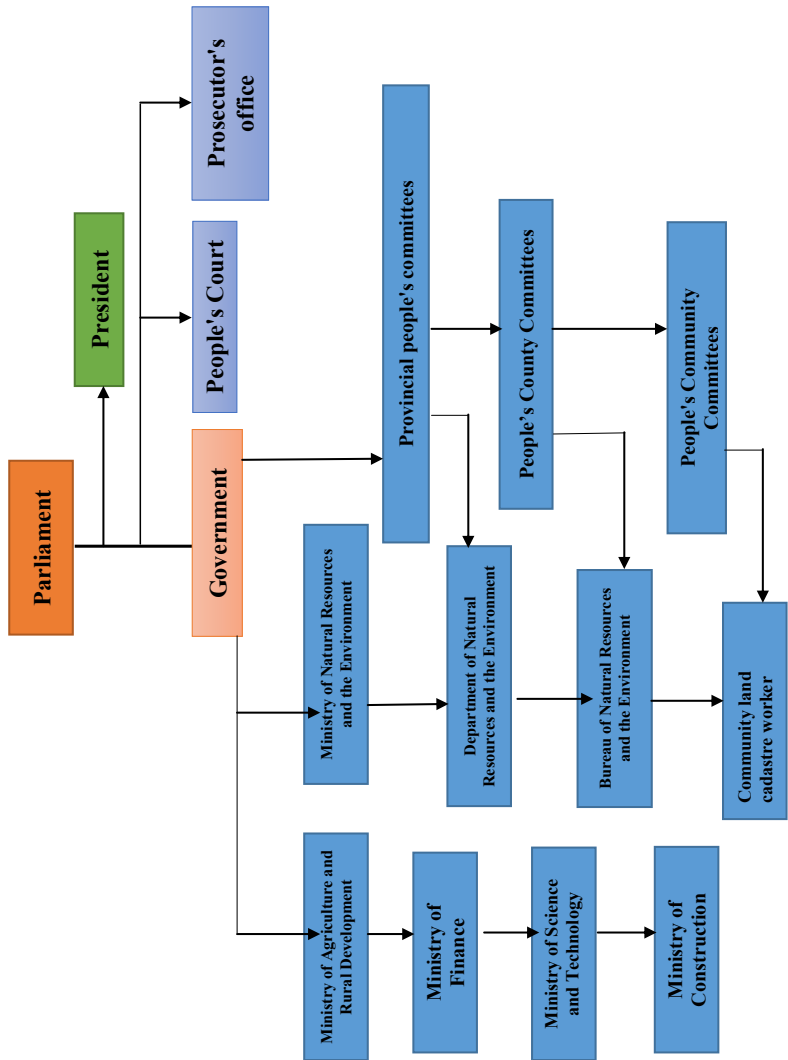
**Annotation.** *The article discusses the problems of agricultural land management in Vietnam; highlighting the difficulties in the management of agricultural land and weaknesses of the state administration apparatus for agricultural land; Recommendations are given to improve the efficiency of the organization of the implementation of legislation on agricultural land and the management of agricultural land in the long term in Vietnam.*

**Keywords:** *problems, management, land resources, agricultural land, land use.*

In the process of state administration of land in general, and agricultural land, in particular, an extremely important role is played by the bodies belonging to the apparatus of state land administration. Based on their status and assigned management tasks in accordance with the provisions of the current land legislation, the people's management committees are bodies that carry out direct work on state land management, namely, transfer and seize land, lease it, issue a certificate of land use right, carry out inspections and measurements, plan and draw up land use plans, inspect and analyze violations, resolve issues with complaints and allegations in land disputes.

### **The system of state land management in Vietnam**

When it comes to the function of state land administration, the government and people's committees of all levels play an important role in its implementation. The apparatus of state land administration is presented in Figure 1.



*Scheme 1. State Land Management of Vietnam*

Article 24 of the Law "On Land" in 2013 establishes that the organizational system of state land management has a single structure both in the center and in the field; The central authority is the Ministry of Natural Resources and the Environment, and at the local level this work is carried out at the provincial, county and community levels [8].

The names of the system of specialized land administration bodies in Vietnam also changed along with the history of the development of the service. The specialized land management body went through 3 periods of development, namely:

The period from 1960 to 1994: the creation of the General Directorate of Land Use under the Government Council;

The period from 1994 to 2002: the creation of the General Directorate of the Land Cadastre under the Government;

The period from 2002 to the present: the creation of the Land Management Service under the Ministry of Natural Resources and the Environment [8, 10].

The Ministry of Natural Resources and the Environment is a state administrative body that helps the government to carry out state administration in the field of land, water and other resources [10].

Since its inception, the state land administration bodies, through their professional activities, have assisted the government and the people's committees at all levels in land administration issues. However, in practice there are many limitations on these issues. The situation with the division of management functions among many agencies has led to the fact that the work on land management was duplicated and began to flow on its own. The potential of agricultural lands was not fully exploited, in some places they were fragmented, were used wastefully, there were cases of violations of land legislation, insufficient compensation and cost recovery, omissions during the release of land. On the other hand, there was a weakness in the apparatus of state administration of agricultural land, when some senior officials of the state administration of land used their official position, which led to corruption and self-interest.

### ***Difficulties of Agricultural Land Management in Vietnam***

#### ***1) The lack of complexity in the mechanism of the land policy, the content of legal acts changes slowly and insufficiently***

Irresponsibility in management makes it difficult to organize performance. The point is that the newly entered into legal acts no longer correspond to the actual state of affairs. The publication of the legal regulation texts in the provinces and cities and the order of their execution goes slowly and with delays [6; 7].

#### ***2) Difficulties in the implementation of administrative procedures when issuing a certificate of land use rights***

In a number of regions, the order and process of carrying out formalities for issuing certificates on land use rights is slow and incomplete compared to the paperwork for investment and construction [6]. On the other hand, the managerial staff

remains bloated, the administrative clearance mechanism is complicated, which leads to a wasting of investor time, and this has a negative effect on the effectiveness of investing in agricultural production.

***3) Difficulties in the formation of land use plans, the withdrawal, transfer of land, its lease and calculations for the payment of compensation, assistance in resettlement***

According to the law, currently in Vietnam there are several types of planning, for example, by administrative division (master plan for socio-economic development, general land use planning in the province, county, community); planning by industry and government departments (agricultural land use planning, environmental planning, transport development planning, urban planning); regional planning (zones of advanced economic development). Existing planning by administrative division creates obstacles for the development of the agricultural sector in the direction of large-scale production and the development of regions [6; 7; 8].

The term (cycle) of general land use planning is 10 years. Therefore, many of the old approximate indicators are no longer suitable, they need to be adjusted in accordance with the situation in the area. The job of transferring land, renting it out, withdrawing it with compensation, and releasing sites according to plans in the field is behind schedule and faces many problems.

The absence of a mechanism to control, supervise, review the activities of these bodies can all lead to violations of the provisions on the transfer and lease of land, the issuance of documents to change the purpose of land use [4].

The policy of land acquisition, the provisions of the legislation on the price of compensation and reimbursement of funds for agricultural land are not yet perfect, which causes damage to the countrymen.

***4) Difficulties and lack of authority of agricultural land management***

The management of agricultural land in its current form suffers from deficiencies in the distribution mechanism at the macro level. The interaction between bureaus and departments of the province with local authorities and investors, aimed at performing the function of state management of agricultural land, is characterized by low efficiency [3].

The organizational structure of the administrative staff of all levels remains cumbersome. The lack of order in matters of land management and control creates loopholes that can involve officials using their official position to carry out corrupt transactions, receive and give bribes, and violate land laws.

***Recommendations to improve the management of agricultural land***

***1) Improving the mechanism for adjusting the activities of state bodies and the legal system related to the use of agricultural land***

It is necessary to once again check the content of legal documents on the use of agricultural land, to collect opinions on the need for adjustments, changes and



additions and improvement of the system of legal acts on the use of agricultural lands [7]. It is necessary to organize work on legal education and the dissemination of legal knowledge on the land issue at the proper level.

*2) Strengthening land use planning*

The work on the formation and organization of the execution of general plans, regional plans for the use of agricultural land should undergo comprehensive coordination between the central ministries and departments, between the center and the regions, as well as between regions.

*3) Strengthening the effectiveness and efficiency of control and audit work in the management and use of agricultural land*

It is necessary to increase the competence and responsibility for carrying out control and auditing work and supervision by the administrative authorities in respect of subordinate units [6].

*4) It is needed to improve the formation of a land information system, turning it into a part of the State data system*

It is necessary that the system of revision and statistics of agricultural lands be automated, based on the system of digitized cadastral data, constantly updated, supplemented and corrected, which would ensure the rapid provision of accurate statistical data and audit results [5].

*5) It is needed to improve the organizational apparatus, strengthen the interaction of ministries and departments with local authorities in the management and use of agricultural land.*

Increase the potential of employees of the land administration department [6]. It is necessary to create and use a mechanism for the exchange and provision of information on available land areas and on the dynamics of their use by users.

**Conclusion**

The above analysis shows that the existing Vietnamese legislation on agricultural land is gradually being improved and supplemented in accordance with reality. However, there are still limitations, shortcomings and contradictions that affect the efficiency of use of agricultural land, as well as the process of sustainable development of the country. Therefore, it is necessary to overcome and get rid of these limitations and shortcomings, and at the same time improve the establishment of administrative procedures for the reform, business conditions, as well as improve efficiency in organizing the implementation of legislation on agricultural land. It is necessary to consider the sustainable development of the agricultural economy as the basis, potential source and driving force of the process of industrialization - modernization and international integration of Vietnam. [1; 2; 9]

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在经济数字化方面转变管理组织方法

**TRANSFORMATIONS OF APPROACHES TO THE ORGANIZATION  
OF MANAGEMENT IN THE ASPECT OF DIGITALIZATION  
OF THE ECONOMY**

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註解。 本文描述了經濟數字化的過程，這是經濟互動轉型的原因和結果。

關鍵詞：商業互動，數字經濟學

**Annotation.** *This article describes the process of digitalization of the economy, which is the cause and effect of the transformation of economic interactions.*

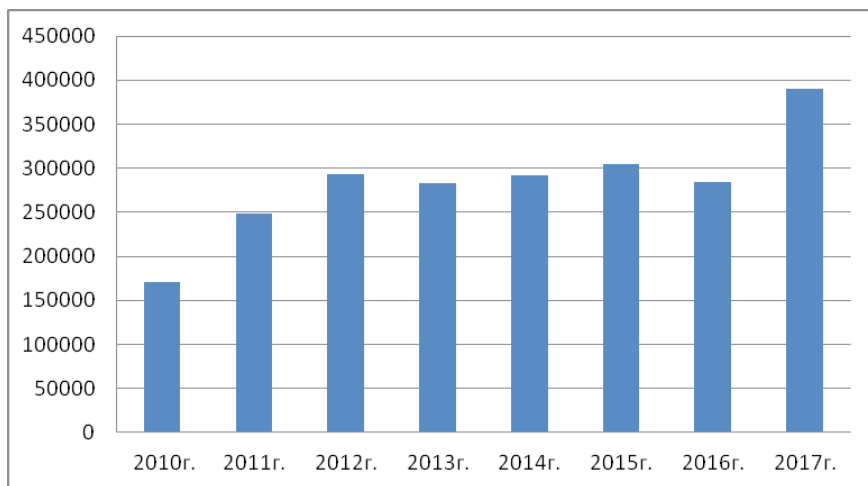
**Keywords:** *business interactions, digital economics*

The evolution of the needs of society, interdependent on the intensive development of productive forces, creates the conditions for the continuous transformation of the parameters of the economic environment and / or interactions of the subjects. The current trend of digitalization of the economy, reflecting a qualitative leap in the organization of economic activity, acts as a kind of “irritant” to the content of established interactions, radically changing the routine of the behavior of the subjects. For example, the use of digital platforms (Yandex, Avito, OZON, etc.), used as the main channels of interaction with customers, serves as a means of creating innovative business models, including in traditional industries. It is noted that the development of the digital economy contributes to the growth of the purchasing power of the population, since digital platforms and marketplaces create price competition, allowing not only to buy goods at the most favorable price, but also to find out its characteristics from real users. [1].

According to the provisions of the Digital Economy of the Russian Federation program, “data in digital form is a key factor of production in all areas of socio-economic activity, which increases the country's competitiveness, quality of life of citizens, ensures economic growth and national sovereignty” [2]. The transformation of management involves the following aspects:

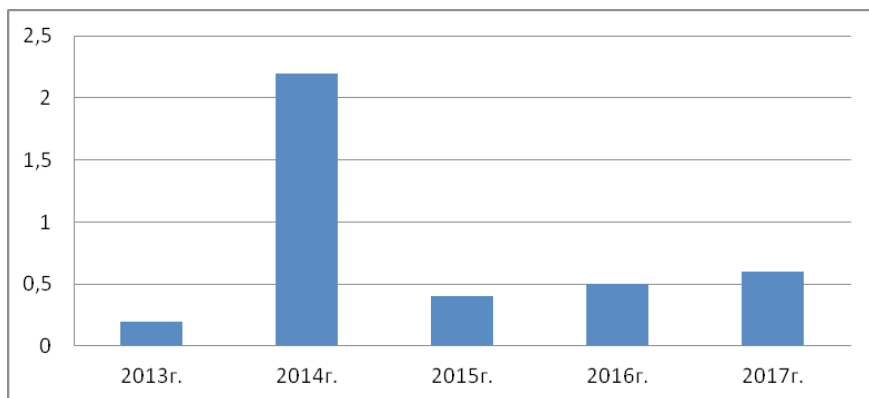
- organizational, associated with a change in approaches to business management, so, the Russian Sberbank centralized personnel administration processes based on SAP HCM and switched to the SAP SuccessFactors cloud HR platform for talent management processes [3];
- resource, affecting the efficiency of production resources - for example, “robot Vera” (MTS, X5 RetailGroup, IKEA, etc.), analyzes the resumes of candidates, selects the most suitable ones and calls them (for two years, 5 million calls [3];
- technological, determining the choice of production method - in 2017, Sberbank and Yandex signed an agreement on creating a joint e-commerce platform based on the Yandex.Market goods and services aggregator with a total value of 60 billion rubles. [4] etc.

The significance of the activity under consideration is also confirmed by the data on the volume of investments in ICT, which show steady growth (see Fig. 1)



**Fig. 1** Dynamics of investments in fixed assets for ICT equipment, mln. Rub. [5]

This also changes the behavior of consumers who share the gains from the introduction of innovations with companies - for example, the Sberbank Online Internet banking audience is 14.5 million active users, users make more than 3 million payments and transfers daily [6]. Awareness of the convenience of using these technologies (see Figure 2, reflecting, in fact, the dynamics of reducing consumer distrust) is an incentive for companies to further improve.



**Fig. 2.** *The proportion of the population that does not use the Internet for security reasons, % of the total population [5]*

The introduction of new technologies, requiring efforts to adapt to them, has an impact on the parameters of management, enhancing the competitiveness of companies (digital technologies in the mass search for employees, including auto search and chat bot, use Sberbank. Thanks to “Robot Anna” (“Sberbank”), the average time call center call duration decreased by 7% [3]. At the same time, companies independently initiate a search for previously unused opportunities, working “for the future” - for example, the “Digital Breakthrough” competition is held on the initiative of Rosseti PJSC in order to facilitate the implementation of the digital network complex digitalization strategy and the search for new innovative technologies environment to stimulate the increase of investment attractiveness of the electric grid complex [7]. This indicates the formation of a bidirectional trend:

on the one hand, the creation and introduction of digital technologies has a disturbing effect on the organization of activities, requiring additional expenditures of various kinds of resources;

on the other hand, being a source of increasing competitiveness, it stimulates companies to further improve them, identify new ways / areas of use that are not taken into account before.

A significant factor is the state support of this direction. Thus, the Program “Digital Economy of the Russian Federation” and the Strategy for the Development of the Information Society in the Russian Federation for 2017-2030. [2, 8] determine the state policy to create conditions for the development of a knowledge society in the Russian Federation, increase the country's competitiveness, well-being and quality of life of citizens, enhance the security of the country by increasing the availability of goods and services produced by literacy, improving accessibility and quality of public services. Moreover, the scale of transformations is confirmed by the expansion of international cooperation - Russian companies are actively integrating into international alliances that set technological standards [9, 10]. In May 2017, the head of the Russian Export company signed a cooperation agreement with Alibaba, under which the Chinese trading platform will open the Russian national pavilion for the sale of food products and household chemicals [4].

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中国能源平衡发展战略的影响因素  
**INFLUENCING FACTORS OF DEVELOPMENT STRATEGY  
OF CHINA ENERGY BALANCE**

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抽象。 本文討論了影響中國能源平衡發展戰略形成的重要影響的外部因素，同時考慮到有助於製定最優戰略，並通過現有信息的系統化製定主要方向。 提出了組織確定這些因素的工作程序，並評估了其影響程度。 本文考慮了經濟，政治和組織因素，分析了既定戰略的分析結果和中國區域分工發展戰略的基本原理。

關鍵詞：能源平衡，電力工業發展，發展戰略，“十二五”規劃，能源。

**Abstract.** *This article discusses the external factors that have a significant influence on the formation of the China's development strategy in the energy balance, taking into account that will help develop an optimal strategy and formulate the main directions through the systematization of available information. A procedure for organizing work in identifying these factors was proposed, and the level of their influence was assessed. The article contains the results of the analysis of the established strategy and the rationale for the development strategy of the regional division in the China, taking into account economic, political, organizational factors.*

**Keywords:** *energy balance, power industry development, development strategies, 12th Five-Year Plan, energy.*

### **Introduction**

After 2000, China's economic growth entered a special stage of industrialization called "accelerated industrialization". Its main feature is the rapid expansion of heavy and chemical industries, along with rapid urbanization and motorization. This economic growth is accompanied by high energy intensity. As a result, there was a rapid increase in the production of steel and cement, the ownership of civilian vehicles and urbanization during the first decade of this century, and from 2000 to 2011 the average annual growth rates of GDP and TPEC (total primary



energy consumption) in China were more than 10% and about 8, 4% respectively. However, after that, GDP growth slowed<sup>1</sup>.

The downward trend in GDP is likely to continue, based on China's desire to restructure its economy away from heavy production; as the data showed, the share of tertiary industry (services) in GDP for the first time exceeded the share of secondary industry (manufacturing and construction), while final consumption expenditures became the main driving force of GDP growth. Therefore, China has entered a turning point. Politically, this was defined by the Chinese leadership as a "period of new normality". This means that future economic growth will be different and probably much less energy consuming than the past 15 years.

### **Main part**

The total emissions of SO<sub>2</sub> and NO<sub>x</sub> from flue gas in China in recent years have begun to decline as a result of improved emission standards and the introduction of modern technologies. Compared to air pollutants, NO<sub>x</sub> and SO<sub>2</sub>, CO<sub>2</sub> emissions from energy use, especially when burning coal, are difficult to reduce, and their number is several orders of magnitude larger. However, based on energy-saving technologies and practices, as well as the emergence of renewable energy sources, the growth of CO<sub>2</sub> emissions in the energy sector in China has slowed. The listed data apply to most regions and technologies.

To understand the factors influencing strategic planning for energy development in China over the past 20 years, first of all, it is necessary to understand the political goals of China's central government. In a series of presidential reports from 2000 to 2010, presented to the NCPC (National Congress of the Communist Party of the People's Republic of China), contained several political objectives. The reports of the 15th and 16th NCTC, presented by President Jiang Zemin in 1997 and 2002, laid down the philosophy of "discovery and reform" and the realization of rapid economic growth. The key goal was to double GDP in 2010 compared with 2000 and double it even more by 2020. The report of the 17th meeting of the CPPCC, signed by Hu Jintao in 2007, reiterated the importance of rapid economic growth and meeting the same goals of GDP growth, but indicated that economic growth should be based on optimizing the economic structure, increasing economic efficiency, reducing resource consumption and environmental protection. A new concept of "scientific development" was proposed, which emphasizes a more balanced development, and not just purposeful economic growth.

The Chinese economy has constantly maintained a good balance between increased efficiency and structural changes in energy intensity trends. This worries Chinese politicians who are trying to incline the economy to an alternative development model that is less responsive to the growth of labor-intensive sectors and focuses on innovation and the growth of the services sector. In 2002, China

<sup>1</sup>Key China energy statistics. China Energy Group - 2016. URL: <https://china.lbl.gov/sites/default/files/misc/ced-9-2017-final.pdf>

adopted electricity reform to stimulate the construction of power plants in order to reduce power shortages. Before the reform, power generation, shipping, transmission and sales were integrated. They were planned by the central government and implemented by the Ministry of State Electricity until 1998 and the State Energy Corporation from 1998 to 2003.<sup>2</sup>

There are many potential factors that influence the development of renewable energy. Among them, the economic factor and the technological factor, which attract wide attention, are especially important. Economic costs (for example, unit investment costs) are the main obstacle to the large-scale development of renewable energy. Most renewable energy technologies are relatively new and not yet fully commercialized. This problem is particularly acute in China, because the government wants to maintain a low price of electricity to support economic development.

According to a study by Kong and Wei, the cost per unit of coal-powered energy was 350 yuan / kW / h, while the cost per unit of wind and solar energy was 620 and 1900 yuan / kW / h separately (1 Chinese yuan is 0, 16). U.S. dollar). The large-scale development of renewable energy is facing strong market competition from traditional energy. However, over the past few decades, the cost of renewable energy has decreased significantly<sup>3</sup>.

A relatively accurate method for predicting the economic value of renewable energy is the learning curve method. The basic idea of the learning curve is that unit costs decrease with increasing experience (for example, cumulative production). Another major obstacle to the large-scale development of renewable energy is appropriate technological support. This problem is more serious in developing countries such as China and India, since most of the renewable energy technologies in these countries are still under development. One of the important indicators describing technological support is the degree of maturity of a technology, which depends on its stage on the life cycle. As a rule, the life cycle of renewable energy technologies includes four stages: infancy, growth, maturity and recession.

A model for explaining the maturity of new technologies over time is often called the diffusion technology model. A typical technological diffusion model is the S-curve model. This is due to the fact that usually the spread of renewable energy technologies is slow at first, and then it grows rapidly and, finally, gradually increases to saturation.

The analysis of the possibilities of application and development of energy balance research methods, taking into account the development strategy of the energy

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<sup>2</sup>Painuly J. P. Barriers to renewable energy penetration: a framework for analysis // *Renewable Energy*. 2001, vol. 24, no. 1, pp. 73–89.

<sup>3</sup>Cong R.G., Wei Y.M. Potential impact of (CET) carbon emissions trading on China's power sector: a perspective from different allowance allocation options // *Energy*. 2013, vol. 35, no. 9, pp. 3921–3931.

sector of the PRC, allowed the author to identify factors of the PRC, among the main ones: acceleration and deceleration of the replacement of traditional hydrocarbon energy resources with alternative ones.

It should be emphasized that a comparative analysis of the economic efficiency of traditional energy and alternative energy needs to be carried out using information on the cost of energy production, the necessary financial investments in energy facilities being created, but also taking into account all possible types of future risks and uncertainties associated with an increase in the price of hydrocarbon fuel. costs of environmental protection, maintaining the health of citizens with an increasing likelihood of deterioration ecology, due to various innovations in the energy sector.

Studying the introduction of technologies for the use of alternative types of energy in developed countries (countries of the European Union, USA, Japan, China, etc.) led to the conclusion that to increase the effectiveness and success of new projects replacing traditional hydrocarbon energy, implementation and development of the most efficient models of government support for such programs. High-energy and over-capacity industries should exercise overall energy control and strict restrictions, other industries should impose strict restrictions in accordance with advanced energy efficiency standards, the energy efficiency of existing facilities should have timelines for compliance and should correspond to domestic production. powerful advanced energy efficiency standards.

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分析和评估腔室法医标记的可能性

## ANALYSIS AND EVALUATION OF THE POSSIBILITIES OF FORENSIC MARKING OF THE CHAMBER

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註解。考慮到標記槍械的下列部分以解決識別槍械和用過的彈藥筒的問題的前景。提出了對槍械室內法醫標記位置進行彈道編碼的可能性的研究。

關鍵詞：彈道編碼，民用和服務武器，槍械，光滑武器，識別，法醫標記，標記，腔室，軌跡細節。

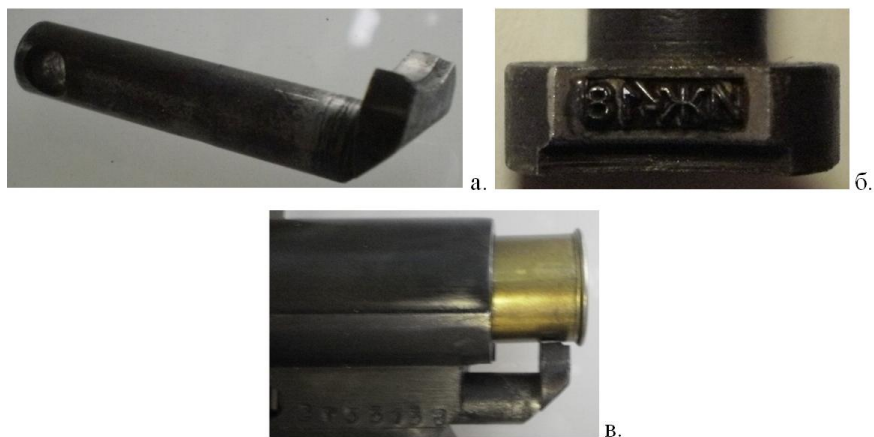
**Annotation.** *The prospect of marking the following parts of a firearm with the aim of solving the problems of identifying firearms and spent cartridges is considered. A study of the possibilities of carrying out ballistic coding with the location of the forensic marker in the chamber of a firearm is presented.*

**Key words:** *ballistic coding, civilian and service weapons, firearms, smooth-bore weapons, identification, forensic markers, marking, chamber, trail details.*

The current state, trends and technological development of society make it possible to take a different look at the development of forensic methods and technologies for marking the following components of a firearm with the aim of solving the problems of identifying such ballistic objects as a weapon - a sleeve or a sleeve - a sleeve. In previously published articles [1-4] we touched upon the topic of ballistic coding with the location of the forensic marker on the mirror of the weapon's bolt. This article presents a study of the possibilities of carrying out ballistic coding with the location of the forensic marker in the chamber of a firearm.

As a firearm for the empirical part of the study was used single-barreled single-shot gun of 16 caliber with a bursting barrel "ИЖ - 18". Initially, during the first experiments, the forensic marker was made on the extractor of the weapon by a

protruding method, using the method that received our designation - "lettered". A platform of high-strength tool steel was welded and leveled onto the concave surface of the extractor, after which excess metal was evaporated using a laser to form a marker code. After the manufacture of forensic marking in this way, the part was placed in the weapon in a regular place, then the inspection of the normal operation of the weapon locking mechanism was carried out. In the process of executing the loading of the "ИЖ – 18" gun, it took considerable physical effort to secure the barrel of the weapon with a pad, since the cartridge did not enter the chamber regularly because of the resulting bias from the protruding forensic marker on the extractor, fig. 1.



**Fig. 1.** Marking with a weapon extractor: *a* - a general view of the extractor "ИЛ 18"; *б* - forensic marker produced by the lettered method with a mirror designation of the "ИЖ-18" ballistic code; *в* - the place of interaction of the extractor with the sleeve

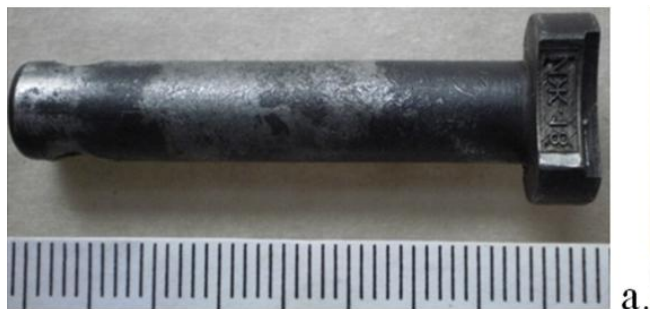
After bringing the weapon into normal readiness in the shooting gallery under normal climatic conditions (ambient temperature 21 °C, humidity 48%), an experiment was conducted with shooting ten cartridges from different manufacturers, on all objects (cartridges) an approximately identical result was obtained, which is shown in Fig. 2



**Fig. 2.** Cartridge case with damage to the metal skirt when loading weapons

The experiment made it possible to formulate the conclusion that even with a slight protrusion of a forensic marker in the chamber of a firearm, its operational properties are significantly impaired. Charging the cartridge and removing the spent cartridge when using a forensic marker made by the lettered method is performed with considerable physical effort and violation of the integrity of the object, as a result, safety precautions for handling weapons are not observed, which is unacceptable. Based on the above, we consider the use of this forensic marker, made in the weapon's chamber in a lettered way, unpromising.

After analyzing the experiment to create a reliable forensic marker in the weapon chamber, it was decided to use the method of manufacturing in-depth details. As a test weapon for objectivity of the result, as in the previous experiment, a single-barreled single-shot rifle of 16 caliber “ИЖ-18” was used, with the production of a valid forensic marker model on the extractor. On the concave surface of the extractor, the background of the ballistic code was selected, leaving mirrored symbols protruding at the level of the inner surface of the chamber, this method of manufacturing a forensic marker was designated by us “die”. After establishing a part with a forensic marker in a weapon at a regular place and conducting an inspection of the normal operation of the mechanism for locking a weapon, ten cartridges of various manufacturers were fired. As a result of the experiment conducted on objects, trail mappings from a forensic marker were obtained, fig. 3.





**Fig. 3.** *Marking with an extractor: a. - general view of the extractor with a forensic marker made in a die-cut manner; б. - the result of the shooting, with the display of a ballistic code from the forensic marker on the side surface of the sleeve*

Summing up the results of the experimental study, we consider it justified to use in ballistic coding with the location of forensic markers in the chamber of a weapon of a die-cut method of their manufacture. The introduction of the developed method of manufacturing forensic markers can increase the capabilities of ballistic identification, applicable both between spent cartridges and to establish a specific instance of firearms using experimental firing for obtaining samples (spent cartridges) of a comparative study, which will increase the effectiveness of conducting forensic ballistic examinations of labeled weapons.

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俄罗斯未成年人安全管理当代问题的政治和法律观点

**POLITICAL AND LEGAL VIEW ON CONTEMPORARY PROBLEMS  
AND PROSPECTS OF ADMINISTRATION OF SECURITY OF MINORS  
IN RUSSIA**

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注解。 作者提出了对俄罗斯联邦未成年人安全管理当前问题和前景的政治和法律研究

关键词：未成年人，安全，管理

**Annotation.** *The authors propose political and legal studies of current problems and prospects for the administration of the safety of minors in the Russian Federation*

**Keywords:** *minors, safety, administration*

From the moment of its appearance on Earth, a human permanently lives and acts in conditions of constantly changing potential dangers, both the natural-technical state and the directly unlawful behavior of another person, which, if realized in space and time, causes harm to a person and is expressed as in injuries, diseases, nervous shocks, even deaths, and other varieties of problems related to property, public order, public safety, and informational viem and much more.

By their nature, hazards are always objective and divisible by the offensive factor, namely, they are probable (i.e. random), potential (i.e. hidden or discovered), permanent (i.e. constant or continuous) and are total (i.e., general or universal), thus, there is no person who is not in danger, either in natural or technical condition, or in connection with informational influence and possible illegal behavior



of other people. And children in such a volume of hazards are one of the least protected social groups of the population, which entails the need for both the immediate care of parents (taking care of children, their upbringing is an equally right and duty of parents<sup>1</sup>), as well as the responsibility of the state as a political institution. Legal line on the safety of minors, which in turn is part of a more general direction - the country's national security. And this position does not contradict Federal Law No. 390-FL of December 28, 2010 "On Security", in which the content of the security activities includes paragraph 2) the definition of the main directions of state policy and strategic planning in the field of security<sup>2</sup>.

At the same time, one of the main functions of state administration is to ensure social security as a continuous state of the entire set of factors of life support and reproduction of social subjects, guaranteeing the minimum necessary and sufficient level of their life activity and development. And among these factors, in our opinion, should first of all be listed: general and vocational education, youth employment, acceptable level and quality of life, housing, health care, access to information and cultural values, personal safety of children, and, of course, an environmentally healthy surroundings. All the above factors in modern Russia are categorized as problematic. Therefore, the prevention of hazards and protection against their probable offense today could not be more pressing problems of socio-economic and political-legal status in Russian society, in the solution of which the state cannot but be interested, which apparently was reflected in Article 6 Of the Federal Law "On the basis of the crime prevention system in the Russian Federation" in the immediate list of the main areas of crime prevention, namely:

- protection of the person from unlawful encroachment;
- offense prevention;
- development of a system of preventive registration of persons prone to committing offenses;
- protection of public order, including during sports, entertainment and other public events;
- ensuring public safety, including road safety and traffic safety;
- combating illegal migration;
- prevention of neglect, homelessness and anti-social actions of minors;
- counteraction to terrorism and extremist activities, protection of potential objects of terrorist attacks, including critical and / or potentially dangerous infrastructure and livelihoods, as well as places of mass stay of people;
- counteraction to illegal circulation of narcotic drugs, psychotropic substances and their precursors;
- ensuring the protection and guarding of private, state, municipal, and other forms of property;
- economic security;
- anti-corruption, identifying and eliminating the causes and conditions for its occurrence;
- ensuring environmental safety, environmental protection;
- fire safety;
- prevention, elimination and / or minimization of the consequences of natural and man-made emergency situations;
- increasing the level of legal literacy and the development of citizens' legal awareness<sup>3</sup>.

However, a systematic analysis of political and legal practices shows that the

existing laws are largely declarative. And declarativeness is primarily due to the fact that the course proclaimed by representatives of the authorities only indirectly affects the economic aspects of public policy. And the state as a political institution does not adequately fulfill the functions assigned to it as a guarantor of the rights and interests of the younger generation, as well as ensuring its security. In this context, it is quite indicative that in the country demographic processes have extremely unfavorable combinations: high mortality (including suicidal), jumping birth rate, an increase in the number of divorces, an increase in the number of children born out of wedlock, deterioration in the health of the younger generation, growth in adolescence crimes, etc. Every year in Russia, about two thousand teenagers commit suicide because of quarrels with their parents. Thus, according to estimates of the Moscow Research Center for Human Rights, about 50 thousand children annually run away from home because of domestic violence. About 2 million children are beaten by their parents, in some cases, the beating ends in the death of a child. It is significant that two thirds of convicted juvenile offenders were beaten by their parents in childhood. About 7 thousand children a year are victims of sexual crimes. And how many children die on the roads of Russia - the numbers are too ghastly to discuss.. However, modern public administration largely follows the path of reducing educational organizations and institutions whose functions are directly related to raising the level of legal literacy and developing the legal conscience of citizens, and as a result - unfavorable tendencies of juvenile behavior and especially alarming processes in youth spheres, which gives reason to predict the possibility of maintaining a high level of danger to the interests of minors, both in the field of education and their perception, and in victimological conditions, to become a victim of unlawful dangers, both real - objectified, and informational - variational. And in this unfavorable reality and its prospects we consider it necessary to turn to the proposal of such a terminological concept as "the administration of the safety of minors". So, in accordance with the dictionary of the Russian language S.I.Ozhegova "administer" means "1. On administration: to manage, to lead by (special meaning); 2. figurative meaning - To manage anything, bureaucratic, formal, without going into the substance of the matter (non-approving)"<sup>4</sup>.

In understanding of term, proposed by S.I. Ozhegov, "administer" in relation to the safety of minors we see political and legal contradiction, which in modern conditions is manifested both from the standpoint of law enforcement of state structures, and the result of management in the absence of proper control. From this it follows that in public administration of the safety of minors in Russia, public participation at the regional level is necessary, since the activity of some official structures in the law enforcement system goes even beyond the limits of admissibility. In the modern regional conditions, there are elements of the mechanism

for protecting the rights and interests of minors as options for administering the security of minor children, but they are not integrated at the system level, which allows us to speak about the existence of a complex political and legal line of the state that meets the requirements of XXI c. in the safety of minors.

The integrated system should include such *basic elements* as: legal mechanisms aimed at the timely detection, prevention, and in necessary cases, bringing to justice of legal entities and individuals violating the safety of minors; a full-fledged state structure with the necessary powers for the interdepartmental coordination of the implementation of the state policy in the field of safety of minors; the coordination structure of civil society organizations focused on protecting the safety of minors; the system of training, retraining and accreditation of cadres of social workers in the field of protecting the safety of minors; the system of media communication channels, allowing to provide a discussion of socially significant problems in the field of life safety of children and adolescents, as well as to influence the formation of communities for the protection of children including parents and social workers. In theoretical terms, in relation to the functioning of the socio-political and socio-legal systems, the concept of administering the safety of minors and the social protection of the child population are interpreted as ensuring the social and legal function guaranteed by the state to support the continuous reproduction of life and development of all social facilities within whole community.

Thus, the administration of the safety of minors implies ensuring appropriate goals and directions for the development of society and the state, ways of meeting the needs of the individual and protecting their interests based on the principles of humanism and harmony in the relationship between all elements of the social and legal structure, identifying and preventing destructive phenomena and processes. At the same time, the safety of minors cannot be ensured only by the policies and actions of formal and unofficial government institutions, this requires favorable social and economic conditions, such as economic growth, provision of employment and professional and business employment for the youth population, access to education, health care, cultural values and many other values.

In connection with the above, and depending on the tasks and affiliation of the executive authorities, designed to guarantee and ensure the safety of minors, we distinguish three levels of its administration: *federal, regional and local*. At each of these levels, the relevance and urgency of the problem of ensuring the safety of minors require the constant attention of all institutions of the state and society, the analysis of its condition in order to prevent destabilization and social upheavals among the population.

Ensuring the safety of minors is a priority for specific individuals, as well as society and the state as a whole. And this is due to the fact that there is no absolute

security, there is always some residual risk. Safety is therefore an acceptable risk, where risk is both a quantitative and qualitative hazard assessment, which can be defined as the frequency or likelihood of one event occurring when another event occurs. Therefore, the existing state in society obliges the state to seek and use such opportunities for administering the safety of minors in which the reality or susceptibility of socially negative problems and phenomena does not violate the general concept of both the safety of minors as a whole and each separate child individually.

Thus, the quantitative and qualitative aspects of social phenomena and processes in the field of ensuring the safety of minors are delimited as follows:

1. **education, culture, social and information security** of minors - the dynamics of the number of enrolled children attending preschool and out-of-school institutions, the characteristics of the educational infrastructure and cultural infrastructure, human potential, threshold values of educational and cultural indicators, based on ensuring their safety;

2. **social and labor** – the characteristics of minors labor resources and the needs of social production in the labor force; employment and unemployment dynamics of the minority population; conditions and pay for minors; thresholds for unemployment and degradation of labor potential;

3. **the level and quality of life of the minority population** – the dynamics of real monetary average per capita incomes, consumption of goods, cash savings, the ratio of effective demand and supply of goods and services, taking into account differentiation by groups and types of families, social benefits for minor and disabled children; threshold values of the level and quality of life of the minority population;

4. **housing for children** – the characteristics of the housing stock by type, square footage, accessories, improvement, the need to improve living conditions; housing thresholds for families with children, boarding schools and orphanages;

5. **Children's health and health care** – dynamics of morbidity and the characteristics of the causes of child mortality, child disability; medical infrastructure and staffing - paediatricians and other specialized doctors;

6. **socio-psychological well-being of the child population** – social satisfaction of minors; infringement, anxiety, tension, tolerance, conflict, both among minors and in relations of minors with adults;

7. **ecology and safety** – dynamics of indicators of purity of water, air, harmful emissions, material costs for ensuring environmental safety, juvenile delinquency and encroachment on them; threshold values of environmental indicators and criminogen indicators.

The solution of these tasks is seen in the creation of a state program to ensure the **safety of minors**, the implementation of which is possible only with due re-

gard for the specifics of social and legal policies in education in general, and for under-aged people in particular. At the same time, in addition to national regulatory legal acts, each of the subjects of the Russian Federation, depending on the national-demographic and natural-geographical features, adopts its own program documents, which take into account the regional political discourse in the sphere we are considering. In sum, the documents of the federal center and the regions should form the normative base on which to implement the state policy in the field of ensuring the safety of children.

The problem of permanent change of the state policy in the field of protection from the dangers for children is relevant not only for Russia. The growth of social claims of youth leads in the post-industrial societies of the West to penetrate into the everyday life of this form of organization of family relationships, as a contract. Almost everywhere, political scientists and lawyers are confronted with manifestations of the phenomenon of childhood deprivation, which means breaking the deep connections between the world of the child and the world of adults, as well as the rest of the world around them. Therefore, one of the most important political practices of the state in the sphere of consolidating the various political actors activities in the protection of the rights and interests of children and the possible provision of their security was the emergence in the country of the institution of the Commissioner for the Rights of the Child. However, despite the fact that the Federal Constitutional Law “On the Commissioner for Human Rights in the Russian Federation” determines that the Commissioner contributes to the improvement of the legislation of the Russian Federation on human and citizen rights and to harmonize national legislation in accordance with generally accepted principles and norms of international law, the real mechanism for the implementation of all of the above is still missing. Often, the activities of both state and non-state actors in protecting the rights and interests of children, as from possible dangers, are not based on a scientifically sound approach, but rather on the principles of “political romanticism”<sup>5</sup>.

For a society, both political actions themselves and political-legal effectiveness formed on their basis and scientific knowledge are important.

Thus, the state policy in relation to ensuring the safety of childhood cannot be viewed in isolation, outside the above listed basic processes of transformation of modern Russian society. Therefore, the state policy in the field of security administration for minors should be understood as a system of economic, organizational and legal measures implemented by the state as a political institution, as well as by municipal entities and other actors, aimed at preventing (mitigating the consequences) adverse effects on generation from the social environment. At the same time, the safety of minors should be considered as an integral part of the political and legal process of national security in the country.

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关于“发现”事实对民事和刑事责任的区分问题  
**ON THE ISSUE OF THE DISTINCTION BETWEEN CIVIL AND  
CRIMINAL LIABILITY ON THE FACT OF "FINDING"**

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**Annotation.** *The authors note that civil law and criminal law, being one of the main branches of the Russian legal system, define the concept of responsibility for the “find” in different ways. The article provides definitions and discusses their common and distinguishing signs and problems.*

**Keywords:** *find, forgotten thing, theft, civil liability, criminal liability*

In the modern philistine-business and political-legal living conditions of the population, more and more questions are raised about the problems of legal regulation of relations in relation on an event or fact of a found thing or “find”, as follows from articles 227 - 229 of the first part of the Civil Code of the Russian Federation. These problems manifest themselves in the “rivalry” of civil law with criminal law, entailing practical application in the form of an offense of responsibility for what has been done, quite different in performance, namely, material - in civil law and criminal record - in criminal law legal.

These circumstances, according to the authors, require not only legal certainty on the facts of “finding”, hiding the found thing, but also civil-criminal policy [1] - assessing the current legislation from the standpoint of the prospects of law enforcement in connection with all more developing technical progress.

The most acute problem is the relationship between the concepts of “finding”, “ownerless thing” and the concept of theft of property, established by criminal law.

So, still the Russian civilist of the XIX century GF. Shershenevich singled out two criteria for distinguishing between a “find” and a “treasure” when, first of all, he noted that “treasure is a deliberately hidden thing, whereas a find is a lost thing; the owner of the find can be found, while the treasure suggests that finding the owner is no longer possible” [2].

The owner of a forgotten thing knows exactly where his forgotten property is located and he has the opportunity to return for them or otherwise return them. The owner of the lost thing also has the opportunity to assume - where and under what circumstances the thing could have been lost. Therefore, the establishment of such circumstances as the place, the situation, the position of the thing, as well as the awareness of the “financier” that the owner may return for this thing may indicate that it is not lost by its owner, but left or forgotten. In court practice, it is the establishment of the fact that a person knows where the owner of the thing is located, as well as non-compliance with the requirements of the law on transferring the thing to the owner or transferring, for example, the administration of the institution to return to the owner, serves as the basis for delimiting the find and theft.

As an example, consider the Resolution of the Presidium of the Rostov Regional Court of July 9, 2015, No. 44Y-131, which states that c. D. committed theft belonging to the victim c. M. of a mobile phone, because, being in a bank room and seeing a mobile phone on one of the ATMs, having a real opportunity to return the phone to the owner or transfer to the bank employees for return to the owner, and is obliged to do so due to the current laws and regulations behavior in society, put the phone in a bag and began to use it as her own [3].

This position of judicial practice has been developing for several years now and has emerged as a result of technical progress, what allows you to capture video - audio or otherwise, as the surrounding environment, as well as directly objects and things that have a technical reference. In modern conditions, such items and things are becoming more and more common, which, of course, entails the need not only for technical control over things, but also for their legal regulation. But it is still ahead, and at today's level of relations between a person and things, we can be guided only by prevailing law enforcement practice in accordance with applicable laws.

Thus, analyzing the provisions of the civil law on the find, one should separate two of its features that will distinguish the concept of “finds”, for example, from the concepts of “treasure” or “forgotten things”.

For the “find” it is characteristic, first of all, that the thing should drop out of the possession of the rightful owner against his will. Together with this title holder, there may be an owner of a thing or another person who legally owns a thing, for example, a tenant, a custodian, a trustee, etc. And in this regard, a person who is a no-title (illegal) owner of a thing cannot legally lose it, for example, it can



be a person who stole a thing from an owner. The title holder is the carrier of a subjective right and consists in absolute legal relations with all other persons who are obliged to refrain from violating his rights. Therefore, if the thing remains in possession of the rightful owner, for example, in the apartment the owner lost his phone, then in this case, one discovered the thing and hiding it committed theft.

The second obligatory feature is the fact that a person, having discovered a lost thing and, realizing that this thing has dropped out of the possession of another person, becomes the actual owner, i.e. takes this thing to herself. It is obvious to the “finder” that the thing he found belongs to another person, and that he has no right to acquire it in his property, and that legal relations will not arise if he, as the finder of a foreign thing, saw and passed by the “find”. Thus, the legal relationship between the find and the title owner of a thing arises at the moment when the finder picks up the lost thing and appropriates it to himself.

As a result, the person who found someone else's property and did not fulfill the requirements of civil law (immediately notify the person who lost it, or the owner of the thing or someone else known to him who has the right to receive it and return the found thing to this person [ 4]), should be responsible for violation of the requirements of this legislation. Thus, Article 1102 of the Civil Code of the Russian Federation establishes the obligation to return non-substantive enrichment (in the form of a thing, object or other property). In particular, it states that if a person who acquired or saved the property (acquirer) at the expense of another person (victim) without a basis of law or other legal acts or transaction, then he must return to the latter the unjustly acquired or saved property ( unjust enrichment), with the exception of cases provided for by Article 1109 of the Civil Code of the Russian Federation. In this case, this rule applies regardless of whether the unjust enrichment resulted from the behavior of the acquirer of the property, the victim himself, a third of their persons, or occurred against their will. As a result, we observe civil legal regulation of legal relations and financial responsibility as a result.

And here, in our opinion, the problem of “rivalry” arises, both of the events of the “discovery” and the qualification of norms of responsibility, when you can look at such relationships from an angle of criminal order. Thus, the system of criminal legislation regarding the concept and types of embezzlement has developed on sociohistorical and politico-legal attitudes and under current conditions has law enforcement practice in accordance with the explanations of the Resolution of the Plenum of the Supreme Court of the Russian Federation “On judicial practice in cases of theft, plunder and robbery” [5].

However, we are talking about a specific situation where a person does not steal, but finds someone else's thing. One such example is the events on a cell phone, when a person finds it, but does not contact the law enforcement authori-

ties. A criminal case is initiated on this event, it is established - who uses this cell phone, a person is found and brought to criminal responsibility under article 158 of the Criminal Code of the Russian Federation - theft. But the man didn't steal anything, he just found it - and in fact the "find" was brought to criminal responsibility and the court delivered a conviction that the accidental find of an expensive thing can be equated to its theft. And the cassation determination issued by the Supreme Court of the Russian Federation in April 2017 in the case of c. N.Yu. Geroevoy, convicted under paragraph "c" of Part 2 of Article 158 of the Criminal Code of the Russian Federation on the fact of possession of someone else's cell phone left in a public place, was left unchanged [6].

However, in some such cases, the verdict is possible and acquittal because of the absence of *corpus delicti*, when the logic of the acquittal is such that, according to the law on the commission of the theft, property is removed from the possession of the owner or the person under whose protection it is. And if the property has already dropped out of the possession of the owner for one reason or another, the possession of such a thing does not constitute theft.

In our opinion, when deciding whether to initiate criminal proceedings on such facts, one should strictly be guided, first of all, by part 2 of article 140 of the Code of Criminal Procedure of the Russian Federation, according to which the reason for initiating a criminal case is the presence of sufficient data indicating signs of a crime. At the same time, it is important to thoroughly and comprehensively check all the circumstances in which the loss or misplacement of a cell phone, passport or other important things, the circumstances of the detection of missing items, determine the time, place, method of loss or misplacement, as well as objective conditions, in which there were possible events or facts about the pro-loss or loss or excluding such a possibility. It is necessary to find out when and where their presence was last checked, who can confirm this [7].

At the same time, it is also necessary to check the possibility of a person reporting inaccurate information about the loss of things, documents, both with a view to obtaining new and avoiding administrative responsibility, for example, living on an invalid passport, late replacement of a photo on a passport due to age, and so on, of for the purpose of slander or knowingly false denunciation.

We conclude that each event regarding a forgotten or lost thing has its own characteristics, according to which the articulated position of the legislator should be in accordance with criminal policy, as one of the directions of state policy in the field of combating crime, counteraction, preclusion and prevention of crime.

Crime prevention, minimization of its volume and social consequences, ensuring the security of the individual, society and the state from criminal encroachment are tasks whose solution is the state function of law enforcement. This function is implemented by the entire legal system of Russia by performing tasks, the content

of which is specific for each branch of law. The tasks set before the criminal law are enshrined in Part 1 of Article 2 of the Criminal Code of the Russian Federation - it is the protection of certain socially significant objects (human and citizen rights and freedoms, property, public order and public safety, the environment, the constitutional system of the Russian Federation criminal offenses) and crime prevention.

Thus, the protection of public relations is carried out by prevention of crimes, and the prevention of crimes ensures the protection of socially significant public relations. And the problems of a criminological nature clearly appear on the surface in matters of their implementation with respect to the events of "find." At the same time, the Criminal Code of the Russian Federation establishes the basis (Article 8 of the Criminal Code of the Russian Federation) and the principles (Articles 3-7 of the Criminal Code of the Russian Federation) of criminal responsibility for determining the listed tasks, determines which acts dangerous for an individual, society or state are recognized as crimes and establishes penalties and other criminal measures for the commission of crimes. And here also there are problems regarding the criminal - legal regulation of events on the fact of "finding" and, first of all, it is connected with the concept of "finding" from the standpoint of criminal law and under what conditions a "finding" can be recognized as theft [7].

The peculiarity of criminal law is that if all other branches of law are created for the purpose of organizing a certain order of any relationship, criminal law, on the contrary, is created for the purpose of protecting, ensuring the normal order of public relations and in these purposes establishes the order of organization of relations arising from the commission of special offenses - crimes. Therefore, criminal law, regulating the relations between the state and the person who committed the act, protecting the relations settled by other branches of law, performs two legal functions, namely, regulatory and protective - and at the same time plays a special role in society, preventing crimes, raising the population in in the spirit of legality, rallying society on the basis of vital values and helping to ensure social justice, which in modern conditions is very relevant to the facts of the "find".

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关于弱势群体对他们的安全问题：俄罗斯和世界问题

**ON THE ISSUE OF THE SAFETY OF INFERIOR-YEAR-OLDS FROM  
ENCROACHMENT ON THEM: RUSSIAN AND WORLD PROBLEMS**

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注释：作者提出了对俄罗斯和国际上未成年人安全问题的法律研究。

关键词：未成年人，安全，预防

**Annotation:** *The authors propose legal studies of contemporary problems of  
the safety of minors in Russia and internationally.*

**Keywords:** *minors, safety, prevention*

The family and the well-being of children are identified as the most important priorities of the state national policy of the Russian Federation. Therefore, a significant event in 2018 was the entry into the Decade of Childhood, announced in Russia by Decree of the President of the Russian Federation No. 240 of May 29, 2017, in order to improve the state policy in the field of child protection.

The well-being of the family, the safe maturing of children, their health, harmonious development, upbringing are a special concern not only for the state, but also for society. And success here depends on the effective interaction of all those who are engaged in this arduous work due to their duty or their heart. Therefore, the forces and resources of all levels of government and the public should be combined and mobilized so that the activities of the Decade of Childhood are filled with real actions and every needy family and child receive the necessary targeted assistance from the state.

The child's right to life is the basic inalienable right from birth, enshrined in the UN Convention on the Rights of the Child and the Constitution of the Russian

Federation.

Still, the death of children from external or unnatural causes remains a serious challenge to time. And among them a special place is occupied by the death of children from criminal encroachments, as well as a result of suicides and accidents. Despite the fact that the number of murders of children decreased in 2018, their number remains quite high. Thus, according to the Investigation Department of the Investigative Committee of Russia, in the reporting year criminal cases were initiated mainly under articles 105 - 107 of the Criminal Code of the Russian Federation, namely, murder, murder by the mother of a newborn child, murder in the heat of passion. Moreover, the crimes of this type occurred not only when the child was ignored by their relatives and friends, but also in the family, where he seemed to be protected and should not be threatened (for example, the mother's boyfriend for allegedly bad behavior of the girl hit her several times; when after a while, seeing the child without signs of life, he took measures to conceal the crime of causing death).

Therefore, the system of prevention authorities neglect and juvenile delinquency have to analyze in detail each such case, to study the causes and conditions conducive to the commission of the wrongful act and take all kinds of measures to prevent such tragedies.

In 2018, the number of incidents of bringing minors to suicide increased. According to the Investigation Department of the Investigative Committee of Russia, under articles 110 (bringing to suicide) and 110.1 (inclination to commit suicide or facilitate the murder) of the Criminal Code of the Russian Federation, criminal proceedings were initiated almost twice as many as in the previous year.

There have been cases of children being brought to suicide by their legal representatives. Thus, under Article 110 of the Criminal Code of the Russian Federation (bringing to suicide), 1 criminal case was initiated against a parent who brought his child to suicide. This shows that the issue of prevention of juvenile suicidal behavior does not reduce its relevance. To this end, in Russia at the legislative level, in 2017, certain measures were taken, namely:

- Federal Law No. 120-Φ3 of June 7, 2017 "On Amendments to the Criminal Code of the Russian Federation and Article 151 of the Criminal Procedure Code of the Russian Federation, establishes additional mechanisms to counter activities aimed at encouraging children to suicidal behavior";

- The Criminal Code of the Russian Federation is supplemented by articles 110.1 "Inclination to commit suicide or facilitate the commission of murder", 110.2 "Organization of activities aimed at encouraging committing suicide" and 151.2 "Involving a minor in committing acts dangerous to the life of a minor";

- training in the early recognition of signs of suicidal behavior in 2018 in the Krasnodar Territory is conducted not only for psychiatrists and psychotherapists, but also for ambulatory primary health care physicians (therapists, pediatricians), A

training program has been launched for nursing staff.

However, in our opinion, the additional measures taken to overcome this situation are not enough. Today, it is necessary to immediately consolidate all interested state bodies for in-depth analysis at the interdepartmental level of all suicide cases, to develop a unified approach to their accounting, and to eliminate the causes and conditions of adolescent mortality.

There is another problem in this direction - the lack of information for parents of teenagers who have noticed suicidal manifestations in their children. Parents (legal representatives) do not know where they can get the necessary help, or are afraid of publicity and avoid contacting specialists: not only psychiatrists, but sometimes psychologists, sometimes without even realizing what the difference is between them. At the same time, information is insufficient not only for those parents who are already concerned about any suicidal manifestations, behavioral deviations of the child, but also for all parents raising adolescents, who sometimes do not notice that their disinterest in the inner world of the child, disapproval, and sometimes explicit condemnation teen culture, they themselves are pushing him to suicidal thoughts and manifestations. Therefore, we believe that it is necessary to inculcate in the population a culture of applying for psychological and, if necessary, for psychiatric assistance, to raise their awareness of these types of assistance using all available means.

It is impossible to take and accept the situation with the death of children as a result of accidents (in case of fires, drowning, traffic accidents). In this regard, we draw attention to the need to take exhaustive measures to prevent the death of children on water bodies, including the timely identification of parents who are prone to drinking alcohol, performing their duties inappropriately. The main reasons were the crossing of the roadway outside the pedestrian crossing, the crossing of the roadway at an unspecified location, the unexpected exit behind the vehicle. Often, minors are dying or getting injured, going through railway tracks in an unidentified place, do not hear warning signals, listening to music with headphones, do not see the approaching transport, and wearing a hood.

Among the threats to the life and health of children there are new ways to entertain them, which are not always safe or useful. In 2018, there were cases of not only injuries to children during a mass event, but also death.

In the Russian Federation, a huge number of problems related to ensuring the rights of minors remain unresolved. In recent years, the attention of the scientific community, public figures and the media to the problems related to the situation of minors in the family and society has increased. It should be noted that the protection of the rights of the child acquires special significance in the framework of criminal law, designed to apply exceptional legal consequences in case of violation of legal regulations in the designated area.

In modern times in Russia there is a problem of very low effectiveness of crim-

inal punishment for crimes against minors. According to statistics from the Investigative Committee in the time interval from 2012 to 2015, “more than 65 thousand minors were recognized as victims, of which more than 34 thousand were juvenile. In 2015, 690 children became victims of sexual harassment by loved ones and family members“. [1]

Many elements of crimes that have a greater public danger when they are committed against a minor (juvenile) do not have qualifying signs related to the minor (juvenile) age of the victim. In particular, we are talking about assault on a person and property with the use of violence, causing harm to health of varying degrees of severity (Articles 111, 112, 115 of the Criminal Code of the Russian Federation), robbery, hijacking and extortion (Articles 161, 162, 163 Criminal Code of the Russian Federation). Thus, the position of the legislator, enshrined in criminal law, is contrary to the principle of justice, reflected in Article 6 of the Criminal Code of the Russian Federation, and is also of little value and requires compensation for the existing gap in criminal law.

Fighting the expansion of crime among young people is also possible through the establishment and prosecution of adults who involve minors in criminal and anti-social activities, as well as differentiation of established responsibility, taking into account the level of social danger of committed acts.

It should be noted that in Russian legal science there are insufficiently relevant accumulations of modern foreign rule-making in the field of preventing violations of the rights of minors.

The above, far from complete list of problems, suggests the need for reforming and improving, first of all, the legal mechanism of state protection of the rights of minors in Russia, and the differentiation of responsibility for encroachment on the interests of minors in this regard plays the leading role, which determines the relevance of this study.

Having listed the main problems of ensuring the safety of minors, we believe that crime prevention is an important part of the general system of social regulation of public life, one of the aspects of managing social processes, since the younger generation is often affected by the socium due to inexperience. The objective factors contributing to the disadaptation of young people include both the poor environment, including family, and the low level of their educational functions.

However, these problems are not only Russian problems. In today's world, the problems of childhood, the protection of the rights of minors are important at the level of the world community as a whole.

It is well known that children are the future of any community. From the middle of the 20th century, the rights of minors, the protection of which, undoubtedly, has its own characteristics, come under stressing the attention of many international memorandums. But it should be noted that few countries have achieved steady success



in this area.

Thus, in Germany over the past 2 years there has been an increase in violent crimes, including sexual assault and rape by migrants of minors and crimes related to trafficking in prohibited substances. In 2017, the number of reported crimes, including murder, robbery, assault, increased by 6.7 percent and amounted to more than 193,000 people. [2]

In France, statistics show an increase in crimes against children for the fourth year in a row. In 2017, 825 people were killed. The most affected category is victims of 15 years and older. Nonviolent robberies attract minors as victims and perpetrators of crimes. Complaints of sexual abuse against women and minors increased by 12%. [3]

According to the Research Institute in Turkey, the number of child victims of violent crime increased from 74,064 in 2014 to 83,552 in 2016. [4]

As a result of the above, the need to make a number of constructive changes and additions to the criminal law is obvious, which will help to increase the effectiveness of the fight against criminal encroachment on the rights and freedoms of minors. At a minimum, it is necessary to work out the differentiation of responsibility for crimes against children. Expansion of the preventive function of criminal law.

We believe that cases of unlawful acts against children should be analyzed by the bodies of the system for the prevention of neglect and juvenile delinquency in order to establish the causes and conditions conducive to the commission of crimes and take measures to prevent such cases in the future. Additional measures are required in the organization of individual preventive work on the part of the bodies and institutions of the system for the prevention of neglect and juvenile delinquency in relation to disadvantaged parents who are registered in the juvenile affairs units.

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测试人类心脏生物学年龄的改进方法  
**IMPROVED METHOD FOR TESTING THE BIOLOGICAL AGE  
OF A HUMAN HEART**

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註解。 本文介紹了一種測試人類心臟生物學年齡的新方法。 該測試基於作者在運動後HR變化與受試者心臟年齡之間所確定的數學關係。

今天確定一個人的生物年齡的問題特別重要。 這是一個重要的指標，在製定娛樂課程方法時必須加以考慮，旨在增加成熟和老年人活躍，全面和健全的生活時期。

關鍵詞。 一個人的生理年齡，體力活動，心率。

**Annotation.** *This article presents a new approach to testing the biological age of a human heart. The test is based on the mathematical relationship identified by the author between changes in HR after exercise and the age of the subjects' hearts.*

*The problem of determining the biological age of a person today is of particular importance. This is an important indicator that must be taken into account when developing methods of recreational classes aimed at increasing the period of active, full-fledged and able-bodied life of people of mature and elderly age.*

**Keywords.** *Biological age of a person, physical activity, heart rate.*

The content and methodology of physical culture and sports with people of mature and old age differs from the content and methodology of exercises with young people. For middle-aged and older people, it is necessary to carry out constant medical and pedagogical control and conduct various tests, including testing of biological age.

It has been established that the vitality of the human body is determined not only by the years lived, but in most cases by the degree of aging of the body. The aging of the body among all people is expressed differently and proceeds at different speeds, so the biological age of the organism usually does not coincide with the calendar age.

The calendar or passport age is a temporary division of a person's life expectancy, which indicates the number of years lived. Biological age is the age that is called true. It shows how, really old a man is.

We have identified a mathematical relationship between changes in heart rate after exercise in running and walking and the age of the test subjects. This dependence formed the basis of the calculations presented by us, which allows determining the biological age of a human heart.

National and foreign scientists claim that the state of the cardiovascular system largely determines the formation of the rest of the human body systems. They argue that a person's life could be at least 100 years old if it were not for undesirable deviations in the activity of the cardiovascular system [4, 6].

Scientists have decided to describe the aging process in humans by indicators of a whole range of systems: respiratory, neuropsychic, muscular, and also the cardiovascular system [11]. The current characteristic of the functioning of the cardiovascular system is the heart rate (HR). Many scientists have studied the relationship of heart rate with life expectancy. So, for example, Paul Bragg found that decreasing the HR at rest has a positive effect on a person's life expectancy [4]. Reducing HR ensures the efficiency of the heart, reduces energy demands, and thus increases its efficiency.

Decreasing HR at rest and, especially during exercise, is an important adaptation mechanism of a person and represents the ability to control the physical state of the body [8].

The purpose of this experimental work is the refinement of the previously proposed coefficient linking the change in HR after exercise with the age of the subjects' hearts. Preliminary check of the testing developed by us was conducted in January-February 2013 [1]. Data was obtained on a small number of subjects.

We studied the dynamics of the HR on the basis of data from literary sources [3, 5, 6, 7] and on the basis of our monitoring of the heart rhythm of the residents of the city of Kaluga and the Kaluga region. The change in HR was monitored by us using a heart rate monitor.

The biological heart age (BHA), we calculated by the formula [1, p.70], for males:

$$BHA = (17,62 -) \times 10.0/Y$$

for women:

$$BHA = (17,62 -) \times 10.3/Y$$

where:

- HR300 - heart rate after running three hundred meters distance along the track of the stadium or on any flat terrain in 125-126 seconds (beats/min); for those who begin to engage in recreational physical culture or having an extra weight, the heart rate is calculated after a two-minute walk at the highest possible pace.

- Y - the estimated coefficient (updated) is presented in Table 1.

To specify the idea of the real heart age, we introduced another coefficient. We called it reference age ratio (RAR).

The verification of the biological heart age compliance with the proper age is carried out when comparing the obtained BHA value with the reference age ratio (Table 1).

**Table 1**  
*Estimation of the biological heart age according to the RAR coefficient*

Age	30	35	40	45	50	55	60	65	70
Y	8,0	8,5	9,0	9,5	10,0	10,5	11,0	11,5	12,0
RAR	8,0	7,5	7,0	6,5	6,0	5,5	5,0	4,5	4,0

Testing of the biological heart age was not conducted by us in the group of individuals with a heart work disorder and in the group of professional athletes with severe bradycardia. According to the criteria of the World Health Organization, bradycardia refers to cases of slowing the HR to 50 beats per minute or less [9].

We compared the age-related changes of the heart condition with the age-related changes in the maximum oxygen consumption (MOC) level. It is known that the rate of age-related decline in MOC in the period from 20 to 65 years for untrained males is on average 0.5 ml / min/kg, for females - 0.3 ml/min /kg per year [12]. To determine the level of maximum oxygen consumption, we used the Cooper 12-minute run/walk test[10].

Correlation analysis between indicators of testing for the MOC level and for changes in HR after metered exercise was 0.9, which confirms the close relationship of correlating signs. The presence of a close statistical connection between the studied parameters gives us the opportunity to judge the degree of aging of the human heart as part of the experiment.

It has been established that age-related changes in the human body can be slowed down under the influence of technologically verified, purposefully organized physical exercises [2].

If, as a result of testing, the age of the test subject's heart turns out to be older than the passport age by 1–2 years, and no serious deviations in the state of health have been identified, then the subject can be engaged in recreational physical culture.

If the difference between the passport age and the biological age of the heart exceeds 3 years, then the subject should consult with the doctor.

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DOW与家庭互动过程中5-6岁儿童健康生活方式基础技术的有效性

**THE EFFECTIVENESS OF THE TECHNOLOGY OF FORMING  
THE FOUNDATIONS OF A HEALTHY LIFESTYLE IN CHILDREN  
5-6 YEARS IN THE PROCESS OF INTERACTION BETWEEN THE  
PRESCHOOL EDUCATIONAL INSTITUTION AND THE FAMILY**

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In modern society, the subject of special care is the education of the younger generation. The priorities of family education require a special relationship with the educational preschool organization, namely cooperation, interaction and trust. Many parents recognize the priority of the preschool institution in solving direct educational activities, but do not consider it necessary to participate in the pedagogical process [3].

From the organization of physical education of children in the family, according to E.S. Elyanova, depends how the child will be - active, sociable, cheerful, or will it always sit in front of the TV. The conditions of modern life seriously limit the physical activity of children. The child does not show any cognitive activity, the desire to play with peers. Therefore, parents and caregivers need to involve the child in sports, tourism, etc. [1].

To identify the features of the formation of the foundations of a healthy lifestyle for preschoolers in the process of interaction between preschool educational institutions and families, a pedagogical experiment was conducted in three stages on the basis of the Municipal budgetary preschool educational institution Kindergarten "Snegurochka", Surgut: - At the first stage of our research, an ascertaining experiment was conducted on which control and experimental groups were formed and the level of physical health of children 5-6 years old was diagnosed.

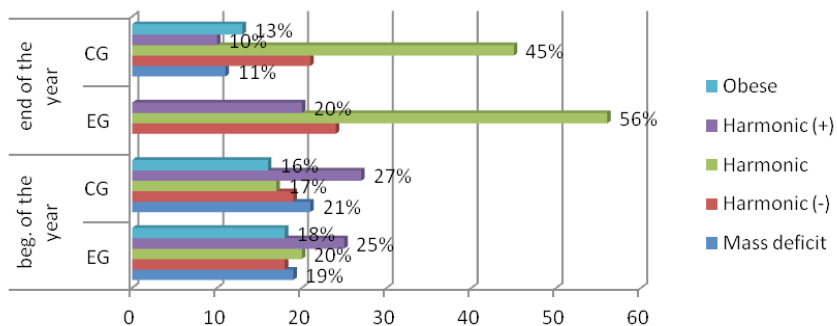
- at the second stage, we used the developed technology of forming the foundations of a healthy lifestyle for preschoolers in the process of interaction between the pre-school and the family of the foundations (Scheme 1).



*Scheme 1 Technology for the formation of the foundations of a healthy lifestyle for preschoolers in the process of interaction between preschool and family*

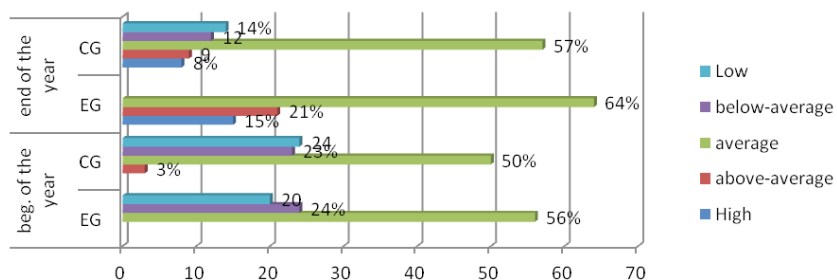
- in the third formative stage, we re-tested the level of physical health of children 5-6 years old according to 5 indices developed by C.D. Polyakov, S.V. Khrushchev, I.T. Korneev [2].

Considering the comparative figures at the beginning and end of the experiment on the Kettle index (Fig. 1), we found that, prior to the experiment, a non-harmonious physique with a body weight deficit in the experimental group was found in 19% of children, and in the control group 21% of children. With an excess of body weight (obese children) was found in the experimental group -19% and 17% in the control group.



**Fig. 1-** Chart of comparative indicators of the physical development of children 5-6 years old by the Quetelet index

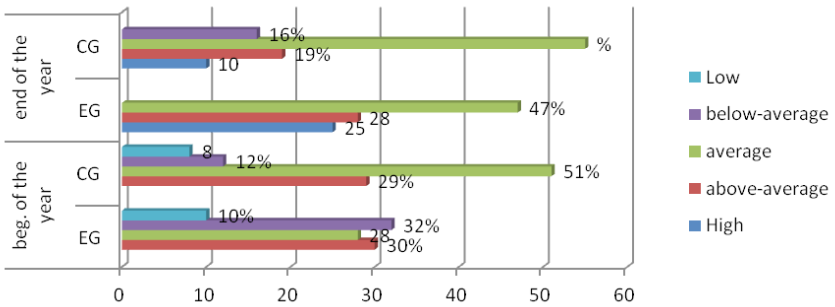
After the experiment, identifying levels of a harmonious physique, we see that, in the control group, the physique with a deficit and an excess of body weight decreased by 8-10%. The results of the Robinson index (Fig. 2) at the beginning of the experiment show that in two groups the obtained indicators are at a low level (from 20 to 24%). This allows us to diagnose dysregulation of the cardiovascular system.



**Figure 2 -** The diagram of comparative indicators of the physical development of children 5-6 years old by the Robinson index

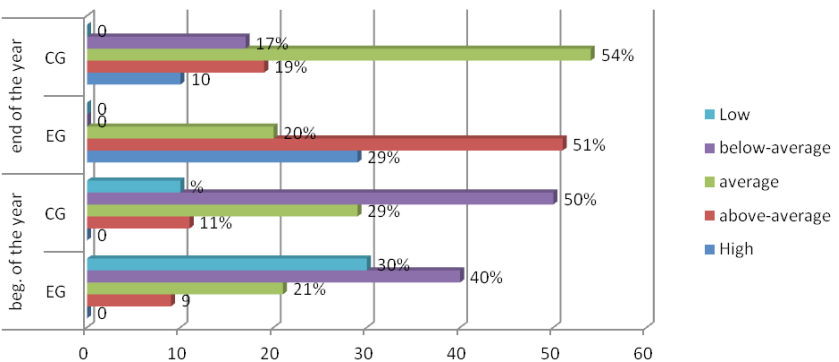
At the end of the experiment, there were significant changes in the results in the experimental group; in the control group, the indicators did not increase significantly. The results of the Skibinsky index (Fig. 3) before the experiment show that in both groups the majority of children are at a low level (from 8 to 10%), a high level was not detected in any group. At the end of the experiment, indicators in the experimental group increased, a high level was detected in 25% of children. In the control group, a high level was detected only in 10% of children, a low level was not detected, but 16% of children have a lower than average level of physical development.





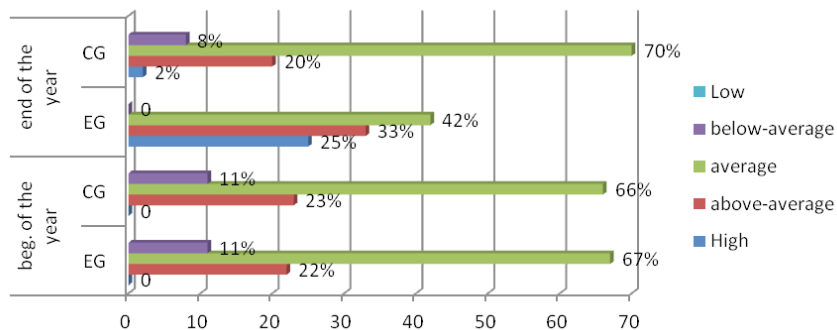
**Figure 3 - Comparative indicators of the physical development of children 5-6 years old by Skibinsky index**

The results obtained by the Shapovalova power index (Fig. 4) at the beginning of the experiment showed that no high level was detected in the experimental and control groups. Lower average level in the experimental group was found in 10% of children, and in the control group in 8% of children. At the end of the experiment, the indicators improved significantly in both groups, but in the experimental group the results were much higher.



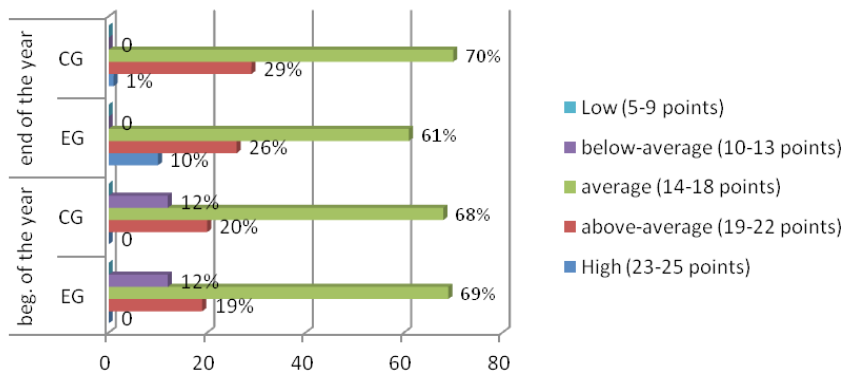
**Figure 4 - Comparative indicators of the physical development of children of senior preschool age according to the Shapovalova index**

The results of the Ruffier index (Fig. 5) indicate that the severity of the response of the cardiovascular system to the standard physical load in both groups (22-23%) is at an above average level. The average level in the experimental group was detected in 70% of children. In the control group - 66% of children.



**Figure 5** - The diagram of comparative indicators of physical development of children of senior preschool age according to Rufe index

Identifying the levels of physical health according to the general assessment of the level of children 5-6 years old, we obtained the following results: (Fig. 6).



**Fig. 6** - Comparative assessment diagram of the levels of physical health of children 5-6 years old in points

At the beginning of the experiment in both groups, high and low levels of physical health were not detected. The average level in the experimental group was found in 69% of children, and in the control group in 68% of children. Above the average level in the experimental group is 19% of children, in the control group - 20% of children.

At the end of the experiment, the following results were obtained: in the experimental group, a high level was detected in 10% of children, 26% had a higher than average level, and 61% had an average level of physical development. In the control group, the average level is 70% of children, and 29% are above the average level and 1% of children have a lower average level.

### **Conclusion**

Evidence of the effectiveness of the proposed technology for forming the foundations of a healthy lifestyle for preschoolers in the process of interaction between pre-school and family is positive dynamics of assessing the level of physical health of the experimental group compared to control group, and also significant improvement physical condition children to period of completion of the experimental work.

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有价值的学生身份取向

## VALUABLE ORIENTATIONS OF THE IDENTITY OF THE STUDENT

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註解。 本文探討了一個人的精神潛能發展問題，在公共空間中保持自己的個性，追溯學生價值取向的動態。

關鍵詞。 個性，價值，創造力，自由，責任。

**Annotation.** *The article discusses the problem of the development of a person's spiritual potential, preserving his individuality in the public space, traces the dynamics of the value orientations of students.*

**Keywords.** *Personality, value, creativity, freedom, responsibility.*

One of the most important characteristics of human self-determination in the world is the overcoming of one's own organic natural being, the desire to rise above oneself, the creative transformation of the world, and therefore one of the main goals of education is associated with the formation of a creative personality. Here we are not talking about revealing talent, about inspiration, or about creativity as a "flash" of genius. Within the given reasoning over creativity, the cumulative characteristic of human activity, the condition of human existence as a kind of homo sapiens, is understood. Only at this level can creative development be understood as a general pedagogical task.

The dynamics of culture, its movement in the future is always associated with the arrival of new generations. Young people as a special social group are characterized by the following general psychological characteristics: increased susceptibility, irritability, sharp criticism, etc. Other things being equal, in the scientific activities of young people such personal qualities as the feeling of the new, the courage, the rich and free imagination, the high working capacity turn out to be especially favorable.

The universal sign of creativity is novelty, the emergence of the formerly not the former, but you can only teach the well-known, the generally accepted. You can be a trained, educated, educated, even very well trained, educated and completely un-creative person.

Experimental research has confirmed that the observations that have revealed a certain decrease in creative potential from junior to senior students, while their experience undoubtedly expands and strengthens, and the amount of knowledge increases. Of course, the creative formation of a student is not limited to the pedagogical impact of the university; it should be a consequence of the educational process, and not go beyond it.

Pedagogical practice, focused primarily on the development of knowledge and skills, does not thereby form the capacity for creativity, since it is based on fundamentally different personal characteristics, which constitute the ultimate goal of the pedagogical process.

The talent of creativity cannot be taught, but in the pedagogical process it is possible to create the necessary conditions for its formation. The primary condition attained as a result of purposeful pedagogical action is personality development. Its essence is not the sum of knowledge and skills, the system of assessments fixed once and for all, but a kind of dialectical quality, which by all means “switches” the mechanism of external pedagogical influence on self-consciousness in all directions of the internally determined pedagogical process.

Personality development does not have a specific substantive basis. It is carried out in the course of training, education, upbringing, being, however, not an automatic consequence of the quantitative accumulation in any part of the pedagogical process or in their mechanical totality, but the result of the implementation of certain tasks of forming an integral creative personality with appropriate attitudes and positions capable of autonomy, flexible and versatile solutions. We are talking about creative principles, which are manifested not only in the field of specialized activity, but in the sphere of social practice, in the moral life.

However, such an opposition of universal and special development is rather arbitrary. The modern theory of creativity, which is actively developing in our country and abroad, in the hierarchy of creative qualities clearly emphasizes the overall talent of the individual (originality of vision, thinking, self-confidence, the need for information, high interest, etc.), giving special abilities important, but still a service role. Thus, the pedagogical process should be focused not so much on the development of knowledge and skills, as on the formation of the motivational sphere, moral and personal qualities, deep culture and the need for continuous self-improvement.

Here we find a serious pedagogical problem associated with the dialectical contradiction of general and special development.

Indeed, in the conditions of an information explosion, a careful selection of what is necessary is needed - training in the “business” and profession. However, it is necessary to understand what determines the “matter” in each specific case, in which it is correlated with the overall development and, finally, how to implement the idea of the integral development of the individual in the system of special education and training. The latter does not need additional utilitarian justification. The question

“Why do you need to be a developed person? - ridiculous. To be a man. The theoretical and methodological foundation of the above complex of problems, of course, is the question of the dialectic of general and special in the development of personality.

Higher education involves a broad horizon, a scientific worldview, citizenship, a high level of needs, moral education, perfection of the intellect, and perhaps more precisely, a culture of mind and feelings. All these qualities are necessary for a conscious, expedient perception of political, scientific, artistic information, guiding people, raising their own children and others. They are also needed to comprehend the essence of the profession.

The need for a holistic knowledge of all forms of activity in the context of human values is becoming increasingly recognized by modern science. Perhaps culture at this stage is experiencing the peak of the search for the meaning of life. The crisis of the modern historical situation is largely due to the increasing trends of disintegration, the specialization of activities not oriented towards the realities of human life. The question of the attitude of any profession to human existence in the world goes far beyond the specialized knowledge and skills. Here, in a dialectical unity and interdependence, a complex complex of humanitarian problems appears: creativity and culture, freedom and responsibility, necessity and choice. In any activity, ultimately, not only a professional task is realized, but also a certain life strategy, based on love, duty, dignity, courage, conscience.

The spirituality of a person is the scale and depth of his world relation, the semantic space within which he thinks himself and with values which he relates his position. These values do not open in the elemental existence. They need to know. Moreover, this knowledge is not only rational, but also comprehended in the experience of personal, subjective *feeling*. Now, more than ever, the thought of the English physicist Michael Faraday is realized with all clarity: a scientist, as well as a representative of any profession, is first of all "a person turned to people."

Formation of a creative person is a holistic process. Human qualities can and should be formed in the implementation of purely special buildings, as well as the implementation of professional programs is based on the appropriate personal characteristics.

The meaning of “universal human education” (by N.I. Ogarev) is most fully embodied in the formation of a person’s worldview. The worldview as a system of value orientations and views of the world and the place of a person in it includes natural-theoretical ideas, principles of knowledge, moral and aesthetic ideals, political convictions. It combines rational and sensual-emotional moments, it simultaneously carries the features of processuality and completion. The worldview component of consciousness is characterized, first of all, by the integrity, which cannot be reduced to a conglomeration of information, views, and assessments. Elements of the worldview are not summed up and not subtracted, but correlated with each other. The absence or deformation of any of them changes the whole system:

the most profound theoretical knowledge does not replace moral inferiority, just as perfect aesthetic ideas cannot compensate for gaps in political consciousness.

It is necessary to reveal to the students the role of an intellectual in solving complex unforeseen situations where there is no strict determinism, no corresponding professional experience, and the "sense of the possible" truly works. In the sphere of moral life, this is how an intelligent person manifests himself. Of course, intelligence and intellect are not identical concepts, but by chance they have a common root.

Dostoevsky distinguished people sincere and honest in their need and ability to be aware of their behavior. He believed that sincere people act according to their convictions, but "it is not enough to determine morality by faithfulness to one's convictions, one must continually ask: are my beliefs correct?"

The world view as a system of holistic semantic installations of creativity does not develop spontaneously due to the development of special skills. It is impossible to comprehend the meaning of the phenomenon from direct observation - it is necessary to go beyond its borders, to consider its functioning in a wider system of connections and relations.

Personality culture is the integrity by which both the relations of the sides and stages of the pedagogical process and the interrelation of general educational and special disciplines in it must be checked. It is the personality culture that forms the vocation of a person. Vocation wider profession. It is in the vocation that the professional role and the "man of life" organically combine. This is the voice of conscience, binding to responsibility. This is spiritual aristocracy as a deeply personal, intimate experience of one's own involvement through the profession of world culture. In the vocation, professional functions are experienced as vital, and service and duty as the only possible forms of behavior.

Vocation is an intimate-personal program of existence in the world, experiencing professional creativity as fate. Here we are not talking about the worldview as a system of principles, but about the life position, which is most fully manifested in human intelligence.

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艺术疗法在现代青少年个人素质发展中的作用

## THE ROLE OF ART THERAPY IN THE DEVELOPMENT OF PERSONAL QUALITIES OF MODERN TEENAGERS

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註解。 本文在分析科學文獻的基礎上，確定了青少年交往和社會領域的特徵。 藝術療法被認為是矯正和發展現代青少年個人品質的方式。 給出了藝術治療類型（方向）的特點及其對青少年個人發展的影響。 給出了與青少年進行藝術治療的技術。 本文介紹了組織和實施藝術療法對青少年交際和社會素質影響的實證研究的階段，程序。

關鍵詞：藝術療法，青少年，溝通技巧，兒童額外教育機構

**Annotation.** *In this article based on the analysis of scientific literature we identify the features of the communicative and social sphere of teenagers. Art therapy is considered to be the way of correction and development of the personal qualities of modern adolescents. The characteristics of the types (directions) of art therapy and its influence on the personal development of teenagers are given. The technique of art therapy sessions with adolescents is given. The stages, procedures for organizing and conducting an empirical study of the effect of art therapy on the communicative and social qualities of teenagers are described.*

**Keywords:** *art therapy, adolescents, communication skills, institutions of additional education for children*

**Introduction.** Many studies of modern psychologists, sociologists, educators, cultural scientists, physicians, psychotherapists note that the fast, accelerated rhythm of modern life, the informatization of almost all spheres of life activity,



generally, lead to isolation, anxiety and nervousness in children. As some studies show [1; 6; 7 et al.], Emotional tension, inability to interact with each other is more manifested in younger adolescents.

Art therapy can help in the development of the communicative and social qualities of personality in younger adolescents [8; 9; 10 etc.]. The main types (directions) of art therapy are: music therapy, pictorial art therapy, dance therapy. All of the above types of art therapy are available for individual and group work with adolescents. With the methodically correct organization of art therapy classes, they will be of interest to children, will contribute to the development of their social and communicative personality traits.

The study was conducted on the basis of the center of additional education for children and adults (creative laboratory) "Music and dancing for the soul." The study involved younger adolescents aged 10.5 to 12 years, consisting of 26 people studying at this center.

**Discussion.** *A). Features of the manifestation of the communicative and social qualities of younger adolescents.* The developed communicative qualities of a teenager are important for his successful socialization [3; 12]. Under the communicative characteristics of younger adolescents, as a means of their social adaptation, we imply a combination of individual personal qualities of a person. They include such qualities as: a) the ability to establish contact with other people; b) the presence of skills of social and communicative activities (the skill of correct, adequate perception of information in the process of communication, the skill to understand the emotional state of a communication partner, the skill to express one's thoughts so that they are understandable to others, the skill to exercise self-control of one's emotional state in the process of communication, the skill to observe the rules of speech etiquette in the process of communication, etc.), c) the need for different types (forms) of communication with other people.

Communicative abilities can be interpreted as individual psychological characteristics of a person, ensuring effective interaction and adequate mutual understanding between people in the process of communicating or performing joint activities [11; 18]. Unfortunately, in the family, in educational organizations not enough attention is paid to the work on the formation of the communicative qualities of adolescents. Meanwhile, the younger teenager begins to more strongly appreciate their communication with peers. It is communication with them that helps him to get a life experience similar to them, and thus causes him more interest [15].

The main (basic) needs of the period of younger adolescence are: the need for a positive assessment of yourself in interaction with peers; manifestation of their own internal position; the need for emotional expression and communicative-social interaction [7; 11; 12]. In general, the development of the individuality of the younger teenager includes two points: a) the younger teenager establishes

closer contacts with a group of peers (peers or a mixed-age informal group, but in which approximately everyone is equal in age), b) on the other hand, independence begins to manifest itself more, new personality traits begin to be laid, self-knowledge, the desire for self-realization in any sphere of life is activated [6; 15].

*B) Types of art therapy and their impact on the personal development of younger adolescents.* Art therapy is used mainly as a means of harmonization and comprehensive development of the personality [2; 13; 14].

The communicative function of art therapy is the interpersonal communication of participants during group sessions. During art therapy, a gradual study and assimilation of socio-cultural values takes place. Moreover, this assimilation is carried out in an accessible and interesting form for persons of different age groups [2; 14; 16; 17]. It is important to note that by applying various forms and types of art-therapeutic techniques, a person can know himself, his attitude towards others, and, due to self-expression, the realization of his creative abilities in the process of art-therapeutic exercises, the emotional and cognitive sphere of his personality develops. Art therapy helps a person to cope (control) with a state of anxiety, stress, fear and even aggression. In general, art therapy harmonizes the emotional state, broadens the mind, develops artistic taste, improves movement coordination, develops communication skills, creative potential, improves attention and memory, contributes to the development of personal will (focus, concentration on the process of creating an art product, etc. ).

Music therapy includes various ways of interaction between younger teens with each other through various forms of communication based on musical content. This can be joint listening to musical works (as a rule, of different genres, especially those that teenagers like), group playing on various musical instruments (moreover, wooden spoons, musical "triangles", metallophones, drums, etc. can be used as instruments. ), joint vocal classes. Thanks to the creative approach of a specialist conducting art therapy (music therapy) classes, adolescents can get to know themselves and each other better. In the process of discussing musical works, adolescents develop their communicative qualities, learn to understand the opinions and tastes of other people, tolerance develops to a certain extent (if musical preferences do not coincide at all) and tact. Also in the process of discussing musical works, adolescents can learn to argue their point of view.

Pictorial therapy contributes to self-knowledge and self-expression of a person (and artistic skills in therapy do not matter, it is important that a teenager is not afraid of a "clean sheet", but chooses the colors he likes and portrays images that appear in the subconscious and conscious). This direction encourages a person to display creative abilities. The process and the result of drawing art therapy is analyzed. The content of the picture, the colors used are analyzed. A specialist who conducts a lesson in drawing art therapy must master the basics of color therapy,

color psychology. For the development of social and communicative qualities of adolescents, you can use the method of creating a group drawing or collage on topics of interest to all. In the process of tactful, correct discussion (this is the responsibility of the specialist who conducts the lesson) from the works, adolescents learn to understand the preferences and tastes of other people, learn to listen to the opinions of others, also develop their communicative qualities, to a certain extent empathy and tact develop.

Dance therapy also contributes to the self-realization of the individual, makes it possible to release muscle clamps, improve mood, and relieve emotional tension. Dance is an expression of various hidden emotions and feelings. In dance therapy, the release of feelings occurs spontaneously in improvisational activity. In dance therapy there are no established rules of behavior, a person can completely surrender to his feelings and move as he wants. In the paired dances of adolescents it is possible to develop empathy, perceptual and social and communicative abilities. In the classroom it is good to use folk group dances, for example, such as Sirtaki (Greek dance), Russian round dances.

*C) Methods of art therapy classes with younger adolescents.* Methods of art therapy classes are used individually with a separate (specific) person, and with a group of people (usually from 7 to 15 people). Through the use of the art-therapeutic technique, a person can explore his personality, and the lessons themselves help a person to open up from various sides. The tasks of applying art therapy techniques are: a) the development of various spheres of personality self-regulation (art therapy techniques can contribute to more effective self-organization of different types of personality mental activity); b) promoting the activation of self-understanding processes (a person will be able to more clearly realize his thoughts, feelings and behavior); c) improvement of a person's self-relation to himself (in the process of applying art therapy techniques it is important to increase a person's self-esteem) [10; 14; 16].

An important link in the application of art therapy is feedback from the participants who are involved in this group therapy. A figurative feedback can be applied, the purpose of which is to convey through the image one's sensations or perceptions of surrounding actions. Methods of art therapy contribute to the fact that a person can concentrate on his feelings and learn how to get rid of negative emotions. The emotional outburst of negative emotions helps to relieve the person and release from internal clips. Expressing one's true feelings and emotions has a beneficial effect on the cohesion of the whole group. Art therapy techniques contribute to the harmonization of personality, relieve stress and emotional clips.

The technique of conducting art therapy classes to a very large extent depends on the level of professional training of the specialist who conducts them (classes), on the level of his personal culture, on his sense of tact, delicacy, on his skills to correctly interpret the art images that participants create.

*D) Brief description of the stages of experimental work.* The study, the results of which are extremely briefly described in this article, was conducted in four stages. The first stage consisted in a comparative analysis of various scientific, literary, and information sources on the subject under study. At the second stage, the primary diagnosis of research participants was carried out on the level of anxiety, on the identification of their emotional state, on determining the level of development of their communicative and social personality traits, on diagnosing problems in the field of communication; dance, fine art.

Analysis of the forms of younger adolescents (before the implementation of the program "Art therapy for the Soul") showed that:- *in the field of musical preferences* they (younger adolescents) like: a) rap, both domestic performers and foreign (68% of respondents), b) popular classical works, both domestic and foreign authors (52%); c) some songs of pop performers, both domestic and foreign (37% of respondents), d) only 13% of respondents like jazz, e) popular parts of musical heroes like 8% of respondents, e) popular parts of rock opera heroes like 5 % of respondents, g) popular arias of heroes of classical operas like 2% of respondents, h) soundtracks for films like 26% of respondents, and) 83% of respondents do not hesitate to sing karaoke as a member of a group (choir), but feel constrained by their individual performance; k) works of folklore (Russian folk or other peoples in an authentic form) like 11% of respondents, l) works in a stylized form - modernized ethno-music - like 45% of respondents,

- *in the field of dance preferences* they (younger adolescents) like: a) modern dances - 96% of respondents, b) folk dances such as sirtaki, Russian dance - 3% of respondents, c) waltz (only to look at dancing couples) - 8%, to waltz themselves - 5% , d) tango (only to look at dancing couples) - 21%, to dance tango by themselves - 3%,

- *in the field of artistic preferences* (in the field of fine art) they (younger teenagers) like: a) works in the style of graffiti - 85% of respondents, b) works of famous foreign artists who worked in the periods up to the 21st century (Titian, Rubens, Leonardo da Vinci, Rafael, Bosch, Durer, Salvador Dali, Pablo Picasso, and others.) - 32% of respondents, c) works of famous domestic artists who worked in the periods up to the 21st century (Karl Brullov, Repin, Surikov, Malevich, Kandinsky, Dayneka, etc.) - 32% of respondents g) works of modern animators, in particular, Japanese skim anime, manga - 38% of respondents, e) works of decorative and applied folk art (peoples of Russia) like 64% of respondents, e) works of decorative and applied folk art (peoples of the world) like 55% of respondents.

At the third stage, classes were conducted directly (cycle of classes) in music therapy, drawing therapy, and rhythm therapy (dance therapy). At this stage, the program "Art therapy for the Soul" was implemented, which included complex (integrative) art therapy classes. The aim of the program "Art Therapy for the Soul" is: the development of communicative and social abilities (qualities) of younger adolescents through art therapy classes.

The objectives of the program are: 1) the development of communication and social qualities, abilities and skills of adolescents, skills of younger adolescents to interact with the team; 2) the removal of emotional stress, improvement of emotional state, emotional background of life; 3) decrease in the level of situational and personal anxiety (which, as a rule, are characteristic of younger adolescents); 4) increase self-esteem in adolescents who have a tendency to underestimate themselves; 5) development of imagination, figurative and abstract thinking; 6) outlook, 7) the development of artistic taste; 8) the development of the creative skills of younger adolescents.

This program made it possible for younger adolescents to try themselves in different creative directions. Music therapy of instrumental and sound creativity was aimed at developing memory, developing active attention, calming children's arousal, improving reaction and perception, vocal lessons were also included, and there were classes focused on direct listening to music. The main focus of this program was the group creativity of children: integrative classes in drawing therapy, music and dance therapy. This direction was aimed at the development of teamwork skills.

The program "Art therapy for the Soul" included: a) "Acquaintance" (at this stage there was an acquaintance of the group members among themselves), b) a large block in the program was devoted to music therapy, the following classes were held: "Game for the Soul" (included lessons on musical instruments, the guys got acquainted with various instruments, everyone could choose the one that he liked best and start practicing on it), "Relax for the Soul" (the guys listened and discussed various pieces of music), c) "Drawing fun" - listening to various musical works, teenagers could dream and draw; d) "Dance of Life" (adolescents expressed their inner mood through movements to music), e) "Sand of fantasies" (sand therapy was offered for the realization of inner potential and the ability to express their emotions, feelings, this therapy was also performed to music), f) "Guess the melody" (the lesson was aimed at recognizing musical works. Younger teens were given the form of a game to listen to works with which they became acquainted in the classes "Relax for the Soul." "Success"); "Little Orchestra" (in this lesson, younger teens learned to work in a group, listen and adapt to each other); g) "Flight of fantasies" (a free day for children, they can choose what art therapy they can do on that day. This lesson is designed for the initiative of younger teens).

At the fourth stage, the participants were re-diagnosed (to the level of anxiety, to identify their emotional state, to determine the level of development of their communicative and social qualities of the person, to diagnose problems in the field of communication); music, dance, art. And also at this stage, a comparison was made of the results with the initial diagnosis of the participants prior to the "Art Therapy for the Soul" program.

**Results.** After the implementation of the “Art Therapy for the Soul” program, the number of adolescents with a high level of situational anxiety decreased, and a high level of personal anxiety also decreased. The data obtained by the methods of diagnosis of the socio-psychological adaptation of C. Rogers and R. Diamond (adaptation by AK Osnitsky) showed that the number of adolescents on the “acceptance” scale increased from 56% to 81%. The percentage of emotional comfort also increased from 63% to 81%. The test “Draw Your Character” (TA Ratanova, NF Shlyakhta) shows that the research participants have changed such indicators as: sociability, communication skills, desire for mutual understanding, friendly attitude to others, skills in teamwork, creative approach to business.

Thus, it can be concluded that the technique of art therapy contributes to the improvement of the communicative and social skills of younger adolescents. Thanks to the art therapy, the participants in the study have become much better able to interact with each other and the people around them.

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心理治疗师社会教育培训在研究生教育体系中的作用和重要性  
**THE ROLE AND IMPORTANCE OF SOCIO-PEDAGOGICAL  
TRAINING OF PSYCHOTHERAPISTS  
IN THE SYSTEM OF THEIR POSTGRADUATE EDUCATION**

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抽象。本文考虑了心理治疗师的社会教育培训在其职业发展和进一步培训系统中的作用和重要性。作者认为,应该为心理治疗师的社会教育文化形成一个特殊的教学系统。该系统应考虑成人从业者学习过程实施(研究生教育)的法律规则和原则。作者认为,社会教育技术将帮助心理治疗师理解并全面分析患者(客户)的问题情况。此外,社会教学理论和实践的知识将有助于心理治疗师了解社会适应过程的问题领域,以及患者(客户的)社会化。本文简要分析了医学高中实施心理治疗师专业发展课程的经验。

关键词: 社会教育学, 心理治疗师, 专业发展系统, 社会教育文化, 跨学科, 综合方法, 协同方法。

**Abstract.** *The article considers the role and importance of socio-pedagogical training of psychotherapists in the system of their professional development and further training. The authors believe that a special didactic system should be developed for socio-pedagogical culture of psychotherapists formation. This system should take into account the andragogical laws, principles of the learning process implementation (postgraduate education) of adult practitioners. The authors think that socio-pedagogical techniques will help a psychotherapist in understanding, and comprehensive analysis of his patient's (client's) problem situation. Also, knowledge of socio-pedagogical theories and practices will help a psychotherapist to understand the problem areas of social adaptation processes,*



*and patient's (client's) socialization. The article presents a brief analysis of medical high schools' experience in the implementation of psychotherapists' professional development course programs.*

**Keywords:** *social pedagogy, psychotherapists, professional development system, socio-pedagogical culture, interdisciplinary, integrative approach, synergetic approach.*

Modern Russian society needs highly qualified psychotherapists who are competent in the field of synergetic approach to the process of providing clients (patients) with medical-therapeutic, psychological services. Under the synergetic approach, we understand the ability (as well as skill and willingness) of a psychotherapist in the process of complex (in organic unity and interrelation) assisting a client (patient) to apply variable methods of psychological, socio-pedagogical, and medical impact to resolve the problem situation in human mental health.

Today, many people (even with medical education) quite often cannot clearly (exactly) explain the fundamental differences in professional activities of specialists such as "psychotherapist", "psychiatrist", "psychologist".

In the minds of many ordinary people (as they are called "man in the street") there is considerable confusion associated with the essence of "psychotherapy" concept.

This article will focus on the content of psychotherapists' additional professional education (refresher courses, professional retraining) programs. Therefore, we consider it is appropriate to explain the differences in professional activities of these specialists (psychotherapists) and psychiatrists, practical psychologists.

Psychiatrist is a specialist who has a higher rather narrow medical education. The specialist is generally engaged in medical treatment (provide psychotropic drugs) of serious (severe) disease (illnesses) of the mind and nervous system.

A person who does not have a higher medical education, but has a higher education, which he received at university in the direction of training "Psychology" can work as a psychologist. It is important that a psychologist does not prescribe drugs to his clients (pharmacological preparations), he ideally works only with so called healthy people. The essence of professional activity of a psychologist is a joint search with a client (at the level of verbal, question-answer, meaning-forming communication) of variable ways to resolve a problem situation (intrapersonal, interpersonal, personal-group, etc.).

Psychotherapist (according to the applied in the Russian Federation standards) is a certified specialist with higher medical education (this is usually a psychiatrist, neurologist, neuropathologist, and sometimes a pediatrician), who necessarily passed (studied) a program of additional professional training "Psychotherapy" (received a document of the established medical high school sample).

The therapist in his professional practice (unlike a psychologist) may use medications (psychotropic group drugs). However, (unlike a psychiatrist) therapist heals, as a rule, mild or moderate mental disorders of mild. In the course of his work (in the course of interpersonal interaction with a patient), a psychotherapist provides professional psychological assistance to a patient (client), using the entire arsenal of psychological tools, techniques, tactics, as well as all types of psychotherapy such as words with therapeutic effect on human psyche, art (art therapy), motor activity, etc.

As a part of the world practice, psychotherapists are designed to help a client (patient) to realize (understand, comprehend) the true motivation of their actions (activities), as well as to help to find ways to solve mental problems of an individual, which largely (to the extent) cause the presence of patient's psychosomatic diseases (they are usually cardiovascular system, gastrointestinal tract, respiratory system, etc. disease). A psychotherapist through effective resolution of client's psychological problems contributes to his bodily problems resolution.

In general, a therapist is engaged in depression, neuroses, panic attacks, anxiety and neurosis-like states treatment. In the case of productive personal interaction with a patient (client), a psychotherapist helps him to overcome mental trauma pain, increase self-esteem, manage his psycho-emotional state, control his negative emotions manifestations, helps to learn how to communicate with other people effectively, etc.

Highly professional psychotherapists in their work seek to minimize drugs prescription, try to strengthen their verbal (word) impact on a client (patient), practice the usage of such techniques synthesis as body-oriented therapy, transactional analysis, hypnosis, cognitive behavioral psychotherapy, gestalt therapy, client-centered therapy, psychoanalysis, etc.

The professional activity of a psychotherapist is extremely complex and multifaceted. After all, in the case of low professionalism of a psychotherapist, there is a high risk of harming the mental health of a patient (client).

It should be noted that today in Russia there is no "Psychotherapist" professional standard. This fact causes a number of problems in professional training of psychotherapists (it is enough to view the content of discussions on such organizations as All-Russian Professional Psychotherapeutic League, Association of Medical (Clinical) Psychologists, etc. websites). However, it should be noted that there is a FGES for higher education in the training of highly qualified personnel in residency in specialty 31.08.22 Psychotherapy. According to this document, a university independently determines the set of academic disciplines. In general, professional training of psychotherapists in residency includes the synthesis of knowledge, skills, competencies in the field of medicine, pharmacology, psychiatry, psychology. And unfortunately, in this preparation there are no even inclu-

sions of social and pedagogical knowledge, and abilities. The analysis of training courses programs (from 72 to 280 hours) of a number of medical universities of the Russian Federation on the subject of "Psychotherapy" showed that they do not represent even minimum of socio-pedagogical knowledge. Meanwhile, such knowledge and skills can enhance the professionalism of psychotherapists-practitioners. Because the study of such topics of social pedagogy as a socio-pedagogical victimology, socio-pedagogical deviantology, socio-pedagogical familistic, ethno pedagogy, social pedagogical deontology, etc. can help a therapist in understanding the reasons for family problems of a patient (client), in establishment of causal relationships in explanation of those or other deviations in his behavior, in understanding ethno-cultural specifics of the client's mentality.

Therefore, we consider it is appropriate to focus on the need to include in training and retraining programs on the subject of "Psychotherapy" sections of socio-pedagogical profile.

First, a few words about the specifics of professional development and retraining of medical personnel in our country.

In the national doctrine of education in the Russian Federation until 2025 it is noted that the country has all the conditions for systematic training and retraining of specialists in various fields. However, we can say that in the Russian Federation over the past ten years there has been a situation of permanent modernization of the system of continuous professional education (CPE) of medical personnel. Leading experts in the field of additional professional education of physicians are actively searching for new forms, methods, tools, technologies to improve the skills of medical personnel.

In general, it can be argued that in the system of additional professional education of physicians there is a tendency of anthropocentricity, i.e. in the courses of advanced training, professional training of physicians they implement personality-oriented, personalized approaches to each student of the courses. As well as the content of courses of additional professional education of physicians focuses them on the implementation in their professional activities of anthropological approach to their patient's personality. And this, in our opinion, can be fully realized only if a physician has at least minimal socio-pedagogical knowledge and competencies.

Now, the main task in the development and implementation of continuing professional education (CPE) programs of medical personnel is not to adapt the course participants to additional professional and educational environment, but such environment modeling depending on needs, and opportunities of both a separate (specific) adult learner (doctor-practice), and a group of students as a whole.

Systematic passage of refresher courses, programs of additional professional education, which include the module of socio-pedagogical knowledge and techniques development, by a psychotherapist is very important for personal and professional self-development of a specialist.

In the process of teaching psychotherapists in the system of additional professional education of socio-pedagogical modules, it is important to focus on the individual-subjective, personally significant aspects of educational process of adults (practitioners) – to identify (diagnose) value orientations of course programs students, their individual-personal and professional attitudes, to determine (if possible) the attitude to themselves and other people, to identify their mood (motivation) to study the socio-pedagogical module, to get acquainted with socio-pedagogical methods and their usage in professional experience of other specialists [1; 2; 4].

It should be noted that teachers of socio-pedagogical module of course programs in additional professional education of psychotherapists should understand well the internal mechanisms of professional and personal self-development of each student. It influences the adoption (or rejection) of new socio-pedagogical knowledge and techniques that can be important for both personal and professional growth of a psychotherapist, and understanding of their own (individual-subject) features of the processes of socialization, social education, social adaptation, etc. It is important that in the process of studying socio-pedagogical module of the course programs of additional professional education of psychotherapists, students (practitioners) get a desire to independently (in future) master socio-pedagogical theories, methods, and techniques that interest them.

Teachers of socio-pedagogical module of the course programs of additional professional education of psychotherapists have an excellent opportunity in the process of training to develop professional reflection of practitioners who can apply new socio-pedagogical knowledge for self-analysis of their professional experience situations, individual cases of work with clients. Note that this method of development in the training courses of professional reflection of practitioners (psychotherapists) is of great importance for the development of professional thinking of a specialist, and also affects the development of socio-perceptive and emotional-value components of his professional culture [3; 7].

The study by psychotherapists socio-pedagogical module in the course programs of additional professional education will also contribute to the development of practitioners' communicative and deontological culture. As in the process of studying the material of socio-pedagogical module there will be presented theories and methods of social communication, deontology of relationships in the "professional – client" from social pedagogy perspective.

In the process of development within the framework of the course programs of additional professional education by practitioners (psychotherapists) of socio-pedagogical module, it is necessary to provide subject-subject interaction in the system "teacher of courses – course listener", to ensure the co-creation of teachers and students in the search for solutions (from the perspective of social pedagogy) of real problem situations that occur in the professional activity of a psychotherapist.

The professional and educational process at the courses of advanced training of psychotherapists during the development of socio-pedagogical module should activate their (practitioners) own personal and professional opportunities.

As the authors' professional experience have shown the study of socio-pedagogical module in the proses of advanced training courses, courses of professional retraining of psychotherapists creates, as a rule, in the audience a special reflective environment, as a lot of new for psychotherapists socio-pedagogical knowledge they seek to immediately apply both to explain certain moments of their own life experience, and to understand the problems of their clients [5; 6]. For example, for many psychotherapists completely new knowledge is socio-pedagogical concepts of the emergence and development of youth, youth subcultures and their impact on the development of a personality, socio-pedagogical theories of victimization of an individual in the process of socialization, socio-pedagogical theories of religion as a micro factor of socialization, etc.

All of the above allows us to talk about the need for socio-pedagogical culture formation in a system of training, courses of professional retraining of psychotherapists. To form this culture, teachers of socio-pedagogical module should develop a local didactic system that would take into account andragogic laws, principles of professional and educational process of adult practitioners, as well as current level of psychological and pedagogical training of students.

The local didactic system should include methodical techniques, techniques of studying by adult professionals (with well-established views, sometimes stereotypes) new socio-pedagogical material; methodical techniques, techniques of understanding the studied material, its application to solve the problems of professional activity; methodical techniques, techniques of controlling the assimilation of program socio-pedagogical material.

Today, in conditions of increasing competition between universities (including medical universities), the opportunity to offer students a new content-technological approach that will improve the quality of their training is a competitive advantage. The authors of this article experience on inclusion in the program of training courses and professional retraining of psychotherapists of modules on the study of socio-pedagogical theories, and techniques has shown that new knowledge, skills enrich professional tools of a specialist, expand his professional horizons, contribute to positive results in the healing of patients.

In general, socio-pedagogical knowledge, knowledge of socio-pedagogical techniques can significantly help a psychotherapist in creating an objective (comprehensively considered) picture of a problem situation in the life of his client (patient). Systemic knowledge in the field of socio-pedagogical theories and practices contributes to a psychotherapist's understanding by a specialist problem areas of socialization, social adaptation of his client.

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继续教育学教育体系向集群发展模式转变的问题及解决途径  
**PROBLEMS OF TRANSITION OF THE SYSTEM OF CONTINUOUS  
PEDAGOGICAL EDUCATION INTO A CLUSTER MODEL OF  
DEVELOPMENT AND WAYS TO SOLVE THEM**

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注解。 实践表明，教师的传统角色不符合现代社会要求和劳动力市场的要求。 可以在集群方法的基础上进行继续教育教育系统的现代化。 教育集群的组织为从专家的生殖生产过渡到创造性人格的形成创造了条件。 文章揭示了这些特征，展示了集群在培养竞争性教师方面的差异，机遇和优势。 展示了继续教育教育系统发展的集群模型的特点 - 免费获取网络资源和创造性特征。 这些功能将有助于为成功转变教师的传统角色创造条件。

关键词：教师教育，继续教育，教育系统，集群，集群模型

**Annotation.** *Practice shows that the traditional role of the teacher does not meet the modern requirements of society and the demands of the labor market. Modernization of the system of continuous pedagogical education can be carried out on the basis of a cluster approach. The organization of the educational cluster creates the conditions for the transition from reproductive production of specialists to the formation of a creative personality. The article reveals the features, shows the differences, opportunities and advantages of the cluster for the effective training of competitive teachers. The features of the cluster model of development of the system of continuous pedagogical education - free access to network resources and creative character are revealed. These features will help create the conditions for successful transformation of the traditional role of the teacher.*

**Keywords:** *teacher education, continuing education, education system, cluster, cluster model*



The transition of the system of continuous pedagogical education into a cluster model of development is able to ensure the implementation and development of the principles of continuity, continuity and system, and thus create conditions for more efficient training of competitive and professionally mobile teachers. To find ways to solve the problem of transition of the system of continuous pedagogical education into the cluster model of development, the analysis of research results, forecasting and comparison were used. The methodological basis of the study consisted of cluster, system-synergistic and competence-based approaches.

The relevance of the research is related to the need to meet the demands of the labor market, the state and society to the education system. The widespread introduction of a competence-based approach requires teachers to skillfully and effectively organize the continuous process of forming competencies of students and pupils. Analysis of professional and pedagogical functions shows that currently competitiveness, responsibility, pragmatism, love of native land, patriotism are in demand. Teachers should be able to form these qualities and competencies of their students. However, there is a problem with providing educational institutions with competent teaching staff. Therefore, the system of continuous pedagogical education requires modernization, including on the basis of a cluster approach.

An innovative educational cluster has been created in the Republic of Kazakhstan, providing an opportunity for continuous “immersion” of students in the sphere of future professional activity, which, in turn, allows studying, summarizing and accumulating experience, testing scientific achievements, updating and generalizing the organization and content of vocational training. The mission of the educational cluster is presented in the form of “an innovative form of integration of science and education for solving complex pedagogical tasks in the process of training, educating and developing the younger generation, professional training of competent specialists, providing educational services to interested consumers” [1, p.160].

According to the results of the research, an analysis of the definitions of the educational cluster was carried out, examples of functioning educational clusters in Great Britain, France, and the USA are given, the arguments of the opponents of the term “cluster” in education are analyzed [2]. The conditions and factors constraining the development of clusters are considered; It is proved that the organization of the educational cluster provides a transition from mass-reproductive production of specialists to the formation of the creative personality of the teacher [3]. A strategy has been developed for the development of a pedagogical university in the context of five areas: the modernization of the educational process, research and innovation activities, the formation of a positive image of the pedagogical university, the modernization of the infrastructure and the improvement of university management efficiency [4].



There is evidence of the successful application of the cluster approach to the organization of inclusive education. Combining the resources and efforts of groups of individual institutions within the cluster has allowed “to expand the possibilities of obtaining quality educational services to people with special educational needs, to ensure the implementation of inclusive education, which is one of the forms of alternative education, and also to solve a number of organizational and pedagogical problems” [6, p.518]. The cluster of continuous pedagogical education is considered “as a set of educational institutions belonging to different levels of education, scientific, methodological, and public organizations that cooperate voluntarily on a contractual basis” [6, p.518]. The specificity of cluster interaction is considered, the features of cluster complexity and branching indicators are revealed, the features of its existence are analyzed [7]. Cluster analysis [8] is recognized as an effective tool for finding out the objective reason for differences in student performance. A new learning model [9] has been developed taking into account those factors that encourage or hinder the integration of accounting research and education.

To apply the cluster approach to the assessment of modern approaches to learning in the higher education system [10], an approach has been used that is aimed at identifying the influence of students' emotional state on academic performance. Cluster analysis was used to divide students into groups (clusters) by type of emotion. The results showed that only the support of successful learning is insufficient, it is important to encourage the positive emotions of the students. Cluster analysis is applied to the study of interactive technologies [11]. Cluster and pair analysis are used to assess the quality of teaching [12] so that the control system correctly identifies all the answers received.

Any subject methodology can be represented as a cluster. As an example, we can cite the method for forming competences of didactic computer visualization of future informatics teachers. The author's position was determined by the very essence of the cluster approach, which “allows to realize the universality and unification of the development of visualization technologies based on a relatively small number of clusters” [13, p.5]. To solve the set tasks, the author introduced the concept of an educational and technological cluster - a structured and logically completed information and technological fragment of a methodological system that includes basic content, teaching methods, an extensible set of educational tasks and methods for solving them. Of course, such an understanding of the cluster can be applied to a wide range of subject methods and applied educational tasks. The marked difference between the cluster approach and the modular one is also important: “the module does not describe the training methods, as well as the possibility of changing the content (due to the fixed output requirements)” [13, p.12]. As a result of the experiment, the effectiveness of the method of forming

the competence of didactic computer visualization in future informatics teachers in terms of training on various curricula, developed on the basis of the cluster approach, has been proved. The cluster approach is a catalyst for the formation of an individual style of student-designer activity, which is explained by the combination of “the efforts of stakeholders and the possibility of personal and professional development of cluster members” [14, p. 200]. The application of the cluster approach forms the desire of students for success in professional and educational activities, develops artistic and imaginative thinking and combining abilities, forms the skills of cooperation, project reflection and self-regulation.

The work highlights the advantages of a creative cluster over the traditional educational and managerial model of a higher education institution - the presence of not only formal, but also informal relationships between cluster members, which, in addition to the university, customer and performer, need to include the society and its institutions. This circumstance is important to take into account, since the training of teachers in general, as well as the specifics of professional pedagogical activity, is a creative process. Consequently, the cluster development model should have the features and characteristics of a creative cluster. Within the framework of such a model, the teacher will constantly receive feedback, an assessment of his own professionalism, which cannot but affect the formation and further development of competencies. Thus, the positive impact of the cluster approach on the formation of students' competencies has been proved.

The transition of the system of continuous pedagogical education to the cluster model of development has distinctive features, caused primarily by the qualitative difference and the state of the national economy. The main task of cluster policy is considered “the choice of a promising model of cluster development and the formation of clusters of a new generation, which will be based not on industrial enterprises, but on innovation and knowledge centers, universities, technological engineering organizations” [15, p.92]. Based on this understanding, the complexity and specifics of the functioning of new-generation clusters (fundamental practice-oriented science, innovative industry and developing education) are indicated. The expediency of the development and functioning of management tools aimed at the formation of clusters of the economy of Kazakhstan has been proved. The main tools include direct financial support, the provision of tax benefits, simplification of administrative procedures, infrastructure development, information and marketing support. Since the transition of the system of continuous pedagogical education in Kazakhstan to the cluster model of development will be carried out in certain economic conditions, the results of the research should be taken into account.

The interaction of cluster members is carried out, including, on the principle of integration, in particular, the integration of education and business, since both the higher education institution and the enterprise are interested in training competent

specialists. In turn, the activation of the integration of education and business is preceded by the creation of incentives. The effectiveness of the integration of education and business at the present stage on the network principle, rather than hierarchical, is justified, and various forms of education and business integration are analyzed [16]. The most promising forms of integration of education and business include innovation and education consortia and clusters. The identified problems of the organization of professional practices are also important: the lack of economic interest of the enterprise in the qualitative organization of practice; the absence of levers of the impact of higher educational institutions on the bases of practice in order to influence the quality of the organization of practice; the lack of state regulation of business participation in training [16, p.256]. Consequently, when developing the transition of the system of continuous pedagogical education to the cluster model of development, which includes, among other things, the creation of conditions for effective integration, it is necessary to provide ways and mechanisms for minimizing the problems identified.

The results of economic research are of great importance for the development of the transition of the system of continuous pedagogical education to the cluster model of development, since they differentiate the principles of cluster formation [17]. The principles of voluntary unification, territorial localization, progressiveness, state support, synergy effect, production efficiency, continuity of development and differentiation of interests are referred to the general principles. The group of system principles consists of the principles of closure, relative closure, constant needs, endowment of resources, mutually beneficial relations, awareness and community management. It is proved that the indicator of the stability of bonds in a cluster is the intensity of the use of flows. Consequently, in order to increase the degree of interaction between the participants of the cluster of the system of continuous pedagogical education, it is necessary to optimize and control the flows within the cluster. All cluster members must adhere to certain rules of behavior, principles of intracluster interaction.

Thus, the world pedagogical practice has confirmed the effectiveness of the cluster approach. However, the problem of transition of the system of continuous pedagogical education into a cluster model of development has not yet been solved. In our opinion, the potential of the cluster system of continuous pedagogical education that has not been taken into account so far is the fact that its components will perform additional and cross functions and can, if necessary, replace the retired or low-quality element. A distinctive feature of the cluster model of development of the system of continuous pedagogical education is also free access to virtually unlimited network opportunities and resources. This circumstance must be taken into account, because digitalization eliminates numerous problems in the development of educational systems related to geographic, temporal, technical,

personnel, and other frameworks.

In our opinion, the cluster approach can significantly enhance the synergism of the system, lead to the emergence of such a unique result that would be impossible under the conditions of traditional interaction in the system. Finally, it is the cluster approach that is able to ensure continuity and branching of the channels of non-formal pedagogical education. Due to the unique structure and innovative content, the cluster model of development of the system of continuous teacher education will increase the level of professional training of teachers.

**This study is carried out in the framework of the project AP05131906 "The elaboration of the transition of a continuous pedagogical education system into the cluster development model".**

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中文, 俄文和巴什基尔语中“太阳”和“月亮”成分的短语  
**PHRASEOLOGISMS WITH COMPONENTS OF THE "SUN" AND  
"MOON" IN THE CHINESE, RUSSIAN AND BASHKIR LANGUAGES<sup>1</sup>**

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註解。 現代語言比較研究的當前問題之一是找出研究語言單元的一般性和不同性。 研究俄語, 巴什基爾語和漢語中的詞組單元具有科學意義, 因為它們通過共同的組成部分相互聯繫, 它有助於回答詞彙理論中的爭議問題: 組成詞在形成詞組單位意義中的作用是什麼。 這項工作的共同組成部分是cosmonyms«sun»和«moon»

關鍵詞: 措辭, 短語單位, 語義群。

**Annotation.** *One of the current problems of modern comparative studies of phraseology is to find out general and different in the units of studied languages. It is scientifically interesting to study phraseological units in the Russian, Bashkir and Chinese languages as they are connected by common components and it helps to answer the disputable question in phraseological theory: what is the role of the components in forming meanings of phraseological units. This work has the common component that is cosmonyms «sun» and «moon»*

**Keywords:** *phraseology, phraseological unit, semantic group.*

Phraseology is an essential treasure of any language which throughout many centuries does not loose its value. It shows ancient history and culture of different folks as well as religious way of thinking and moral character. Using phraseological units in our live speech, we make our conversations more imaginative and vivid, diverse and colorful, expressive and emotional.

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<sup>1</sup>The article was written with support of the grant of the Republic of Bashkortostan for young scientists No. 1G from 14.03.2019

Images of the sun and the moon have physical nature and are connected to the world around us. They have physical properties and parameters. Moreover they are culturally significant as they have rich and diverse mythological tradition.

The sun and the moon are the unique objects of the world around us. They are available to be observed and described directly. Also they are lexical units of the common language and have common nominative function. Also, they have some symbolic, imaginative and metaphorical meanings: some of them such as beauty, anguish, human qualities and time are common for the Russian, Chinese and Bashkir languages.

Phraseological units contain words «sun» and «moon» because they had influenced the lifestyle of people far in ancient times and lots of different mythes and religious believes appeared.

Chinese phraseological units with «sun» and «moon» components were analysed and several groups were divided according to different semantical groups of the idioms. Some of them are connected to the appearance, time, salvation of difficult problem (light - dark), separation, human qualities etc.

Idioms with «sun» component hieroglyph 日 (Pinyin rì) has two meanings: the sun and the day.

After we conducted our research, we concluded that inside of the idioms with «sun» component it is reasonable to divide the following semantical groups:

#### 1. Time:

1) 今日事今日毕 [Pinyin: jīn rì shì jīn rì bì] (literally: today's business needs to be finished today); in meaning: Do not put off until tomorrow what you can do today;

2) 一日之计在于晨 [Pinyin: yī rì zhī jì zài yú chén] (literally: morning defines the whole day); that means: it is better to sleep on it;

3) 一日三秋 [Pinyin: yī rì sān qiū] (literally: one day as three years); that means: time goes slowly;

4) 日久生情 [Pinyin: rì jiǔ shēng qíng] (literally: relationships that develop over a long period of time); that means: the opposite of love from the first sight;

5) 夜以继日 [Pinyin: yè yǐ jì rì] (literally: regardless of the time of day); that means: during the day and night;

6) 日月如梭 [Pinyin: rì yuè rú suō] (literally: the sun and the moon scurry across the sky, like a weaver's shuttle); that means: time flies like an arrow; time runs.

#### 2. The way out of a difficult situation (light-darkness):

1) 重见天日 [Pinyin: chóng jiàn tiān rì] (literally: to see the sun in the sky again); that means: to see the light again; to breathe deeply again;

2) 拨云见日 [Pinyin: bō yún jiàn rì] (literally: the clouds scattered and the sun appeared); that means: to break through the darkness and see the light;

3) 开云见日 [Pinyin: kāi yún jiàn rì] (literally: the clouds scattered and the sun appeared); that means: the hard times have passed.

3. Human qualities:

1) 蒸蒸日上 [Pinyin: zhēngzhēng rìshàng] (literally: to improve oneself everyday; to do better step by step); that means: to develop rapidly; to go steadily uphill;

2) 争光日月 [Pinyin: zhēngguāng rìyuè] (literally: to seek the light of the sun and moon); that means: to achieve fame;

3) 天无二日 [Pinyin: tiānwúèrì] (literally: there can not be two suns in the sky); that means: there can not be two rulers in a country.

4. Separation:

1) 一日三秋 [Pinyin: yīrìsānqiū] (literally: one day as three autumns); that means: to languish in separation;

2) 一日不见，如隔三秋 [Pinyin: yīrì bù jiàn, rú gé sān qiū], that means: have not seen each other for just one day, but feels as if it took three years.

Next, we turn to the phraseological units with the component "moon". Chinese 月 (Pinyin: yuè) has two meanings: the moon and month.

The analysis shows that there are the following semantical groups in idioms with «moon» component.

1. Appearance:

1) 闭月羞花 [Pinyin: bìyuè xiūhuā] (literally: to outshine the moon and shame the flowers); that means: about a beautiful girl;

2) 貂蝉闭月 [Pinyin: diāo chán bì yuè] (literally: Diao Chan outshines the moon); that means: that one who outshined the moon. Diao Chan (one of the four famous beautiful ladies of ancient China, the character of the novel "three kingdoms" ) 三国演义);

3) 月坠花折 [Pinyin: yuè zhùi huā zhé] (literally: the moon had fallen and the flowers have died); that means: the death of the beauty;

4) 花容月貌 [Pinyin: huā yuè róng mào] (literally: face of a flower, face of the moon, beauty); that means: very beautiful appearance;

5) 面如满月 [Pinyin: miàn rú mǎn yuè] (literally: face like the moon); that means: white complexion.

2. Time:

1) 蹉跎岁月 [Pinyin: cuōtuó suìyuè] (literally: to skip years, but to lose months); that means: to waste time; to waste years;

2) 光阴似箭，日月如梭 [Pinyin: guāngyīn sì jiàn, rìyuè rúsuō] (буквально: days and months to the weaver's Shuttle); that means: time flies like an arrow;

3) 销岁月 [Pinyin: xiāo suì yuè], that means: to waste time;

4) 成年累月 [Pinyin: chéngnián lěiyuè] (literally: through the years and months); that means: throughout years;

5) 日月如流 [Pinyin: rì yuè rúliú] (literally: time is like a stream); that means: time flows like water.



3. Human qualities:

1) 九天揽月 [Pinyin: jiǔ tiān yuè lǎn] (literally: to tear the moon from the heavens); that means: high aspirations, daring dreams;

2) 月明星稀 [Pinyin: yuè míng xīng xī] (literally: when the moon is bright, stars are rare); that means: it is hard to notice ordinary people in presence of a wise one.

The Russian language has a lot of idioms with «sun» and «moon» components.

Fixed word-sets with the word «sun» can be divided into three general semantic groups:

1. Appearance:

1) as clear as the sun ( that means: a beautiful and kind person);

2) like the sun in the sky ( that means: the comparison with the sun);

3) like the sun (peeking out) from the clouds ( that means: beauty.)

2. Place: place under the sun ( that means: position in society.)

3. Referents:

1) the sun of my life ( that means: appeal to your loved one);

2) my sun ( that means: appeal to a dear person);

3) red sun ( that means: appeal to your loved one).

4. Natural phenomenon:

1) the sun cries ( that means: natural phenomenon);

2) scorching sun ( that means: hot weather);

3) cold sun ( that means: cold weather.)

There is quite a big amount of idioms containing «moon» (month) component, which can be grouped according to the following features:

1. Appearance:

1) round like the moon ( that means: beauty);

2) like the young crescent ( that means: about somebody who appears for a short time);

3) clearer than the crescent ( that means: beauty.)

2. Misunderstanding: as if someone fell down from the moon ( that means: about somebody who can not understand that what everybody else know).

3. Human qualities:

1) get lost like young crescent ( that means: about a person who appears one moment and disappears quickly)

4. Anguish: to howl at the moon ( that means: to languish from anguish, boredom).

The Bashkir idioms containing «sun» components we notionally divide into the following groups:

1. Appearance: бер бите кояш, бер бите ай (that means: beauty.)

2. Human qualities: 1) кояш тишкәре (кире) яктан сығыр (сыкмаһа ярап

ине) (that means: untypical human behavior); 2) кояшы байыу (that means: dry up (about lige possibilities)).

3. Time: 1)    кояш һөңгө (тәртә) буйы күтәрелгәс (that means: the period of time between the morning and evening).

Let us focus on the idioms with «moon» component:

1. Appearance:

1) ай йөзлө (that means: female beauty);

2) бер бите кояш, бер бите ай (that means: beauty.)

2. Human qualities:

1) ай за кояш (that means: a person with a sincere and open soul);

2) ай күрзе, кояш алды (that means: about a person who appears one moment and disappears quickly);

3) ай-кояш булыу (that means: to show a warm attitude);

4) айзы күккә сығарыу (that means: to do one's best, stay your ground).

3. Natural phenomenon: ай колаклары (that means: on both sides there is a bright line (in winter)).

4. Time: ай үсәһен көн үсә (that means: time flies quickly).

Thus, after we analyzed the semantics of idioms with «sun» and «moon» components in the Chinese, Russian, Bashkir languages, we divided the most frequent phraseological units with the meanings "appearance", "time", "human qualities", "natural phenomenon" among the others.

The semantical analysis showed that the meanings of the idioms with «sun» and «moon» components have a lot in common in the Chinese, Russian and Bashkir languages. Russian and Bashkir philological units have different amount of components and the majority of Chinese idioms consists of four components (of four hieroglyphs) which are based on different Chinese myths, literature or historical events etc.

The idioms with «sun» and «moon» components are connected in the Chinese, Russian and Bashkir languages are connected to: the appearance (female beauty), human qualities (purposefulness, daring dreams), natural phenomena. The majority of the idioms of this kind in Chinese are connected to the meaning of "time", in Bashkir and Russian they are rarely presented.

Thus, the semantical analysis of idioms with «sun» and «moon» components in the Chinese, Russian and Bashkir languages helped to find their common and different features. The study of the collected material revealed that each language is rich in their imaginative means. It is notable that the word-sets with the components mentioned before are quite frequent in speech.

车臣 - 双语者互动交流中“Khetam”概念的语言认知表征  
LINGUO-COGNITIVE REPRESENTATION OF THE CONCEPT  
“KHETAM” IN INTERACTIVE COMMUNICATION  
OF CHECHENS- BILINGUALS

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**This work was supported by the Russian Foundation for Basic Research, project 18-412-200001 "Models of research of communicative behavior of Chechens-bilinguals"**

注解。 本文分析了車臣雙語者在與文化環境代表互動互動過程中的交際行為。 交際行為被定義為在民族心目中形成的社會文化體驗，用語言表達，通過概念反映出來。 “khetam”（意識）概念的語言和認知特徵被認為是最重要的，並且表達了車臣民族文化的普遍概念。 結論是，車臣雙語者與另一種文化代表之間互動互動的成功決定了認知靈活性和同理心的發展。

關鍵詞：交際行為，概念，人格，民族文化，互動互動，心態，意識。

**Annotation.** *The article analyzes the communicative behavior of Chechens-bilinguals in the process of interactive interaction with representatives of the cultural environment. Communicative behavior is defined as the sociocultural experience that has taken shape in the mind of an ethnos and verbalizes in language, reflected through concepts. The linguistic and cognitive features of the concept “khetam” (consciousness) are considered as one of the most significant and expressing the concept universal for the ethnic culture of Chechens. It was concluded that the success of interactive interaction between Chechen bilinguals and representatives of another culture determines the development of cognitive flexibility and empathy.*

**Keywords:** *communicative behavior, concept, personality, ethnic culture, interactive interaction, mentality, consciousness.*

Communicative behavior is a complex characteristic of an individual, manifested in constructive communication in the process of interactive interaction and

adaptation of a person to conditions in another cultural environment. The study of the communicative behavior of a person is impossible outside his native language, which is the main form of expression of ethnic culture. According to V. Humboldt, the language is the repository of the national spirit, culture, “the united spiritual energy of the people, miraculously captured in certain sounds” [3]. The language of each ethnos forms, at its carrier, a certain image of the world, which is reflected in the consciousness by a semantic network of concepts characteristic of this particular language.

Communicative behavior of representatives of various ethnic groups is determined by the history, myths, traditions and symbols of culture, which form the basis of the ethnic characteristics of the language. Thus, it can be said that the conceptual picture of the world of the linguocultural community as a whole is shaped by language. In this context, Karaulov believes that the linguistic picture of the world corresponds to the way of thinking, the inherent era, spiritual values developed by mankind and existing in the national ideosphere of language and culture, interpretation of the general value hierarchy, organizing the livelihoods of society based on the declared goals and ideals. [6] Communicative behavior is connected with the linguistic picture of the world of a person and is reflected through images, symbols and manners of communication.

By communicative behavior, we mean the sociocultural experience that has taken shape in the consciousness of the ethnos and verbalized in language, and is reflected through concepts. Thus, it should be emphasized that communicative behavior is a reflection of the mentality of a nation, its linguistic consciousness. In the process of development of each society, linguistic and cognitive features of communicative behavior are characterized by a specific semantic content, giving them an individual understanding.

The linguistic-cognitive features of the Chechens' communicative behavior are manifested in the national-cultural characteristics of their linguistic consciousness. In [8], an analysis of the concepts acting as regulators of moral behavior in Chechen society was carried out. As an illustration of the ethnic component of the communicative behavior of the Chechens, we consider the concept of “khetta” as one of the most significant and expressing the concept universal for the ethnic culture of the Chechens. The Russian-Chechen dictionary edited by A.T. Karashev, A.G. Macieva; the etymological dictionary of A. Vagapov; the Chechen-Russian dictionary of A. Ismailov; Chechen-Russian phraseological dictionary D. Baysultanova. The associative field of the concept “khetam” in the Chechen language is built on the material of the lexicographic sources of the Chechen language and includes the following areas: communicative area - “нахана юкъахъ лела хаар” behavior, etiquette; intellectual zone - “хъекъал” intelligence, wisdom; emotional-volitional - “яхъ” competitiveness in good deeds, “собар” patience, will.

Consciousness - khetam A. Macie [5] describes as a debt (шен декхапех кхеташ хилап); as a philosophical category of synkhetam (understanding of the soul); as the ideological basis of class consciousness being determines consciousness (хиламо билгалбокху кхетам). A. Matsiev also connects khetam with the mind (хьекъал) and consciousness (кхетамалла).

The first experience of the Chechen etymological dictionary belongs to A. Vagapov [2], who considers the formation of the lexeme "Khiyet" (concept, consciousness), as a derivative of the general Akh verb *кхуета*.

Khietam, by definition, A. Ismailov [4] means consciousness, memory, wisdom, ability, gift. Khietam includes mental operations and characteristics of human intelligence. As noted by J. Lakoff [7], the metaphor should be considered as a mechanism of thinking and the formation of a conceptual system. If we consider the concept of "Khietam" as a mind, that is, as a person's ability to think logically and creatively, to generalize the results of knowledge, thereby revealing the connection of Khietam with the intellectual zone - head, mind, intellect. At the same time, Khietam acts as a superior property.

According to D. Baysultanov [1], speaking of khetes as phraseological units of the Chechen language, it has the following semantic characteristics: кхетамах вала (to lose the ability to think, remember, and reason; getting crazy); кхеташо ян (consult a meeting); кхетош-кхиор (to educate someone morally). In our opinion, the concept of khetosh-kkhior appeared in the Chechen language in the communist period. In the traditional culture of the Chechens, there was no differentiation of education according to the types of moral or mental. Personality development a priori suggested spirituality, morality, intelligence, and one of the main forms of education was a personal example of relationships, interpersonal communication between parents and other adults who surrounded a child.

Khietam subjugates эсс (memory), кхетар (understanding), кхиар (consideration), жамл (judgment, conclusion, result). The cognitive model "хьекъале корта" is represented in the language picture of the Chechens by a certain living being and is verbalized by such lexemes as «шорта хьекъал» (big mind), «клеззиг хьекъал» (little mind), «хьекъал долуш» (smart), «хьекъал доцуш» (unintelligent), «лаккхар хьекъал» (high mind), «кура хьекъал» (proud mind), «ира хьекъал» (sharp mind), хилла долу хьекъал (sly mind), саьхьаре хьекъал (smartly mind). Mental abilities, intense intellectual activity are also immediate characteristics of the Khiet. As a separate organism, Khietam makes decisions independently thinks: сан кхиетамо боху соьга (my mind tells me), со ца кхета (I do not understand), сан кхиетамехь (in my understanding), суна хетарехь (in my opinion). Negative connotation khyetam can be expressed as сонта кхиетам (reckless mind), кхиетам боцуш (unconscious), кхиетамах воьхна (lost consciousness). It should be noted that in the Chechen language picture there is an opposition хьекъал – дог.

In this context, *dog* implies feelings. So, *хьекъал лекха ду* (high mind), *хьекъал кура ду* (mind proud), *дагъ хьекъале ца дугъла ла* (the heart does not mind).

In the linguistic consciousness of the Chechens, the communicative categories are distinguished, which contain the main generalized communicative information: «*тлекапе*» (communication), «*ладоглар*» (hearing), «*дошобъдалла*» (politeness), «*баркалла*» «thanks», «*тешам*» (trust) and determine their own internal representations of the individual forms of interactive interaction.

With the adoption of Islam, the concept of "Khiet" in the language picture of the Chechens acquires new connotations associated with the enrichment of its zone of influence. Religious content penetrates all spheres of social and individual consciousness. Transformations occur in the communicative behavior of the Chechens. First of all, it is connected with the change of their «*дахар*» (life) and «*дуьнене болу кхерам*» (worldview). Every person in Chechen society, by self-improvement, is striving to achieve the highest level of moral ascension, which is expressed in Chechens by the concept of "nokhchalla".

Thus, summing up all the above, it should be noted that the mechanisms of intercultural communication are communicative behavior and communicative consciousness. The success of interactive bilingual Chechens with representatives of another culture determines the development of cognitive flexibility and empathy.

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欧盟在世界政治中

## EUROPEAN UNION IN WORLD POLITICS

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註解。本文側重於歐洲統一作為政治聯盟和現代世界政治行為者的形成和作用。研究了世界政治的這些方面，如世界秩序和地緣政治影響。文章回顧了導致形成統一的歐洲提及因素和特點的歷史事件，這些因素和特點決定了歐盟在世界政治中的作用。

關鍵詞：歐盟，世界政治，世界秩序。

**Annotation.** *The article focuses on forming and role of united Europe as a political Union and actor of modern world politics. Such aspects of world politics as the world order and geopolitical influence are studied. The article reviews historical events which caused forming of united Europe mentioning factors and peculiarities which had determined the role of European Union in the world politics.*

**Keywords:** *European Union, world politics, world order.*

Europe as a geographical and cultural center has exported its practices and norms worldwide. It has been an engine of social progress for many centuries. Rationalism as the basis of philosophy, democracy and liberalism as the basis of political life appeared exactly on the territory of the old World

Creating and changing its own order and components of political system, Europe has provided new systems of world order. Westphalian, Viennese, Versailles, and rightly considered the main subject of world politics before World War II.

Of course, the world order itself and its changes (caused by impossibility to save a balance of power) caused uniting of national states of Western Europe in 50-s of XX century firstly into economic and then into political formation.

The fall of the Versailles system of world order led to the greatest social cataclysm of the 20th century and it became obvious that no European nation-state is able to shape its future on its own, that was one of the reasons for the formation of a United Europe.



The Founding Fathers of European unity were such political figures as Robert Schumann from France, Konrad Adenauer from Germany, and Alcide de Gasperi from Italy. These politicians did not create a new balance of power in Europe, but they launched of the greatest modern political players - the European Union. The base of their actions was comprehension of European economic collapse after the war. The solution was to leave the differences and create a new European order. [1]

After Coal and Steel Community creation, the states of Western Europe launched the process of integration of societies into a great political and economic formation. Undoubtedly, one of the most important steps in the integration process was the unification of the occupation zones of the United States, Great Britain and France into the Federal Republic of Germany. This happened even though Germany was the source of instability in Europe since the second half of the 19th century.

The United Europe has gone through several steps of forming the European Union but one of the most important steps, from the point of view of international politics and world order, was the access of Great Britain (after a number of negotiations and retirement of French president - Charles de Gaulle, Great Britain joined European Communities in 1973). It was Roy Denman, one of the great British politicians in the European commission and British representative in the European Union, who emphasized his skepticism about European integration at the conference in Messina in 1955 in his memoirs. British politician said: "The future treaty which you discuss has no chance to be approved by everybody; but if still the agreement will be reached, it has no chance to be implemented. And even if it is implemented, it will be unacceptable for the UK... Goodbye, Gentlemen! Good luck" [2].

At the same time, the USA were participating the process of unification of Europe. They were implementing their own influential strategy for after-war Europe as a basis for proamerican world order by means of:

- Economic interventions, including the Greek-Turkish aid program of 1947, the post-world war II European aid program known as the Marshall plan. De jure, the main goals and objectives of the programs were to restore the war-torn economy of Europe, the removal of trade barriers, the modernization of industry in European countries, the displacement of Communists from power structures and the development of the whole Europe. De facto, the result was the dependence of Western European States on the US dollar and the control of monetary policy until the 1970s.

Military-political Association into the North Atlantic Treaty Organization was in order to exclude the possibility of Communist expansion, as it was noted by Fogh Rasmussen Anders, NATO Secretary General in 2009-2014: "NATO was created in a dangerous world. While the shadow of the Soviet Union thickened over Europe, 12 countries on both sides of the Atlantic united to protect their

security and main values: freedom, democracy, human rights and the rule of law" [3]. However, the Union was rather a joint campaign with America at a role of an Executive Director [4].

Thus, the strengthening of the USA positions and the weakening of European role had been seen throughout the whole second part of XX century. At the moment, Europe is a major political and economic Union of states, which is at the intersection of many trends.

Indeed, Europe has developed a combination of national and regional approaches. On the one hand, the European Union diminishes the sovereignty of national states by its monetary policy and system of public power and on the other allows states to represent their own interests through the European government and its own fiscal policy. Europe has a number of hotbeds of separatism (Bavaria, Catalonia, Basque Country, Scotland, Flanders), which undermine both the integrity of the national States and the safety of European institutions. The presence of own public power of each state in Europe causes the inner conflicts about sovereignty and possibility to live without European institutions. For example, Brexit (the process of the UK's exit from the European Union) indicates violations in the balance of relations between the national state and the European Union, and, consequently, undermining the system of at least the European order.

Henry Kissinger, famous political scientist and former American statesman described the role of European order in the world politics. Also he stated three tendencies of European development in modern world order [5]:

1. Strengthening the Atlantic partnership (Europe and the United States);
2. Lobbying and neutrality;
3. Conclusion of an Alliance with non-European power (Russia, China).

Atlantic partners, according to the political scientist, should influence the choice of Europeans, so that Europe was interested in building a new world order, and not only the solution of constantly emerging problems caused by the diversity of political trends.

Of course the conclusion of the political scientist about the possibility of falling of the European Union into "geopolitical vacuum" and hence transformation of the USA into "an island next to Eurasia" is not less important. Although Europe is not a monopolist in the formation of the world order, it can become one of its main authors. This approach demonstrates the ambiguous role of the European Union in world politics.

Obviously, other political scientists have their opinions about the present and the future as well as about the role of Europe in it. So, Harold Mackinder developed the concept of "the core of the Earth" and he owns the famous aphorism: "One who rules Eastern Europe, owns the Heart of the Earth; One who rules the Heart of the Earth, owns The world island; One who rules The world island, owns

the world" [6, p. 175-194.]. From this point of view, the European Union has certainly achieved success, because it includes a number of Eastern European countries, and there are countries which are candidates. In this regard, the European Union as a political entity has a political resource of influence and is one of the main subjects of world politics.

Zbigniew Brzezinski, American political scientist of geopolitics has also studied the role of the European Union as a united formation. He noted that the wish of the USA to see Europe united is no more than political rhetoric of high-rank officials. Brzezinski pointed to the unwillingness of the United States to share geostrategic leadership in the middle East. Mainly because of this it is a supporter of Germany as a leader in the European space as France is distinguished by its active foreign policy program [6]. Brzezinski notes the possibility of losing the leadership of the United States of America in The North Atlantic Treaty organization due to the unification of Europe and the formation of the European Union as a player on the world political map. At the same time, from the point of view of his geopolitical theory, many European territories are geostrategic centers, which indirectly increases the role and importance of the European Union in world politics.

Thus, it can be concluded that the European Union is not currently an active actor in the formation of a new model of the world order, while there is a duty in the historical and political perspective to make the choice that will radically affect the entire world politics. Political scientists of world politics ambiguously highlight the role of the European Union in modern world politics, but point to the territorial importance of the European Union on the world political map.

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俄罗斯青年参与国家通信领域的政治法律问题

**POLITICO-LEGAL PROBLEMS OF PARTICIPATION OF THE  
RUSSIAN YOUTH IN COMMUNICATION AREAS OF THE STATE**

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注解。该文章的作者提出，从表现出他们对实现自己利益的感兴趣的角度来理解俄罗斯青年参与社会和国家事务的现代政治和法律形式。

关键词：俄罗斯青年，社会，国家，通讯

**Annotation.** *The authors of the article propose to comprehend modern political and legal forms of participation of the Russian youth in the affairs of society and the state from the standpoint of manifestation of their interest in the realization of their interests.*

**Keywords:** *Russian youth, society, state, communications*

In modern democratic conditions, among the many instruments of citizen participation in managing the affairs of society and the state, public comments on drafts of laws being drafted and many other normative acts occupy an important place, since citizen involvement in rule-making processes is seen as a tool for deliberative democracy [1].

In the framework of the implementation of the modern “digitalization” of the country, a public conversation is needed between the authorities and the population about objectively existing development challenges and about the need for cooperation in creating certain policies that meet the requirements of the time legislation. The package of “radical reforms” proposed by the top leadership of the country will be a response to the demand in the public consciousness of new possibilities for transforming the political, legal and psychological climate in the

country as part of a direction of young Russians to the slogan “Yes, we can live in a digital society”.

Electronic and technical-social innovations of the last decades allowed to give a new quality to the existing technology of direct interactions of citizens with the state, which received into Russian the difficult to translate name “electronic norm-creation of citizens” (English - e-Rulemaking). Such an increase in public participation of citizens allows not only to influence the quality of bills affecting the interests of social populations, but also to raise the level of political and legal culture of young people and younger generations in society, giving them confidence in their importance to power.

Currently, the list of communication channels is expanding and includes e-mail, blogs, mailing lists and many other network services. Using the possibilities of interactive communication, users can not only propose some kind of amendments to the draft normative acts for discussion, but also, before making proposals, familiarize themselves with comments already recorded, as well as present their vision of the relevance of previously proposed texts. At the same time, the main modern youth protest moods are connected with immediate problems, namely, finding a job and realizing their professional abilities, with higher prices for education and lack of material resources, as well as rising prices for housing and utility services.

As a result, for a young citizen of Russia, participation in public rulemaking becomes a reflexive political and legal practice that develops a reactive communicative action that arises as a response to the problem he is interested in. This is how not only political culture is formed, but the legal enlightenment of Russian youth is also indirectly carried out. And this is one of the few forms of interactive public participation that materialize in the form of specific proposals on a regular basis - to municipal, regional and federal authorities.

We emphasize that young citizens are participating in this activity on a voluntary basis and free of any charge, but focusing on the achievement of the public good, since the result of the discussion is a bill or regulation that affects their interests. However, it is cognitive and motivational problems that are the main obstacles to increasing the participation of young people in the process of social rulemaking. As a result of such youth participation, we are dealing with a complex interweaving of motivational, intellectual and emotional barriers in the field of collective action. And in the history of modern Russia, there are many confirmations of this, for example, the low efficiency of the Public Chamber of the Russian Federation, as well as the public advisory councils created under the ministries and departments, the insufficient demand for public expertise of individual normative acts at the regional level and ignoring expert potential of an emerging civil society in local government structures. As a result, the participation of Russian youth in rule-making is hindered not only by bureaucrats, but also by a large part of the deputies, representing political

parties, as the new political technology for the country undermines their monopoly on the representation of representation in various instances of the so-called "public opinion". We have to recall the material losses that the country suffered as a result of the application of poorly developed legislation on the monetization of benefits and conflicts arising around solutions related to the problems of ecology, education, medicine and social services. Tens of thousands of corruption loopholes in the regulations adopted only in the last decade indicate the existence of dysfunctions in the political-legal system.

At the same time, the presence of these dysfunctions and the need for mandatory public examination of legal acts were recognized by the country's top leadership - the current Resolution of the Government of the Russian Federation No. 195 "On Approval of the Rules for Examining Draft Normative Legal Acts and Other Documents in order to Identify the Provisions Aid in Creating the Conditions for Corruption" [2]. In order to conduct an independent examination of corruption, the federal executive body — the developer of draft documents — places them on its official website on the Internet, while the relevant reviews and conclusions are entitled to be submitted by independent experts. This position received further legal regulation in the Federal Law No. 172-Φ3 "On anti-corruption expertise of regulatory legal acts and draft regulatory legal acts" [3]. As a result, on March 1, 2018, the President of the Russian Federation confirmed that "it is necessary to digitize the document flow between government agencies, which is important for the government agencies themselves, and for citizens.... and that digitalization of the entire public administration system, increasing its transparency is also a powerful factor in countering corruption" [4].

At the same time, as applied to the phenomenon of "digitalization", the mutual influence of the institutes of modern society plays an important role in the development of the country and the mobilization of the active part of society for the implementation of a qualitative leap in development. And an important element of the modern picture of the country is the socio-economic background, which is characterized by fundamentally different aspects. This prolonged stagnation is a long "creeping out" of the crisis. And here it is important, that the authorities tried to convince people in every way that the crisis that has occurred will not be long, and that the country will quickly get out of it. Back then it contributed to the preservation of the popularity of the authorities. But now it is the cause of growing irritation in relation to the authorities, as a deferred reaction to the crisis. The authorities, even using all the reserves to continue populist social policy, still irritate young people. This irritation accumulates, and, having no normal way out, it breaks through whenever the power, voluntarily or unwittingly, makes a mistake or simply makes an awkward gesture. Plus, due to the fact that the government can no longer solve its internal conflicts non-publicly, it is self-discrediting in the eyes

of citizens. This was shown by the election results of September 18, 2016. And it became a clear indicator of the outcome of the election of the President of the Russian Federation on March 18, 2018

Young citizens see that the government is not adequate enough, that it is not able to cope with emerging problems, both internal and external, and this convincingly shows them that the heads have decay in decision-makers and that there are system failures. Economists who are eager to understand why some countries are more prosperous than others, are confident that the matter is in the nature of institutions - the existing rules. If existing laws and rules protect property rights only for a minority, if many young people are forced to take on work that they don't like, and it's very difficult to start their own business, then such institutions are called extractive. In fact, in this case the state becomes not an ally of society, but an instrument of protection of privileges for the elite-power. And, as scientists show, this mechanism is capable of reproducing itself for a long time, which we know well from our own history as an example.

Extractive political institutions give rise to economic institutions that allow a small group of people to extract maximum income at the expense of everyone else. Those who receive all the benefits, receive all the resources to maintain power [5].

In the rest of society, political and legal discontent appears where a "critical mass" of the social accumulates. When this "mass" demands its own laws of functioning, when it makes its demands on power, it sometimes becomes power. The possibilities for the formation of these new laws have never been more accessible. [6].

However, this thesis is not fully applicable to Russia, which is at a different stage of political and legal development, within which active political processes are unlikely. Add here that through growing well-being, a "man of action" was to appear, which in practice just did not happen, due to the lack of interest of the elite-government in a competitive political environment. V.V. Putin in his Address to the Federal Assembly - "The meaning of our entire policy is to save people, to increase human capital as the main wealth of Russia. Therefore, our efforts are aimed at supporting traditional values and families, and demo-graphic programs, improving the environment, people's health, developing education and culture." [4]. Thus, according to the results of the election campaign on March 18, 2018, the growth of youth civic activism was noted in large cities, and at the same time new forms of self-organization arise in various spheres: - landscaping, - leisure associations, - various relief societies, territorial self-government, - the fight against sealing construction, - parental councils, - environmental groups, etc.

Today, many activists are thinking about creating coalitions to unite efforts on various issues, but in general the public sphere remains fragmented. Human rights organizations have noted a slow increase in the legal literacy of the population,



and their readiness to protect their rights if they are violated. This allows us to talk about the formation of potential demand for the activities of organizations that are able to provide citizens with legal and consulting assistance in protecting their interests and in interacting with government bodies on this issue. However, emerging community groups often do not know where and whom to turn to, and established organizations do not always perceive them as their potential customers. [7]. At the same time, it is important to take into account that sociopolitical institutions, by definition, are not intended for development, but for the reproduction of norms that ensure order and stability in society.

Today, young citizens of Russia want to understand who will defend their interests in power and how. The emergence of social groups that are not politically represented and therefore forced to go into opposition to the authorities leads to the sewage of public discontent, while the stability of the country's political system decreases and political nihilism increases. So political uncertainty in the functioning of institutions contributes to the growth of anomie and provokes political nihilism.

Apparently, that's why the President of the Russian Federation in the Message to the Federal Union of the Russian Federation - 2018 was declared the Year of the Volunteer in Russia and stated that "today active, not indifferent citizens, socially oriented NGOs have been actively involved in solving the most important tasks. It is the involvement of people in the affairs of the country and civic activism, as well as cultural, moral, spiritual values that make us a single people capable of achieving big goals. Russian young people are already proving their leadership both in science and in other spheres" [4].

Taking into account the peculiarities of reforming modern Russia, it can be predicted that in the foreseeable future similar models of public youth participation will be introduced both at the regional and municipal levels. But today, the result is still not only the loss of young Russian citizens, as participants of social and political events, but most importantly the loss of promising ideas of young generations in their need for the Russian state.

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关于俄罗斯当代现代化的特点和前景的政治法律意见  
**POLITICO-LEGAL OPINION ON THE PECULIARITIES AND  
PROSPECTS OF CONTEMPORARY MODERNIZATION OF RUSSIA**

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注解。 作者提出了对现代问题的政治和法律研究以及俄罗斯联邦现代化的前景

关键词：俄罗斯现代化

**Annotation.** *The authors propose political and legal studies of modern problems and prospects of modern modernization of the Russian Federation*

**Keywords:** *modernization of Russia*

The historical path of Russia has led to such a feature of Russian society, as a pronounced statocratic. And the specificity of modern Russian modernization lies in its authoritarian character. Authoritarian modernization acquired at different historical stages different forms, proceeded with varying degrees of intensity. Stimulating the modernization processes in some areas, the power inhibited these processes in others. The most controversial were the results of the Soviet stage of authoritarian modernization. Having created a powerful industrial and technical base, urbanizing the country, building powerful educational and scientific systems, the Soviet state, however, completely inhibited such an important element of modernization as the development of civil society and a market economy. Due to the

undivided dominance of official Soviet ideology in all spheres of spiritual life, Soviet culture, despite its outstanding achievements, retained, paradoxically, some archaic features, in particular, insufficient differentiation of cultural contents. The Soviet political system also conserved the archaic structures of political power, and it was not for nothing that many analysts, describing the Soviet regime, used the term “feudalism”. The management elite that emerged during the Soviet period, with all-encompassing control and lack of competition from other social groups, did not have the skills to manage complex dynamic societies, being accustomed to acting solely within rigid authoritarian models, outside of dialogue with society. In other words, it was well acquainted with the model of mobilization development, but it was beyond its power to switch to the development mode of innovation. The reforms initiated by the political elite led to the collapse of the system. However, part of the political elite was able to take advantage of this collapse for economic and political gain. Having no self-organization skills, the extremely weak Russian civil society could not actually counterpose anything to progressively increasing authoritarian tendencies.

Over the years of post-Soviet development in Russia, a peculiar political system has emerged, which can be defined as neo-patrimonial. The political elite concentrated in their hands not only the levers of political governance, but also control over the economic resources of society; there was a merging of power and property. At the same time, the mechanisms of political competition were actually negated, the elite was inhibited. Within the framework of this system, Russian society has achieved a certain progress - the institutions of a market economy and democratic representation (despite their largely decorative nature) have emerged and strengthened, and the living standards of a significant part of the population have been raised. However, the new system could not overcome many of the negative consequences of the collapse of the USSR. In particular, the Russian economy has acquired a distinct raw material nature, deindustrialization of the economy has occurred and continues to occur, there is virtually no progress in the development of knowledge-intensive industries, the infrastructure inherited from the Soviet era is deteriorating, the quality of education is decreasing, and science is not developing. The pace of development of small and medium-sized businesses is significantly lower than in developed countries, with the development of these areas is hampered not only by the passivity of the population, but also by defects in government, excessive state control, which has a significant corruption component. And in the period of the 1990s, the need to overcome managerial chaos arose, and by way out of the crisis, the usual for Russia model of strengthening the vertical of power and strengthening centralization turned out to be.

However, in modern conditions the centralization of the political system, according to some experts<sup>1</sup>, has already reached the logical limit, and in the future,

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<sup>1</sup> Finding the future. Strategy 2012. Institute of Contemporary Development. -M. 2011

while maintaining the current situation, is fraught with degradation of the power vertical: in the absence of feedback from society, there is a great danger of further growth of the irresponsibility of the ruling stratum and the growth of contradictions within society.

The peculiarity of the current Russian situation lies in the fact that the usual model of authoritarian modernization has been exhausted. The current limitations of political and economic modernization are not created by the backwardness of society, but by the specifics of the most established political system and its management practices. Over the years of partial reforms in Russia, a sufficiently developed society has formed, already familiar with the realities of the market, and with democratic values, and having acquired certain skills of independent existence. Russian society no longer needs someone to lead it along the path of modernization. On the contrary, it needs that its initiative to set free - both economically, politically, and culturally. The excessive centralization of power, the state presence in the economy, which binds private initiative, is an obstacle to the transition to innovative development. But at the same time in Russia there are still no (and under the current political system there can hardly be any) powerful social forces capable of competing with the political elite.

Thus, a paradoxical situation is created - the model of authoritarian modernization, implying a key role in the implementation of changes by the political elite, should be modified by the elite itself, and only on this path can the country's further development be possible.

In Russia, institutions of checks and balances characteristic of democratic societies that limit imperious arbitrariness — independent media, influential civil society, independent business, a working parliament, and a strong parliamentary opposition — are absent or extremely weak. Not having normal channels of communication with society, the ruling elite is, ultimately, the hostage of the bureaucracy, concentrating in its hands all the administrative resources and capable, in principle, to stop any “modernizing” message threatening its domination from above. Such a closed, inert and rigid system can function relatively normally only in favorable, stable conditions, which in recent decades have provided Russia with high oil prices. Commodity incomes ensured a growth in consumption and a more or less acceptable standard of living for the majority of the population, which was the reason for the high level of support for the existing government. However, a favorable economic situation did not become an incentive for the ruling elite to carry out the necessary reforms that could destroy this support. The lack of channels of communication with society puts power in a disadvantageous position — it simply has no one to rely on in resolving the complex problems facing the country. On the other hand, closeness and alienation of power from society contributes to the accumulation of social and economic contradictions, latent conflicts, which,

without the established practices of reaching agreements and compromises, are also fraught with devastating consequences. Verticalization and bureaucratization of power restrains initiative in any areas of activity, but in the absence of initiative, transition to innovative development is impossible, which is the essence of modernization. It also holds back the initiative within the political elite itself - a significant part of the elite is aware of the causes of the existing Russian problems, but this awareness does not entail any attempt to change the situation. The process of making key decisions, as noted by many researchers, is concentrated in an extremely narrow circle of the ruling elite; even the majority of representatives of the ruling class itself do not influence it. The process of reaching important agreements is completely hidden, and has the character of shady collusion and agreements. Such a decision-making mechanism cannot be considered effective in modern conditions.

The lack of dialogue with civil society, communities of independent experts, the opposition leads to a gradual increase in the gap between society and the government. The small and medium business that emerged in the years of post-Soviet development, the middle class themselves feel that they are participants in modernizing development and see in power structures not an ally, but an obstacle. The manipulative policy of the authorities only exacerbates such sentiments. Critical sentiments are gradually increasing in society, and there is a danger that these critical moods, with the deterioration of the economic situation, will reach wider segments of the population. Already, an increase in xenophobia has been recorded, since it is precisely xenophobia that often becomes the first manifestation of dissatisfaction with its position among low-resource groups. Thus, the growing alienation of the political elite from society is fraught with destabilization of the political situation. This destabilization is fraught with growing alienation of the center and regions. The concentration of all resources and powers in the center with a lack of normal feedback mechanisms between the center and local communities leads to insufficient consideration of their interests, which is also facilitated by the weak development of local governments and their depression by the bureaucratic machinery. Local authorities are turning into a lever of regional authorities, which, in turn, in decision-making are more focused on the federal center than on the interests of local communities. As a result, the solution of local problems occurs in the mode of dealing with coming out emergencies and accidents, rather than a well-thought-out permanent management policy focused on the needs and demands of the population.

It is obvious that to overcome the negative consequences of excessive verticalization and bureaucratization of power, fraught with further degradation of the Russian society, liberalization and democratization of the existing political system is necessary. The paradox of the situation is that these tasks again - the very logic

of the current political system - are placed on the political elite. It is the elite who co-built the existing system of power must take steps to change it.

Attempts at technical improvement of the already existing management system will not have the expected effect, which is shown by the experience of attempts to carry out partial reform in the most diverse management sectors - from the government itself in the framework of administrative reform to the reform of the law enforcement system. Technical improvement of management activities should occur only under the condition of profound changes in the electoral process, improvement of parliamentarism mechanisms, development of the institute of expertise, real implementation of the principles of the rule of law, expansion of dialogue and interaction with civil society, improvement of public policy mechanisms.

Recently, there has been an opinion among opposition groups that it is impossible to reform the existing political system, it is necessary to remove the power of the existing elite from power. However, this approach is unproductive. In Russian society there is no mature counter-elite that would be able to make a demon of the political system and build some kind of new viable structure. Oppositional forces are too small, scattered and do not have a clear political program, broad social support and resources. Recently, there has been an opinion among opposition groups that it is impossible to reform the existing political system, it is necessary to remove the existing elite from power. However, this approach is unproductive. In Russian society there is no mature counter-elite that would be able to make a demon of the political system and build some kind of new viable structure. Oppositional forces are too small, scattered and do not have a clear political program, broad social support and resources.

Improving parliamentary institutions and political representation would allow the ruling elite not only to establish a dialogue with society, reduce pro-sentiment, integrate the most active and productive representatives of the opposition forces into the elite, but also ensure the legitimacy of the system, would allow the ruling elite to carry out the necessary but painful reforms that are obligatory for the further development of the country.

Reforming the political system does not necessarily imply the removal from power of certain personalities. The main task should be measures to democratize the existing system of political relations, strengthen its openness and strengthen feedback mechanisms. To implement these measures, some large-scale personnel changes may even hinder, destabilizing a system that is not very stable anyway. Ultimately, the democratization of the political system - if successfully implemented, would have served to strengthen the system. Therefore, such democratization is not only in the interests of society, but also in the interests of the political elite itself.

The most important component of the process of democratization of the politi-

cal system should be the improvement of the mechanisms of political competition, first of all, party competition. Stimulating party competition and allowing party competition will create an institutional framework for dialogue between the government and civil society.

In the circles of the political elite and a number of experts, there are certain concerns related to the negative assessment of the readiness of Russian society for real democracy, real political competition. There is an opinion that open free elections will certainly lead to the power of extremists, populists and radicals. However, such arguments are of some speculative nature, since how can one be confident in advance that the society as a whole is ready or not ready for democracy, and what are the criteria for such readiness? Therefore, improving the electoral process and defrosting the mechanisms of political competition can only positively affect the evolution of the Russian political system, not only establishing the necessary feedback between the government and society, but also stimulating the skills of political participation and civic responsibility of the population.

Another important direction in the modern improvement of the political system should be the strengthening of the separation of powers mechanism. It is no secret that the current state of the Russian political system is characterized by the dominance of the executive power, which largely blocks the reform process, since the executive power is by its very nature intended to implement tactical, not strategic goals, to strengthen the status quo. Without the institution of elections, which guarantees the responsibility of government to society, the executive power becomes uncontrolled, losing incentives to increase efficiency and improve.

The guidelines outlined above for strengthening political competition and parliamentarism should strengthen the legislative branch of power. But it is also necessary to reform the judiciary, to strengthen its real independence from the executive branch. Without improving the judicial system, achieving its real independence, the fight against corruption, in particular, is not possible. Independence of the judiciary can be achieved by clearly defining the reasons for dismissing judges, creating effective mechanisms for protecting the judicial community, introducing the practice of electing rather than appointing judges, etc. Measures to achieve real independence of the judiciary have been repeatedly formulated by representatives of the expert community, and the fact that they have not yet been implemented is due only to a lack of political will, as well as probably implicit but powerful opposition from those forces within the ruling class, who are interested in maintaining a dependent and weak judiciary. At the same time, distrust to the court is one of the most compelling reasons for people's distrust of government. Mistrust to the court undermines all possibilities for the formation of a legal state, aggravates the alienation of society from power, contributes to legal nihilism, which destroys the mechanisms of social trust.



The recent negative trend is to reduce the use of jury trials, while this practice is the most important step towards strengthening citizens' confidence in the court, one of the most important forms of citizen participation in political power, stimulating a sense of civic responsibility and forming a political culture of participation necessary for the functioning of democratic political institutions.

The spheres of law enforcement also need to be improved, as well as the work of law-enforcement agencies, the quality of which causes the citizens a completely natural lack of confidence and anxiety, as recorded by sociological surveys. In particular, it should be noted that the growth of xenophobic attitudes is often associated precisely with the inappropriate work of law enforcement agencies, not only allowing unlawful actions, but also avoiding the responsibility of those who committed them. The model of relations of law enforcement and judicial systems with society should be changed. They should be perceived as mechanisms for the protection of citizens, and not an instrument of state violence. But such a reorientation of the law enforcement and judicial systems is possible only in the event of fundamental changes in the political system itself - rethinking the role of the state in society.

But the most important element of the democratization of the political system should be the promotion of the development of civil society. Until now, the ruling elite has solved this task by creating decorative institutions that replace real civil initiatives. After all, a developed civil society is not only and not so much a mechanism of impact on power. This is a mechanism of self-organization, which allows to unload the state to some extent. A developed civil society is able to take on the solution of certain tasks that, in the absence of civil society, the state must solve. In particular, civil society can manifest itself in local government, in education, in maintaining order, and in charity and human rights activities, etc.

慢性扁桃體炎作為扁桃體淀粉樣變性的誘導劑  
**CHRONIC TONSILLITIS AS AN INDUCER  
OF THE TONSILS AMYLOIDOSIS**

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註解。 石蠟切片4微米厚的扁桃體切除材料62例患者11至52歲，扁桃體相對健康自殺49歲，其中人體脾臟和小鼠脾臟實驗性澱粉樣變性形成後，脫蠟並用1) Carazzy's蘇木素染色 在所有62例患者中，檢出慢性扁桃體炎20例 (32.3%) – 扁桃體切除術。 在許多患者中，在單個唾液腺中發現澱粉樣沉積物意外地被切成片。 當用硫磺素S染色時，小鼠脾臟，人扁桃體和較小程度的人脾臟的製劑顯示出微噬菌體，可能吞噬澱粉樣蛋白。 結論是，30%的慢性扁桃體炎伴有扁桃體的澱粉樣變性。

關鍵詞：澱粉樣蛋白，人扁桃體，小鼠脾臟，慢性扁桃體炎，實驗性澱粉樣變性

**Annotation.** *Paraffin sections 4 microns thick material of tonsillectomies of 62 patients from 11 to 52 years and tonsils of relatively healthy suicide of 49 years, lardaceous human spleen and mouse spleens after the formation of experimental amyloidosis in them were deparaffinized and stained either with 1) Carazzy's hematoxylin and eosin, or 2) congo red, or 3) thioflavin S. In all 62 patients, chronic tonsillitis was detected, in 20 cases (32.3%) - tonsillectomy. In a number of patients, amyloid deposits were found in single salivary glands accidentally caught in a slice. When staining with thioflavin S, preparations of mice spleen, human tonsils and, to a lesser extent, human spleens, revealed microphages, possibly phagocytizing amyloid. It was concluded that chronic tonsillitis in 30% of cases is accompanied by amyloidosis of the tonsils.*

**Keywords:** *amyloid, human tonsils, spleen of mice, chronic tonsillitis, experimental amyloidosis*

Acquired amyloidosis is traditionally considered a complication of long-lasting chronic infections, such as tuberculosis, or systemic diseases that develop over a long period of time. Recently, it has been suggested that amyloid may be a functional substance, possibly a part of innate immunity (Soscia et al., 2010). Therefore, we assume that amyloid can form in the tonsils with their chronic infectious lesion, either by performing a protective role, or create a more severe problem when amyloid enters the tonsils into the general circulation. Our hypothesis was objectively confirmed when thioflavin was stained on tonsil scrapings taken immediately before tonsillectomy in patients with chronic tonsillitis. In the scrapings, we detected free amyloid in detritus of crypt tonsils and intracellular in bacteria and oral amoebas (Kozlov et al., 2018). The search for information on the development of local amyloidosis of the tonsils in chronic tonsillitis in either native or foreign literature did not give a positive result.

Objective: to detect the formation of amyloid lesion of the tonsils against the background of the formation of chronic tonsillitis.

### Materials and methods

Brief description of the group of patients. Under conditions of the Department of Otorhinolaryngology of the Budget Institution of the Chuvash Republic, the Emergency Medical Care Hospital of the Ministry of Health of the Chuvash Republic, 62 individuals aged from 11 to 58 years were examined for decompensated chronic tonsillitis, the average age was  $32.2 \pm 10.5$  years. Females - 31 individuals, the average age -  $31.6 \pm 11.5$  years. Males - 31 individuals, the average age -  $28.9 \pm 11.2$  years. The average age of patients diagnosed with amyloidosis of tonsils was  $27.0 \pm 11.5$  years (10 males —  $28.3 \pm 10.6$  years and 10 females —  $30.8 \pm 12.8$  years). The examination was carried out before planned tonsillectomy. Of those examined, there was no concomitant diagnosis — four individuals, all females. The complication of tonsillitis in the form of rheumatic heart disease was in one female aged 32 years and a boy of 14 years. Glomerulonephritis - one male aged 41 years. An 11-year-old boy was diagnosed with a Marshall syndrome. Fifty-four individuals had concomitant diagnoses not related to chronic tonsillitis, but in all 62 patients examined, myocardial repolarization disorders were observed and in one case, a 51-year-old male had an extrasystole. In two cases, a 23-year-old male and a 34-year-old female had a paratonsillar abscess, all other patients underwent surgery during remission.

The histological material was fixed in a 10% formalin solution and embedded in paraffin in the usual manner. In a preliminary histological study, to confirm or exclude the diagnosis of chronic tonsillitis, all 4 micron paraffin sections of the test organs were stained with Carazzy's hematoxylin followed by dyeing with eosin using the usual procedure.

At the second stage of the study, sections after repainting with Carazzy's hematoxylin were repainted with 1% solution of congo red according to H.H. Benhoold and sealed in a transparent environment (Sarkisov, Perov, 1996). The quality control of staining was the sectional material of the lardaceous spleen of a man

who died from generalized secondary amyloidosis. Light microscopy of sections was carried out in transmitted white light from a 7000K LED emitter on a LOMO microscope. The obtained micrographs were investigated by morphometric methods. The relative area in percent of the total area of the micrograph in pixels was measured using the LevenhukLite program.

Fluorescence microscopy of sections stained with thioflavin S was performed on a Lyumam-4 luminescence microscope. The locking optical filter YG18,  $\lambda_{exc.} = 410$  nm, the optical filters VG, WG, BGG. The electrical parameters on all measurements were determined by the following parameters: input voltage 900 V, amplifier resistance 106 Ohm. A 0.5 mm probe was installed in the nozzle. Micrographs of all preparations were obtained using a Levenhuk C800 NG 8M digital camera, USB 2.0.

The resulting digital material was processed by descriptive statistics methods in the Excel 2007 spreadsheet editor. The data are presented in the  $\bar{M} \pm m$  form, where  $\bar{M}$  is the average,  $m$  is the standard error. Mean differences are determined using the  $\chi^2$  method.

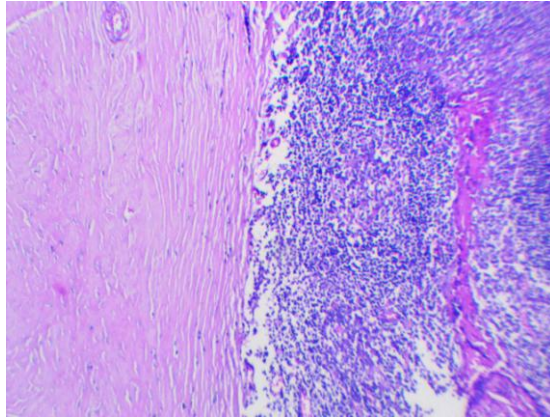
### Results and discussion

The histological picture of tonsil preparations stained with hematoxylin-eosin corresponded to the picture of chronic tonsillitis without exacerbation with stroma sclerosis and atrophy of the lymphatic apparatus of the gland. Figure 1 shows stained with a) hematoxylin-eosin and b) congo red sequential sections of the human tonsil. In fig. 1 a), stained with hematoxylin-eosin, a classic picture of chronic inflammation that has passed into the stage of tissue hyalinosis is shown. But, when staining with congo red by H.H. Benhold consecutive slices of the same amygdala show a pattern typical of an amyloid lesion. Thus, staining of sections with only hematoxylin-eosin in histopathological examination of the tonsils resected for chronic tonsillitis can lead to diagnostic errors, and hide the real picture of the prevalence of amyloidosis, at least local.

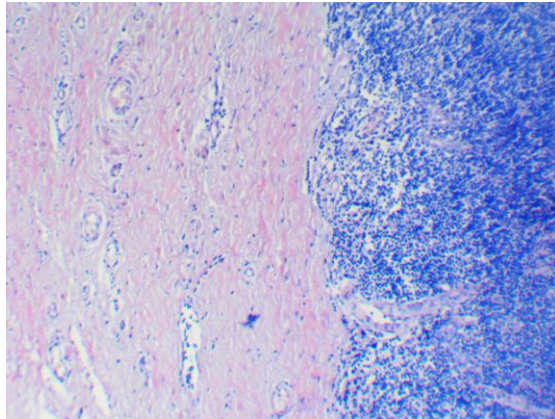
As a result of histopathological examination of the post-resection material of 62 patients, in 20 of them (32.3%), regardless of age, gender and associated diseases, we found amyloid deposits in the tonsils. The relative area of congo red stained areas was  $25.6 \pm 17.9\%$ .

The discovered complication of chronic tonsillitis casts doubt on the well-established view that secondary amyloidosis affects only healthy organs and never develops in an organ with chronic inflammation that induced the development of amyloid disease. The revealed fact allows us to assume that amyloid is formed in the affected organ, but intense amyloidoclasia occurs with the participation of phagocytic cells that have arrived there, whereas in healthy organs the number of phages is insignificant and therefore the intensity of amylocasse is low. To confirm this assumption, we conducted a study of the tonsil preparations of the same patients when stained with thioflavin S, which is highly specific to amyloid fluorophore, which induced fluorescence intensity increases many times when inserted into amyloid (Guntern et al., 1992).

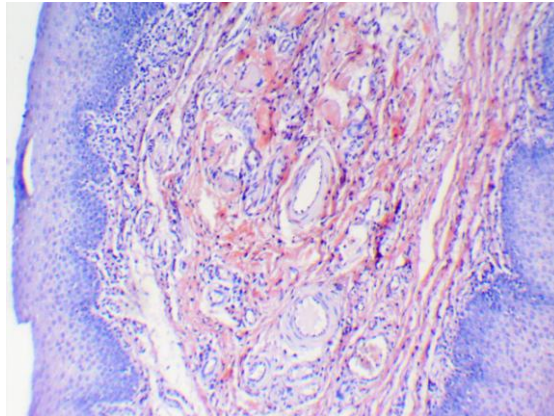
With the same colouring, we additionally studied the anonymized preparations of the lardaceous spleen provided by the BI Republican Bureau of Forensic Medical Examination of the Ministry of Health of Chuvashia, as well as preparations of the spleen of mice subjected to modeling of systemic amyloidosis according to our own methodology (Kozlov V.A. et al., 2016).



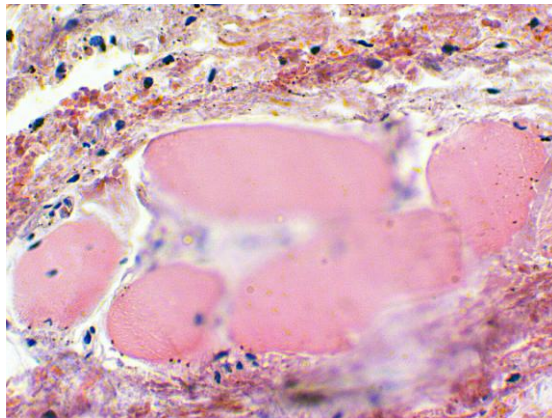
(a)



(b)



(c)



(d)

**Fig. 1.** Human tonsil preparations

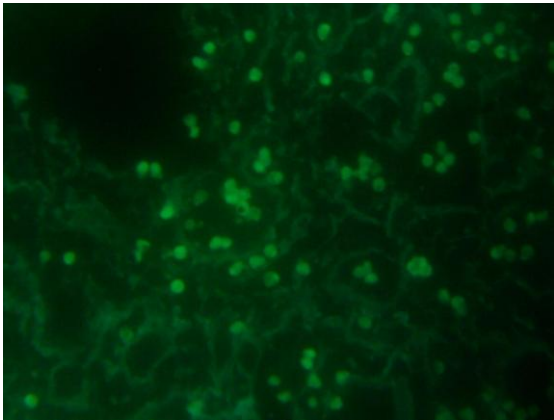
- a) cut, stained with hematoxylin-eosin, Zoom. 100;
- b) cut, sequential cut a), congo red, Zoom. 100;
- c) amyloid submucosal lesion, congo red, Zoom. 100;
- d) the salivary gland in the amygdala of an 11-year-old child with Marshall syndrome. congo red.  
Zoom. 400



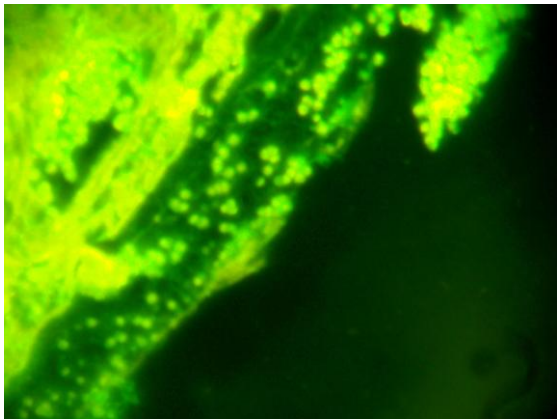
Microphages in the spleen of mice when simulating experimental amyloidosis were randomly identified by staining paraffin sections of the spleen with thioflavin S after preliminary deproteinizing paraffin sections in acidein pepsin for one hour. In the stroma of the spleen of mice, they are found as numerous brighter than the main cell background (Fig. 2a). In size and shape, these cells are not similar to macrophages, plasma and mast cells, their cytoplasm does not contain granules. Since these cells are visualized only after staining with thioflavin S, it is permissible to assume that they contain phagocytosed amyloid, that is, a group of cells that belong to microphages. We found similar cells in the human organs under study, fig. 2b and 2d. In fig. 2b, brightly fluorescent cells, authentic in shape and size, are located in the submucosal layer of the tonsil. In fig. 2b, these cells merge with the background, they are not so numerous. This may be due to the fact that this is a case of a lardaceous spleen, culminating in the death of a patient as a consequence of generalized amyloidosis. An additional finding was the detection of amyloid deposits in the salivary glands, detected by staining with thioflavin S (Fig. 2d) and congo red (Fig. 1d).

From the results of the analysis of the obtained histological material of the tonsils, removed for medical reasons due to the presence of chronic tonsillitis, as well as material obtained from a relatively healthy suicide, it clearly follows that a third of patients examined against the background of chronic inflammation of the tonsils with corresponding morphological changes regardless of age has at least local amyloidosis of tonsils. This fact, especially the presence of an inverse negative correlation between the age of the patients and the optical density of the amyloid deposits, can be explained by the fact that hardening of the tonsils in chronic tonsillitis is caused by at least two non-exclusive processes.

Amyloid as part of the innate immunity system (Soscia *et al.*, 2010) can form in response to a bacterial and/or fungal infection of the oral cavity, both chronic and acute. Some representatives of a mixed infection persistent in the deep parts of the tonsils: enterococci, mesophiles, *Candida*, and their associations with streptococci, staphylococci, and micrococci (Tsyркunov *et al.*, 2016) produce the extracellular amyloid they need to form biofilms - *Candida sp.* (Mann, Blank, 1975). In addition, amyloid is a structural element of their movement organelles - pili and curley (Rekstina *et al.*, 2016). Thus, it is permissible to make the assumption that the amyloid found by us in the tonsils may be of bacterial and/or fungal origin. Both assumptions explain well the cause of the development of amyloidosis, which complicates chronic bacterial infections, such as tuberculosis.

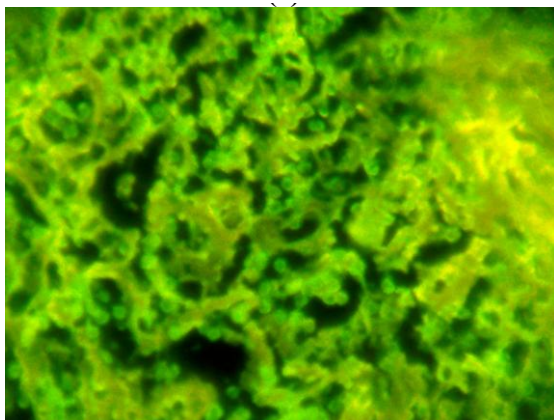


(a)

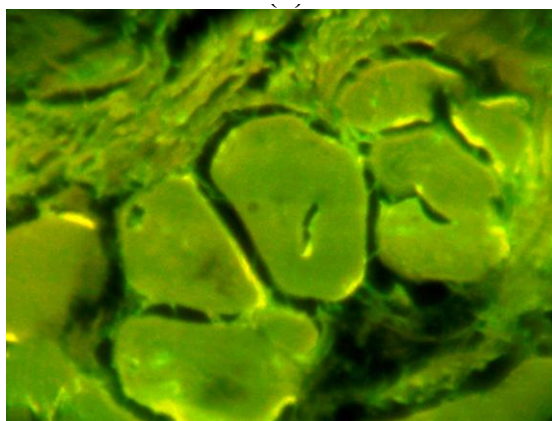


(b)





(c)



(d)

**Fig. 2.** *Microphages in organs affected by amyloidosis and amyloid deposits in single salivary glands*

a) spleen of a 70-day-old mouse subjected to amyloidosis modeling. Thioflavin S. Zoom. 400

b) the amygdala microphages of an 11-year-old child with Marshall syndrome. Thioflavin S. Zoom. 400

c) the salivary gland in the amygdala of an 11-year-old child with Marshall syndrome. Thioflavin S. Zoom. 400

d) lardaceous spleen. Thioflavin S. Zoom. 400

The source of amyloid tonsils can be saliva lysozyme, a protein of the innate immunity system, which is an amyloidogen and causes systemic amyloidosis (Sipe et al., 2012). Direct evidence of the involvement of saliva in amyloidogenesis was obtained by histopathological examination of single salivary glands. The most striking amyloid damage was observed in Marshall syndrome in an 11-year-old child.

The microphages found by us at research of the drugs painted by thioflavin S, perhaps, may be one of forms of amyloidoclasts. In mice, they were found in almost all fields of view, in greater numbers closer to the capsule of the spleen. In the tonsils we found them also in the subcapsular region. In the lardaceous spleen of a human, they are found as single cells merging with a common brightly lighted background. Perhaps we did not see them in large numbers because we did not have the drug, cut out close to the capsule. In the available literature, we did not find information about the participation of microphages in the processes of amyloidogenesis. Perhaps this is due to the fact that with the usual methods of staining they are not detected as something special, as happens when staining with thioflavin. Moreover, even when stained with thioflavin, we were able to detect these cells only after preliminary incubation of the sections mounted on the glass in the acidide-pepsin solution.

From the data we obtained, it is obvious that the tonsils, as a border organ of the immune system, constantly in contact with pathogenic and conditionally pathogenic microflora, a part of which is a producer of functional amyloid, are affected by amyloid lesion in chronic tonsillitis. Since our relatively small sample was completely random, it can be assumed that the frequency of local amyloidosis of tonsils associated with the formation of chronic tonsillitis is at least one third of the number of patients with chronic tonsillitis. In addition, from our data, it follows that a certain number of amyloidosis, due to the absence of significant damage to vital organs (the sebaceous kidney, the sebaceous liver, the sago kidney), can be asymptomatic or hardly symptomatic and not reflected in the medical statistics due to the lack of direct indications for such studies. This circumstance requires the development and introduction of methods for the express diagnosis of amyloidosis into clinical practice.

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原发性器官非上皮性肿瘤表型的特征  
**CHARACTERISTICS OF THE PHENOTYPE  
OF PRIMARY ORGAN NON-EPITHELIAL TUMORS**

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抽象。 研究了來自不同人體器官的三種原發性組織內非上皮腫瘤的表型。已經確定這些形成的表型可以對應於腫瘤前體的正常組織基因型。 該研究結果允許使用免疫組織化學診斷方法在實踐中定義腫瘤組織發生和疾病預後。

關鍵詞：原發性組織內非上皮性腫瘤，表型，免疫組化研究。

**Abstract.** *The phenotypes of three primary intraorgan non-epithelial tumors from various human organs were studied. It has been established that the phenotype of these formations may correspond to the normal tissue genotype of the neoplasm precursor. The study results allow to define the neoplasms histogenesis and prognosis of disease course in practice using an immunohistochemical diagnostic method.*

**Key words:** *primary intraorgan non-epithelial tumors, phenotype, immunohistochemical studies.*

**Relevance.** The primary intraorgan non-epithelial tumors are neoplasms of mesenchymal nature of any human organ. The source of these tumors is any cell of the supporting tissues of internal organs, i.e. a specific organ connective tissue stroma. According to the rules of the international classification, non-epithelial tumors, as well as epithelial tumors, are classified by localization as neoplasms of a specific organ.

Therefore, the general statistics of the incidence of non-epithelial intraorganic tumors is not kept - in the guidelines, such tumors are mentioned as quite rare. Perhaps the exception is gastrointestinal stromal tumors (GIST), the rapid study of which fell on the first decade of this century [9]. At the same time, histogenetically non-epithelial intraorganic tumors are similar to soft tissue tumors, which, according to the WHO definition, should be considered “all non-epithelial extra-skeletal tissues of the body, with the exception of the reticuloendothelial system and supporting tissues of internal organ.

The commonness of histogenesis of organ and extraorgan non-epithelial tumors is confirmed by the data of immunohistochemical and molecular-biological studies of the majority of known mesenchymal tumors. However, in practical work, immunohistochemical verification of non-epithelial intraorgan tumors sometimes reveals the expression of antigens, which are not characteristic of similar soft tissue tumors.

**The aim of the study:** to determine the direction of the antigenic drift of these tumors using as the example the primary intraorgan non-epithelial tumors of various human organs.

**Materials and methods:** the material of the primary intraorgan non-epithelial tumors of brain, uterus, bladder were used as an objects of study. The surgical material obtained from 3 patients (2 men and 1 woman) aged 54 to 64 years (mean age 59.7 years), who underwent surgical treatment in the urological and neurosurgical departments of the Tula Regional Clinical Hospital and the gynecological department of the medical center "Consultant", the city of Tula.

After the study of histological preparations using routine histological and histochemical stains (hematoxylin and eosin, according to Van Gieson), the immunohistochemical method (IHC) was used to determine histogenesis and biological potential of the neoplasms. All immunohistochemical studies were carried out in the autostainer "Ventana" (USA).

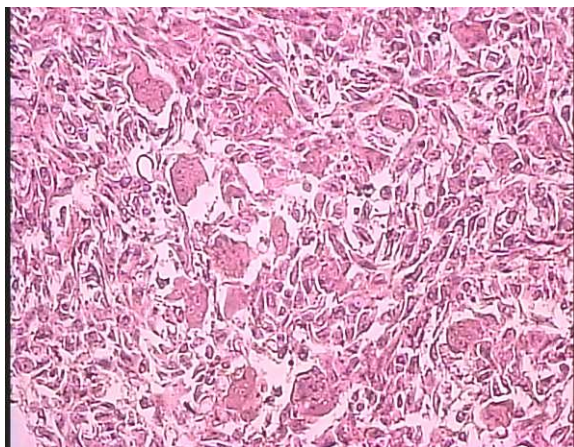
Since all tumors by histological parameters did not correspond to the classical tumor variants of these organs, a wide panel of antibodies was used. Antibodies to Vimentin were used for IHC studies. (clone V9, Novocastra), HBM-45 (clone HBM-45, Novocastra), Melan A (clone A103, Novocastra), MITF (clone 34CA5, Novocastra), Tyrosinase (clone T311, Novocastra), Pan Cytokeratin (clone AE1/AE3, Novocastra), CK 7 (clone RN7, Novocastra), CK 18 (clone DC-10, Novocastra), EMA (clone GP1.4 Novocastra), RCCm (clone 66.4 C2, Novocastra), Ulex (clone UEA-1, Novocastra), E-Cadherin (clone 36 B5, Novocastra), CAIX (clone TH22, Novocastra), Pax-8 (clone BC12, Novocastra), SMA (clone asm-1, Novocastra), Calponin (clone 26 A11, Novocastra), Desmin (clone DER-11, Novocastra), ER (clone 6 F11, Novocastra), PR (clone 16, Novocastra), Inhibin (clone AMY82, Novocastra), CD 10 (clone 56C6, Novocastra), CD 34 (clone QBEnd/10, Novocastra), CD 68 (clone 514H12, Novocastra), CD117 (clone T595, Novocastra), S-100 (clone POLYCLONAL, Novocastra), p53 (clone D0-7, Novocastra), Ki-67 (clone K2, Novocastra) according to the protocol recommended by the manufacturer. Ki-67 index counts were per 1000 cells on digital micrographs.

Tumor histogenesis was determined according to the "Classification of soft tissue tumors" (WHO 2013). The biological potential (Grade) of tumors was evaluated according to the FNCLCC system [7].

### **The results of the study.**

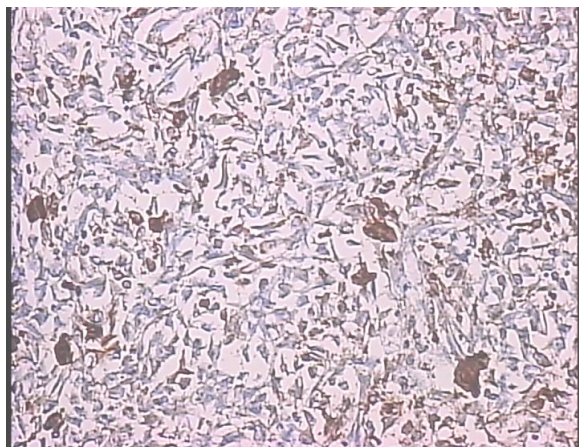
When examining the patient revealed a tumor of the posterior wall of the bladder with erosion of the mucous membrane on the surface. After surgical treatment, he was discharged in satisfactory condition.

Macroscopically, the formation looked like a soft-elastic dark red tissue,  $1.5 \times 1.5 \times 1.0$  cm in size, visually located from the resection edges at a distance of 0.3 cm. In the study of histological preparations (Fig. 1), a polymorphous cell soft tissue tumor with giant multinucleated cells was detected. The histogenesis and biological potential of a neoplasm were not identified, immunophenotyping was performed, on the basis of which negative staining was detected: S100, CD 10, Desmin, Cytokeratin 7 and positive staining: Vimentin, Cytokeratin pan, CD 68 (Fig. 1.1), Cytokeratin 20 (Fig. 1.2 ) Antytropsin (Fig. 1.3). Ki-67 proliferative activity index: $> 10\%$ . Based on morphological and immunohistochemical studies, the phenotype 8804/3 of undifferentiated epithelioid sarcoma, WHO grade I according to the FNCLCC system, was diagnosed.

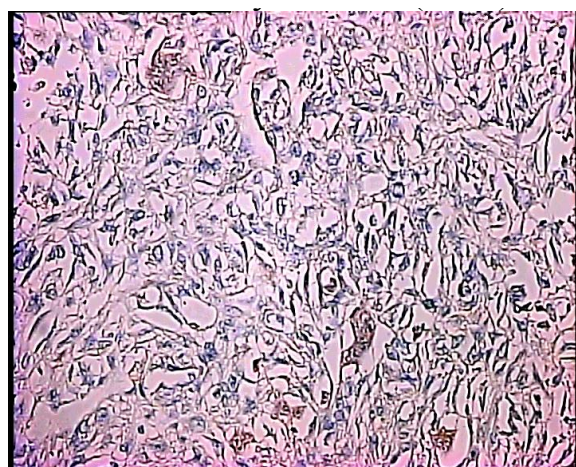


***Fig. 1. Bladder tumor**  
Hematoxylin-eosin (x200)*

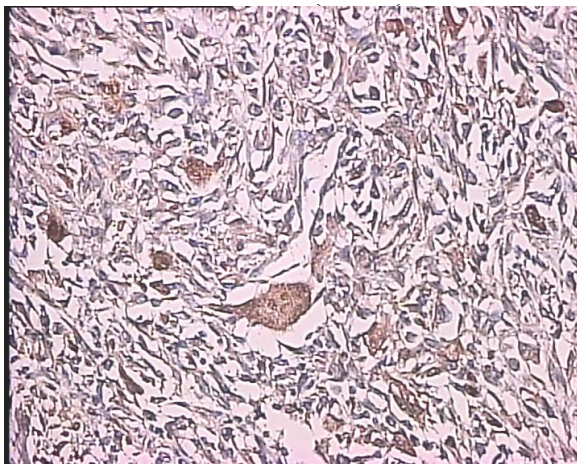




***Fig. 1.1. Bladder tumor***  
*CD68 (x200)*



***Fig. 1.2 Bladder tumor***  
*Cytokertin 20 (x200)*

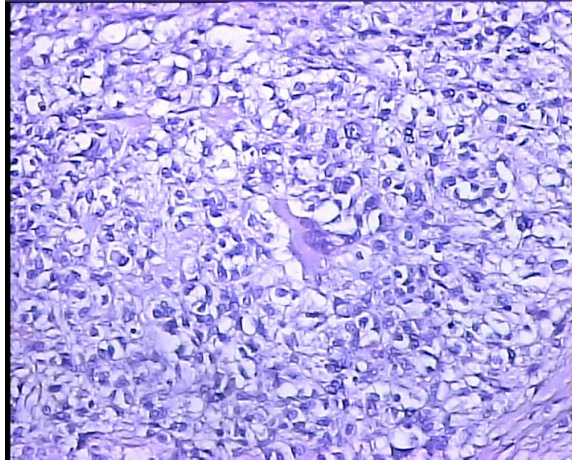


*Fig. 1.3. Bladder tumor  
Antytrypsin (x200)*

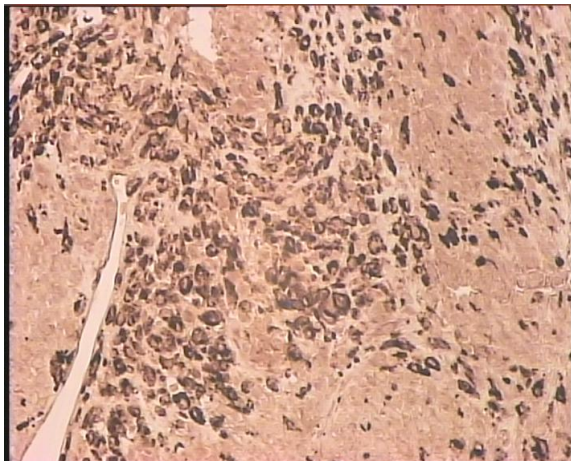
In the second case, the patient undergoes supravaginal amputation of the uterus with appendages for subserous and intramural uterine leiomyoma. Subserous knot in the form of a hilly formation, size 11x10x10cm, gray in color, on cuts of fibrous type, with softening centers in the central parts of the node of pale gray and pink color. The histological picture of the node (Fig. 2) is regarded as “high-grade epitheloid leiomyosarcoma M8891 / 3 with areas of necrosis”.

IHC-study allowed us to determine the presence of negative staining: SMA, S 100, CD 10, Desmin, Collagen IV and positive staining: Vimentin, CD 68, Cytokeratin pan, ER (Fig 2.1, 2.2). The proliferative activity index was Ki-67:> 19% (Fig. 2.3). On the basis of morphological and immunohistochemical studies, the presence of the phenotype 8804/3 of an undifferentiated epithelioid sarcoma, WHO grade III according to the FNCLCC system, has been proven.

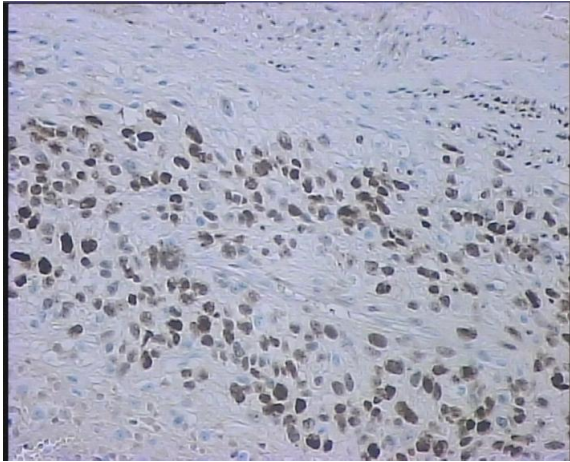




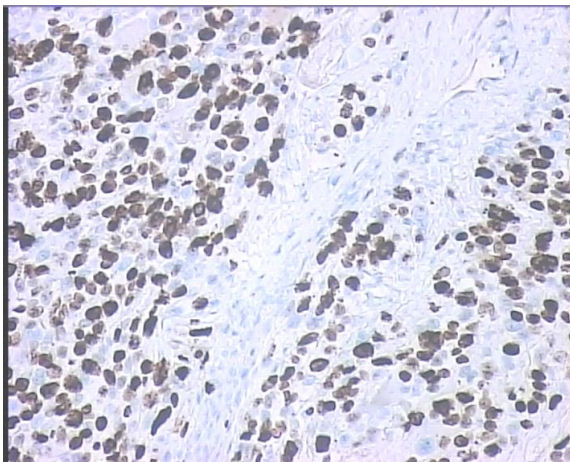
**Fig. 2.** Uterine tumor  
*Hematoxylin-eosin (x200)*



**Fig. 2.1.** Uterine tumor CD68 (x200)

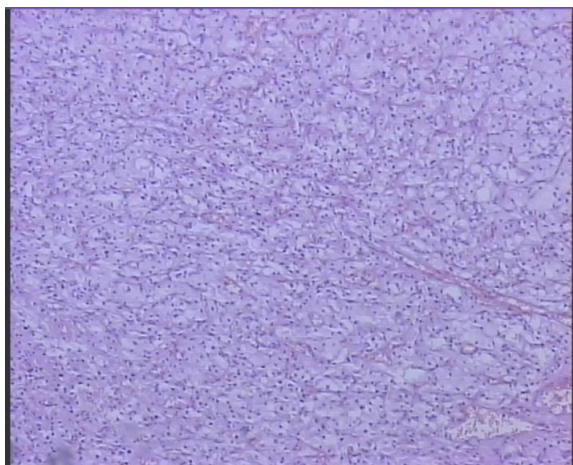


*Fig. 2.2. Uterine tumor Er (200)*

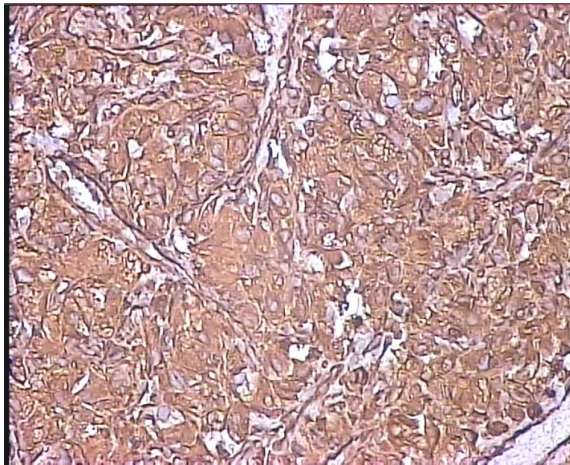


*Fig. 2.3. Uterine tumor Ki-67 (x200)*

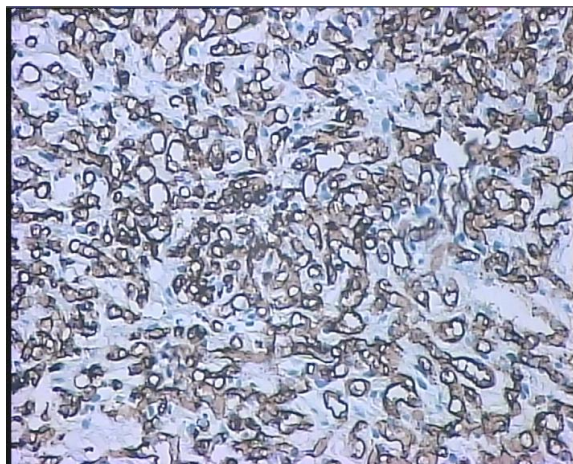
In the third case, the patient was operated for volume formation of the left hemisphere of the cerebellum. Histological examination describes a "clear cell tumor of large polygonal cells with small nuclei, between which there is a pronounced capillary network" (Fig. 3). An IHC study revealed negative staining: GFAP, CD 10, Citokeratin pan, Napsin-A, PSA, HMB 45 and positive staining: Vimentin CD 31, CD 34, S 100 (Fig. 3.1, 3.2, 3.3). The proliferative activity index Ki-67 was 3%. Based on morphological and immunohistochemical studies, the phenotype 9161/1 of WHO grade I hemangioblastoma was assigned according to the FNCLCC system.



**Fig. 3.** Cerebellar tumor  
*Hematoxylin-eosin (x100)*

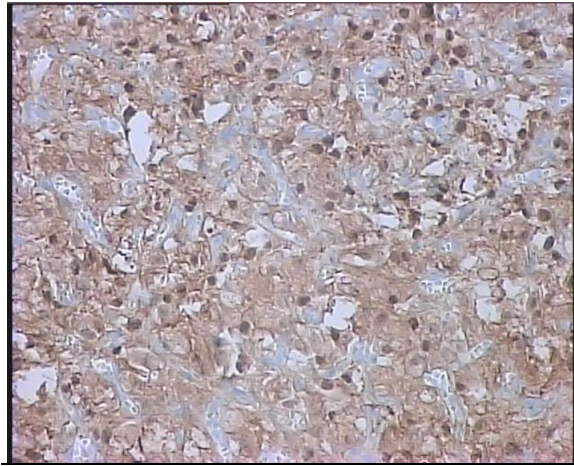


**Fig. 3.1** Cerebellar tumor  
*Vimentin (x200)*



**Fig. 3.2** Cerebellar tumor.  
*CD34 (x200)*





**Fig. 3.3** Cerebellar tumor.  
*S100 (x200)*

In cases No. 1 and 2, primary intraorgan with undifferentiated epithelioid sarcoma (malignant fibrous histiocytoma - according to the WHO classification of 2002) was diagnosed. Along with typical markers of sarcoma (Vimentin, CD 68 Cytokeratin pan) [4], expression occurs in the first case of Cytokeratin 20 (Ctk 20), and in the second - estrogen receptors (ER). So far, it has been known that Ctk 20 (46 kDa) is expressed both in normal epithelium and in carcinomas of the gastrointestinal tract, urothelium, and skin Merkel cells, is found in mucinous carcinomas of the lung, female and male genital organs, biphasic synovial sarcoma.

As for monophasic soft tissue tumors and epithelioid sarcomas, the cases of expression of Ctk 20 in them have not yet been described.

Like many other steroid hormone receptors, the ER is a nuclear transcriptional protein regulator for a number of hormone-dependent genes. There are  $\alpha$ -ER and  $\beta$ -ER.  $\alpha$ -ER is expressed in the epithelium of the breast, ovary and endometrium, and in the stroma of the endometrium and myometrium. In soft tissue tumors,  $\alpha$ -ER expression occurs in uterine and some abdominal ectopic smooth muscle tumors in women. Other  $\alpha$ -ER-positive mesenchymal tumors are stromal tumors of the female genital organs, such as endometrial stromal sarcoma, aggressive pelvic angiomyxoma and vulva angiomyofibroblastoma.  $\beta$ -ER has a wider distribution, including expression in desmoid fibromatosis and most vascular tumors. However, the expression of ER in the primary intraorgan non-epithelial tumors of the female genital organs, and in the available literature sources is not mentioned.

In case No. 3, protein “S 100” is expressed in a tumor of vascular origin. Protein S100 is a small, acidic calcium-binding protein (mol. Weight 21 kDa), which belongs to the family of EF-hand proteins. In conventional polyclonal antisera, S100B is used. “S100” protein is expressed in various cell types, which include melanocytes, Schwann cells and supporting paraganglia cells, chondrocytes, adipocytes, myoepithelial cells of various glands, skin Langerhans cells, and related interdigital reticular cells. Positive cells usually show both cytoplasmic and nuclear staining. However, the prevalence of S100 is not typical for vascular tumors.

Thus, in all three cases of primary intraorgan non-epithelial tumors of different human organs presented here, the expression non-specific proteins for these tumors takes place. However, the expression oddly coincides with organ specificity: Ctk 20 is characteristic of the uratelium epithelium, ER to female genitals, S 100 – to brain tissue. This coincidence seems to us not accidental.

The reason for this phenotypic heterogeneity may be genomic instability, characteristic of tumor cells. The genetic instability provides ample opportunities for the emergence of numerous mutant variants, contributing to malignant growth, and can also determine the phenotypic variability of tumor cells. On the other hand, such heterogeneity, noted in tumor cells, may be the result of the phenotypic plasticity of the tumor progenitor cells, that is, correspond to the normal manifestation of the genotype [1, 2, 3].

### **Conclusion:**

Thus, modern ideas about soft tissue tumors were formed due to the wide spread of immunohistochemistry and the achievements of molecular genetics of the last 15-18 years of the XXI century. The obtained data constantly make adjustments to certain characteristics of tumors, changing our understanding of histogenesis, biological potential and determine the place of the tumor in the classification.

The phenotype of the primary intraorgan non-epithelial tumors of various human organs may correspond to the normal genotype of the precursor tissue of the neoplasm.

The features of the phenotype of primary intraorgan non-epithelial tumors of various human organs indicated in the work allow us to characterize the histogenesis of neoplasms and make a prognosis using IHC in practice. Further studies using immunohistochemical and molecular genetic methods may allow for targeted chemotherapy.

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量化具有不同认知缺陷水平的年轻人中的BDNF水平  
**QUANTIFICATION OF BDNF LEVEL IN YOUNG PEOPLE WITH  
DIFFERENT GRADES OF COGNITIVE DEFICIT<sup>1</sup>**

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抽象。該研究致力於評估50名白人/高加索人和亞洲/東方族群的年輕人的神經營養因子水平與認知缺陷的嚴重程度相關。在高加索人中發現癡呆症的個體症狀明顯高於蒙古人。在具有中度癡呆症狀的亞組中，BDNF水平與鋰含量之間存在顯著關係。

關鍵詞：BDNF，認知缺陷，鋰。

**Abstract.** *The study is devoted to assessing the level of neurotrophic factor in 50 young people of White/Caucasian and Asian/Oriental ethnic groups in correlation with the severity of cognitive deficit. Statistically more significant individual signs of dementia were found in Caucasians than in Mongoloids. A significant relationship was found between the level of BDNF and the lithium content in subgroups with moderate signs of dementia.*

**Keywords:** *BDNF, cognitive deficit, lithium.*

The decline in the arbitrary memory and attention, which, together with a decrease in the productivity of mental activity, are one of the most common neurological syndromes, traditionally referred as "cognitive impairment", "cognitive decline" in the neurological practice. The structure of this neuropsychological syn-

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<sup>1</sup>The work was carried out as part of the RFBR grant No. 19-07-00356-Vladimir Semenov



drome is extremely diverse and manifests itself with a wide range of pathological conditions of the central nervous system, both with predominantly local lesions (usually in combination with a disorder of gnosis, praxis, emotional sphere), and with cerebral pathology. In this case, the cognitive sphere disorder is a component of the clinical manifestation of majority of neurological disorders at a certain stage of development, or the disease clinical form, and, often, acts as a manifesto of their occurrence, forcing patients to seek help from specialists. Based on the uptodate provisions of the World Health Organization - a biopsychosocial model of human health, solving the problem of reducing cognitive functions is an integral part of the treatment and prevention process. In social terms, the deterioration of the performance indicators of mental activity entails a reduction in the quality of patient's life as one of the significant indicators of the effectiveness of therapy. And with an unfavorable prognosis, it can lead to labor, family, household, micro- and macro-social disadaptation and, as a result, disability and unautonomous being of a person.

This problem acquires special significance in the case when a cognitive functions decrease is already manifested at a young age. This becomes a serious obstacle for following the modern global trend of continuous professional competencies improvement throughout a person's life, which reduces the quality of human capital on a national scale.

A number of studies, primarily foreign ones, are currently devoted to the problem of pre-demenitional states in young people (5,6), but the question of the pathogenesis of these conditions and the biochemical markers accompanying the decline in cognitive functions still remains open.

This article attempts to highlight the problems of pre-demenitional states of young people of different ethnicity, assess nonspecific changes in cognitive functions, identify the relationship between objective indicators of aural-speech memory and arbitrary attention with the levels of lithium and neurotrophic brain factor (BDNF) obtained by laboratory methods.

In recent years, the scientific literature has paid increased attention to a variety of neurotrophic factors, due to the very specifics of these polypeptides: the view of the nervous tissue, as something that subsequently subjected only to death, is gone. At present, numerous studies have proven the ability of nervous tissue to regenerate, the rate of which is determined by both internal and external factors. In this regard, special attention is paid to neurotrophic factors as compounds of a polypeptide nature with a neuroprotective effect.

Neurotrophins are a family of large polypeptides that regulate the survival, development, and coordinated functioning of neurons (2). Numerous studies allow us to conclude that without the participation of neurotrophins, neurogenesis is impossible, because due to neurotrophic and some growth factors, the leading role

in the regulation of nerve cells formation in a number of brain regions from neural progenitors. In this sense, the role of neurotrophins and growth factors "seems to be comprehensive and can be seen at all stages of pre- and postnatal neurogenesis, in ensuring the physiological norm of the brain and in certain types of neuro-and psychopathology" (2).

Neurotrophic and growth factors participate in cascades of biochemical reactions that ensure the normal functioning and regenerative abilities of nerve cells in various stressful situations.

To date, the following polypeptides that play a crucial role in the transformation of neural stem cells have been identified:

1. brain neurotrophic factor (BDNF);
2. platelet and epidermal growth factors (PDGF / EGF);
3. transforming growth factor (TGF-beta1) and bone morphogenic protein (BMP);
4. a group including interleukin-6 (IL-6), leukemia inhibitory factor (LIF), ciliary neurotrophic factor (CNTF).

All these substances are synthesized in an inactive form, and the number of their active forms depends on the body environmental situation specific. The lack of neurotrophic factors clearly correlates with a decrease in neuroplasticity, i.e. the ability of the nervous system to optimal morphological and functional restructuring in response to endogenous and exogenous stimuli (1).

At present, the literature covers issues related to the correlation of BDNF level and the severity of various pathological conditions, but about the level of BDNF and the degree of cognitive deficit manifestation the question remains, because it is logical to assume that within the cognitive functions decrease the level of BDNF becomes a marker of the compensatory response of the body.

This article presents the results of a screening study in young people in order to analyze the correlation between the degree of manifestation of cognitive functions, the level of BDNF and the microelement composition of the body in quantitative terms.

The study involved 50 young people (the age of the subjects is 20-25 years). Of these, 36 representatives of White/Caucasian and 14 representatives of the Asian/Oriental ethnic groups. An attempt is made to determine the possible association of BDNF level with the level of cognitive functions, as well as the relationship between the level of BDNF and the concentration of lithium in the body of the subjects.

**Objective:** to evaluate the quantitative indicator of the BDNF level in young people of White/Caucasian and Asian/Oriental ethnic groups in comparison with the assessment of their cognitive functions.

### Material and methods.

The study, conducted on the basis of quota sampling, was attended by 50 subjects. All studied persons are students of 3-5 courses of medical university. Among them, on the basis of race, 2 groups were singled out: 36 people belonging to White/Caucasian ethnic groups represented the first group, 14 people belonging to Asian/Oriental (Mongoloid) ethnic groups represented the second group.

To study the cognitive functions the pathopsychological experiment was conducted. This is the method in domestic medical psychology (3) that is the most adequate for the qualitative assessment of cognitive functions. The study was conducted in an abbreviated version using test tasks - learning 10 words according to A.R. Luria, and finding the numbers on the Schulte tables (monochrome version). The level of serum BDNF was determined by the method of quantitative enzyme immunoassay of the sandwich type, by ELISA, using kits for the quantitative determination of human brain neurotrophic factor (BDNF) in plasma.

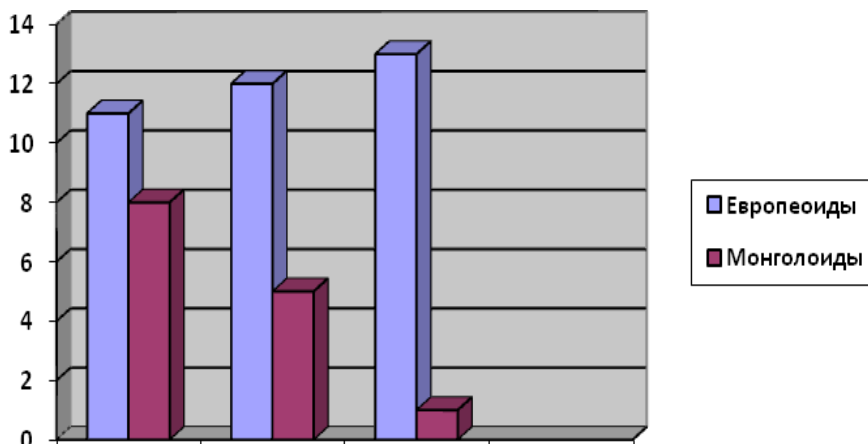
To analyze the microelement composition, a study of hair from the scalp was performed. Used samples preparation underwent "wet ashing" in the autoclave (Teflon bomb) in the microwave complex of the "CEM" firm (USA). The determination of trace elements was carried out by atomic absorption method using a "Zhimaazu" spectrophotometer (Japan) and mass spectrometry method using an "ELAN DRC" mass spectrometer (USA). Total content of the following trace elements was investigated: lithium, beryllium, boron, sodium, magnesium, aluminum, silicon, phosphorus, potassium, calcium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, selenium, rubidium, strontium, yttrium, zirconium, niobium, molybdenum, silver, cadmium, tin, antimony, cesium, barium, mercury, lead. Since reliable and the most frequent deviations from the norm were found only in the lithium content (reduced in 70% of subjects), it seemed necessary to trace the possible correlation between the level of BDNF and the lithium amount.

Statistical data processing was performed using the standard Microsoft Excel program and "Statistika" for Windows software package.

### Results and discussion.

#### *Brief assessment of cognitive status.*

50 people were surveyed: 36 representatives of Caucasian ethnic groups (group E) and 14 representatives of Asian ethnic groups (group M). The following tests are the most representative for assessing cognitive status: a 10-word learning method according to A.R. Luria, and finding the numbers in the tables of Schulte (4). According to the study results, each group was divided into three subgroups: the first subgroup included subjects with the maximum number of points in both methods, the second - subjects with clinically significant decrease in points in one of the methods, in the third - subjects with a decrease in points in two methods. The norm of the function: learning 10 words - reproduction of 10 words after 4 or 5 repetitions, delayed - reproduction of at least 7 words; Schulte tables - the time to search for no more than 50 seconds per table, flat or downward profile on five tables.



*Fig. 1. The distribution of subgroups in accordance with the assessment of cognitive status  
blue - White/Caucasian, red - Asian/Oriental ethnic groups*

Thus, among representatives of Caucasians, the distribution is as follows: in the 1E group 11 representatives (30.5% of all surveyed Caucasians), in the 2E group - 12 representatives (33%), in the 3E group - 13 representatives (36%). The type of distribution of the trait in this statistical population is asymmetrical left-sided (increase in the number of representatives with an increase in the level of cognitive deficit). Among the representatives of the Asian/Oriental ethnic groups, the picture is different: in the 1M group there are 8 representatives of the Asian race (57% of all surveyed Mongoloids), in the 2nd group - 5 representatives (35%), in the 3rd group - 1 representative (7% of all the surveyed Mongoloids). The type of distribution of the trait in this statistical population is asymmetric right-sided (decrease in the number of representatives with an increase in the level of cognitive deficit). It should be noted that, in general, among the Caucasians, 69% of the representatives showed moderate signs of cognitive deficit, while among the Asians - 42%.

#### Оценка уровня BDNF.

На основании иммуноферментного анализа сыворотки крови было проанализировано количество BDNF у всех шести подгрупп испытуемых.

В целом колебания в уровне BDNF составляют у европеоидов от 47098 пк/мл (у представителя 3E группы) до 28871 пк/мл (у представителя 2E группы), у монголоидов – от 49876 пк/мл (у представителя 2М группы) до 28171 пк/мл (у представителя 1М группы). На сегодняшний момент в научной литературе за норму сывороточного BDNF принята величина  $28,39 \pm 3,28$  нг/мл.

*BDNF grade assessment.*

Based on the enzyme immunoassay, the amount of BDNF was analyzed in all six subgroups of subjects.

In general, fluctuations in the level of BDNF in Caucasians are from 47098 pg / ml (for representative 3E groups) to 28871 pg / ml (for representative 2E groups), for Mongoloids - from 49876 pg / ml (for representative 2M groups) to 28171 pg / ml (at the representative of the 1M group). To date, the scientific literature for the rate of serum BDNF adopted the value of  $28.39 \pm 3.28$  ng / ml.

**Table 1.**

*The average BDNF content in the studied subgroups*

Group	1 <sup>st</sup> sbgroup	2 <sup>nd</sup> sbgroup	3 <sup>rd</sup> sbgroup
Caucasian	34669 pg / ml	36058 pg / ml	35403 pg / ml
Asian	32885 pg / ml	39723 pg / ml	41456 pg / ml
Reference value	28390 $\pm$ 3280 пг/мл		

Thus, the greatest increase in the level of BDNF is observed in the second and the third subgroups, i.e. with a decrease in cognitive status, the content of neurotrophic factor in the serum increases to 30% of the normal level in the serum.

*Evaluation of the correlation between the level of BDNF and the lithium content in the hair of the subjects.*

Interest in lithium as a specific microelement is due to the role of lithium in the functioning of the central nervous system: lithium helps to reduce the excitability of the nervous system, reduces the amount of available free norepinephrine serotonin in the central nervous system, increases the sensitivity of neurons in some brain areasto dopamine.

In accordance with the selected subgroups, a correlation analysis was conducted between the level of BDNF and the lithium content in the hair according to the Pearson method. The study showed a significant relationship in the second subgroups of both Caucasians ( $r = 0.72$ ,  $p \leq 0.05$ ) and Asian/Oriental ( $r = 0.90$ ,  $p \leq 0.05$ ). In other groups, a reliable relationship between the lithium level and the level of BDNF is not noticed.

**Conclusion**

As a result of a screening study of young people in the comparison of White/Caucasian and Asian/Oriental ethnic groups, it was shown: some signs of cognitive deficit were found in 69% of tested Europoids and 42% of tested Mongoloids. A significant relationship was found between the level of BDNF and the lithium content in subgroups with a moderate decrease in cognitive functions. In the future, an expansion of the research base is required to verify the obtained results and increase the reliability of the predictive value of the research.

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在r.Kigash的pikeperch食物  
**FOOD OF PIKEPERCH IN R.KIGASH**

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抽象。 文章描述了基加什河下游的梭鲈的食物习性。 本文介绍了2014 – 2018年饲喂期梭鱼鲈鱼营养状况的研究结果，对梭鲈成虫的营养进行了定性和定量评估。 还给出了对其人口当前饲养的评估。

关键词：梭鲈饲料，Kigash河，肥力系数

**Abstract.** *The article describes the food habits of pikeperch in the lower reaches of the Kigash River. The results of research on nutrition of pike perch during the feeding period for 2014–2018, which allowed giving a qualitative and quantitative assessment of the nutrition of adults of pikeperch, are presented. An assessment of the current feeding of its population is also given.*

**Keywords:** *feed of pikeperch, Kigash River, coefficient of fatness*

A large number of works are devoted to the nutrition of pikeperch in various reservoirs. However, the dependence of the nature of its food on various environmental conditions is far from complete. In particular, the feeding of perch in the Kigash River, which is distinguished by its peculiar physicochemical and hydro-biological features, contains only fragmentary information.

The material for this article served as a five-year (2014-2018) research of the Atyrau branch of Kazakh Research Institute of Fishery on food for pike perch during the feeding period in r. Kigash. Sampling was carried out on “the Nizhny Bogatinsky”, “Sand”, “Kamyshinka”, and “Bird plots” and in the pre-drainage space of the river (square 38, 62, and 87).

The main goal of the research is to identify possible changes in the nature of the food of the pikeperch in the Kigash River. For this, it was necessary to establish the composition of adult pikeperch food, to identify the most preferred food items, as well as the intensity of consumption of feed objects.

100 digestive tracts were processed and analyzed. To study the nutrition of the pikeperch, a combined approach was applied: the material was collected by the group method; the processing of the gastrointestinal tracts in the sample was car-

ried out by an individual method, i.e. each separately. The fishing was carried out with filler net, according to the method of studying fish nutrition [3].

The pikeperch (*Sander lucioperca*) is known to be a typical predator that feeds mainly on young fish. Pikeperch juveniles are potentially capable of switching to a predatory lifestyle with a body length of 12–30 mm.

At the early stages of development, larvae of perch consume rotifers, with an increase in size they switch to feeding on cladocera and copepods. In general, zooplankton organisms in fingerlings account for 50% of the mass of food coma. As it grows, the food spectrum expands, and nektobentichnye (mysidy, gammarids) appear in the diet, as well as benthic organisms (chironomid larvae and other invertebrates) [1].

The food base of an adult pikeperch is very diverse and its food has a wide range. The food of an adult pike perch in the Kigash river delta is made up of small, mass fish: bleak, white bream, roach, roach, bream, and sabrefish. Bersh, perch, ruff, ide, podust, bullhead, gudgeon, pinch-off and the gentle sturgeon fry are also noted in the stomachs of the predator. Cannibalism is manifested only in April-June and does not have much importance in the nutrition of the perch, which is associated with the rapid growth of its young.

A large number of species, noted in spring in the predator feeding spectrum, is due to the fact that in spring, during the pre-spawning and spawning periods, fish in the mass concentrate on a small area and represent the most accessible and widespread food object [2].

Summer and the first half of autumn for semi-anadromous species of fish is the period of feeding and fattening. It should be noted that the main fattening sites for these species of fish are located in the Caspian Sea and in the mouth of the Zhaiyk and Kigash rivers [3].

To characterize the intensity of nutrition of the pike perch, the following indicators were used: the actual weight of the food coma, the gastrointestinal filling index (table 1).

In 2014, 25 individuals were investigated: 9 of them are males of the IV stage of maturity and 18 females of the I, II, III stages of maturity. The length of fish ranged from 295 to 489 mm, weight - from 210 to 1022 g. Analysis of the contents of the stomachs and intestines of the pikeperch showed that the main food at this life stage was small fish, which could not be determined due to their strong digestion, 48% of pikeperch stomachs were empty. It should be noted that mostly empty stomachs are observed in individuals of stage IV of maturity, which according to literary data [4] corresponds to the period when the pike perch eats poorly. In contrast, the highest indices of the stomach filling index are observed in females of the II – III stages of maturity ( $34.18 \text{ ‰}$  and  $90.89 \text{ ‰}$ , respectively).

The average value of the stomach filling index is  $74.84 \text{ ‰}$ . The average value of the Fulton fatness coefficient is 1.29, which indicates the food security of the pikeperch. Most of the gastrointestinal tracts were covered with a significant layer of fat.



In 2015, 12 specimens were seized for the analysis of pikeperch nutrition, of which 9 males and 3 females. The length of the investigated fish varied from 36 to 61 cm, weight from 340 to 3143g.

The stomachs of the two fish from the entire sample were empty. The average index of filling of the stomachs was  $71.13\text{‰}$ . In the filled stomachs of a pike perch, young carp were found (19.93%), roach, roach (60.03%) and bream (3.44%).

In the majority of fish studied, the gastrointestinal tract was covered with fat, the average obesity rate was 5 points, which indicates that the perch was rather high. The average coefficient of pike perch fatness has not changed significantly since 2014 and amounted to - 1.30 according to Fulton, 1.11 according to Clark.

In 2016, 15 copies of pikeperch were seized, 11 females and 4 males met in the sample. The length of the investigated fish varied from 42 to 52 cm, weight from 700 to 1555g.

In 73% of the investigated pikeperch stomachs were empty. The degree of filling other varied from 1 to 5 points. The average index of gastric filling was  $50.92\text{‰}$ . Young roach and bleak fry were found in the filled stomachs, the proportion of the latter by weight of the total food coma - 96.29%, the frequency of occurrence - 50%.

The average coefficient of pikeperch fatness was 1.60 according to Fulton, 1.41 according to Clark. The average index of the degree of obesity of the gastrointestinal tract is 1-2 points, which means that the pikeperch is still exhausted after spawning. Intestinal parasites, in particular worms, were not observed on the fish examined.

In the autumn of 2017 in the river Kigash was seized 5 copies of perch, 3 of which are males and 2 are females. Age of fish is 3-5 years. Gonadal maturity is stage 2. The length of the investigated fish varied from 41 to 48 cm, weight from 522 to 923 g.

All the studied fish stomachs were empty. The degree of obesity of the gastrointestinal tract did not exceed 1 point. The average coefficient of fatness of a pike perch according to Fulton is rather low, and amounted to 1.29, according to Clark 1.23.

In the mouth of the Kigash River, 5 copies of perch were seized, 1 of which is male and 4 are females. Fish age 2-4 years. Gonadal maturity stage 3. The length of the investigated fish varied from 38 to 48 cm, weight from 413 to 973 g.

In the majority of fish examined, the stomachs were empty. The index of the gastrointestinal tract with food is  $23.23\text{‰}$ . A food ball in the stomach of a pikeperch was made up of young bream, 2 - 4.5 cm long. The degree of obesity in the gastrointestinal tract did not exceed 1-2 points. The average coefficient of fatness of a pike perch according to Fulton is rather low, and amounted to - 1.25 according to Clark - 1.19.

In the summer of 2018, 25 perch copies were seized, 16 of which are females and 9 are males. The sixth and second degree of gonad maturity. The length of the investigated fish varied from 41 to 55 cm, weight from 562 to 1419 g. The age of the pike perch is 3-5 years. Food contained 40% of the stomachs of the investigated fish. The average index of filling the gastrointestinal tract - 14,73 ‰, the degree of filling 1-4 points.

In the filled stomachs, the bream yearlings were found - 66.68% of the total food weight, carp - 12.5%, sabrefish - 7.33% and bullheads - 4.82% of the total weight of the food coma. Other species of fish may have been victims of perch as well, but because of the severe destruction they could not be identified. The share of digested food was 8.67%. The frequency of bream in the stomachs of pikeperch - 40%, carp - 20%, sabrefish - 10%, gobies - 8%.

The coefficient of fatness of the pike perch was at the level of average long-term indices averaged 1.29 for Fulton, 1.22 for Clark. The index of the degree of obesity in the digestive tract of most fish is 4 points, which means that the pike perch was actively feeding immediately after spawning and gained enough fat before the onset of heat.

In the mouth of the river Kigash 23 copies of perch were seized, 14 of which are females and 9 are males. The second degree of maturity of the gonads. The length of the studied fish varied from 38 to 53 cm, weight from 486 to 1441 g. Age of pikeperches is 3-6 years.

In 35% of the fish examined, the stomachs were filled with food. The average degree of filling 3 points. The average index of filling the gastrointestinal tract - 84.91 ‰.

Carp young were found in the stomachs of pike perch - 32.67% of the total food weight, young sabrefish - 29.52%. The share of digested food accounted for 37.81%. Scales, scattered bones, muscle fibers and mucus were present in the food coma. The frequency of occurrence of carp was 4.34%, sabrefish - 8.70%.

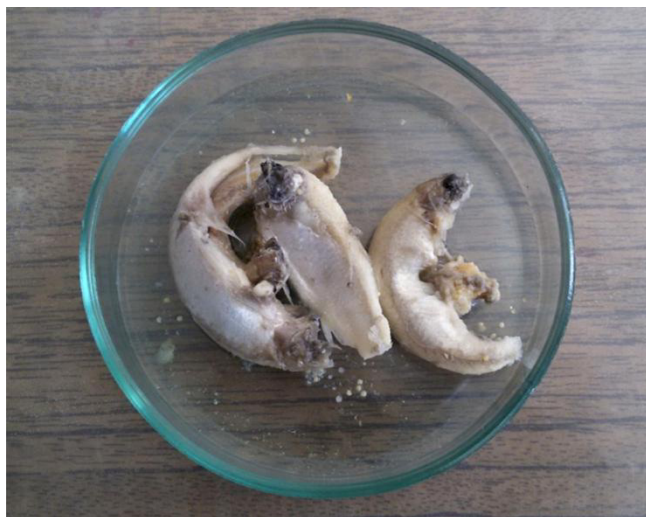
The average degree of obesity in the gastrointestinal tract is 4-5 points. The coefficient of fatness of pikeperch is relatively not high and averaged 1.31 according to Fulton, 1.21 according to Clark [5].

**Table 1 - Summary data on the analysis of food perch in Kigash River, in June-July from 2014 to 2018**

Summary data	2014г.	2015г.	2016г.	2017г.	Fore mouth	2018г.	Fore mouth
Amount of fish, specimen.	25	12	15	5	5	25	23
Amount of empty stomachs, %	48	17	73	100	40	60	65
Average length of fish, cm	39	50	45	43	41	48	45
Average weight of fish, g.	600	1650	1100	720	690	990	1050
Fulton's fatness ratio	1,29	1,30	1,60	1,29	1,25	1,29	1,31
Clark Nutrition Factor	1,09	1,11	1,41	1,23	1,19	1,22	1,21
The total mass of food ball, g	50,4	39,1	19,2	0	11,8	20,5	24,7
GI Filling Index, ‰	74,84	71,13	50,92	0	23,23	14,73	84,91
Digested food (indefinite taxonomy), %	98,5	16,6	3,7	0	2,5	8,7	37,8

It was impossible to estimate the range of food for pike perch according to the results of research in 2014. All food was digested. In 2015, crucian carp, roach, roach and bream became the main feeding sites for perch in the Kigash River; in the following 2016, the spectrum was reduced to two species: roach and bleak, with the latter species significantly exceeding the first in mass and frequency of occurrence (Figure 1).

Since 2017, pikeperch nutrition studies have been extended to the riverhead. Based on the results of the opening of the stomachs of the pikeperch seized in the premature, it can be concluded that the basis of its nutrition was the young of bream. But it was difficult to judge the frequency of occurrence of a particular food item, due to the small number of samples taken [6].



1



2

**Figure 1** - Young fish found in the stomachs of pikeperch  
(1 - bleak, 2 - bream, sabrefish, bullheads)

In 2018, a more thorough assessment of the food spectrum of the pikeperch was carried out. According to its results, in the summer months, the main food objects of the predatory fish studied were young bream, carp, sabrefish and bull-heads. The pikeperch caught in the river's mouth, fed on juvenile carp and sabrefish (Figure 2.3).

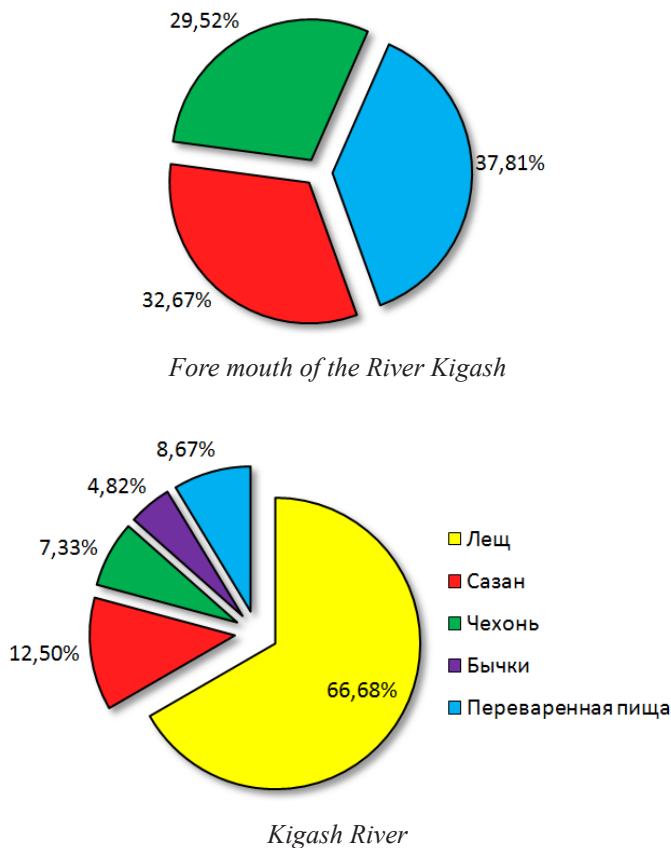


1



2

**Figure 2** - Young carp fish in the food bell of pikeperch (1 - chekhon, 2 - carp)



**Figure 3 - The composition of food in the stomachs of perch in 2018 (in% of the mass of food ball)**

Pikeperch nutritional studies covered fish age groups from 3 to 6 years. Judging on the food of the pikeperch population in r. Kigash on the degree of obesity of the gastrointestinal tract and indicators of the coefficient of fatness, which ranged from 1.25 to 1.60 in Fulton, 1.09 - 1.41 in Clark, then her condition can be considered satisfactory [7].

However, it is extremely difficult to judge the nutrition of the pikeperch population during the entire vegetation period, due to the small number of samples and the late period of their withdrawal. Pikeperch begins to feed in March at a water

temperature above 5 °C [8], and the removal of fish for nutritional analysis begins only in June, which undoubtedly reduces the reliability of the obtained research results. A large number of empty stomachs at the time of catch are, probably due to high water temperatures in the river, when the process of digesting food is very intensive. In addition, in the hot period of summer, in the afternoon the pike perch becomes sluggish and stops feeding.

The common pikeperch performs the functions of a medic in the river, destroying weed and diseased fish, thereby maintaining the health of populations of commercial species of peaceful fish. Since pikeperch has a narrow throat, narrow-bodied fish species most often become its victims: bleak, roach, roach, sabrefish [9].

In view of this, the presence of juvenile carp and bream in the stomachs of the studied fish became a curious fact. This phenomenon can be explained by the fact that the composition of food of a pikeperch is also associated with fluctuations in the number of its potential victims, their availability, the period and place of feeding. The pikeperch, as a rule, shows food plasticity, intensively consuming the most numerous representatives of small fish.

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鱼类胶原蛋白的使用特性和前景

**PROPERTIES AND PROSPECTS OF USE  
OF COLLAGENIC SUBSTANCES OF FISH ORIGIN**

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抽象。已經研究了這些條件，並且已經顯示了在醫用，化妝用途的分散體，膜和多孔材料形式的魚原料中使用膠原物質的前景。

結果表明，分散的膜和海綿可以通過在清洗後處理鱧魚皮而獲得，然後在有機酸的弱溶液中分散。膠原蛋白物質具有顯著的恢復活力，改善頭髮結構，有助於延長保質期並穩定食物質量。

關鍵詞：膠原蛋白，池塘魚，分散液，薄膜，海綿，醫藥，化妝品，食品。

**Abstract.** *The conditions have been studied and the prospects for the use of collagen substances in fish raw materials in the form of dispersions, membranes and porous materials for medical, cosmetic purposes have been shown.*

*It is shown that dispersed membranes and sponges can be obtained by processing the silver carp skins after cleaning, followed by dispersion in media of weak solutions of organic acids. Collagen substances exhibit a pronounced rejuvenating effect, improve the hair structure, contribute to an increase in shelf life and stabilize the quality of food.*

**Key words:** *collagen, pond fish, dispersions, films, sponges, medicine, cosmetic, food.*

Proteins are carriers of life, among them collagen, as the most common animal organisms in the world, are of particular importance. They account for about 1/3 of all proteins and almost 6% of body weight. In the body, they perform a significant list of functions, the main of which are deciphered and strengthened by a person

in maintaining health, youth, beauty and in practical activities in various sectors of the economy: medicine, veterinary medicine, agriculture, the production of various forms of nutrition, including functional and specialized purposes, technology gelatin, glue, etc [1,2,3].

The properties of collagen are unique, and the sources are varied. Collagen products from animal skins, namely from cattle hides, are the most popular products on the world market. Recently, information has emerged about the possibility of obtaining collagen proteins from fish skins [4].

In connection with the outlined growth in fish production in inland waters in Russia, there is considerable scientific and practical interest in studying collagen proteins from these sources, which is explained by the availability of raw materials, its low cost, safety, and the possibility of organizing production at fish production sites. Particular attention is attracted by the solubility of the resulting collagen substances due to the structural features of these proteins due to the hydrated forms of the molecules.

The object of the study was the skins of silver carp grown in ponds of the Voronezh region of Russia to a mass of 0.7 - 1.5 kg. In the process of processing fish for food purposes, the skins were removed after filleting, aftertreatment of the surface from the remnants of the scales, and the amount of adipose and muscle tissue. The resulting raw material was further processed for the purpose of deep degreasing. Collagen substances - dispersions of various consistencies (2–8%) were obtained after swelling, clarification and homogenization in accordance with the patented technology (RF Patent No. 2614273).

In the course of experimental studies carried out in accordance with the textbook of modern methods, it was found that 100 g of carp skins contain an average of 25.0 - 25.5 g of proteins, which are more than 90% represented by alkaline-soluble fraction (Table 1).

*Table 1 - Fractional composition of proteins of carp skins*

Raw material	Mass fraction of protein fractions,% by weight of protein		
	Water-soluble	Salt- soluble	Alkali-soluble
Silver carp	3.47	5.79	90.73

The high content of hydroxyproline (0.22 g per 100 g) in the protein composition of the sample under study indicates their collagen nature.

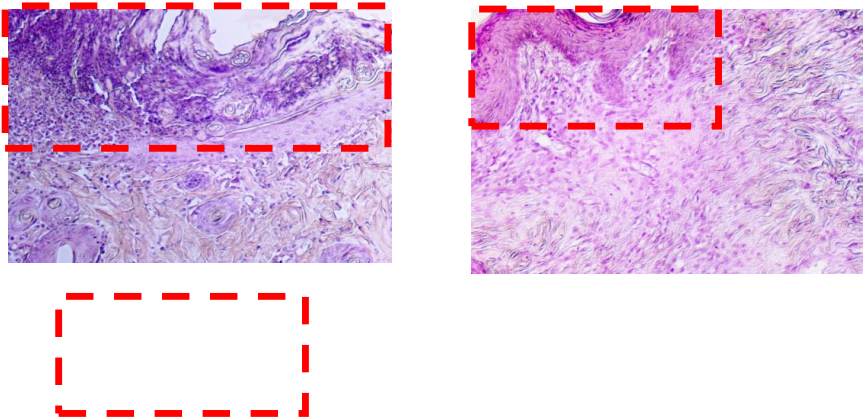
World experience shows the feasibility of obtaining collagen films for the cosmetic, medical and food industries. To do this, use the most purified substance, followed by dispersion. For cleaning use preparations with a known set of enzymes, as well as diluted solutions of organic acids. The expediency of applying the latter is associated with the transformation of the structure of collagen when the pH

of the medium shifts from the IEP and the corresponding increase in functional groups, which leads to the displacement of the dispersed phase relative to the dispersion medium and affects the rheological properties of dispersion systems.

In the course of experimental studies on the production of membrane from collagen dispersions, it was established that, according to their organoleptic and physicochemical properties, the obtained collagen membranes by spreading on a polyethylene substrate had different characteristics depending on the specific organic acid. In terms of preference, organic acids can be arranged in a descending order: acetic acid > succinic acid > grape acid > lactic acid. The obtained data are confirmed by X-ray phase analysis. When decoding radiographs, it was found that the intensity of the diffraction lines (the index of the crystalline phase of collagen) was maximum in the case of acetic acid. Collagen films have sufficient elasticity and strength, which allows them to be used as coatings, increasing the shelf life and preservation of food.

In studying the possibility of using collagen films and porous sponges for wound healing, using white rats as an example, I. A. Sychennikov's modified method was used under ether conditions in aseptic conditions on a hair shaved area after skin treatment with an antiseptic solution with a disposable medical scalpel the thigh was made a linear incision of the skin, fascia and muscles with a length of 1 cm. The area of wounds before the start of treatment in groups averaged  $26.0 \pm 0.5$  mm. The treatment was started immediately after modeling the early process by applying a membrane. The dynamics of the cupping of the wound process was assessed on the basis of a set of indicators: the general condition of the animals (closure rate of the defect, exudation, the presence of necrotic masses, the appearance of granulations, epithelialization, etc.); calculation of the area of the wound according to the method of L. N. Popova.

The results of histological studies are shown in Figure 1. The material was fixed in 10% neutral formalin solution, 6 mic thick paraffin sections were prepared and stained with hematoxylin - eosin, microscopy was performed under a light microscope by cross-radiation of several fields of view using the image analysis system Leica Qwin Standart v 2.6 (Leica, Germany) equipped with a digital camera, using Leica Q 550w software.



**Figure 1** - A) Formed epidermis in the regenerate zone. 2 control group.  
11 days Stained with hematoxylin and eosin. Increase x280. -  
B) - Formed epidermis in the regenerate zone. 2 control group.  
11 days Stained with hematoxylin and eosin. Increase x280

Additionally, we studied the activity of the marker of transendothelial transfer - alkaline phosphatase, and also conducted toxicological studies and studies on allergenicity using current methods. It has been established that collagen membranes are not toxic, do not cause allergic reactions, convincing results are obtained, indicating acceleration of reparative processes in soft tissues under the action of collagen materials of fish origin, especially expressed in the first phase of the early process.

In the development of forms of collagen substances, the conditions for obtaining porous materials — sponges for medical purposes, cosmetic and hygienic means — have been determined. At the same time, the spongy materials were obtained by drying a 2% dispersion of fish collagen by sublimation or by lyophilization. It has been shown that collagen porous materials have an intensive absorption of moisture (1 g holds 30 - 35 g of water) and additionally exhibit a deodorizing effect due to the many different functional groups in the specific protein molecule - the chemical basis of the porous material.

Positive results were obtained when testing collagen dispersions and fish raw materials in shampoos, as rejuvenating masks. Respondents of different ages and experts noted good skin hydration, wrinkle smoothing. At the same time, they stated the absence of allergic reactions, the absence of any damaging effects, the absence of unpleasant odors and sensations.

Thus, fish collagen proteins have a real possibility of wide use for the production of materials for various purposes with environmental advantages in comparison with analogues from terrestrial animals.

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根据三维数据, 巴伦支海陆架上Cenomanian复合体上方的地质构造和油气潜力特征

**CHARACTERISTICS OF THE GEOLOGICAL STRUCTURE AND OIL  
AND GAS POTENTIAL ABOVE CENOMANIAN COMPLEX  
IN THE BARENTS SEA SHELF ACCORDING TO 3D DATA**

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The area of research covers the East Barents Oil and Gas Province (OGP) of the Barents Sea, within which we evaluated the petroleum potential of the underlying complexes earlier [1, 2, 3, etc.].

The Upper Cretaceous-Quaternary (above-Cenomanian) sediment complex, which unconformably lies on the rocks of the Apt-Alb-Cenomanian complex, has been opened by 15 exploratory wells and is characterized by a ubiquitous distribution over the research area.

The productivity of the complex was established in the Norwegian sector of the Barents Sea, where, as a result of drilling a 7316/5-1 well, on the southwestern margin of the Stappen lift, a relatively small gas field was found, confined to Cenozoic sandstones.

Within the study area, in the interval of loose Neogene-Quaternary sediments, in which as a result of vertical migration of hydrocarbons (HC) by disjunctive disturbances, bottom gas deposits can form.

Based on the results of 2D and 3D seismic exploration and well drilling data, it was established that the above-Cenomanian section interval is clearly divided into two parts.



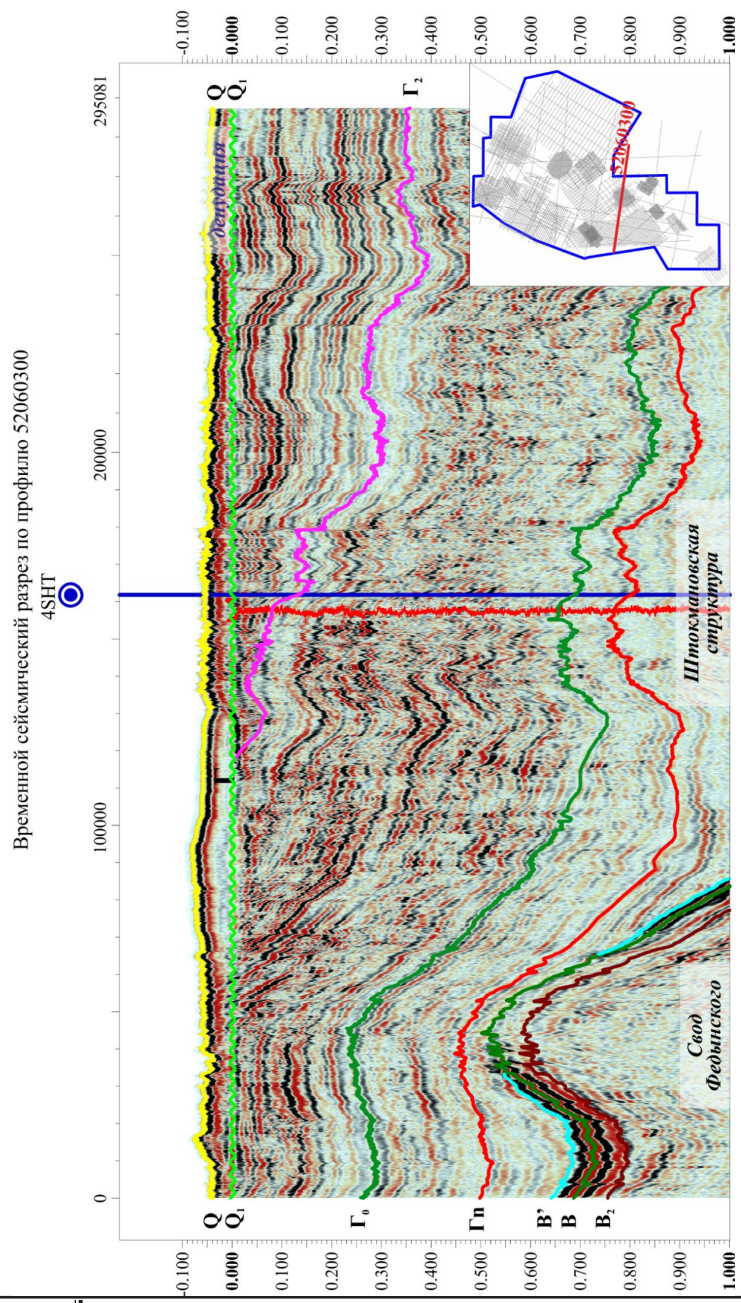


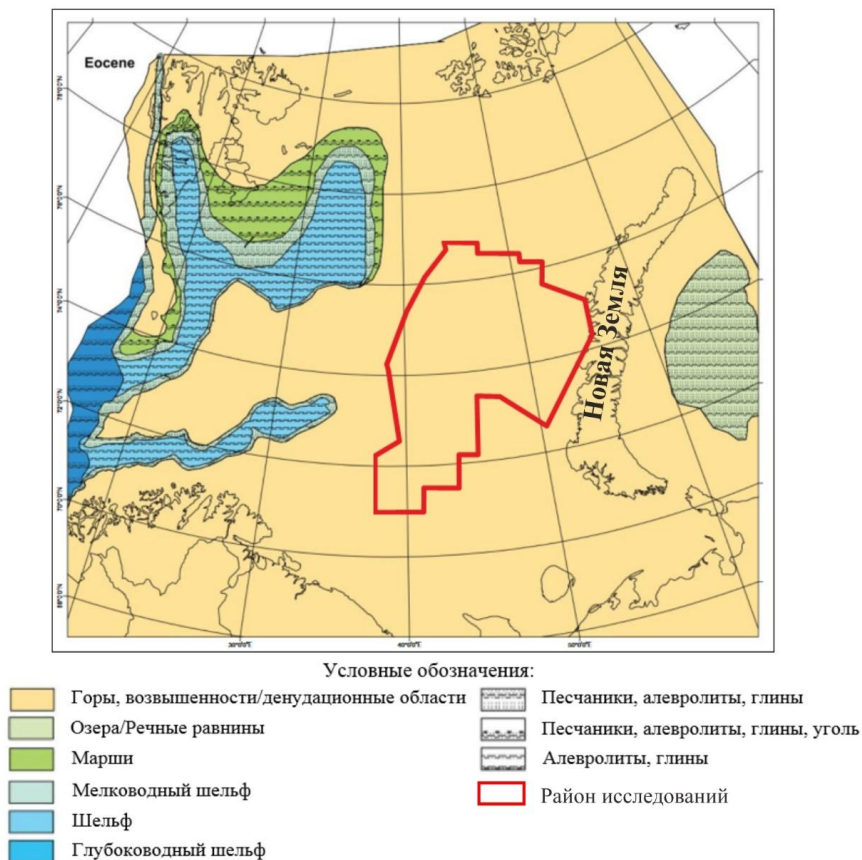
Fig. 1 Characteristics of the structure of the Upper Cretaceous-Quaternary complex (RH  $\Gamma_2$ -Q)



The lower part, bounded by reflecting horizons (RH) of T2-Q1 (Fig. 1), identified with undifferentiated strata of Upper Cretaceous sediments, is characterized mainly by clayey composition with rare thin layers of aleurolite and sandstone. On temporary seismic sections (TSS), the stratum is represented by a series of extended reflected waves (RW) of varying intensity and in the roofing part is controlled by the surface of a regional stratigraphic disagreement (RH Q1) (see fig. 1). The upper part of the above-Cenomanian complex (RH Q1-Q) is represented by Cenozoic, mainly clayey sediments with a significant admixture of gravel and pebbles.

Paleogeographic reconstructions of the formation of the complex in the area of research have not been carried out, due to the complete absence of Late Cretaceous sediments in the frame of the East Barents Megapolib, partly within it, and commonly, rocks of Paleogene age. According to a number of researchers, the formation of Upper Cretaceous sediments took place in shallow-sea environments.

At the end of the Late Cretaceous, the territory of the Barents Sea shelf experienced a sharp rise (uplift) due to the beginning of the discovery of the Norwegian-Greenland and Eurasian ocean basins [4]. In the Paleocene and Eocene epochs, the eastern part of the present-day water area was drained and represented the area of detrital material demolition in the marine paleobasin, located in the west of the Svalbard Plate (Fig. 2).



**Fig. 2** Formation-paleogeographic scheme for the Eocene Paleogene epoch  
(Atlas-Geological history of the Barents Sea)

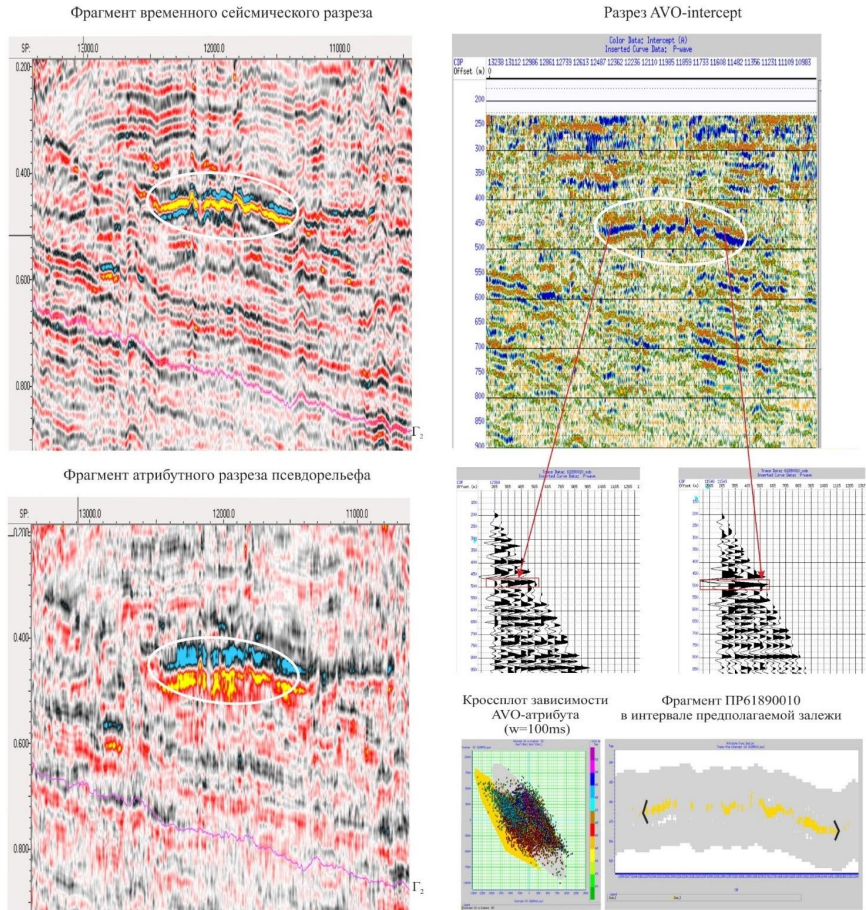
At the end of the Oligocene, in connection with the tectono-eustatic fall of the level of the World Ocean and the general rise of the Arctic shelves, the sea retreated to the limits of the located continental slopes. During this period, the surface of the peneplain, formed mainly in subaerial conditions, is subjected to intensive dismemberment with the latest block movements and the erosion activity of the rivers. The lake-alluvial plain in the area of the modern shelf was bordered by erosion-accumulative coastal lowlands in the area of the South Barents Basin [6]. The Neogene stage of development of the Barents Sea shelf is characterized by the repeated activation of tectonic spreading processes leading to the displacement of

the boundaries of the marine paleobasin. The rise of the territory in the Pliocene-Pleistocene was accompanied by deep glacial erosion of the shelf areas and the formation of powerful rolling grabs in the west and north of the region (Leonchik et al., 2015). Thus, tectonic activity throughout the Cenozoic period and large-scale erosion during glaciations had a significant influence on the formation of the hydrocarbon potential of the Barents Sea water area.

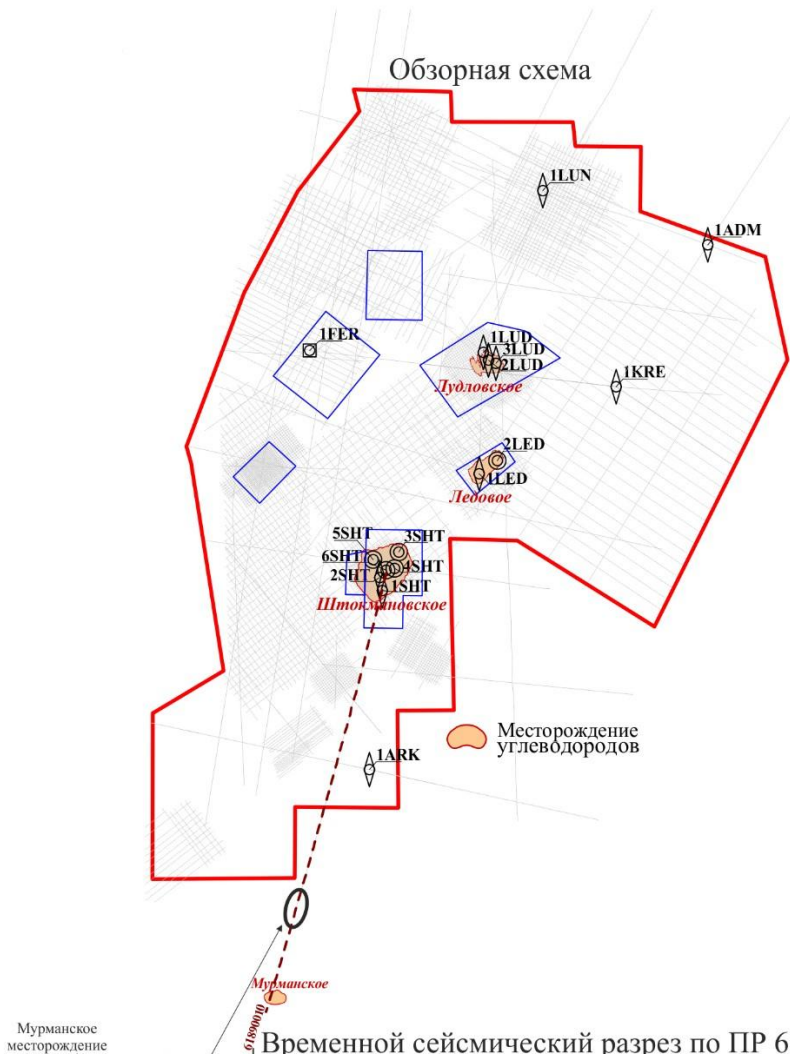
According to the results of regional and site seismic surveys of past years (Smirnov et al., 2017), the above-Cenomanian sediment complex revealed numerous, relatively small seismic recording anomalies (SRA) of the “bright spot” type, which are characterized by gas saturation according to AVO-studies. The identified anomalies, as a rule, are confined to tectonic disturbances and are located both above the hydrocarbon deposits and above the identified promising objects. Based on the analysis of the available data, an assumption was made that they are associated with local gas “pockets” formed as a result of vertical migration of hydrocarbons [7] and their subsequent concentration in the zone of distribution of local fluid-impermeable materials. In the absence of the latter, pockmarks [2, 3, 5] were formed on the seabed, followed by the release of gas into the marine basin.

It should be noted that a potentially promising zone, characterized by elevated amplitudes and pseudo-relief, confirmed by positive results of AVO analysis (Fig. 3), was recorded slightly south of the research area (profile 61890010) in the interval of Upper Cretaceous sediments.

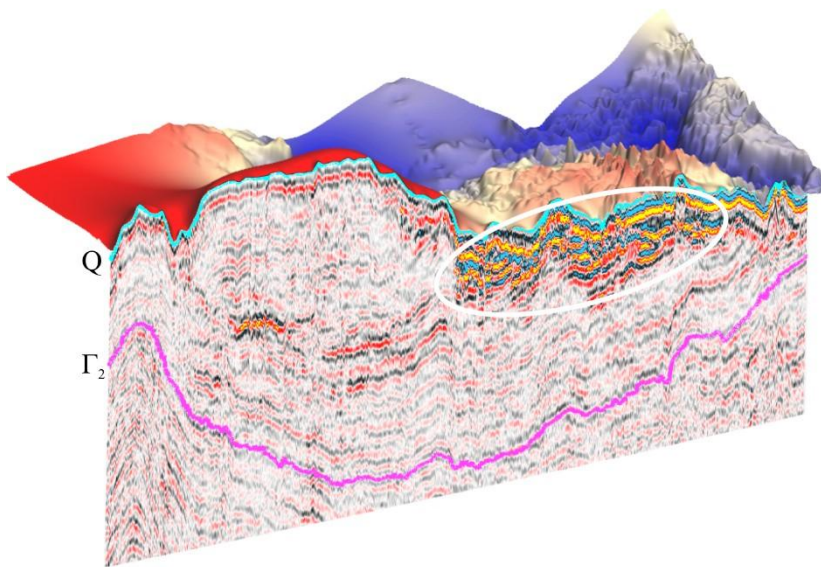
The largest promising stratigraphically shielded region in the bottom part of the sea was found south of the Shtokman field (Fig. 4). At TSS, it manifests itself as a “bright spot” type SRA and is controlled by elevated energy values in the attribute section (Fig. 5).



**Fig. 3** Promising object in the above-Cenomanian sediment complex. ПР61890010

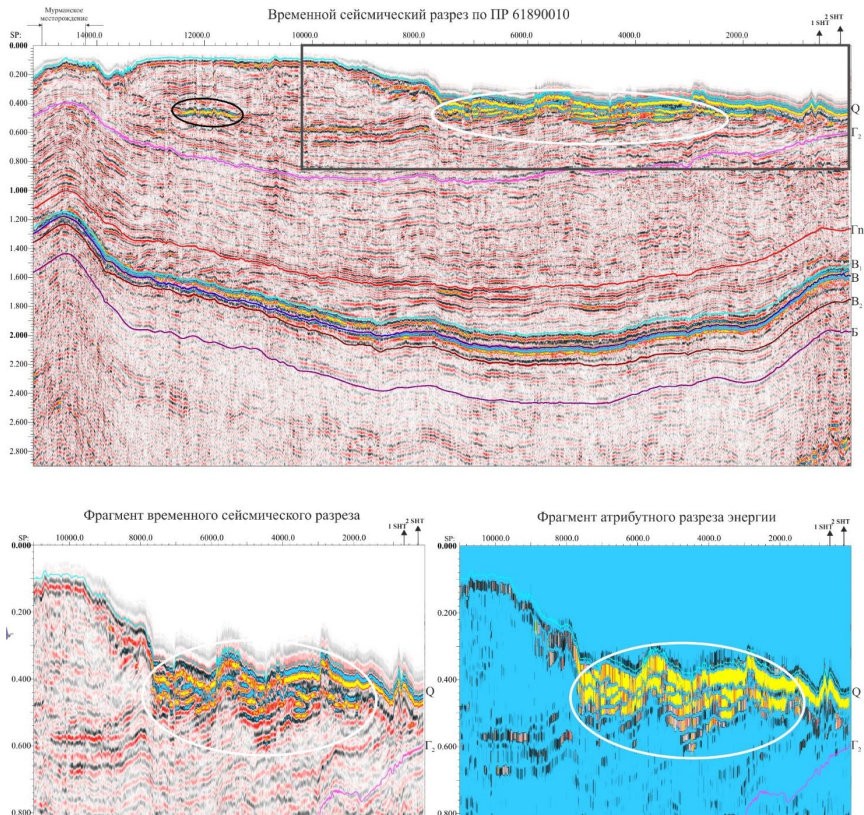


Аксонметрическое отображение перспективной ловушки



*Fig. 4 Promising object in the complex south of the Shtokman field*





**Fig. 5** Promising object in the bottom part of the water area. ПР61890010

In general, it should be noted that all the identified gas-perspective objects in the above-Cenomanian sedimentary complex are controlled by tectonically fragmented zones, along which, apparently, migration of hydrocarbons from the underlying horizons occurred.



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对高加索俄罗斯部分自然综合体“关岛峡谷”的评估，作为国际旅游发展的对象

**SOZOLOGICAL ASSESSMENT OF THE NATURAL COMPLEX  
"GUAM GORGE" IN THE RUSSIAN PART OF THE CAUCASUS AS AN  
OBJECT FOR THE DEVELOPMENT OF INTERNATIONAL TOURISM**

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抽象。提供有關自然複合體“關島峽谷”的物理學意義的信息。關島峽谷具有很高的保護地位，可以保護生物多樣性。迄今為止，在俄羅斯和該地區受保護的自然綜合體領土上登記了29種。在自然複合體的領土上有許多罕見的地質自然物。關島峽谷是高加索山脈北部宏觀山谷上Colchian植物群的一個驚人的避難所。關島峽谷是高加索山脈北部宏觀山谷上的Colchian植物群的避難所。該地區科學的古生物學意義重大，可以重建石器時代的自然景觀，尤其是舊石器時代中期洞穴附近的動物世界。自然複合體“關島峽谷”對於俄羅斯和國際旅遊業的發展來說是一個有趣的罕見。

關鍵詞：俄羅斯高加索，自然複合體，關島峽谷，稀有物種，洞穴，森林意義，旅遊

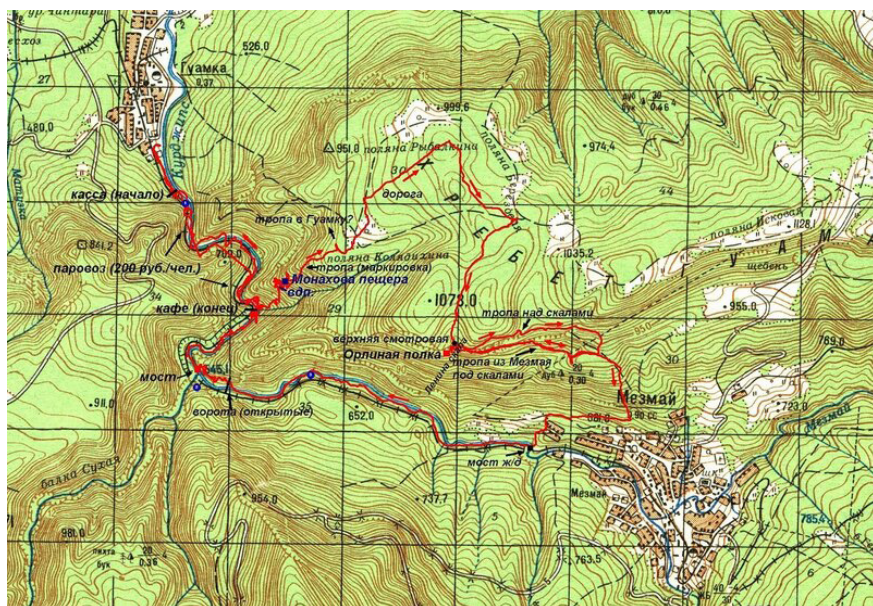
**Abstract.** *Information about the sozological significance of the natural complex "Guam Gorge" is provided. The Guam Gorge has a high conservation status to conserve the calcephilic biodiversity. To date, 29 species have been registered on the territory of the natural complex to be protected in Russia and the region. On the territory of the natural complex there are a number of rare geological natural objects. The Guam Gorge is an amazing refugium of the Colchian flora on the northern macroslope of the Caucasus Mountains. he Guam Gorge is a refugium of the Colchian flora on the northern macroslope of the Caucasus Mountains. The scientific paleontological significance of the territory is great, which allowed reconstructing the natural landscapes of the Stone Age, especially the animal world in the vicinity of the cave in the middle Paleolithic. The natural complex "Guam Gorge" is an interesting rarity for the development of not only Russian, but also international tourism.*

**Keywords:** *Russian Caucasus, natural complex, Guam Gorge, rare species, caves, sozological significance, tourism*

The Guam Gorge is a landscape natural monument of regional significance.

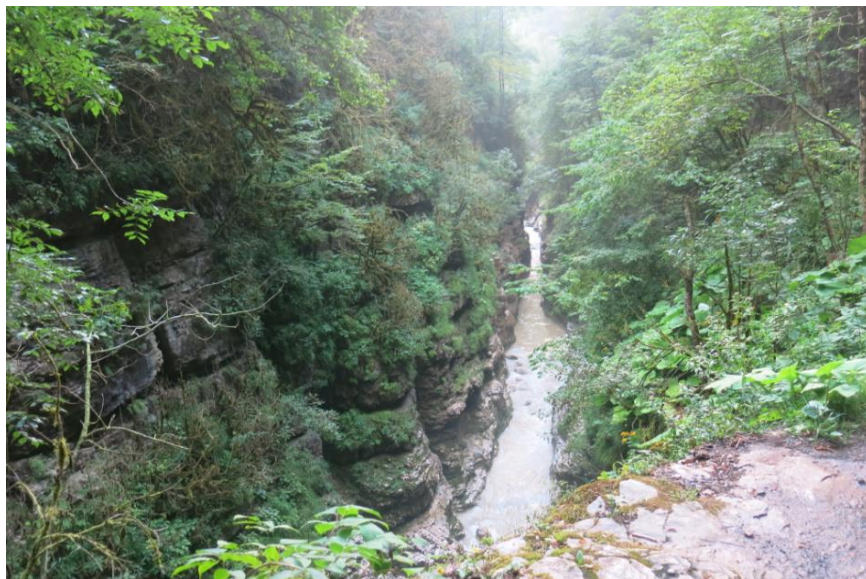
Geographically, the Guam Gorge is located in the northern part of the Lagonaki Plateau, in the section of the Kurdzhips River valley, cut between the Lagonaki and Guam ranges near the rural settlement of Mezmay and Guamka (Fig. 1).

The length of the gorge along the Kurdzhips river bed - 3 km, width in some places does not exceed 2 m; the depth of the gorge is 400 m. The Kurdzhips River within the gorge falls by 95 m (in terms of the slope - 31.67%). The gorge is developed in a thick layer of limestone and dolomites of the Upper Jurassic and Lower Cretaceous (Fig. 2). Tectonic fracturing in the gorge contributes to the formation of large bends [Litvinskaya, Lozovoy, 2005]. Average water consumption is from 2.46 m<sup>3</sup> / s in December to 20.3 m<sup>3</sup> / s in April.



**Figure 1 - The position of the natural complex on a geographical map**

The landscape type is medium mountain karst and erosion-tectonic with beech, beech-oak and hornbeam-oak forests on mountain-forest brown and humus-carbonate soils. The required area to preserve the natural complex “Guam Gorge” is about 2,230 hectares.



**Figure 2 - General view of the Guam Gorge, Kurdzhips River**

The natural landscape uniqueness for Russia is typical of the Guam Gorge natural complex. Taking into account the significance and uniqueness of this territory for the formation of the Pan-European Ecological Network as a potential area of special conservation value in the Western Caucasus, the Guamskaya SCLC was proposed [Litvinskaya, 2013]. Habitats of European significance were identified here: G1.6 *Fagus* woodland / Beech forests [Orlov, 1953]; G3.17 Balcano-Pontic *Abies* forest / Balkan-Pontic spruce forests. *Abies nordmanniana* forests mixed with beech (Bebia, 2002); H1. Terrestrial underground caves, cave systems, passages and water bodies / Caves, cave systems, tunnels, underground water bodies [Litvinskaya Lozovoy, 2005].

The Guam Gorge has a high conservation status in order to preserve the calcinophilic biological diversity, including rare, endangered and economically and scientifically valuable objects of flora and fauna and their habitat. On the territory of the natural complex there are a number of rare geological natural objects: Monash'ya Cave, Ar-Ed Cave, Musical Grotto, Matuzka Grotto - Ancient Man's Parking, panoramic rocky protrusions at tectonic fault areas: Eagle Regiment, Kovrik, Mezmaystone, Pyramid, Rybalkina Polyana. Of the range of hydrological objects, one should mention the Sukhaya Balka waterfalls and the Maiden Spit. The grotto "Musical" is famous for rich exits of calcite. The peculiarity of the structure of the grotto causes



in it a special acoustics, why it got its name. From the caves, the unique object is the Matuzka Cave, located on the northern edge of the Lagonaki Plateau, 27 km from the station. Guamskaya Apsheron district at a height of 720 m above sea level. The Matuzka River is a narrow canyon with steep, steep slopes and waterfalls. A cave and a grotto are situated in the right side of the canyon. The relative height of the cave is estimated at 80 m. The cave cavity is 35 m wide, 40 m deep and 20 m high at the entrance. The riverbed near the cave is practically impassable, since a series of waterfalls form vertical ledges up to 10 meters or more. Matuzka Cave was originally taller and three-tiered. Cave Matuzka known anthropogenic sediments.

The territory is characterized by a considerable thickness of rocks amenable to karsting (dissolution). At all levels of the gorge, karst relief forms are common: sheer cliffs with cracks, craters, dips, caves, grottoes, and punishments.

The Guam Gorge natural complex is an amazing refugium of the Colchian flora on the northern macroslope of the Caucasus Mountains. Due to the specific microclimate, the slopes of the gorge are covered with clear boxwood forest. The unique forest communities of the Guam Gorge natural complex are the beech-fir forest with the second tier of evergreen *Buxus colchica* Pojark., The beech forest with *Ruscus colchicus* P. F. Yeo. The territory of the natural complex "Guam Gorge" is characterized by an abundance of diverse landscapes and ecotopes, the presence of calciphilic substrates, and a wide range of high-altitude zones, which contributes to the growth of rare species. In different communities, the presence of a significant number of rare species, endemic and species that are at the extreme limit of the range, is noted. On the dolomite outcrops, the largest population of the rare woods fern *Woodsia fragilis* (Trev.) T. Moore is represented; on the rocky outcrops grow *Campanula pendula* M. Bieb., Rare Caucasian endemics *Silene pygmaea* Adams and *Scrophularia lateriflora* Trautv. Located on the border of the range. On the slopes and summits grow beech, beech-boxwood, beech-oak, pine communities with relict species *Buxus colchica*, *Ruscus colchicus* P. F. Yeo., *Staphylea colchica*, *Ilex colchica*, *Daphne pontica* L., West Caucasian endemic *D. pseudoserice* Pobed.

The Guam Gorge is unique as an integral natural complex, a refugium of Colchian flora and vegetation on the northern macroslope of the Western Caucasus. An indicator of the zoological significance of the territory is the presence of rare species that are subject to protection at the level of Europe, the Russian Federation and the regions. European species include fauna: brown bear (*Ursus arctos*), lynx (*Lynx lynx*), wolf (*Canis lupus*), Triton Karelin (*Triturus karelinii*), eagle-dwarf (*Hieraetus pennatus*), Gyps fulvus (*Gyps fulvus*), peregrine (*Falco peregrinus*), large horseshoe (*Rhinolophus ferrumequinum*), small horseshoe (*Rhinolophus hipposideros*), Hungarian ground beetle (*Carabus hungaricus*), Hera bear (*Callimorpha quadripunctaria*); of flora: rhododendron yellow (*azalea*) (*Rhododendron luteum*), Caucasian blueberries (*Vaccinium arctostaphylos*).

At present, there are about 30 species registered in the natural complex in Russia and the region (the Red Book of the Russian Federation [2008] and the Krasnodar Territory [2017]. Of the species listed in the Red Book of the Russian Federation, they are marked from the floristic component: *Anacamptis pyramidalis*, orchards (*Orchis tridentata*, *Orchis mascula*, *Orchis purpurea*), pollen head of length leafy (*Cephalanthera longifolia*), red polzhegolovnik (*Cephalanthera rubra*), Colchian boxwood (*Buxus colchica*), yew berry (*Taxus baccata*), *Cyclamen coum* Mill. subs. *caucasica*, Caucasian peony (*Paeonia caucasica*); *Usnea* blooming (*Usnea florida*). From the faunistic complex there is a large horseshoe (*Rotholophus ferrumequinum*), a small horseshoe (*Rhinolophus hipposideros*), a viper of Dinnik (*Pelias dinniki*), the Triton of Karelin (*Triturus karelinii*), Vulture (*Gyps fulvus*), peregrine falcon (*Falco peregrinus*), deer beetle (*Lucanus cervus*), large-oak barbel (*Cerambyx cerdo*), Mnemosyne (Apollon black) (*Parnassius Mnemosyne*), Hungarian Carabus (*Carabus hungaricus*).

The species listed in the Red Book of Krasnodar Region [2017] are abundantly represented. Of flora, it is *Campanula pendula*, double-leaved Lyubka (*Platanthera bifolia*), green-colored Lyubka (*Platanthera chlorantha*), volcheyagodniki (*Daphne albowiana*, *Daphne circassica*), Wood Anemone (*Anemone sylvestris*), fine saffron (*Crocus speciosus*), thin swordfish (*Gladiolus tenuis*), orchards (*Orchis purpurea*, *Orchis militaris*, *Orchis mascula*), from lichens: pulmonary lobar, blooming (*Usnea florida*), Burnet's leptohium (*Leptogium burnetiae*). The rare fauna is represented by: Caucasian lynx (*Lynx lynx dinniki*), Caucasian forest cat (*Felis silvestris daemon caucasica*), large horseshoe (*Rhinolophus ferrumequinum*), small horseshoe (*Rhinolophus hipposideros*), Tareon Karelin (*Triturus karelinii*), Triton Lanza (*Triturus vulgaris lantzi*), Colchian toad (*Bufo verrucosissimus*), Caucasian cross (*Pelodytes caucasicus*), Asian frog (*Rana macrocnemis*), already Colchian (*Natrix megalcephala*); big-oak barbel (*Cerambyx cerdo*), mnemosin (Apollon black) (*Parnassius Mnemosyne*), beetle-ole ordinary (*Lucanus cervus*), Hungarian carabus (*Carabus hungaricus*), Kalyuzhny carabus (*Carabus Kaljuznyi*).

The natural complex is important in faunistic terms. In areas of active karst development, populations of rare and relict insect species are often noted. The territory of the natural complex plays an important role in the migration of ungulates and predators. Here is the reproduction of a number of hunting animals. The growth of such a number of rare species to be protected at the level of the Russian Federation and the Western Caucasus is an indicator of high conservation value.

The territory of the natural complex "Guam Gorge" is important for the conservation of biological diversity, including rare, endangered and economically and scientifically valuable objects of flora and fauna and their habitat. The natural landscape of the gorge represents a special aesthetic, scientific and cultural value.

Within the gorge there are geological, biotic, hydrological and paleontological objects of special scientific, cultural and aesthetic value. On the river Kurdzhips deposits of blue clay are concentrated, the healing activity of which is widely known and due to its rich chemical composition.

Guam Gorge has a scientific (study of the geological structure, modern exogenous processes, Quaternary sediments, karst processes and relief forms, biological diversity, the genesis of the formation of the organic world), paleontological (study of the Paleolithic, the cave sites Matuzka and Mezmaiskaya, as well as a series of small locations belonging to different periods of the Stone Age), ethnographic, historical, cultural, educational, educational informative, aesthetic values.

The scientific paleontological significance of the territory is great, which allowed reconstructing the natural landscapes of the Stone Age, especially the animal world in the vicinity of the cave in the middle Paleolithic. For the first time for the North-Western Caucasus, a comparative characteristic of flora, paleo-vegetation and paleoclimate was obtained for 6 Late Pleistocene thermometers and 7 cryometers, characterized in one section, which has a reference value for the entire Caucasus. Different variants of human habitation in the Matuzka cave are highlighted. Zooarchaeological and archaeological observations provide an opportunity to discuss environmental management in the Middle Paleolithic, hunting strategies and specialization.

The abundance of unique natural geological, paleontological, biological objects concentrating on such a small area indicates that the Guam Gorge natural complex is an interesting rarity for the development of not only Russian, but also international tourism.



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中西伯利亚多年的纬向气候变化

## MULTI-YEAR ZONAL CLIMATE CHANGE OF MIDDLE SIBERIA

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註解。本文分析了森林 – 苔原, 針葉林, 森林 – 草原和中西伯利亞草原氣候的時空動態。結果表明, 研究區年平均氣溫和年平均降水量的增加速度比俄羅斯聯邦境內的平均氣溫增長速度快。

關鍵詞: 氣候, 年平均氣溫, 年平均降水量, 趨勢, 數學模型, 氣候變化預測。

**Annotation.** *The article analyzes the spatial and temporal dynamics of the climate of the forest-tundra, taiga, forest-steppe and steppe of Central Siberia. It is shown that the increase in average annual air temperature and average annual precipitation in the study area is proceeding at a faster rate than the average throughout the territory of the Russian Federation.*

**Key words:** *climate, average annual temperature, average annual precipitation, trend, mathematical model, climate change forecast.*

In recent decades, a significant change in the global climate has been observed on a global scale [1-3]. The question of the causes of modern climate warming requires studying [4-6, 8-10]. According to the assessment report on climate change and its consequences on the territory of the Russian Federation, the average annual precipitation for the whole territory increased at a rate of + 0.72 mm / year [11].

The vast territory of the Russian Federation is characterized by significant natural-caused differences in the climate, which is one of the most important factors determining the conditions of the socio-economic development of regions [7, 11-15].

The aim of the study was to identify the long-term dynamics of climatic indicators for forest-tundra, taiga, forest-steppe and steppe zones of Central Siberia.

Along with the fact that the forest-tundra and taiga zone within Central Siberia has a latitudinal strike, a regional feature of the southern part of the region is the insular nature of the spread of forest-steppe and steppe landscapes. This feature is due to the presence of piedmont troughs and intermountain depressions [16], which in turn contributes to the formation of contrasting climatic conditions within natural zones.

The long-term data of mean monthly and average annual air temperature and precipitation by the meteorological station of the natural areas studied are grouped into periods: 1) 1917–2016, 2) 1917–1970, 3) 1971–2016. The boundary between the first and second period was adopted in 1971, due to the fact that according to some data from the beginning of the 1970s the climate change is most pronounced [17].

Patterns of spatial and temporal changes in climatic indicators were studied using mathematical statistics methods: the norm and variability of statistical series were evaluated, the correlation method and trend analysis were used. The significance of trends was established by the magnitude of the coefficient of determination ( $R^2$ ), showing the contribution of the linear trend to the total variability of the variable under study. A trend was considered significant if the confidence level was equal to or exceeded 95% ( $p \pm 0.95$ ). With a sample size of 50 years and more, this corresponds to a value of  $R^2 = 0.08$ , with a sample size of 100 years -  $R^2 = 0.04$ .

According to the results of climate change studies, in general, in the territory of natural zones within Central Siberia for the period from 1917 to 1970, a decrease in air temperature by  $1.02^\circ\text{C}$  was detected, with a trend of  $0.0122^\circ\text{C}/\text{year}$  and the amount of precipitation increased by 100 mm with a trend of  $+1.8791\text{ mm}/\text{year}$ , which suggests a significant increase in the wetting of the territory. For the period from 1971 to 2016 the average annual air temperature increased by an average of  $1.71^\circ\text{C}$  in all natural zones, with the most significant warming of  $1.80^\circ\text{C}$ , with a trend of  $+0.0400^\circ\text{C}/\text{year}$  observed in the forest tundra. Changes in the average annual precipitation for the whole territory of Central Siberia are illustrated by a significant increase in moisture by 46 mm with a trend of  $+1.0275\text{ mm}/\text{year}$ .

Analysis of the change in average annual air temperature over the entire one hundred year period showed that warming occurs more rapidly within the steppe and forest-steppe than in the forest tundra and taiga (Fig. A – D). Generalized graphs of the change in average annual air temperature for the entire region reflect its increase by  $1.44^\circ\text{C}$  (from  $-4.77$  to  $-3.34^\circ\text{C}$ ) with a trend of  $+0.0145^\circ\text{C}/\text{year}$  (Fig. E).

An analysis of the data for the entire a hundred year period for the zones of Central Siberia allows us to make a conclusion about a significant increase in the average annual precipitation in the forest tundra and taiga (Fig. F – I). In general, over a hundred-year period within the study area, the trend of average annual precipitation was  $+ 0.83 \text{ mm / year}$  with an increase in precipitation by 82.4 mm, from 389.5 to 471.9 mm (Fig. J).

Analysis of climate data from the period from 1917 to 2016 in the zonal-regional aspect showed that the climate of the territory of Central Siberia is subject to a fixed reliable dynamics both in time and in space. Zonal trends are different and do not coincide with the general regional trend. For the period from 1917 to 1970 the average annual air temperature decreased in the forest-tundra and taiga and increased in the forest-steppe and steppe, with a generally negative regional trend. During the same period, the average annual rainfall increased in all natural zones, with the exception of the steppe. For the period from 1971 to 2016 there is a rise in temperature in all natural zones and in the region as a whole and a significant increase in precipitation. At the same time, a significant increase in moisture in the forest-steppe zone was not recorded.

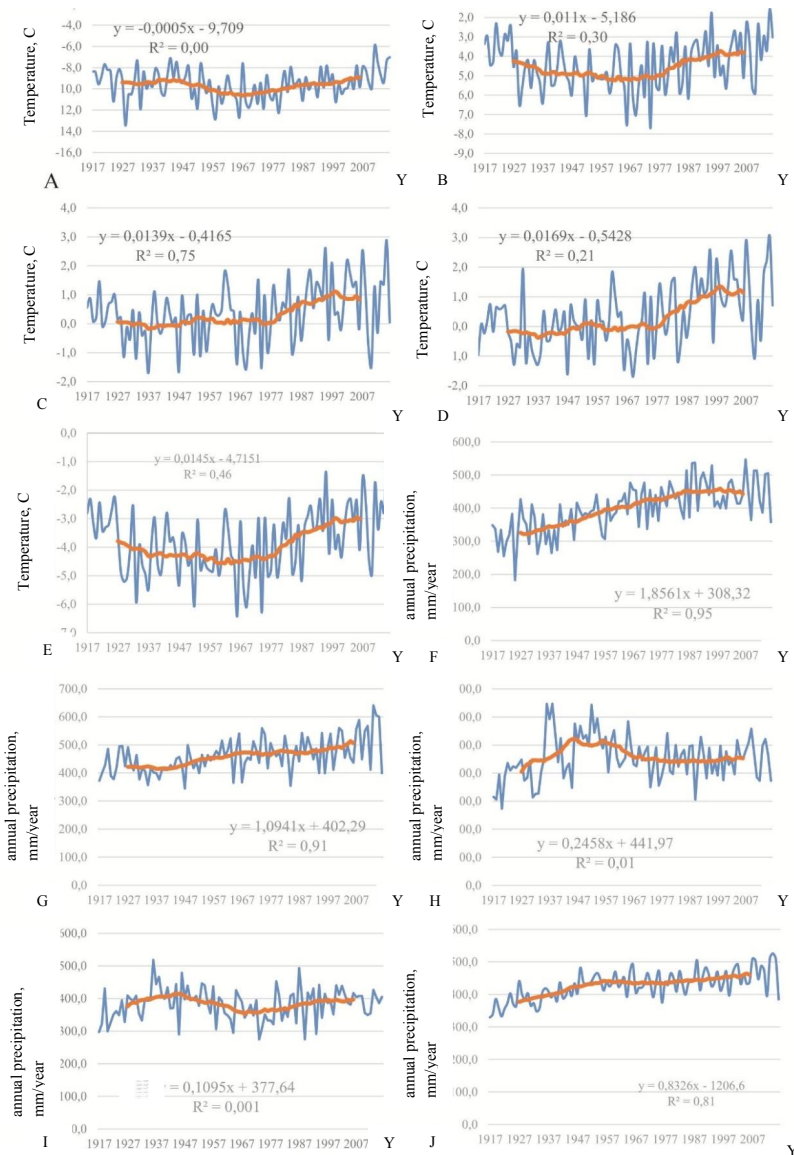
In general, for the period from 1917 to 2016 there was an increase in average annual air temperature by  $1.44^\circ \text{C}$  with a trend equal to  $+ 0.0145^\circ \text{C / year}$ . There was also an increase in the average annual precipitation of 82.4 mm with a trend of  $+ 0.83 \text{ mm / year}$ . Changes in these climatic parameters in Central Siberia are proceeding at a faster rate than the average for the entire territory of the Russian Federation.

An analysis of the mathematical models performed allows predicting in Central Siberia an increase in average annual air temperature by  $0.49^\circ \text{C}$  (up to  $-2.85^\circ \text{C}$ ) and an increase in the annual total precipitation by 28.3 mm (up to 500.2 mm) by 2050. This will probably lead to the transformation of forest-tundra, taiga, forest-steppe, steppe landscapes and changes in their boundaries.

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**Fig.** Changes in average annual air temperature (A - forest-tundra; B - taiga; C - forest-steppe; G - steppe; D - Central Siberia in general) and average annual precipitation (A - forest-tundra; B - taiga; B - forest-steppe; G - steppe; D - Central Siberia in general)

考虑诺里尔斯克地块岩石圈环境非线性构造要素

## CONSIDERATION OF ELEMENTS OF NONLINEAR TECTONICS OF THE LITHOSPHERIC CIRCLE OF THE NORILSK GEOBLOK

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注解。工作的相關性是由於需要對礦區的結構和構造特徵進行綜合研究，這是開發系統選擇所需的初始材料，挖掘山壓的管理方式和參數。在對非線性構造領域的科學信息進行分析的基礎上，對諾里爾斯克地質岩石圈岩體的結構和等級創造規律進行了總體規劃，並在礦區水平上發現了規律。試圖在假設水平上解釋從旋轉模型的位置形成諾里爾斯克地塊的地球動力學過程。

關鍵詞：諾里爾斯克地質塊，硫化礦田，技術，旋轉模型，環結構。

**Annotation.** *The relevance of work is caused by need of comprehensive study of structural and tectonic features of ore fields which are the initial materials necessary at the choice of systems of development, ways and parameters of management of mountain pressure in excavations. On the basis of the analysis of natural-science information in the field of nonlinear tectonics regularities of structural and hierarchical creation of objects of a lithosphere of the Norilsk geoblock as in general, and at the level of ore fields come to light. An attempt at the level of a hypothesis to explain the geodynamic processes forming the Norilsk geoblock from positions of rotational model is made.*

**Key words:** *Norilsk geoblock, fields of sulphidic ores, techtonics, rotational model, ring structures.*

Silt. – 6.

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The signs indicating the possibility of the nonlinear structure of the lithospheric medium of the Norilsk geoblock are based on the analysis of natural science



information in the field of nonlinear tectonics [Vikulin, 2013, 2016; Krivitsky, 2016 Mirlin, Oganesyanyan, 2015; Sadovsky, Pisarenko, 1989; Vikukin A.V.; Sherman, 2015].

In regional content, the territory of the Norilsk region is located at the joint of the young West-Siberian plate and the Siberian platform, in the zone of its regional structures with the Baikal base.

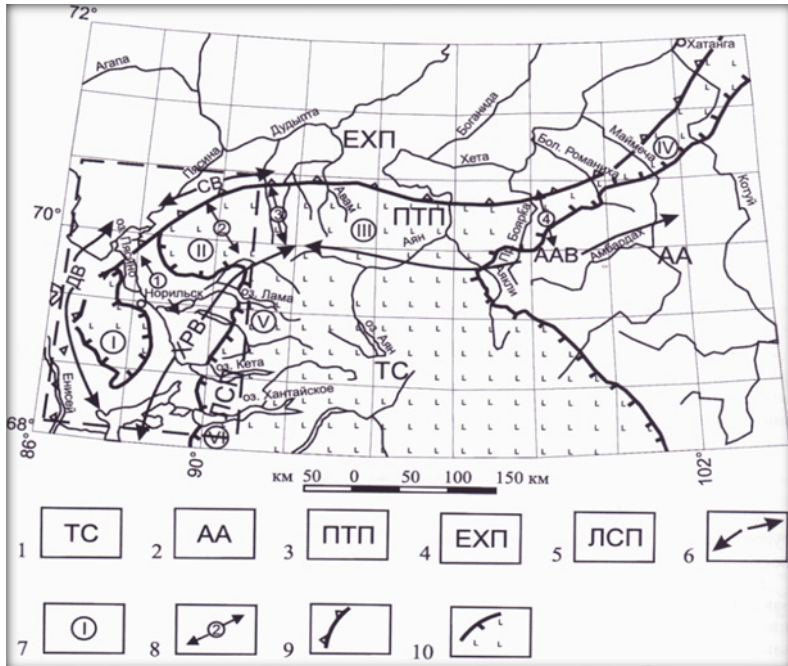
The Norilsk geoblock is located in the region of the triple joint of rifts. The formation of "nesting" of structures of different ranks in smooth, rounded contours, the construction of which is represented by second-order structures of the Yenisei-Khatanga, Norilsk-Kharelahsky and Predtyimyr structures, which have an oval shape, which most likely formed as arcuate and not rectilinear one (Fig. 1).

The Norilsk and Kharaelakh deflections are located within the Norilsk-Kharaelakh trough, in which a number of troughs are distinguished, which are volcano-tectonic depressions. When decoding of telephotographs of the earth's surface of the Norilsk region, the regions of the Norilsk and Kharaelakh plateau within the same-name troughs in the plan have an oval and rounded shape, which corresponds to the sign of ring structures.

As a result of geophysical studies of recent years, information which was different from the previously existing one was obtained. The main role in the formation of geological environment was large abyssal disjunctive structures.

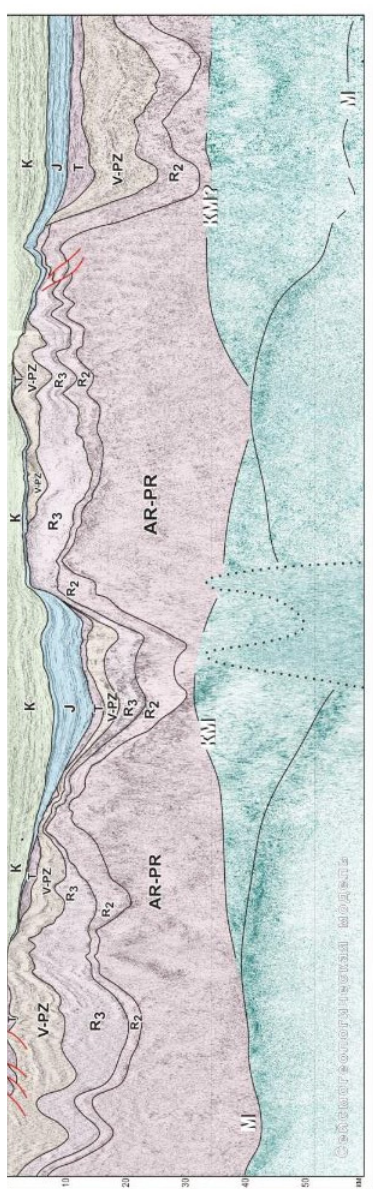
"New geophysical information on the junction area of the Yenisei – Khatanga Trough, the Siberian Platform and the West Siberian Plate records the absence of the characteristic disjunctive manifestations of rifting (Fig. 2, 3). The obtained seismic data do not confirm the presence of large grabens in the section, demonstrating well-preserved Riffean-Paleozoic folds at the base of the Mesozoic depressions that formed under horizontal compression, which is a systemic nature, manifested in the alternation of anticlines and synclines of different order" (Kushnir D. G, 2018 ).

In tectonic terms, the Norilsk geoblock is part of the Turukhano-Norilsk structural zone, the deep structure of which is shown in Fig. 3. On the boundary of the Paleozoic-Mesozoic and Riffean sedimentary rocks are reflected sinusoidal lines that agree with each other and have a significant correlation, which is typical of the structures formed as a result of wave movements.

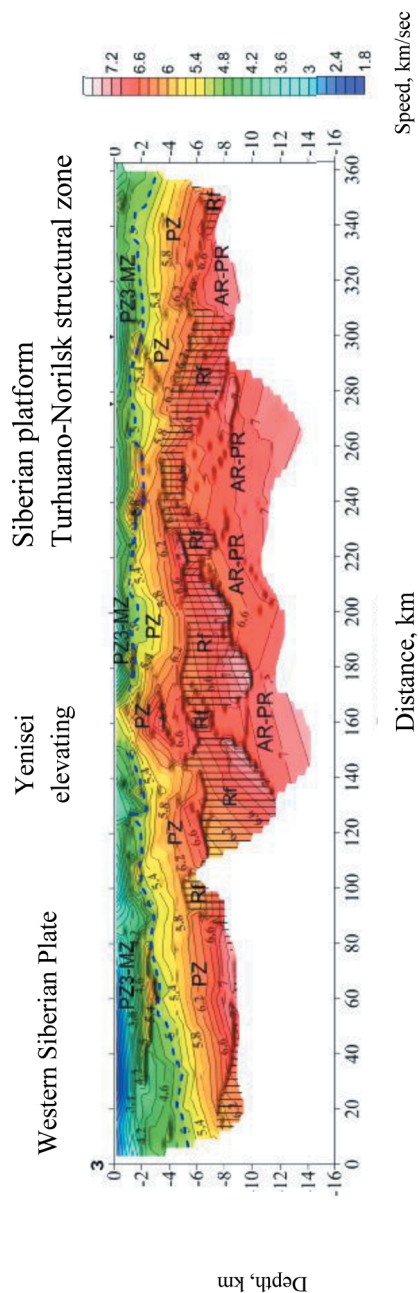


**Fig. 1. - The position of the Norilsk region in regional structures:**  
 1 - Tunguska syneclise; 2 - Anabar anteclise; 3 - Predtaymyr Trough;  
 4 - Yenisei-Khatanga trough; 5 - Lamsko-Severorechensky deflection;  
 6 - Shafts: DS - Dudinsky shaft, SS - Samoyedsky shaft, KRS - Khantaiko-Rybninsky shaft, AAS - Ayano-Ambardakhsky shaft; 7 - Depressions: I - Norilsk, II - Kharaelakh, III - Avamsky, IV - Delkansкая; V - Lamsko-Khantai, VI - Kureisko-Gorbiachinskaya; 8 - Anticlines and dome-shaped uplifts: 1 - Piasinskoe, 2 - Talminsky, 3 - Kystyktakh, 4 - Boyarsky; 9 - The boundary of the spread of powerful Jurassic-Cretaceous sediments; 10 - The present-day distribution boundary of the tuff-lava rock mass and Paleozoic sediments.

Yenisei-Khatanga trough



**Fig. 2.** Model of the deep geological structure of the Priyenisei area of Taymyr (Kushnir DG, 2018)

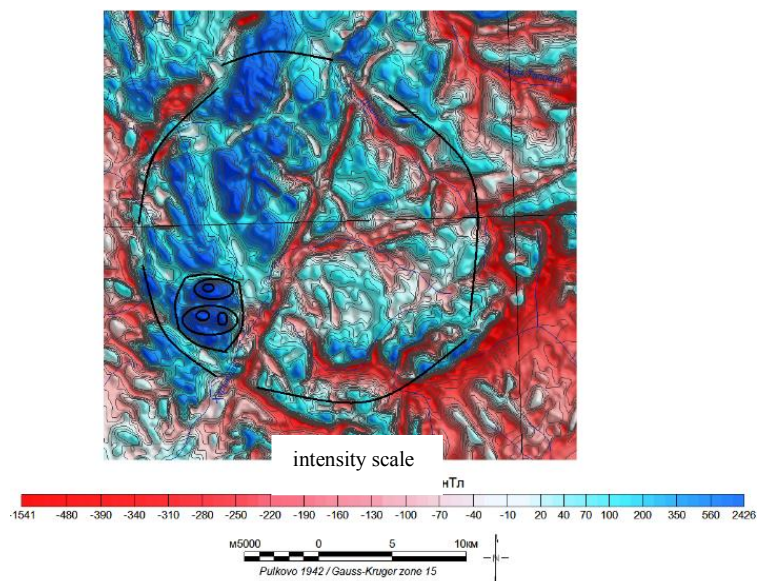


**Fig. 3.** Seismological section along the profile Saline – Ayan Shag between the isolines is 0.2 km / s, the blue dotted line indicates the bottom of the sedimentary layer, and the shading indicates the range of Riffean (Rf) sediments

**Structures of the Talnakh ore field.** For vortex or ring structures, a specific feature is the presence of alternating arcuate intermittent shells of revolution, asymmetrically and unevenly surrounding the core — the main core of the structure. The nuclei of such structures are usually located outside the center of the surface of rotation of its side” [Li Si-Guan, Sun-Dian-qing, Wu Le-bo, 1960].

Within the Kharaelakh trough, where deposits of sulphide ores of the Talnakh ore field are located, the formation of arc structures is determined by a combination of discrete compression and tension cells [Dodin, 2002]. In the central part of the trough, in the form of a double figure of a ring structure, the intermediate magmatic chamber is most likely manifested.

**Geophysical anomalies.** The vortex and ring structures are distinguished by "the configuration of anomalous geophysical fields and, above all, the magnetic field" [Mirlin, Oganessian, 2015]. The configuration of the anomalous magnetic field within the Kharaelakh trough is ring-shaped (Fig. 4).



**Fig. 4.** The ring structure on the map of the anomalous magnetic field (according to VSEGEI, 2016)

The origin of ring structures is associated with endogenous activity of the subsoil, caused by ascending thermal-material flows from the Earth’s core [Vikulin, 2015]. The structural elements of the Talnakh ore field are reflected in the zonal structure of geochemical fields, where geochemical anomalies form concentric zonality with respect to the barren space of the raised central part of Kharaelakh tins [Miroshnikova, 2009].

**Tectonic blocks.** For vortex structures, it is characterized by "... the formation of oblique faults or" geojunction "that divide tectonic scales - blocks and plates of the earth's crust, pulled over each other along inclined surfaces" [Mirlin, Oganessian, 2015]. The degree of deployment of the layers composing the Norilsk geoblock increases from the lower structural levels to the upper ones. In this direction, the amplitude of the plicative and disjunctive dislocations increases, and also the change of plastic deformations by discontinuous structures are observed. The structure of the ore site is determined by two fracture systems - the north-east and north-west strike. The gaps in the plan are comfortably shaped for the sides of the Kharaelakh trough and have an arched shape, in space they are spheres complementary to the boundaries of the structural tiers.

The cascading arrangement of fractures determines the scaly structure of the ore cluster. These blocks of geologic environment are distinguished in the upper structural level (effusive formations). Rocks of the frame on different sides of the blocks are shifted. The geometrization of discontinuities shows that "in the fall, passing through the "critical point of the sphere" in the northern part, they move from faults prevailing in the south to reverse faults. Gaps break up into several branching small-amplitude disturbances, determining the scaly character of the structure of structural blocks" [Tarasov, 1971]. As a result, wedge-shaped tectonic blocks are formed which are generally omitted with respect to the surrounding structural elements.

**Ore anomalies.** "Ore bodies are confined to vortex tectonomagmatic structures developed within trappean fields" [Mirlin, Oganessian, 2015]. N.K. Bulin and A.V. Egorkin established a stochastic relationship between the location of anomalies of  $V_p / V_s$  parameters (ratio of shear and longitudinal waves) in the earth's crust and ore clusters or individual mineral deposits [Bulin, Egorkin, 1994]. In the Norilsk-Kharaelakh ore zone, all large deposits are confined to mid-Crustal Anomaly with high values of  $V_p / V_s$  (1.82 -1.92 km / s).

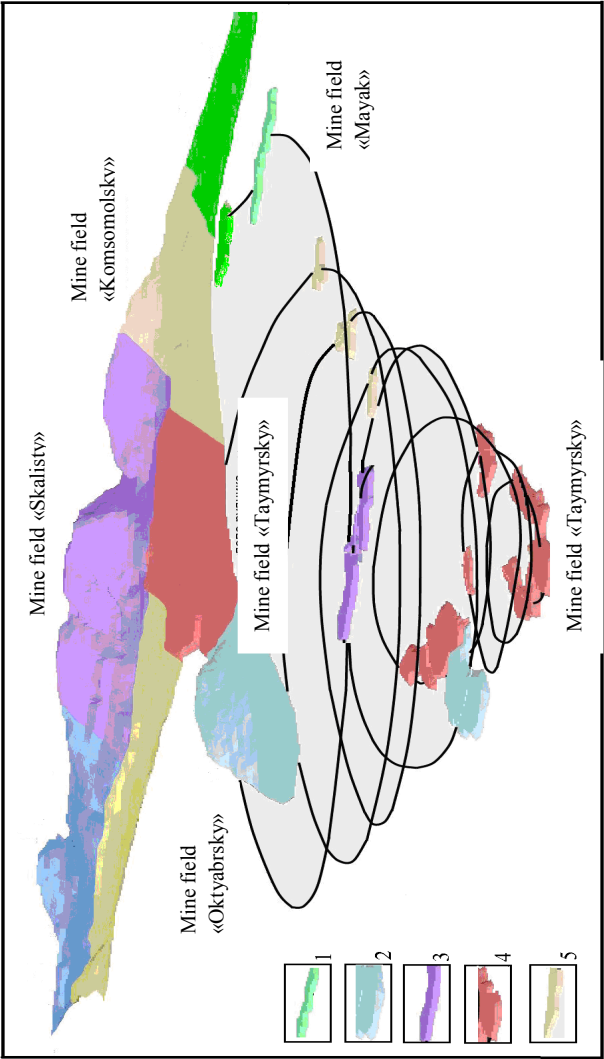
The Norilsk midcrustal geoblock geometrically has the shape of a cone that faces the surface with a base and bounded by tectonic disturbances along the edges. In general, the structure is a series of conical bodies nested in each other with the most lowered central cone [Ivanova, 1990].

On the surface, the fracture structure has the shape of a spiral and is complicated by a mass of filial forms. In spiral-helix geodynamic systems, ore-bearing differentiated intrusions are concentrated and localized, which form ore clusters (Fig. 5, 6).

**Conclusion.** On the base of the analysis of natural science information in the field of nonlinear tectonics, an attempt has been made to identify patterns of structural and hierarchical constructions of objects in the lithosphere of the Norilsk geoblock, both in general and at the level of ore fields.

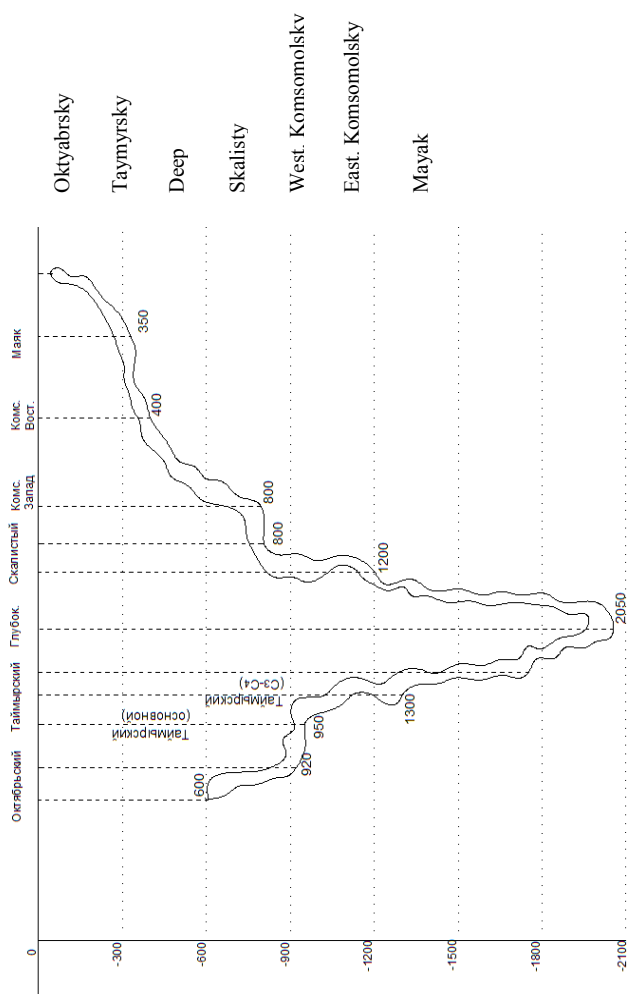
The elements of nonlinear tectonics identified by various researchers, the similarity of which is reflected in the lithosphere of the Norilsk geoblock, are considered. It is assumed that in the formation of the geological environment, along with the generally accepted genetic conditions for the formation of the Norilsk geoblock and its ore fields, there is a rotational model of the geodynamic process.





**Fig. 5.** The model of the location of the Talnakh ore cluster under the conditions of a spiral-helix geodynamic system (Miroshnikova LK 2015): 1-8—fields of mines





**Fig. 6.** Model of the location of ore bodies of the Talnakh ore cluster under the conditions of a spiral-helix geodynamic system (Miroshnikov LK, Mezentsev A.Yu., 2018)

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不同时期荞麦品种CO<sub>2</sub>气孔导度的研究

**STOMATAL CONDUCTANCE OF CO<sub>2</sub> THE LEAVES OF BUCKWHEAT  
VARIETIES FROM DIFFERENT PERIODS OF BREEDING**

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注解。在完整植物的田间和营养实验条件下，实时研究了11个不同育种期蕎麥標本中葉片CO<sub>2</sub>氣孔導度的基因型特徵。結果表明，通過培育高種子生產力的培養物，蕎麥葉片的氣孔導度顯著增加，這與光合作用和蒸騰活性的表現呈正相關。其價值顯著取決於生長階段，植物上葉子的位置，一天中的時間和環境條件。二氧化碳分子通過氣孔的最活躍的擴散發生在大規模開花期間，在現代品種的下午（從9點到11點），在上層的葉子中形成和填充果實，以及下午（從13到16小時） - 有更長的時間來創造品種。

關鍵詞：選擇，蕎麥，品種，氣孔導度CO<sub>2</sub>，個體發生，晝夜和長期變異，光合作用和蒸騰作用強度。

**Annotation.** Under the conditions of field and vegetative experiments on intact plants, the genotypic characteristics of the stomatal conductance of CO<sub>2</sub> of leaves in 11 buckwheat specimens from different breeding periods were studied in real time. It was shown that as a result of breeding a culture for high seed productivity, the stomatal conductivity of CO<sub>2</sub> of buckwheat leaves increases significantly, which is positively associated with the manifestation of photosynthesis and transpiration activity. Its value significantly depends on the growth phase, the location of the leaves on the plant, the time of day and environmental conditions. The most

*active diffusion of carbon dioxide molecules through the stomata occurs during the period of mass flowering, the formation and filling of fruits in the leaves of the upper tiers in the afternoon (from 9 to 11:00 hours) in modern varieties, and in the afternoon (from 13 to 16 hours) - have older time to create varieties.*

**Keywords:** *selection, buckwheat, variety, stomatal conductivity CO<sub>2</sub>, ontogenesis, diurnal and long-term variability, intensity of photosynthesis and transpiration.*

## **Introduction**

Photosynthesis plays an important role in the production process of plants, providing up to 95% of the formation of dry matter yield [1, 2]. But, in the selection of crops, the possibilities of photosynthesis are used very poorly [3, 4], apparently due to the fact that it is a very complex process of organization and functioning, the activity of which depends on the influence of many endogenous and exogenous factors [2, five]. One of them is the stomatal conductivity, which is an important regulator of the carbon and water metabolism of plants through a certain change in the width of the stomatal cracks in the leaves [6, 7, 8].

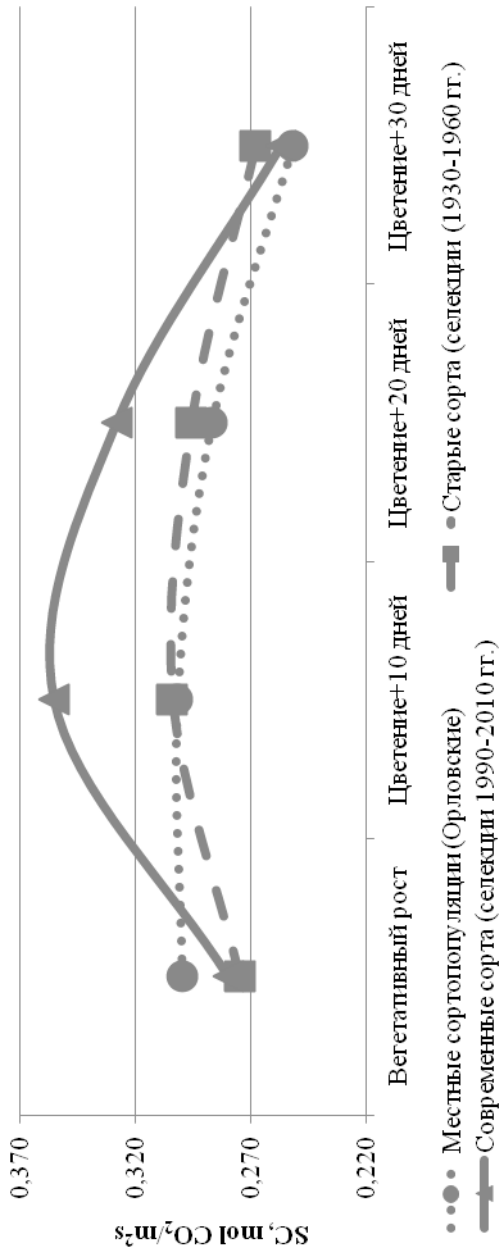
Therefore, it is very important for each crop to identify the varietal characteristics of the stomatal conductance of CO<sub>2</sub> in conjunction with photosynthesis and transpiration and to determine effective ways to control them, taking into account changing environmental conditions.

## **Objects of study and research methods**

The studies were carried out at the Center for Genetic Studies of the Oryol State Agrarian University "Plant Genetic Resources and Their Use" under a joint program with breeders of the Federal State Budgetary Institution "Federal Research Center for Grain and Bean Crops.

The objects of research were 11 variety samples, which were conventionally divided into 3 groups: local (K – 406 and K – 1709); old breeding of the 1930s – 1960s. (Kalininskaya, Bogatyr and Shatilovskaya 5) and modern varieties - selection of 1990-2010 – x (Demeter, Rain, Dikul, Inzer, Nine and Design). Experimental material was grown in breeding rotation. The area of the plot was 7.5 m<sup>2</sup>, the placement was randomized, repeated 4 times. In the vegetation experiments, the cultivation of plants was carried out in a selection greenhouse by the method of soil culture using polymeric vessels with a capacity of 5 kg of dry soil. Soil moisture was maintained at 70% of full capacity. Care of crops and cleaning were carried out in accordance with the guidelines for the region [9].

The stomatal conductivity (SC), the intensity of photosynthesis (IP) and the intensity of transpiration (IT) were determined on intact plants in real time using a portable gas analyzer of the brand Li - 6400 XT using the original technique of the American company Li – COR. The obtained experimental data were processed using modern computer programs and taking into account the methodological recommendations of B.A. Dospekhova [10].



**Figure 1** - Stomatal conductivity of  $CO_2$  of leaves in the ontogenesis of varieties of buckwheat from different breeding periods, average for 2013 - 2015

## Results and discussion

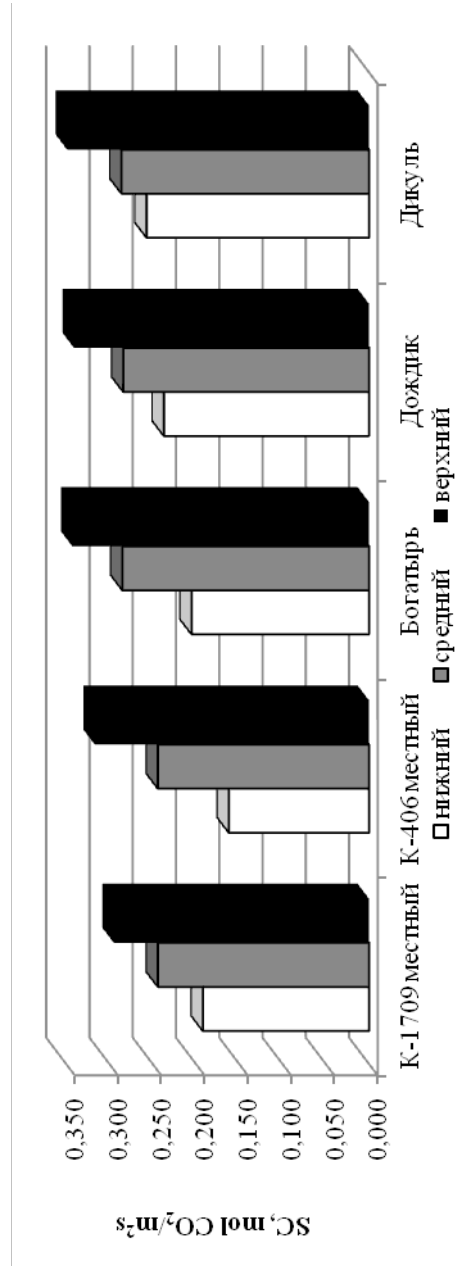
During the years of research, the genotypic range of variation of the stomatal conductance of CO<sub>2</sub> of leaves in the fruit formation phase of buckwheat plants ranged from 0.232 to 0.373 mol CO<sub>2</sub>/m<sup>2</sup>s. Modern varieties of culture in the phase of “bloom + 10 days” exceeded the SC leaves old and local variety samples on average by 17.2%, and in the phase of “bloom + 20 days” - by 12.3%. During the period of vegetative growth and the “bloom + 30 days” phase, no significant genotypic differences were found for this indicator (Fig. 1).

According to experimental data of vegetation experiments, as a result of selection, buckwheat plants increase stomatal conductivity of not only the upper, but also the lower leaves. In the fruit formation phase of modern varieties Dikul and Dojdik, the stomatal conductivity of CO<sub>2</sub> of the leaves of the upper, middle and lower tiers of plants was higher than that of the local populations (K-1709, K-406) and old varieties (Bogatyr), respectively, by 8.5, 10, 5 and 32.8% (Fig. 2).

It is important to note that in modern varieties of culture, stomatal conductance of CO<sub>2</sub> leaves is most actively manifested in the pre-lunch time (from 9 to 11 hours), and in older ones - in the afternoon (from 14 to 16 hours). At 10:00 Moscow time, the modern varieties of buckwheat on SC leaves exceeded the old varieties of culture and local populations by an average of 11.1%, and at 15:00 they were inferior in this indicator by an average of 19.3% (Fig. 3).

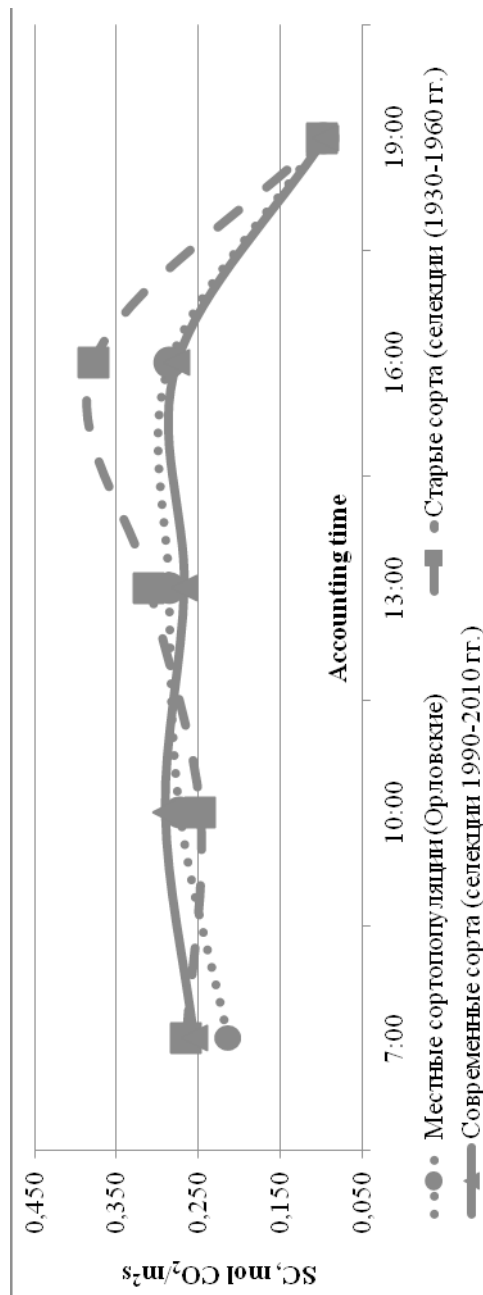
However, several other features were revealed in the course of daytime photosynthesis. In this case, all experienced variety samples most actively assimilated CO<sub>2</sub> by plant leaves in the pre-lunch time - from 9 to 11 o'clock, when the sun begins to shine actively, and the air temperature is not so high (18–20°C) and favorably affects this process. Modern varieties of crops at 10:00 in terms of leaf photosynthesis intensity exceeded the old varieties by an average of 9.4%, and local populations - by 30.4% (Fig. 4).

The mismatch of the peaks of stomatal conduction activity and the intensity of photosynthesis is due to the fact that the stomata of the leaves not only assimilates CO<sub>2</sub>, but also evaporates water, protecting the plants from overheating. Therefore, in the afternoon, when the air temperature very often reaches 28–30 °C, transpiration is actively carried out by the leaves of the plants, and the intensity of photosynthesis drops sharply compared with the morning time. The correlation coefficient between the stomatal conductance of the CO<sub>2</sub> and IF molecules was positive only in the morning hours, and since 13:00 it became negative, in contrast to the relationship with transpiration activity (see table).

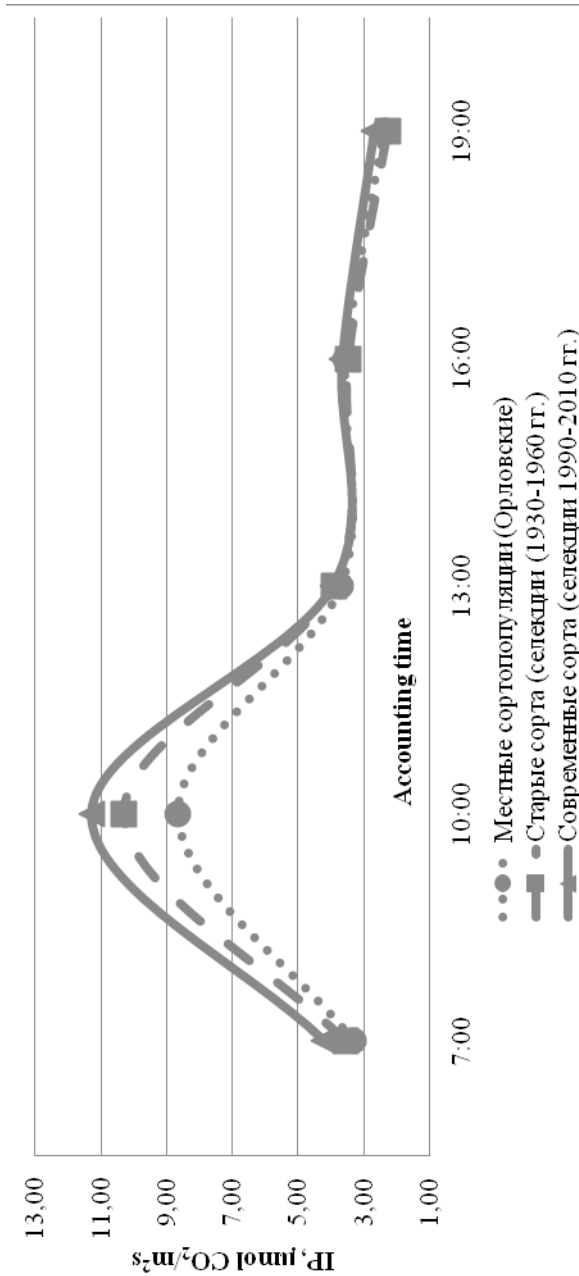


**Figure 2 - Stomatal conductivity (SC) of leaves of different plant tiers in buckwheat variety samples during the flowering phase + 10 days, data of vegetation experiments of 2013-2014**





**Figure 3 -** Daily variation of the stomatal conductivity of CO<sub>2</sub> in buckwheat varieties from different breeding periods in the flowering phase + 20 days



**Figure 4 -** The daily course of the intensity of photosynthesis in varieties of buckwheat from different periods of selection in the flowering phase + 20 days, data of vegetation experiments of 2014-2016

**Table -** *Correlation coefficients between the stomatal conductivity of CO<sub>2</sub>, the intensity of photosynthesis (IP) and the intensity of leaf transpiration in buckwheat varieties during the daytime accounting*

Readings	Accounting time, hours				
	7:00	10:00	13:00	16:00	19:00
SC CO <sub>2</sub> and IP	0,52	0,64	-0,06	-0,47	-0,21
SC CO <sub>2</sub> and IT	0,95	0,99	0,55	0,74	0,59

**Conclusion.** The stomatal conductance of the leaves plays an important role in the carbohydrate and water metabolism of buckwheat plants. Therefore, as a result of the selection of a culture for high seed productivity, its capacity increases substantially. The most active diffusion of carbon dioxide molecules through the stomata occurs during the period of mass formation and filling of fruits in the leaves of the upper tiers in modern varieties in the morning hours (from 9 to 11 hours), and in old ones - in the afternoon (from 13 to 16 hours). On the one hand, this allows plants to maintain the necessary balance of water and temperature using transpiration, on the other hand, to provide the necessary conditions for photosynthesis in different environmental conditions.

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幼羊和牛中含氮物质的代谢与饲养条件的差异

## **METABOLISM OF NITROGENOUS SUBSTANCES IN YOUNG SHEEP AND CATTLE WITH DIFFERENCES IN FEEDING CONDITIONS**

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抽象。根据俄罗斯南部野外饲料生产的饲料基础和区域特征，我们调查了三种主要类型的饲养幼牛和绵羊 - 干草，草料和绿草质量。公牛使用的氮的沉积和氮的百分比在组II中最高，其接受干草饮食。饲喂干草配方的公羊群体在体内放置氮气22.13克，干草饲喂类型 - 26.47克，绿色 - 与牛犊相比增加25.20克。与第I组相比，II组瘢痕液中的总氮和低残留氮浓度分别为3.9 ( $P < 0.05$ ) 和6.3 mg% ( $P < 0.01$ )，表明动物蛋白质代谢更加强烈。喂干草饮食。与第II组相比，第I组蛋白质的公牛所消耗的活体重增加了10.1%，比第III组的同龄人增加了12.6%。来自饲料的能量更好地被第二组的公牛使用。幼羊蛋白质转化为日粮蛋白质的转化率比牛低2.15–1.43倍。与此同时，接受干草饮食的第二组公羊将蛋白质转化为食物蛋白质，比第一组的同龄人高2.31%。

关键词：公牛犊，公羊，消化率，瘢痕消化，氮，蛋白质生物转化。

**Abstract.** *In accordance with the feed base and regional characteristics of field feed production in the South of Russia, we investigated three main types of raising young cattle and sheep - hay, haylage, and on green grass mass. The deposition and the percentage of nitrogen used by bulls were the highest in group II, which received a hay diet. The group of rams fed the hay ration put aside nitrogen in the body by 22.13 g, with hay feeding type - by 26.47 g, with green - by 25.20 g compared with bull-calves. High concentration of total nitrogen and low residual nitrogen in the cicatricial fluid of group II compared with Group I, by 3.9 ( $P < 0.05$ ) and 6.3 mg% ( $P < 0.01$ ), respectively, indicate a more intensive flow of protein metabolism in animals fed hay diet. The increase in live weight is 10.1% more spent by bulls from group I protein compared to group II and 12.6% more than*

*peers from group III. The energy coming from the feed was better used by the bulls of group II. The conversion rate of protein into dietary protein in young sheep was 2.15-1.43 times lower than that of cattle. At the same time, rams of group II, who received a hay diet, converted protein into food protein 2.31% better than peers from group I.*

**Keywords:** Bull-calves, rams, digestibility, scar digestion, nitrogen, protein bioconversion.

**The urgency of the problem:** The ability to use pasture forage, the ability to use a large amount of roughage, to adapt to the harsh climatic and forage conditions of arid territories, does not exclude the fact that ruminants need balanced and full feeding [1]. In addition, the digestibility and bioavailability of nitrogen from different types of feed, depending on the biogeochemical zone is different, therefore, the feeding conditions depend not only on the set of feed, but on the nutrient content [4].

In addition, according to N.V. Bogolyubova, V.N. Romanova, V.A. Devyatkina at al. [2], the digestibility and bioavailability of nitrogen-containing substances from different types of feed varies depending on the biogeochemical zone; therefore, nitrogen metabolism depends on the set of feed, the nutrient and mineral content in the breeding zone of the animal.

A comprehensive study of the nutritional processes of such closely digestible species as cattle and sheep in various technological and feeding conditions is of not only biological, but also production and economic interest.

Therefore, the goal of our research was to study the effect of differences in feeding types on digestion, nitrogen deposition in the body, cicatricial digestion, protein bioconversion into growth and meat products in young cattle and sheep.

**Research methodology:** In accordance with the feed base and regional characteristics of field feed production in the south of Russia, we investigated three main types of growing and fattening — hay, haylage, and on green grass mass.

To achieve this goal, in the conditions of the dry-steppe zone, a scientific and economic experiment was conducted at the Kharakhusovsky enterprise of the Republic of Kalmykia. For the experiment, 3 bulls of the Kalmyk breed were selected according to the method of analogs, 10 animals each, with a live weight of 266.3-267.6 kg at the age of 11 months, 3 groups of lambs (rams) of the Grozny breed of 20 animals each, 4 months, live weight of 25.8-26.2 kg. Scientific and economic experience was carried out until the bulls reached 17 months, with the rams of 8 months of age. A physiological experiment on feed digestibility was carried out on 3 animals from each group of bull-calves and sheep aged 16 and 7 months.

The rations of experimental animals were made taking into account the recommendations developed by A.P. Kalashnikov at al. [5], according to the program “Feed Optima”.

Animals of group I were on the hay type of feeding. The specific weight of steppe hay in terms of nutritional value for bull-calves was 52.1, and for lambs, respectively, 73.9%. For animals of the second group, the mixed grass haylage in the ration for energy nutrition was 52.8 for calves, 71.9% for rams; therefore, these animals had a haylage type of feeding. In the third group, for bull-calves, green fodder in the diet was nutritionally 51.5, for rams 71.3%, so this group of animals was fed on a green type of feeding.

Laboratory studies of feed, feed residues, feces and urine were performed according to generally accepted methods. The data obtained during the experiments were processed by mathematical methods of variation statistics [6] using a PC and the Excel 7 software package.

**The results of the study:** According to the results obtained during the balance experiment, the digestibility factors of the main nutrients of the diet were calculated.

The true digestibility of nitrogen is very high given the loss of nitrogen due to metabolism. The difference in the types of feeding has a significant effect on the digestion and deposition of nitrogen in the body in all species of ruminants.

The deposition and the percentage of nitrogen used for bulls were the highest in group II who received the hay ration (Figure 1). If the calves in the I group of hay rations, it was set aside 31.93 g, in the II group - 37.03 g, in the III - 35.63 g, then the rams had less of it in the body. The group of rams fed the hay ration put aside nitrogen in the body by 22.13 g, with hay feeding type - by 26.47 g, with green - by 25.20 g compared with bull-calves.

The rams of Group II, who received green fodder, absorbed nitrogen by 2.17% better as compared with Group I and 0.20% as compared with Group III. Bull-calves and rams from group II, who received a hay ration, exceeded in nitrogen assimilation animals from other groups that received hay and green rations.

The percentage of use of nitrogen taken with food, for calves fed the hay diet, was lower by 6.76% than for lambs from a similar group. In group II, lambs used 5.33% better nitrogen than gobies. The use of nitrogen to bull-calves in group III was higher by 4.58% compared with lambs.

Better uptake of nitrogen by bulls and rams from Group II is explained by an increase in protein digestibility, since its excretion in the urine is practically independent of the type of feeding.

Research has shown that nitrogen, as the end product of bacterial protein destruction, is extensively used by rumen microorganisms for the synthesis of their body.

One of the indicators of the intensity of metabolism and the level of digestion of feed in ruminants is the pH of the contents of the rumen, which, as is well known, can vary widely and depends on differences in feeding of animals, their age and origin.



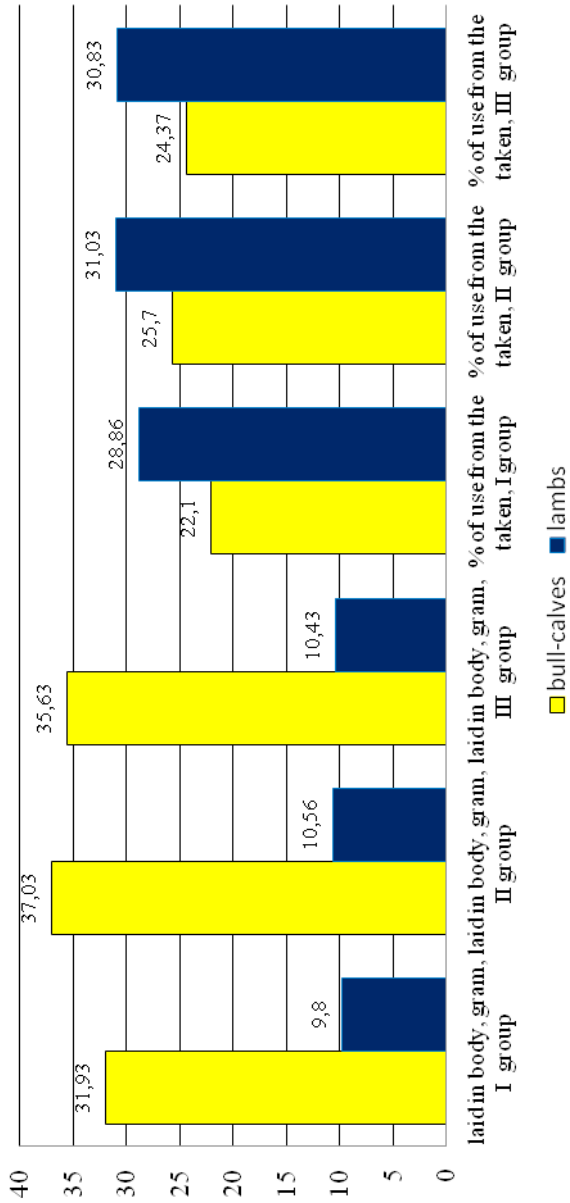


Figure 1 - Deposition in the body and the coefficient of nitrogen digestion

The study of the characteristics of cicatricial digestion in ruminants showed that the composition of the diet has a significant impact on the formation of products of fermentation of feed in the rumen, and, consequently, on the degree of their use in metabolic processes on deposition in the body [3].

*Table 1 - Indicators of cicatricial metabolism*

Type of animal	Group	Indicators			
		pH	Total nitrogen, mg%	Residual nitrogen mg%	VFA, mlkv / 100ml
Bull-calves	I	6,96±0,15	41,9±1,18	19,1±0,40*	11,65±0,39
	II	6,61±0,14	43,9±0,80	15,8±0,56	14,04±0,37*
	III	6,80±0,20	42,9±1,17	16,2±0,56	12,93±0,62
Lambs	I	6,48±0,34	45,6±0,95	23,4±0,70**	13,25±0,27
	II	6,58±0,22	49,5±1,08*	17,1±0,47	15,34±0,46*
	III	6,29±0,26	48,9±0,98	19,9±0,53	15,06±0,30

From the indicators in Table 1 it can be seen that the pH reaction changed back to the concentration of volatile fatty acids.

Differences in the concentration of residual nitrogen in the rumen fluid between the I and II groups of bulls was 3.3 mg% ( $P < 0.05$ ), while a large amount of residual nitrogen indicates a slower course of nitrogen metabolism.

For experienced bulls of all groups, the content of the total VFA was within 11.65-14.04 ml eq / 100 ml of cicatricial fluid. Animals of group I had the lowest concentration of VFA. The feeding of hay diet contributed to an increase in the total number of VFA in Group II by 18.7% ( $P < 0.05$ ) as compared with the first.

The molar ratio of individual volatile fatty acids in the cicatricial fluid varies depending on the state of the animals and the feeding regime. The predominant organic acids formed in the rumen are acetic, propionic and butyric.

Significantly changes the indices of cicatricial digestion by sheep, changing feeding conditions. The differences in the active acidity of the cicatricial fluid, expressed in pH, between groups I of the rams, who were on the hay diet, and II, who received the hay diet, were 1.5%.

Experienced lambs of group I had the lowest concentration of VFA, while the content of the total amount of volatile fatty acids was within the physiological norm. Feeding the hay diet contributed to an increase in the total number of VFA in Group II by 2.09 ml Eq / 100 ml ( $P < 0.05$ ) as compared with Group I.

High concentration of total nitrogen and low residual nitrogen in the cicatricial fluid of group II compared with Group I, by 3.9 ( $P < 0.05$ ) and 6.3 mg% ( $P < 0.01$ ), respectively, indicate a more intensive flow of protein metabolism in group II.

In the process of growth and development by young animals of all species of animals, the nutrient costs of metabolic processes increase, therefore, the consumption of crude protein and the exchange energy of feed per 1 kg increase in live weight significantly increase.

Payment for feed by meat products with intensive cultivation of animals for meat depends on the intensity of nutrient bioconversion and feed energy into food protein of meat. The dynamics of accumulation of nutrients in the body of bulls, indicators of protein conversion ratios and feed energy into food protein and energy of the edible part of the carcass were greatly influenced by the difference in feeding types and the type of ruminant animal.

In our studies, differences in the bioconversion of the main nutrients of the feed were found when changing the type of feeding in young cattle and sheep.

As can be seen from table 2, the production of 1 kg increase in live weight of bulls from group I, who were on a hay diet, spent 10.0 MJ of exchange energy more than the peers from group II who received hay ration, and 5.8 MJ more than bulls from group III, which was on a green diet.

Animal growth is also 10.1% more spent by bulls from group I protein compared to group II and 12.6% more than peers from group III. The energy and protein that comes from the feed was better used by the bulls of group II.

The conversion ratio of protein feed into animal protein in bulls from group II is 1.59% more than in bulls from group I and 0.21% than in animals of group III. For the production of flesh meat, bullheads of group II used 3.56% of the energy supplied from feed, which is 0.84% better than in group I and 0.25% than peers from group III.

In the production of 1 kg of live weight gain, the first group rams, who were on hay feeding, were consumed by 282 g of protein and 29.5 MJ of exchange energy more than their peers from group II, and by 342 g of protein, 24.0 MJ of energy is more, than animals of group III.

The conversion rate of protein into dietary protein in young sheep was 2.15-1.43 times lower than that of cattle. At the same time, lambs of group II, who received a hay ration, converted protein into food protein 2.31% better than their peers from group I, and 0.12% worse than animals of group III who received a green diet.

*Table 2 - Bioconversion of protein and feed energy in meat protein food*

Indicators	Bull-calves			Lambs		
	I	II	III	I	II	II
Spent raw protein per 1 kg gain in live weight, g	1309	1177	1144	1332	1250	1190
Spent energy feed per 1 kg increase in live weight, MJ	93,7	83,7	87,9	117,2	87,7	93,2
Contained in flesh trunk: protein, kg	32,75	38,88	36,31	1,62	2,59	2,51
Fat, kg	12,46	16,21	15,73	1,27	1,29	1,27
Output per 1 kg of pre-slaughter body weight: protein, g	82,28	93,17	88,13	45,1	65,7	63,9
Fat, g	31,31	38,84	38,18	37,5	45,3	44,1
Energy, mJ	2,55	2,98	2,91	3,09	2,80	2,73
The conversion ratio of protein,%	6,32	7,91	7,70	3,39	5,25	5,37
The conversion ratio of energy,%	2,72	3,56	3,31	2,63	3,19	2,93

The use of energy in the diet for the production of edible trunk was the best in the second group of rams. They exceeded in conversion of exchangeable energy of the rams from group I by 0.56% and group III - by 0.26%.

**Conclusion:** In accordance with the feed base and regional characteristics of field feed production in the South of Russia, we investigated three main types of raising young cattle and sheep - hay, haylage, and on green grass mass.

The deposition and the percentage of nitrogen used by bulls were the highest in group II, which received a hay diet. For calves in the I group of hay diets, 31.93 g were deposited, in Group II - 37.03 g, in the III group - 35.63 g, then by the rams it was put off in the body less.

High concentration of total nitrogen and low residual nitrogen in the cicatricial fluid of group II compared with Group I, by 3.9 ( $P < 0.05$ ) and 6.3 mg% ( $P < 0.01$ ), respectively, indicate a more intensive flow of protein metabolism in animals fed hay diet.

The increase in live weight is 10.1% more spent by bulls from group I protein compared to group II and 12.6% more than peers from group III. The energy coming from the feed was better used by the bulls of group II.

The conversion rate of protein into dietary protein in young sheep was 2.15-1.43 times lower than that of cattle. At the same time, lambs of group II, who received a hay diet, converted protein into food protein 2.31% better than their peers from group I.

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牛红壤条件的信息评估

**INFORMATION ASSESSMENT OF OX-RED SOIL CONDITIONS**

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注解。所进行的研究证明，有必要确定牛红土壤条件，土壤的牛红过程和牛红模式（农业和生态土壤评估中的时间和空间特性和过程的典型变化）。

提出了通过恒电位库仑法测定土壤中红牛系统的分数组成，确定土壤中氧化剂和抗氧化剂含量的信息内容。

在 $E_h = -0.3V$ 下使用恒电位库仑法回收的土壤中化合物的数量在sod-podzol土壤中为 $0.6mg-EQ / 100g$ ，在腐殖质 - 泥炭土壤中为 $6.8g$ ，在 $E_h = + 1.0V$ 下氧化，分别为 $0.20$ 和 $0.20$ 。  $2.60 mg-EQ / 100 g$ 。在最佳水分的土壤溶液中，以槲皮素的抗氧化剂量 ( $mg / g$ ) 为 $2.9$ ，在过量水分的土壤中为 $5.5$ 。

土壤中的氧化还原过程的特征在于施肥时的值 $Da / DrN$ ， $\Delta Fe / De$ 等。在3至10的pH范围内，sod-podzol土壤中 $DEH / DrN$ 值为 $62.2$ ； $43.9$ 灰色森林土壤； $78.1$ 在红壤中。

研究表明需要表征土壤的氧化还原状态，以评估植物根区的 $E_h$ 。

根据获得的数据，与土豆根接触的sod-podzol土壤的 $E_h$ 溶液为 $+ 50mV$ ，在tavalga  $+ 153mV$ 。在苹果叶片蒸腾产物中，在正常和过量水分的sod-podzol土壤上发育，CA的含量分别为 $20.1$ 和 $11.0 mg / l$ ； $Fe - 0.4$ 和 $0.8$ ； $MP - 0.04$ 和 $0.08$ ； $K - 15.1$ 和 $27.6$ 毫克/升。

随着 $CNO_3$ 在胶粘的sod-podzol土壤中的引入， $E_h$ 从 $-235 mV$ 增加到 $105$ ； $pNO_3$ 值从 $4.0$ 变为 $2.0$ 。

关键词：氧化还原条件，土壤，植物，调节，缓冲能力。

**Annotation.** *The conducted researches prove that it is necessary to determine ox-red soil condition, ox-red processes of soils and ox-red modes (typical changes of properties and processes in time and space at the agricultural and ecological soil assessment.*

*The information content of determining the fractional composition of red-ox systems of soils by potentiostatic coulometry, determining the content of oxidants and antioxidants in soils is presented.*

*The number of compounds in soils recovered using potentiostatic coulometry at  $E_h = -0.3$  V was 0.6 mg-EQ/100 g in sod-podzol soil, 6.8 g in humus-peat soil, oxidizing at  $E_h = +1.0$  V, respectively, 0.20 and 2.60 mg-EQ/100 g. The amount of antioxidants in mkg/g in terms of quercetin was 2.9 in the soil solution of sod-podzol soil of optimal moisture, and 5.5 in the soil of excessive moisture.*

*Redox processes in soils are characterized by values  $Da/DrN$ ,  $\Delta Fe/De$ , etc. when fertilizing. In the pH range from 3 to 10, the  $DEH/DrN$  value was 62.2 in sod-podzol soil; 43.9 in gray forest soil; 78.1 in red soil.*

*Studies have shown the need to characterize the oxidation-reduction state of soils to evaluate  $E_h$  in the root zone of plants.*

*According to the obtained data, the  $E_h$  solution of sod-podzol soil in contact with the roots of potatoes was +50 mV, and in tavolga +153 mV. In the products of transpiration of Apple leaves, developing on sod-podzol soil of normal and excessive moisture, the content of CA was 20.1 and 11.0 mg/l, respectively; Fe – 0.4 and 0.8; MP – 0.04 and 0.08; K – 15.1 and 27.6 mg/l.*

*With the introduction of  $CNO_3$  to the glued sod-podzol soil,  $E_h$  increased from -235 mV to 105; the  $pNO_3$  value changed from 4.0 to 2.0.*

**Keywords:** *oxidation-reduction condition, soil, plant, regulation, buffer capacity.*

The object of the study is sod-podzol, gray forest, chestnut soils, humus[1, 8, 9, 10].

Research methodology consisted of the assessment of agrochemical and physico-chemical properties of soil by means of standard methods [1, 5, 9], of the assessment of the fractional composition of redox systems, buffer capacity of soils in oxidation-reduction interval by the method of potential static coulometry, the definition of positively and negatively charged complexes at the statistical processing of the obtained data, in the formulation of model experiments for assessing the changes of soil properties in conditions of excessive moisture [5, 6, 7, 11].

### **Research results and discussion of them**

1. The redox properties of soils are characterized by  $E_h$ ,  $r_e$ ,  $rH_2$ , fractional composition of redox systems, the redox capacity of the soil.

According to our results, oxidation-reduction (OR) capacity of the soils determined by the method of potential and static coulometry on the electrodes from the soil and carbon paste, was higher in the humus-meadow and humus-peaty soils and lower in sod-podzol soil. This is illustrated in table 1.



**Table 1-***Oxidation-reduction capacity of soils defined by the method of potential and static coulometry on electrodes from soil -charbon paste in a background KCl electrolyte*

Soil	Number of mg-EQ/100 g soil compounds			
	recoverable at		oxidizing at	
	-0.3 V	0,0 V	+0.7 V	+1.0 V
sod-podzol	0.60	0.30	0.10	0.20
leached humus	1.10	0.50	0.20	0.70
humus-meadow	1.20	0.80	0.40	1.90
humus-peat	6.80			2.60

And oxidation and reduction occurred in certain types of soils at different speed rates.

Antiradical activity (in mkg/g in terms of ascorbic acid) was in soil solutions of leached humus optimal moisture 2,05; excessive moisture – 13,5; in soil solutions of ordinary humus, respectively 1,54 and 8,82; in meadow-humus degraded soil, respectively 2,2 and 2,9.

An important parameter of the redox state of soils is the redox buffer capacity of soils.

$$P_{OR} = dOX/dE_{OR}; dRed/\Delta E_{OR}$$

For example, according to the results, during titration of sod-podzol soils  $K_2Cr_2O_7$  (X):  $P_{OR} = 20,7 + 18,9 X$ ;  $r = 0,99$ ; for light chestnut soil:  $P_{OR} = 0.2 + 1.9 X$ ;  $r = 0.99$ ; for chestnut soil:  $P_{OR} = 2.9 + 4.7 X$ ;  $r = 0.99$ .

2. Redox processes in soils are accompanied by changes in almost all soil properties.

The state and mobility of cations and anions in the soil change with the change of the oxidation-reduction state of soils [3]. According to the results of the research, the  $Fe_2O_3/FeO$  change is the same with the Eh change and it is ahead of the  $NO_3/NH_4$  change. With increasing oxidation state, the ratio of mobile forms of iron and manganese decreases, since iron compounds in the soil pass into the reduced state (which significantly increases their solubility) at a lower value of the potential than manganese compounds. At the same time, with excessive soil moisture, the content of mobile compounds Fe, MP, Al significantly increases, which is one of the causes of plant death in these conditions. The increase in the content of mobile iron (determined by the method of chemical autography based on electrolysis) with excessive soil moisture is illustrated by the following table.

**Table 2 - content of mobile iron compounds in sod-podzol well-cultivated soil, mkg / sm**

Humidity	Voltage 5 V, time 1 min.		Voltage 75 V, time 1 min.		Voltage 75 V, time 30 min.	
	-	+	-	+	-	+
optimal	1.58±0.25	1.08±0.04	1.19±0.06	1.05±0.07	2.54±0.84	1.07±0.06
excess	2.06±0.09	2.08±0.09	2.17±0.08	2.35±0.11	2.21±0.08	2.47±0.08

Excessive soil moisture leads to a change in the ratio of mobile cations in soils, which is important to know when adjusting the fertilizer system on soils of varying degrees of hydromorphism and depending on weather conditions.

3. The speed rate of change of Eh in soil flooding, the value of DEH/DrN in different pH intervals;  $DEH/\Delta t$ ;  $DEH / \Delta t^0$  is very important agronomically. Practically, it is necessary to know  $\Delta X/\Delta Eh$ , where X is the amount of mobile connections of iron, aluminium, manganese, sulfur, nitrogen, phosphates and other elements. These indicators change in seasonal dynamics. It is described by the hysteresis loop. The degree of open loop characterizes the unsteadiness of the soil condition and the trend of their evolution.

It is known that increasing of pH the value of Eh decreases. However, this dependence is typical only for some soils. In the pH range from 3 to 10, the  $\Delta Eh/\Delta pH$  value was 65.2 in sod-podzol; 43.9 in gray forest; 78.1 in red soil; 48.0 in black soil. However, these indicators were different for the soils of the same type but with different granulometric and mineral composition. The gray forest soils of farm "Druzhba"  $Eh = 540,1 - 40,9$  pH;  $r = -0,99$ ; The gray forest soil of Kashir  $Eh = 622,5 - 52,4$  pH;  $r = -0,98$ .

4. There are zones of oxidation and reduction, represented by both external and internal layers of structural units in soils. Also there are microzones of organic and mineral fertilizers, root passages, drifts in the soil profile of humus, silica, etc. [2, 4]. Obviously, the processes occurring there will spread vertically and horizontally because of the oxidation and reduction zones.

The studies have shown that the front of oxidation and reduction is presented in soils. The following table illustrates the example of this phenomenon of introduction of  $KMnO_4$  to the soil (1 row - zone of oxidizer application, 2,3 rows - different distances from the zone of oxidizer application).

**Table 3** - Wave proliferation of oxidizer to the studied soils ( $n = 8$ )

Soil	Humidification	Row	Eh mV on HSE
sod-podzol well-cultivated	optimal	1	355,0±54,2
		2	276,2±33,7
		3	256,2±30,2
	excess	1	260,0±15,3
		2	232,5±18,6
		3	147,5±15,8

As the results show, the value of redox potential is higher with the optimal soil humiditation. Its value decreases with the distance from the area of application of the oxidant. Soils of excessive moisture have a greater buffering to oxidation, so they have a difference in the value of Eh in the 1st and 3rd row more than in soils of optimal moisture.

Thus, the studies have shown the prospects of studying the oxidation-reduction properties, processes and modes for a more complete assessment of the oxidation-reduction state of soils. It is proposed to identify fractional composition of the redox systems at titration of soils by the oxidizing and reducing agents, by the method of potential and static coulometry.

The additional information about oxidation-reduction condition provides the definition of all the connections charged either positively or negatively in soils.

Knowledge of indicators of change Eh from humidity, temperature, over time, changes in soil properties per unit of change Eh is very important in practise.

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灰铸铁激光微结构的控制  
**CONTROL OF LASER MICROSTRUCTURING  
OF GRAY CAST IRON**

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注解。 本文介绍了研究激光处理灰铸铁, 不同化学成分的GI25和GI30级对渗透深度, 粗糙度, 结构和表面硬度的影响的研究结果。 结果表明, 当热输入为  $10.5-11.0 \text{ J}\cdot\text{s} / \text{mm}$  时, 仅观察到峰顶的熔化, 高度降低  $4-8 \mu\text{m}$ , 加热硬化区的结构为马氏体。 能量的进一步增加导致渗透深度的增加和莱氏体区的形成。

为确保灰铸铁抗磨环的最佳穿透深度, 粗糙度, 表面结构和表面硬度, 应使用激光硬化的比热输入值, 范围为  $40-86 \text{ J}\cdot\text{s} / \text{mm}$ 。

关键词: 耐久性, 活塞头, 活塞槽, 柴油, 摩擦材料, 涂层, 耐磨性

**Annotation.** *The paper presents the results of a study of the laser treatment influence of gray iron, grades GI25 and GI30 of different chemical composition on the depth of penetration, roughness, structure and surface hardness. It was established that with heat input of  $10.5-11.0 \text{ J}\cdot\text{s}/\text{mm}$ , only melting of the tops of the peaks is observed, which height decreases by  $4-8 \mu\text{m}$ , the structure of the heat-hardening zone is martensite. A further increase in energy leads to an increase in the depth of penetration and the formation of a ledeburite zone.*

*To ensure the optimum penetration depth, roughness, surface structure and surface hardness of gray cast iron anti-wear rings, the specific heat input value of laser hardening in the range  $40-86 \text{ J}\cdot\text{s} / \text{mm}$  should be used.*

**Keywords:** *durability, piston head, piston grooves, diesel, tribological material, coating, wear resistance*

## Introduction

Analysis of failures of piston heads of ship low-speed diesel engines (SLSDE) installed on vessels of the Far Eastern Basin showed that the main reason for their replacement (up to 80% of the total number of failures, on average) is wear of the bearing surfaces of piston grooves due to low wear resistance of the part material, high thermal and mechanical loads, as well as uneven loading of working surfaces.

It has been established that the most common defect of the SLSDE piston heads is the wear of the bearing surfaces of the piston grooves with the acquisition of a certain conicity by the working surfaces due to the greater wear rate of the sections adjacent to the working surface of the piston head. The maximum amount of wear of the groove edge reaches 1 mm with a maximum allowable gap between the piston ring and the groove of 0.6 mm already 18 thousand hours. A large number of factors affect the wear process of piston grooves and piston rings: engine type, design features, degree of forcing, used fuel and oil, climatic zone of operation, etc. Increasing the degree of boost leads to an increase in the maximum combustion pressure, an increase in the friction pressure between the piston ring and the piston groove and the temperature in the region of the first compression ring to 240 °C [1].

The most promising method for increasing the durability of piston heads during their repair is the installation of cast-iron anti-wear rings (cast iron GI25 and GI30), which are usually made from defective liners of ship diesel engines. However, the constructive impossibility of supplying lubricant to the friction zone is a compression ring - piston groove, high friction pressures and temperatures substantially intensify the wear process, therefore, to reduce wear rate, it is necessary to strengthen anti-wear rings. In addition, during the cutting process, when machining is performed with a chisel or abrasive wheel as a result of tearing out particles of material, sharp side edges of the microrelief are formed, which must be blunt to reduce wear rate during friction while operating the part. To ensure high wear resistance, friction surface structuring is applied by laser processing [2].

Laser microstructuring allows controlling the geometrical parameters of the surface structure and its phase composition (it is possible to obtain both needleless martensite structures and ledeburite, which provide high wear resistance of cast iron parts) [2, 3]. Laser hardening can both reduce roughness parameters and increase them depending on processing mode. To ensure the manufacturability of the restoration process of the piston head, it is advisable that laser hardening is a finishing operation, i.e. subsequent machining would be required.

The reliability of friction units of ship diesel engines significantly depends on the quality of the surfaces of mating parts. As is known from practice, friction and wear of parts are largely due to the microgeometry of their surfaces, and in this regard, the assessment of microgeometry and the analysis of the influence of this factor on the functional properties of products are of particular importance [4].

The surface structure after laser treatment is significantly influenced by the depth of melting of cast iron due to the dissolution of graphite particles in the iron matrix and cooling rates to fill the voids formed. The melting depth of the iron depends on the parameters of the laser processing mode (the specific radiation power and the speed of the beam moving over the surface of the part).

**The purpose of the work** is to determine the parameters of the laser hardening mode, which provide optimal values for the depth of penetration, roughness, structure and surface hardness of anti-wear rings made of gray cast iron.

#### **Methods and materials**

Laser hardening of the surface was carried out on the installation "Comet-2" with a radiation power of 1.2 kW.

Metallographic studies were performed on a Leica DM4000 M microscope with zooming of 50 to 1000 times.

The hardness measurement was carried out on an MNT-10 microhardness tester with a load of 150 N.

The microgeometric properties of the surfaces of the parts after mechanical and refined laser processing are anisotropic. Three-dimensional profilometry allows us to more accurately assess the actual characteristics of the surface: unambiguously differentiate the depressions formed by single holes or grooves; determine the values of the extrinsic roughness characteristics, since in the traditional method of their measurement the profile runs along the slopes of the peaks and valleys, and does not intersect with them, which distorts the reference curve of the surface; to increase the informativeness of the results due to an increase in the determined independent parameters, to visualize the surface using a computer, i.e. to present its topography in detail; obtain a number of new parameters, such as the material volume of cavities or protrusions [5–7].

The roughness parameters and the topography of the samples after grinding and laser processing were determined using a Bruker Contour GT-I 3D Optical Microscope measuring instrument. The parameters for assessing the structure of surfaces obtained by three-dimensional measurements comply with GOST R ISO 25178-2–2014 (ISO 25178-2: 2012).

Samples for research cut out of the cylinder liners of ship diesel engines of various brands. The chemical composition of the cast iron is given in table 1.



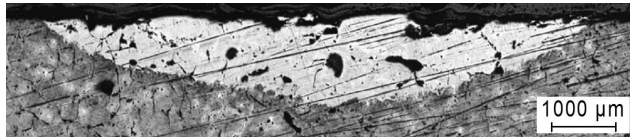
**Table 1**

*The chemical composition of the investigated cast iron, %*

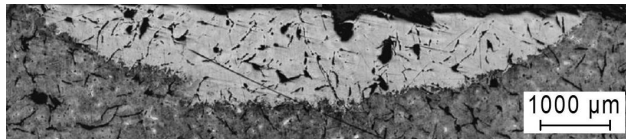
Type of cast iron	Name of the Element				
	C	Si	Mn	S	P
1	3,63	1,02	1,08	0,08	0,85
2	3,16	1,60	0,80	0,08	0,26
3	3,21	1,92	0,63	0,22	0,19

### Experimental results and discussion

The microhardness of the metal base of the original cast iron is in the range of 300–334 HV, after laser treatment without melting, the microhardness of the heat-affected zone increases to 574 HV, and the melted zone 706–756 HV, depending on the type of cast iron. The type of zones of laser altering on cast iron is presented in Fig. 2



*a*

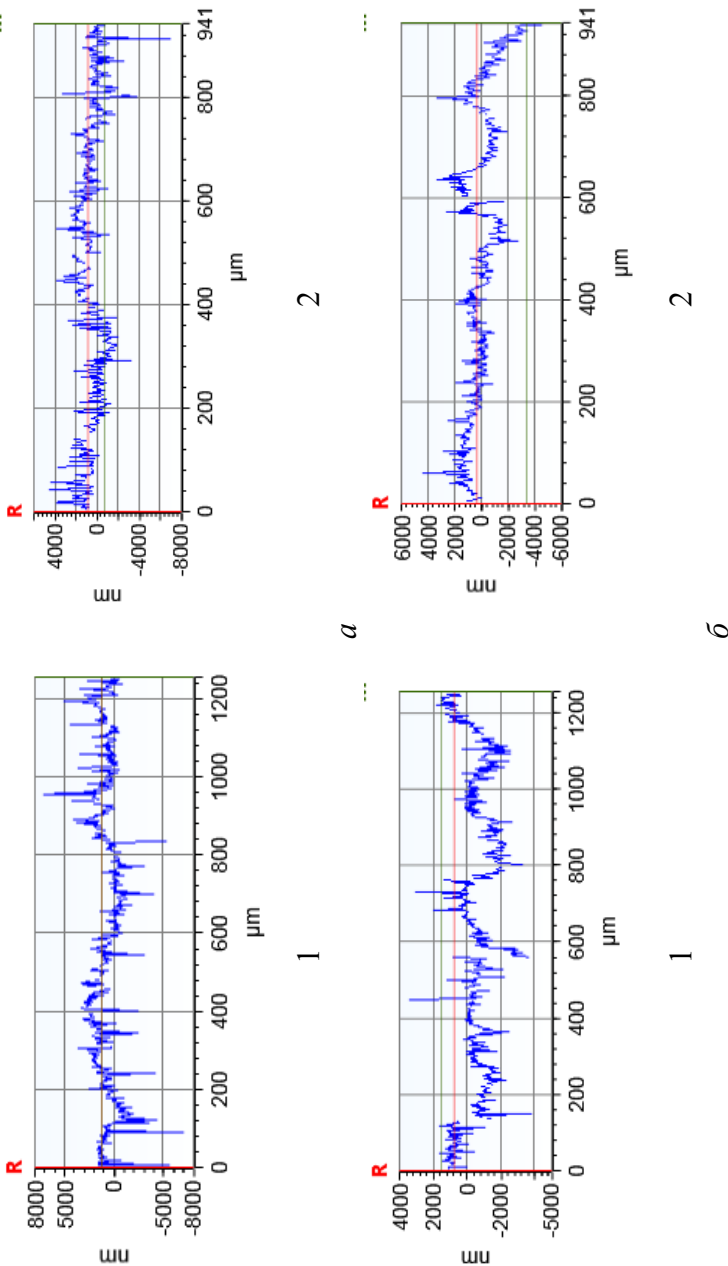


*b*

**Fig. 1.** Zones of laser altering on cast iron ( $\times 50$ ):

*a* – without melting ( $E = 10,7 \text{ J}\cdot\text{s}/\text{mm}$ ); *b*)– melted ( $E = 38,2 \text{ J}\cdot\text{s}/\text{mm}$ )

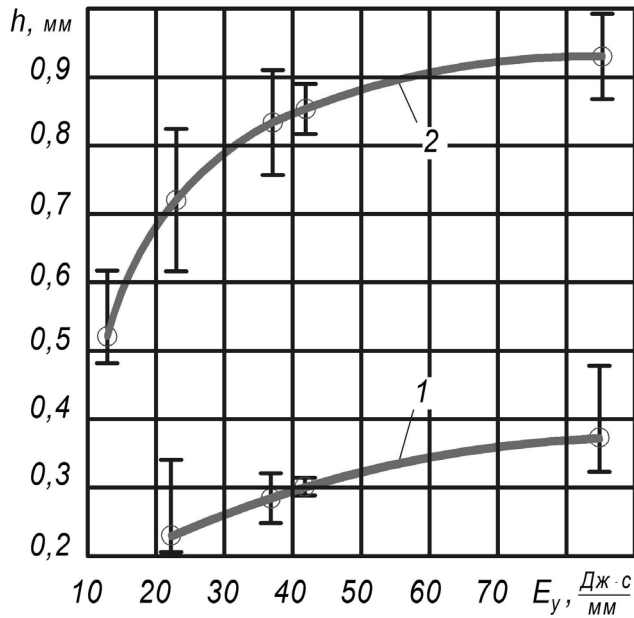
With heat input of 10.5–11.0 J•s/mm, only the melting of the tops of the peaks is observed and the height of which decreases by 4–8 μm (Fig. 2), due to which the height parameters of the structure decrease somewhat. The metallographic structure of the heat-affected areas is martensite.



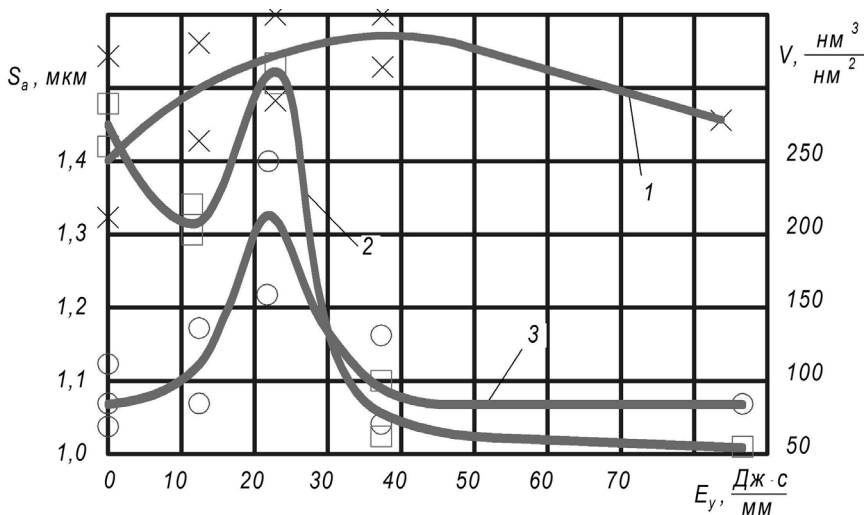
**Fig. 2.** The surface roughness of the original cast iron (a) and after laser altering at 10.7 J•s/mm (b);  
1 – in the direction of the laser beam;  
2 – perpendicular to the direction of the laser beam

With heat input of 22 J•s/mm and more, the upper layer of cast iron melts to form a ledeburite. With an increase in heat input from 22 to 86 J•s/mm, the depth of penetration smoothly increases from 235 to 394  $\mu\text{m}$  (Fig. 3).

Analysis of the depth of laser altering to cast iron showed that with an increase in heat input from 10.5 to 86.0 J•s/mm, the depth of the laser altering zone increases smoothly from 505 to 918  $\mu\text{m}$  (Fig. 3). In this case, there is a large scatter of the values of the melting depths and thermal effects relative to the average value due to a significant difference in the content of silicon and carbon in the initial alloy.



**Fig. 3.** The effect of specific heat input in laser altering on the depth of impact: 1 - without melting; 2 - with surface melting



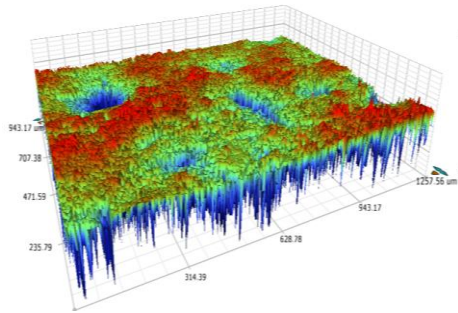
**Fig. 4.** The effect of specific heat input in laser altering on the surface structure parameters:

- 1 - the volume of voids per unit area for a given crushing coefficient ( $V_v$ );
- 2 - arithmetic mean value of the height of the surface of a limited scale ( $S_a$ );
- 3 - the volume of material per unit area for a given crushing ratio ( $V_m$ )

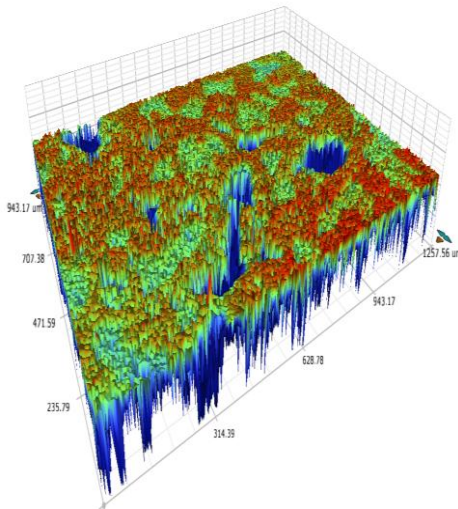
The arithmetic mean of the height of the surface of limited scale ( $S_a$ ) depends on the specific heat input during laser altering (Fig. 4), the minimum height corresponds to the energy range of 10.7–11 J·s/mm, at which only the melting of the tops of the peaks occurs, the maximum value of the height  $S_a$  is observed at an energy of 22 J·s/mm, then gradually decreases.

The volume of the material per unit area for a given crushing coefficient ( $V_m$ ) has the same dependence as for the average value of the surface height of a limited scale (Fig. 4).

The volume of voids per unit area for a given crushing ratio ( $V_v$ ) increases as the specific heat input reaches 38 J·s/mm due to carbon burning out and dissolving in the iron matrix, but because of the short laser time the voids are not filled with metal (Fig. 5), then gradually decreases.



*a*



*b*

**Fig. 5.** The surface topography of the original cast iron (a) and after laser altering at 38.2 J•s/mm (b)

### Summary

To ensure the optimum penetration depth, roughness, surface structure and surface hardness of gray cast iron anti-wear rings, the parameters of the specific heat input of the laser hardening in the range of 40–86 38.2 J•s/mm should be used.

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船用柴油机耐久性曲轴轴承的摩擦材料选择  
**THE SELECTION OF TRIBOLOGICAL MATERIALS  
FOR DURABILITY CRANKSHAFT BEARINGS  
OF MARINE DIESEL ENGINES**

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注解。本文介绍了“曲轴 - 涂层 - 刀片”界面的摩擦学性能研究结果。为了提高曲轴轴承的耐久性，建议在轴销上形成耐磨薄膜金属陶瓷涂层，其通过用天然和人造层状硅酸盐对表面进行三轴改进而获得。

已经确定，通过改变摩擦材料的化学组成和结构，可以通过优化涂层的组成，结构，形貌，硬度和弹性模量的参数来在大范围内增加摩擦共轭的耐久性。。给出了一些金属陶瓷涂层的化学成分。

关键词：耐久性，轴承，曲轴，柴油，摩擦材料，涂层，耐磨性

**Annotation.** *The paper presents the results of studies of the tribological properties of the “crankshaft - coating - insert” interface. To increase the durability of crankshaft bearings, it is proposed to form wear-resistant thin-film cermet coatings on shaft pins, which are obtained by tribomodification of the surface with natural and artificial layered silicates.*

*It has been established that by changing the chemical composition and structure of tribological materials, it is possible to increase the durability of tribo-conjugation in a large range by optimizing the parameters of the composition, structure, topography, hardness and elastic modulus of the coating. The chemical composition of some cermet coatings is given.*

**Keywords:** *durability, bearing, crankshaft, diesel, tribological material, coating, wear resistance*



## **Introduction**

The wear resistance of the rubbing surfaces of the components of the tribounits of machines, mechanisms and equipment is the main factor determining their durability and operating costs, as well as the need for repair. The solution to the problem of improving wear resistance and, accordingly, durability is associated with the use of various methods of hardening friction surfaces and tribo-active additives in lubricant.

Currently, a large number of various tribological materials, which are capable of forming protective metal-ceramic films, are used to modify the friction surfaces. The most widely used minerals have a layered structure: serpentinites, vermiculite, mica, clay, graphite, etc. and polymeric materials. Their positive effect is due to the ability of these materials to form on the friction surfaces thin films consisting of scaly particles oriented parallel to the friction surface. These films (or layers) separate the rubbing surfaces, smooth their microrelief, and in the case of friction without lubricant they transfer it to internal friction, at which a shift occurs inside the layer of particles. Thus, purely mechanical protection of rubbing surfaces against wear is carried out.

In this regard, of great practical interest is the task of developing such a tribological material that would have the ability to create thin-film coatings on surfaces with friction with improved tribological properties.

The formation of wear-resistant thin-film coatings is carried out by tribomodification of friction surfaces both in the course of normal engine operation and in the repair of crankshafts [1], therefore the technological costs are minimal.

Recently, the prospect of using vermiculite and clay as a tribological material (TM), which is widely distributed in nature and has a low cost, is being studied, and artificial layered silicates are being developed.

However, it should be noted that in spite of deep and thorough research in the field of application of TM to increase the durability of tribo-knots, it is practically impossible to select the optimal TM for specific conditions, since studies have been performed for various operating conditions and by various methods. Therefore, to assess the tribological properties of various types of TM, we carried out comparative tests using a single method [1].

It is known that layered silicates form metal-ceramic coatings only on ferrous metals, therefore the tribo-node "crankshaft pin - coating - bearing insert" is of the greatest interest. In addition, crankshaft bearings operate at high speeds and specific loads. Therefore, studies of TM were carried out in relation to this friction unit.

The purpose of the work is to identify a group of organic-inorganic tribological materials based on vermiculite, clays and artificial materials, ensuring maximum efficiency of their use for modifying the pins of the crankshafts of ship diesel engines to improve the wear resistance and durability of the tribocoupling.

### Materials and research methods

To study the performance properties of thin-film wear-resistant coatings formed on the friction surfaces of steel by tribomechanical modification, 17 organic-inorganic tribological materials from 4 groups were taken - natural and artificial polymers, of which over 20 compositions and composites were made (Fig. 1).

Layered silicates were used as base materials for the manufacture of compositions and composites: vermiculite and clay minerals, since they are of low cost and are widely used in construction. To reduce the abrasive properties, part of the layered silicates were subjected to modification with hydrochloric acid. Some of the layered silicates and composites based on them were calcined at 600–700 °C to change their properties. To improve the tribological properties, fine particles of layered silicates were clad with natural and artificial polymers.

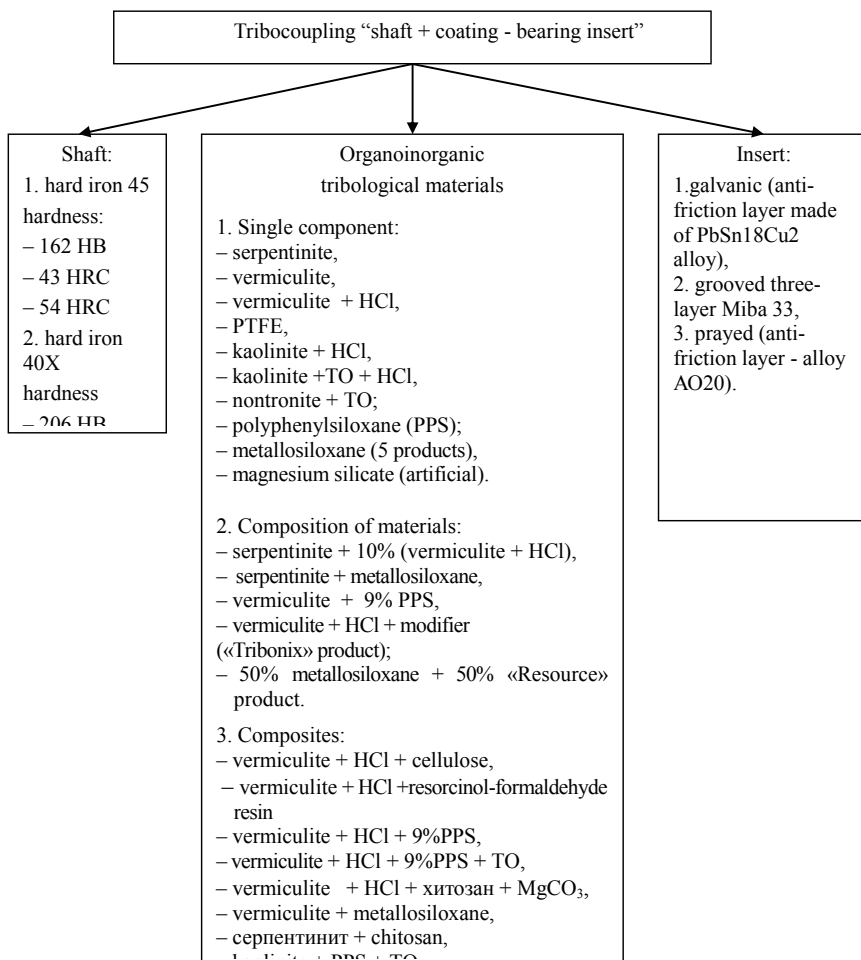
The original vermiculite has a layered structure. After its mechanical activation, the particle size is about 5 µm. With acid treatment, the particle size decreases to 6–40 nm, and the vermiculite crystal structure is destroyed and becomes amorphous [1].

Polyphenylsiloxane (PPS) has a stable chemical composition  $[C_6H_5SiO_{1.5}]_n$  and a layered structure. In addition, it is possible to clad particles of vermiculite and kaolinite with siloxane to modify it and reduce its abrasive properties and improve tribological engineering. This creates a mineral silicate base on which a polymer silicate coating is formed. Composites containing PPS have high adhesion to metals.

When vermiculite is modified in solutions containing PPS or cellulose, a coating of molecular character is formed.

The search for the optimal chemical composition of tribological materials for the formation of wear-resistant coatings on the friction surfaces of parts to solve the problem of increasing their wear resistance was carried out in several stages. At the first stage, the tribological properties of the starting materials were investigated, then promising materials were selected and compositions or composites were created from them, the content of the starting materials in the composition was optimized. The final decision on the prospects of the use of tribological material is made after conducting tribological tests and analyzing the effectiveness of metal-ceramic coatings formed on their basis for specific operating conditions.

Accelerated comparative tribological studies of organic-inorganic materials (tribological characteristics of the most promising materials are given in Table 1) made it possible to establish the following: natural layered silicates have high abrasive properties that have a significant impact on both the steps of applying friction to the surface and the formation of a coating, and in the process of tribological tests. Most TM provides a significant reduction in the rate of wear of the steel sample (Fig. 2).



**Fig. 1.** The materials used to study the performance properties of the tribocoupling “shaft + coating - bearing insert”

Analysis of the results of tribological tests showed that part of the TM could not be used to modify the crankshaft pins due to a significant increase in the wear rate of the insert. These include the following TM: kaolinite, metasiloxanes (polyphenylsiloxane, aluminumphenylsiloxane), composites based on vermiculite modified with acid and chitosan, etc. Increased wear of the antifriction layer of inserts necessitates their more frequent replacement at the engine. However, the formed coatings significantly reduce the rate of wear of steel. Some materials can significantly reduce the wear rate of the insert, but have virtually no effect on the wear of the steel (for example, vermiculite, modified with acid and  $\text{MgCO}_3$ ), i.e. the effectiveness of their use is very low to increase the durability of the crankshaft-insert coupling.

**Table 1**

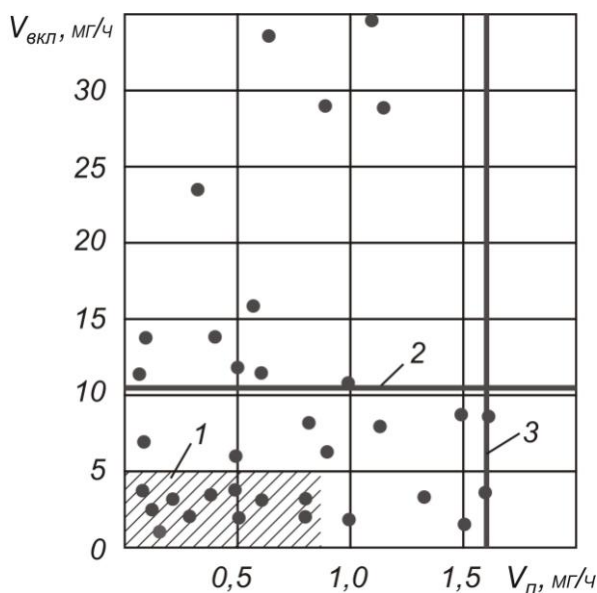
*40X steel wear rates at various stages of coating formation, coupling details in the process of tribological tests and materials for coating formation*

№ o/n	Tribological material for coating formation	Steel wear rate, mg/h			Insert wear rate, mg/h	Friction coefficient at maximum load
		when applying tribological material	when forming a coating	during tribological tests		
1	Steel 40X without hardening	–	–	2,7	10,5	0,079
Single Component Materials						
2	Serpentine	58	2,4	1,4	2,3	<b>0,007</b>
3	Vermiculite	64	3,4	0,6	3,5	0,018
4	Vermiculite + HCl	28	1,7	<b>0,1</b>	6,2	0,036
5	PTFE	0	0,3	1,6	2,1	0,054
6	Kaolinite + HCl	60	1,5	1,0	11,2	<b>0,011</b>
7	Nontronite	40	1,2	<b>0,3</b>	3,9	<b>0,014</b>
8	PPS	0	1,1	1,7	2,8	0,022
Compositions of materials						
9	Serpentine + 10% ( vermiculite + HCl)	50	1,4	0,5	8,9	0,028
10	Vermiculite + 9% PPS	68	0,1	0,4	2,2	0,029
11	Vermiculite + 50%PTFE	50	2,2	0,8	1,2	0,014
12	Tribonix	2	0,1	0,6	1,7	0,022
Composites						
13	Vermiculite + HCl + Cellulose	2	0,1	1,0	1,9	0,014
14	Vermiculite + HCl + resorcinol-formaldehyde resin	0	1,4	<b>0</b>	11,0	<b>0,007</b>
15	Vermiculite + HCl + 9% PPS + TO	8	1,4	<b>0,1</b>	1,9	0,007

Notes. \* - groove insert Miba № 33.

Some TMs slightly reduce the wear rate of hardened steel, but lead to increased wear of inserts (for example, nickel-phenylsiloxane).

The most promising TM to increase the durability of the “crankshaft - insert” coupling should be those that provide minimum wear rates for both coupling surfaces (area 1 in Fig. 2) and allow to increase the wear resistance of the node by 4–10 times. These include the following TM: nontronit; acid modified vermiculite; vermiculite, modified with acid and cellulose or polystyrene, composition “Tribonix”, etc.



**Fig. 2.** The values of the wear rates of the interfaces “disc 40X - bearing insert of Miba No. 33” for various coatings of the disc ( $V_{вкл}$  - insert wear rate;  $V_n$  - shaft coating wear rate):  
 1 - area of optimal values of wear rates of interface surfaces;  
 2 - the average wear rate of the insert for friction with non-hardened steel;  
 3 - average wear rate of the non-reinforced steel disc

Modifying vermiculite with an acid not only reduces the size of its particles, but also the content of alumina, thereby reducing the rate of wear on the steel, both during the surface modification stage and during tribological testing. Heat treatment of organic-inorganic materials leads to a decrease in the rate of wear of steel during the application of the material.

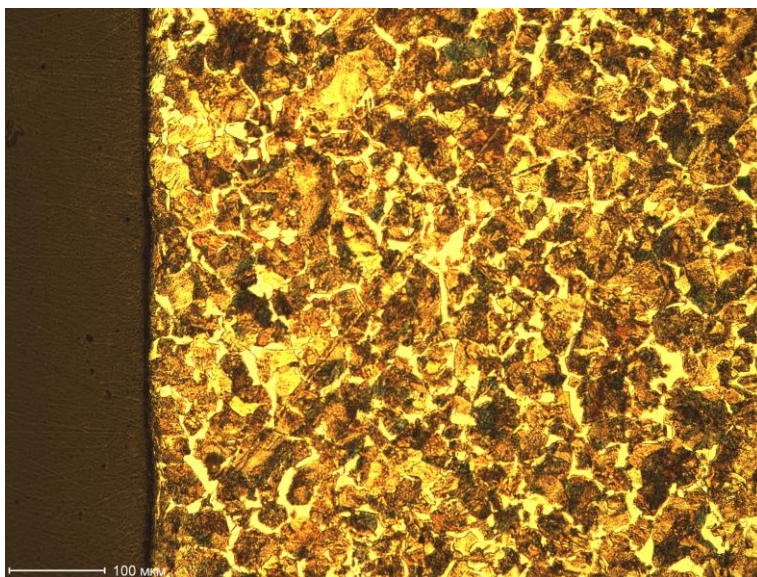
It should be noted that the composition of materials and composites can significantly reduce the wear rate of the coupling part (for example, bearing insert) compared with single-component tribological materials. The use of serpentinite allows you to get a minimum coefficient of friction, however, the wear rate at all stages of testing is about the same as when using vermiculite. The use of compositions based on modified vermiculite can significantly improve the tribological characteristics compared with the starting material, especially during the formation of coating and tribological tests. The most promising is a composition based on complexly modified vermiculite (material "Tribonix"), since it provides stable tribological properties: minimal wear rates at the stages of application and coating formation and tribological tests, as well as a low coefficient of friction.

It was established that as a result of tribomodification of nano-structured tribological materials and the formation of a metal-ceramic coating on the friction surface, there is a significant decrease in surface roughness parameters with  $R_a = 0.86 \mu\text{m}$  to  $R_a = 0.12 \mu\text{m}$ , structure parameters with  $S_a = 2.88 \mu\text{m}$  to  $0.77 \mu\text{m}$ , which ensures a decrease in the specific pressure on the interfaced surfaces and the probability of seizure and tearing under friction conditions with boundary lubrication.

Creating compositions of materials and composites based on modified vermiculite allows you to change the mechanical properties of coatings due to the modification and cladding of particles of vermiculite in a wide range:

- microhardness from 244 to 822 HV;
- modulus of elasticity from 0.3 to 60.7 Mpa.

As a result of tribomodification of the friction surface at a depth of up to 0.25 mm, there is a high content of alloying elements that make up the tribomaterial. Metal-ceramic coating on the friction surface is characterized by a minimum iron content (only 8.2%) and a large amount of carbon, oxygen and silicon. The coating thickness is in the range of 6.0–7.5  $\mu\text{m}$ , an average of 6.7  $\mu\text{m}$  (Fig. 3).



**Fig. 3.** *The microstructure of the surface layer of steel 40X after tribomodification with “Tribonix”*

The study of composite coatings using X-ray electron spectroscopy made it possible to establish the composition of a thin-film coating on the surface and at a depth of up to 100 nm. Depending on the material used to modify the steel, the surface layer has the following composition (in atomic percent):

1) during hardening by serpentinite after tribological tests: O = 42.4, C = 40.3, Fe = 9.4, Al = 2.4, Si = 2.2, N = 1.6, Ca = 1.1, Sn = 0.4, Pb = 0.3; after etching the surface with argon at a voltage of 1000 V/cm at a depth of 100 nm: Fe = 80.8, O = 12.1, C = 3.8%, Al = 1.5, Si = 0.7, Ca = 0.6, Sn = 0.1, N = 0.1, Pb = 0.2;

2) when hardening polyphenylsiloxane polymer after tribological tests: O = 46.6, C = 40.6, Fe = 9.3, Si = 2.0, N = 1.2, Ca = 0.4; after etching the surface with argon at a depth of 100 nm: Fe = 34.2, O = 49.9, C = 14.6, N = 0.6, Ca = 0.7;

3) when hardening with a composite: vermiculite + polymagnesium phenylsiloxane after tribological tests: O = 43.2, C = 39.8, Al = 7.2, Fe = 4.5, Si = 2.4, N = 1.6, Ca = 1.0, Sn = 0.3, Pb = 0.1; after etching the surface with argon at a depth of 100 nm: O = 45.5, Fe = 21.1, Al = 18.6, C = 10.6, Si = 2.9, Ca = 1.1, N = 0.5, Sn = 0.3, Pb = 0.1.



### Summary

Tribological tests of a large group of tribological materials allowed to establish the following:

- natural layered silicates have high abrasive properties, which have a significant impact on the stages of applying to the surface of friction and the formation of the coating, and in the process of tribological tests;
- most materials provide a significant reduction in the wear rate of the steel sample;
- compositions and composites based on modified vermiculite have the best tribological characteristics.

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选择性激光熔化技术的发展  
**DEVELOPMENT OF TECHNOLOGY  
FOR SELECTIVE LASER MELTING**

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注解。 本文重点介绍了经典方法向现代宇宙工业细节生产技术转化的现状。纵观航空和火箭科学的整个历史，其中一项主要任务是减轻发电厂的重量。近5-6年，制造三维物体的技术不是通过经典的材料切割方式（磨刀，铣削，EDM）或通过改变坯料的形状（锻造，冲压，压制）而是通过研究生建立（添加）材料开始形成意向性。

关键词：添加剂技术，3D打印机，增材制造，选择性激光熔化，工件，印刷。

**Annotation.** *The article focuses on the actuality of the transformation of classical method to modern technologies of detail producing in cosmic industry. Throughout the whole history of aviation and rocket science one of the main tasks is to reduce the weight of the power plant. In recent 5-6 years the technologies of making 3-D objects not by classical way of material cutting (sharpening, milling, EDM) or by changing the form of the blank (forging, stamping, pressing) but by graduate building up (adding) the material started to form intensively.*

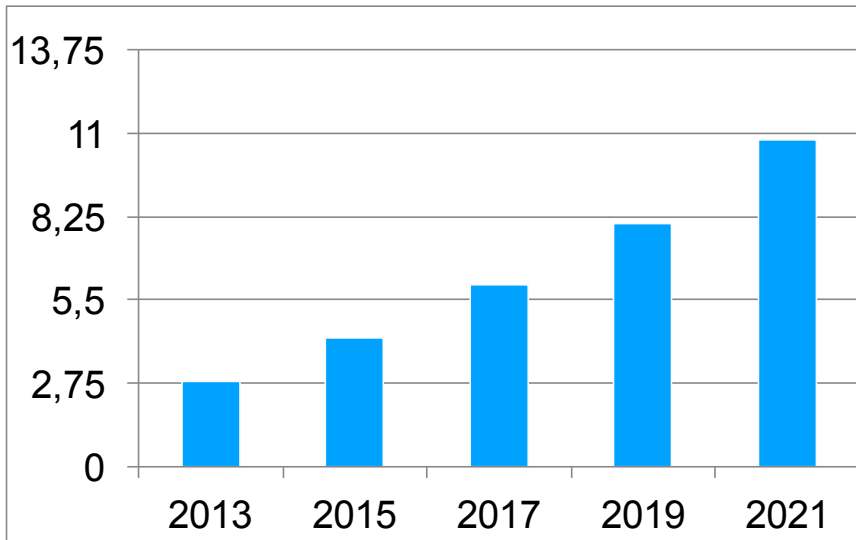
**Keywords:** *additive technologies, 3D printer, additive manufacturing, selective laser melting, workpiece, printing.*

Since the beginning of 1980-s the technologies of making 3D objects not by cutting the materials (sharpening, milting, EDM) or by changing the form of the blank (forging, printing, pressing) but by graduate building up (adding) of the material or changing the substitute phase condition in a given space area began to form.

The first industrial printer on material appeared in 2000.

Nowadays, there is rapid development of additive technology (AT) in the world industry: the global market of products and services related to AM technologies (additive manufacturing) is projected to be estimated at 6 billion USD in 2020. and in 2022 - 10.8 billion USD. The number of scientific publications grows (Fig. 1).

**Forecast of volume growth of additive manufacturing in the world, billion dollars**



*Fig. 1. Market review AT*

At (English Additive Fabrication) - a generalized name of technologies involving the manufacture of complex shaped things according to the digital model (or CAD-model) by layer-by-layer building up the material. Thus, the manufacture of a detail is building up a material in contrast to traditional technologies which make the detail by means of cutting the "extra" material.

**The object of the study** - materials and blanks of the details got by selective laser melting of titanium alloy (CL41TI ELI, Germany), stainless steel (CL 20ES, Germany) and aluminium (ACII-27 AISi10Mg, Russia) powders on the Concept-Laser M2cusing plant at AO "Corporation "MIT".

**The aims of work:**

1. To confirm the material quality got by the method of selective laser melting.
2. To confirm the quality of the blanks and parts obtained by this technology.

**The main indicators** - are mechanical properties obtained on the samples-witnesses and samples cut from parts, they are shown in table. 1-3.

**Table 1**

*Results of mechanical tests of samples  
tensile strength according to GOST 1497-84 of STEEL alloy CL20ES*

Sample type	Maintenance	Yield stress, kgf / mm	Tensile stress, kgf / mm	Relative elongation, %	Relative narrowing, %
Samples- witnesses	Were not maintenanced	51,0-55,8	60,7-61,8	42,0-52,0	63,2-66,2
		average value 53.4	average value 61.25	average value 47.0	average value 64.7
Samples- witnesses	550 □ placed for 3 hours, cooling with the furnace in protective atmosphere	40,5-49,0	61,0-66,8	43,0-58,0	56,0-66,5
		average value 46.57	average value 64.82	average value 50.4	average value 62.36
Samples cut from ribs 3L-03.01.001		47,8-54,5	69,5-71,0	31,0-36,0	54,0-58,0
		average value 51.15	average value 70.25	average value 33.5	average value 56.0
Samples cut from the center of the "bushing" 3L-03.01.001		44,7-47,3	65,5-66,0	47,0-49,0	60,0-65,0
		average value 46.0	average value 65.75	average value 48.0	average value 62.5
Hot rolled rod (12X18H10T GOST 5949)	-	≥20	≥52	≥40	≥55
Casting of steel grade 35L (according to GOST 977- 88)	-	28.0	50.1	15	-
Properties of steel grade CL 20ES, curled Consept Laser	-	47.9	58.1	>15	-

**Table 2**

*Results of mechanical tensile testing of samples according to GOST 1497-84 for titanium alloy*

Samples	Maintenance	Sample designation	Strength, kgf / mm	Elongation, %
1. Located in the space at an angle of 90°	In a vacuum furnace at 850° for 1 hour	R	98-113,5	1,0-7,7
			average value 109.5	average value 4.06
1. Located in the space at an angle of 45°		RX	115-117	9,3-12
			average value 116.0	average value 8.8
GOST 26492-85	-	Blazed loop	85-90	6-8
Consept Laser Manufacturer	-	Sample of CL41TiELi alloy	112-132	5-10

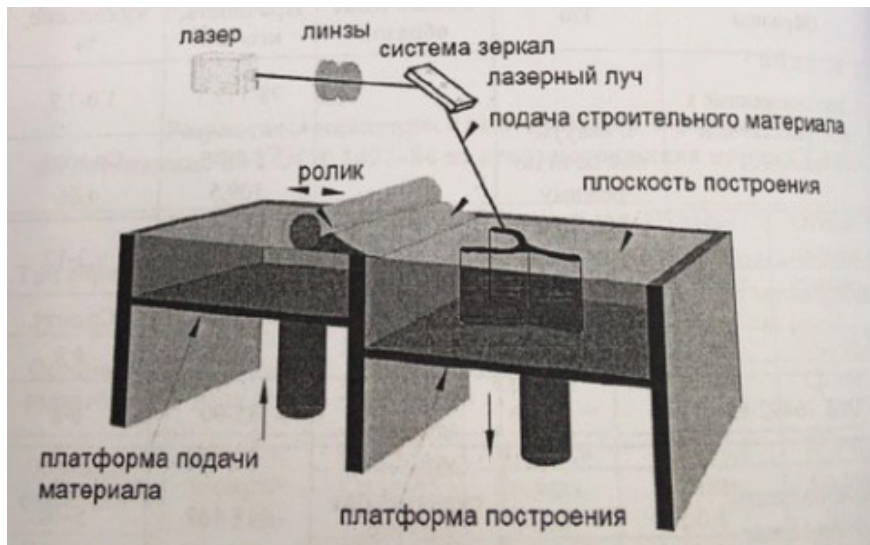
**Table 3**

*Results of mechanical tests of samples for impact strength according to GOST 9454-78 and stretching according to GOST 1497-84 made of ASP-27AlSiMg aluminum alloy*

In 2015 AO "Corporation "MIT" studied the materials got by the method of selective laser melting.

Samples	Mechanical properties				
	□, kgf / mm	□, kgf / mm	□, %	□, %	□, kgf / mm
Shock	-				>0,5
Discontinuous	24,0-25,0 average value 24.5	36.0	8,0-10,0 average value 9.0	13,0-16,0 average value 14.5	-

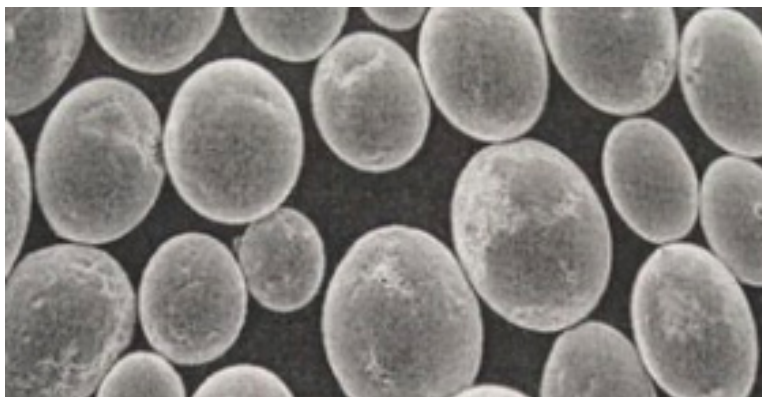
The process of selective laser melting helps to make layer-by-layer 3D physical objects by means of point fusion of metal powders by the laser energy. The process diagram is shown in Fig. 2.



*Fig. 2. Scheme of selective laser melting process*

The main technological parameters of the process are laser capacity, scanner speed, layer thickness.

The initial raw material for the preparation of blanks is a metal powder (Fig.3).



*Fig. 3. Metal powder*

Basic requirements for powder: the sphere shape, absence of satellites on the surface of the grains of powder, particle size distribution of the powder.

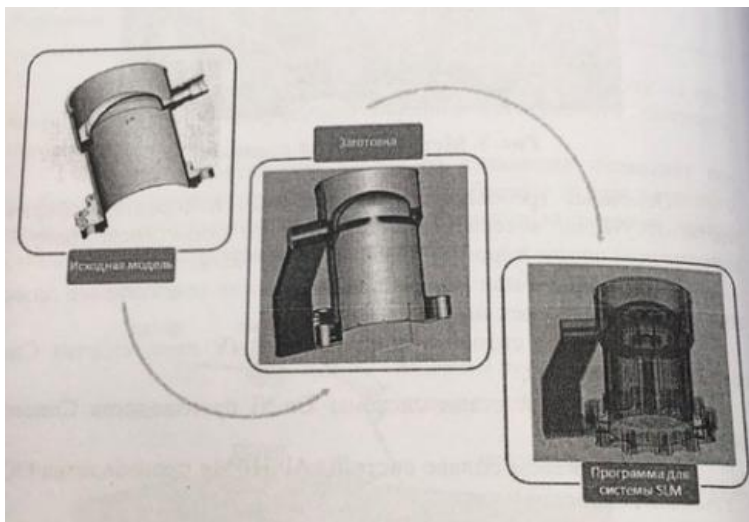
In 2015, the technology of selective laser melting of three materials was developed:

- of titanium alloy of Ti-6Al-4V systems made by ConceptLaser (Germany),
- austenitic steel of Cr - Ni system manufactured by ConceptLaser (Germany),
- aluminum alloy of AISi10Mg system manufactured by OOO "Sual-PM" (Russia).

Currently, the materials of Russian manufacturers are being tested:

- the titanium alloy of Ti-6Al-4V system manufactured by PJSC "Kompozit" (Russia),
- steel - PNIPY (Russia).

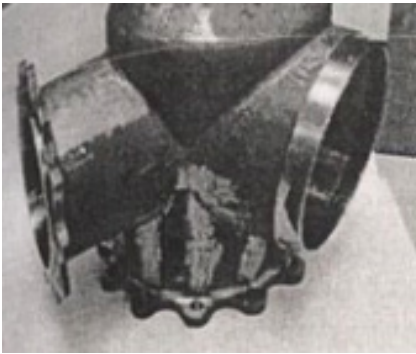
Preparation print process (Fig. 4) is to apply to the original 3D-model developed by the design departments, gaps in those places where subsequent machining (landing, responsible surfaces, etc.) is necessary. Then the blank is placed by Magics software so that the tensions occurring in materials during the printing are minimal and so that maintenance constructions (technological supporters) are out of locked space of the detail to delete them at the end. Then technological supporters are applied (mesh structured made of the same material with the detail and placed to support the detail from the stress because of its weight during the printing). Then the construction is divided into layers and is placed into the plant. Then the print settings are configured: laser capacity, scanner speed, layer thickness.



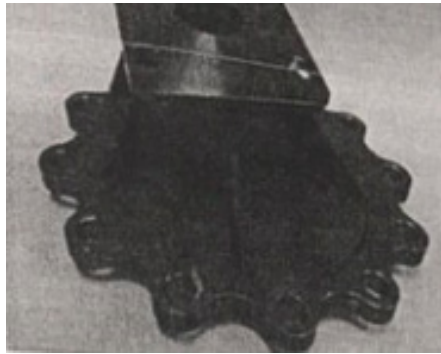
*Fig. 4. Print preparation process*



In the course of this work, we have made a number of parts(Fig.5)made of all of the above mentioned materials (details were printed with samples-witnesses). These parts and witness samples were tested to compare their mechanical properties. All samples withstood the required loads with a significant margin.



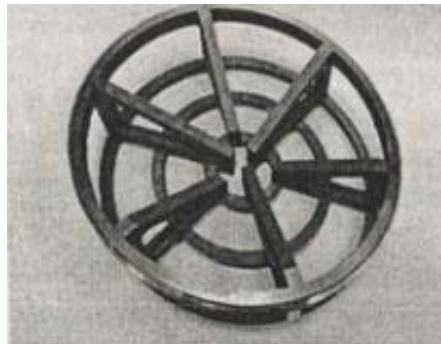
*a*



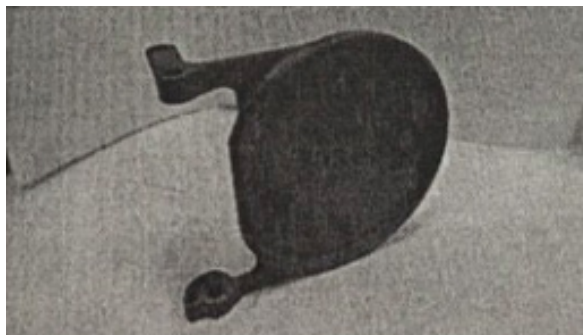
*b*



*c*



*d*



*e*

**Fig. 5.** The details manufactured by the method of selective laser melting:  
*a* - body of ITDA, *b* - lid of STE, *c* - Basis 3L-03, *d* grid 3L-03,  
*e* - lid of J80

### Conclusion

The details made by the method of selective laser melting correspond to constructive documents in geometric parameters and they have the strength characteristics which are not lower and mostly are higher (by 15-25% (see tables 1-3)), than the details made by standard technologies.

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根据两个关于岩石强度的标准, 构建莫尔极限的包络圈

## CONSTRUCTION OF THE ENVELOPE OF THE MOHR'S LIMIT CIRCLES BASED ON TWO CRITERIA FOR THE STRENGTH OF ROCKS

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注解。在坐标“正常 - 剪切张力”的莫尔图上的极限圆的包络被视为岩石强度的护照。为了构造包络, 使用了最大和最小主应力之间的关系, 以两种不同的强度标准的形式呈现。其中一个众所周知的Hoek-Brown标准, 另一个是T.B.最近提出的。Duyshenaliev和K.T.Koichumanov。当考虑A.N.的实验数据时, 验证了这些标准的适用性。通过在三轴压缩条件下测试各种岩石的圆柱形试样以及在单轴拉伸的情况下获得的Stavrogin。

关键词: 岩石强度, 极限应力圆包络线, 强度准则, 主应力, 莫尔图。

**Annotation.** *The envelope of limit circles on the Mohr's diagram in the coordinates "normal - shear tensions" is taken as a passport of rock strength. To constructing the envelope there were used the relationship between the maximum and minimum principal stresses, presented in the form of two different strength criteria. One of them is the widely known Hoek-Brown criterion, the other is proposed relatively recently by T.B. Duyshenaliev and K.T. Koichumanov. The applicability of these criteria is verified when considering the experimental data of A.N. Stavrogin obtained by testing cylindrical specimens of various rocks under conditions of triaxial compression, as well as in the case of uniaxial tension.*

**Key words:** *rock strength, envelope of limit stress circles, strength criterion, principal stresses, Mohr's diagram.*

The stress state of rocks in the massif is modeled by testing standard cylindrical specimens on installations using the Kármán scheme, when the ratio between the axial compressive stress  $\sigma_1$  and the main stresses  $\sigma_2$  and  $\sigma_3$  from uniform lateral pressure is:  $\sigma_1 > \sigma_2 = \sigma_3$ . In this case, the compressive stresses are considered positive; their ratio at the time of destruction is told on the strength of the rocks.

Stresses  $\sigma_1$  and  $\sigma_3$  can take many values, and it is impossible to carry out the whole complex of experiments with different ratios of these components. Therefore, various methods of calculation are being developed [1], which can be used to estimate the degree of danger of the stress state by the postulated dependencies between the main stresses, i.e. predict the strength properties of materials at the time of destruction.

According to Mohr the stress conditions at which the material is destroyed can be represented by limiting circles in the coordinates  $\sigma - \tau$  (normal - shear stress):

$$\left(\frac{\sigma_1 + \sigma_3}{2} - \sigma\right) + \tau^2 = \left(\frac{\sigma_1 - \sigma_3}{2}\right)^2 \quad (1)$$

In that case the main stresses  $\sigma_1$ ,  $\sigma_3$  correspond to the moment of onset of destruction.

We preliminarily indicate the following: the Mohr's equation of circles can also be represented in a form different from (1):

$$\varphi(\sigma, \tau, c) = \sigma^2 + \tau^2 - (1 + c)\sigma_1\sigma + c\sigma_1^2 = 0, \quad (2)$$

In that case as a parameter of the family of circles there is a parameter  $c = \sigma_3 / \sigma_1$  - is a type of stress state.

In this case, the coordinates of the envelope (according to the theorem on its existence) after the corresponding transformations are:

$$\sigma = \frac{\sigma_1(\sigma_1 + 2c(\sigma_1)_c)}{\sigma_1 + (1+c)(\sigma_1)_c}, \tau = \frac{(1-c)\sigma_1\sqrt{(\sigma_1 + c(\sigma_1)_c) \cdot (\sigma_1)_c}}{\sigma_1 + (1+c)(\sigma_1)_c}, ((\sigma_1)_c = \partial\sigma_1/\partial c) \quad (3)$$

Equation (2) in the principal tensorial axes of the stress is a quadratic algebraic equation, from whose invariants it can be concluded that it is a hyperbola equation. Using this property of equation (2), in the monograph [2], the relationship between stresses  $\sigma_1$  and  $\sigma_3$  is presented in the form:

$$\sigma_3 = A + \sqrt{\sigma_1^2 + B^2} \quad (4)$$

In which A and B are material constants to be determined for specific materials.

Thus, formula (4) is one of the possible criteria for the strength of rocks.

The definition of the constants A and B can be done by using the parameters and the formula (4), the stress  $\sigma_1$  is represented as:

$$\sigma_1(c) = \frac{-Ac + \sqrt{A^2 - (1-c^2)B^2}}{1-c^2} \quad (5)$$

In the formula (5), the stress  $\sigma_1$  can be selected for any two types of stress state, carried out in the experiment. Then these stresses will be “reference points” for determining the constants A and B. One of them is advisable to take at  $c=0$  ( $\sigma_1(0)=\sigma_1 c$ ), the second is at  $c_{max}$  from the available experimental data.

The dependence (2) (with the constants A and B) makes it possible to determine the ultimate tensile strength:

$$\sigma_p = A + B \quad (6)$$

The criterion similar to (2) in structure for undisturbed rocks was proposed in [3] in the form:

$$\sigma_1 = \sigma_3 + \sqrt{A_h \sigma_3 + B_h^2} \quad (7)$$

Relation (7) is a quadratic algebraic equation:

$$\sigma_1^2 - 2\sigma_1\sigma_3 + \sigma_3^2 - A_h\sigma_3 - B_h^2 = 0 \quad (8)$$

In accordance with the classification of the quadratic equation [4], the equation (8) (judging by its invariants) is a parabola equation.

As in the consideration of criterion (2), using the uniaxial compression strength and stress for a specific type of stress state ( $c_{max}$ ) as “reference points”, we obtain the expressions for the constants  $A_h$  and  $B_h$  6:

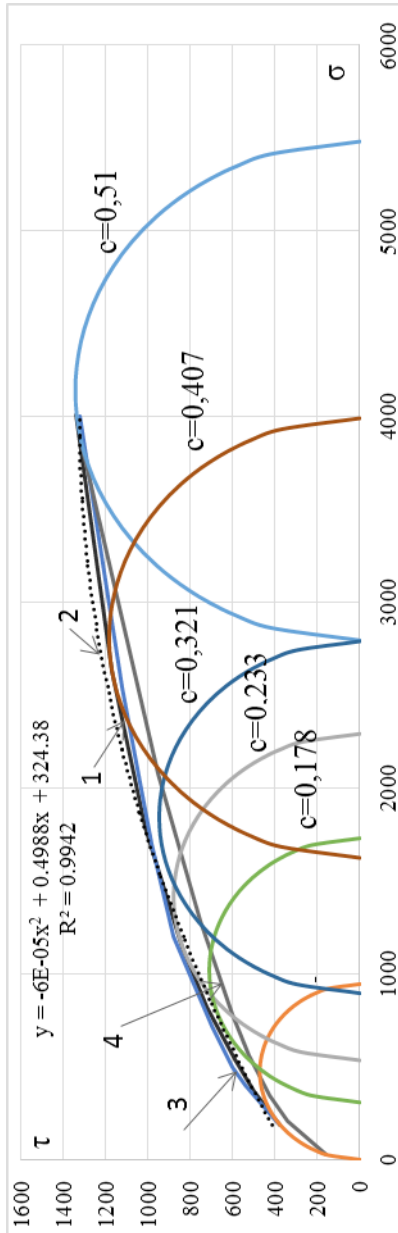
$$B_h = \sigma_c ; A_h = \frac{\sigma_1^2(1-c)^2 - \sigma_c^2}{\sigma_1 c} \quad (9)$$

With the known constants  $A_h$  and  $B_h$ , for construction in the case of a triaxial compression of Mohr's circles, an envelope to them and a tensile strength, we obtain:

$$\sigma_1 = \frac{A_h c + \sqrt{A_h^2 c^2 + 4(1-c)^2 B_h^2}}{2(1-c)^2} \quad (10)$$

$$\sigma_p = \frac{A_h - \sqrt{A_h^2 + 4\sigma_c^2}}{2} \quad (11)$$

To test the strength criteria (2) and (10), experimental data from triaxial compression tests presented in the monograph [4] were used. As an example in fig. 1 shows the corresponding comparisons for talcum peach



**Fig.1.** Mohr's circles and envelopes for talcum peach  
 1 - Calculated envelope when using the strength criterion (2);  
 2-approximation by the trend line envelope 1;  
 3- empirical envelope [4];  
 4- calculated envelope when using the strength criterion (10)

Mohr's circles are constructed from experimental data; these circles (see figure 1) almost coincide with those calculated using the strength criterion (2) in almost all types of stress state (c), except for a slight deviation of  $c = 0.178$ ,  $c = 0.321$ .

As can be seen from fig. 1, the strength of a given rock is better reflected by criterion (2) than criterion (7). In addition to this rock, sandstone D-8, Sandstone P-03, Marble II, Limestone (Estonian), Diabase were also investigated. This situation is observed for all the above listed rocks.

According to criterion (2) and formula (6) for talcum peach is obtained:  $A = -3815.35$ ,  $B = 3696.5$ ,  $\sigma_p = -118.88$ . The experimental value of tensile strength  $\sigma_p = -130$  (hereinafter, the dimension of stresses and material constants is presented in MPa\*9, 81<sup>-1</sup>).

According to the criterion (7), using the formula (9), for the breed under consideration,  $A_h = 2260,37$ ;  $B_h = 945$ ;  $\sigma_p = -343,02$ . This value for  $\sigma_p$  differs significantly from its experimental value.

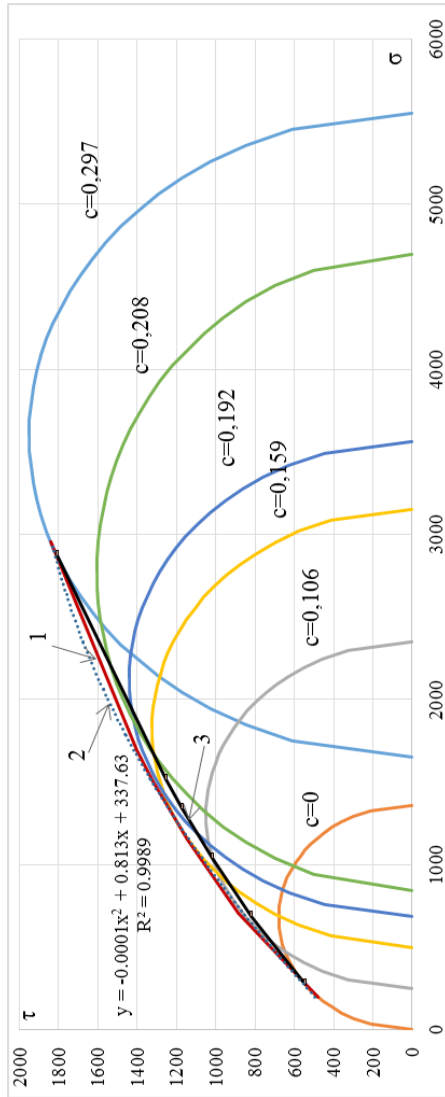
The experimental data of T. Karman for Carrara marble [5] are also considered. An envelope has been constructed for stress limit circles according to the two strength criteria presented above, which is shown in Fig. 2

This study shows that the Duyshenaliev – Koichumanov strength criterion reflects the strength properties of the considered rocks better than the Hoek – Brown criterion, both in cases of non-uniform triaxial compression and uniaxial tension. As follows from the equation for the envelope represented by the trend line, this equation (according to its invariants) is a parabola equation.

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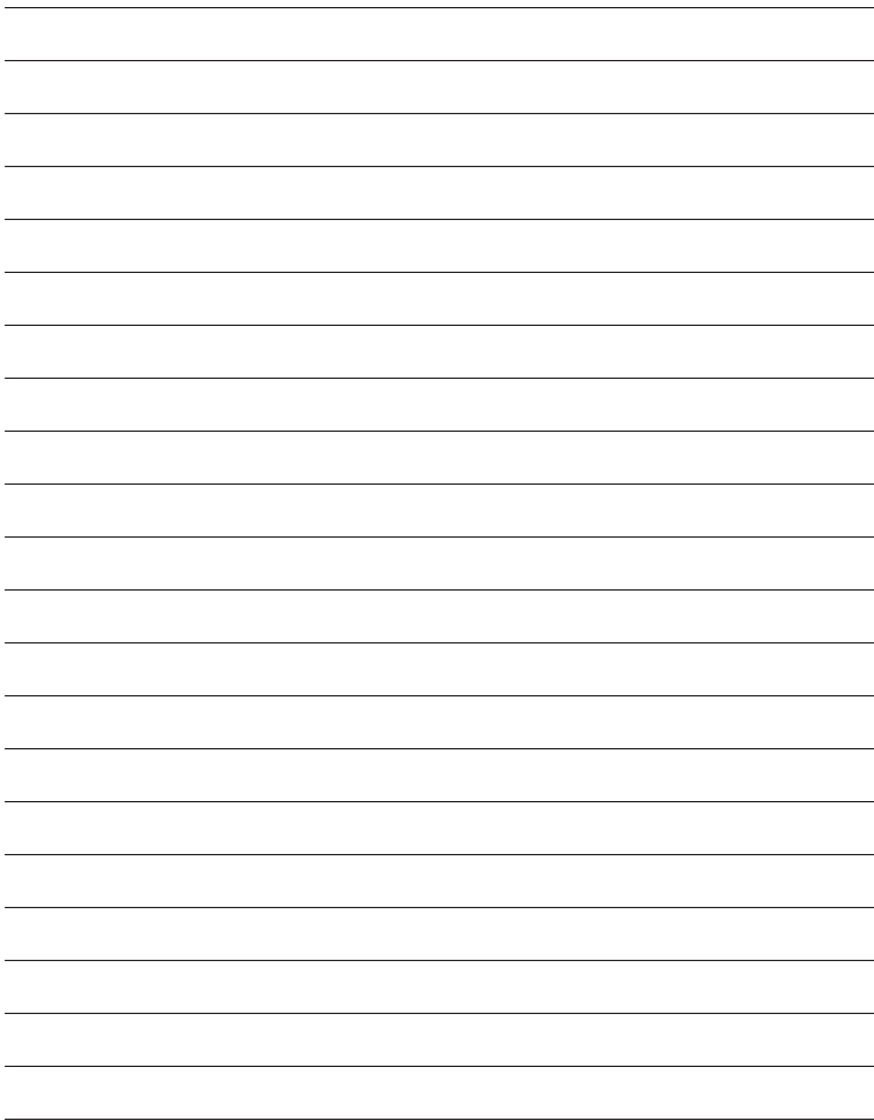


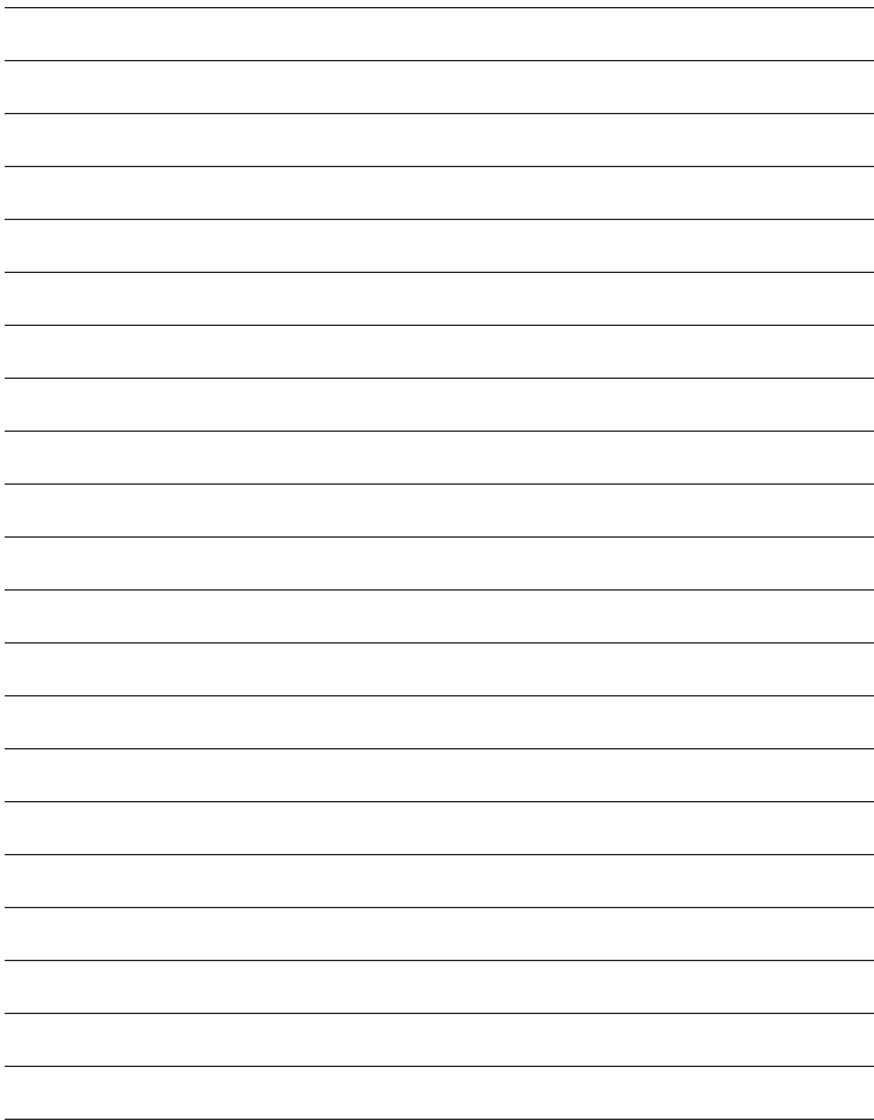
**Fig.2.** Mohr's circles and envelopes to them for Carrara marble.

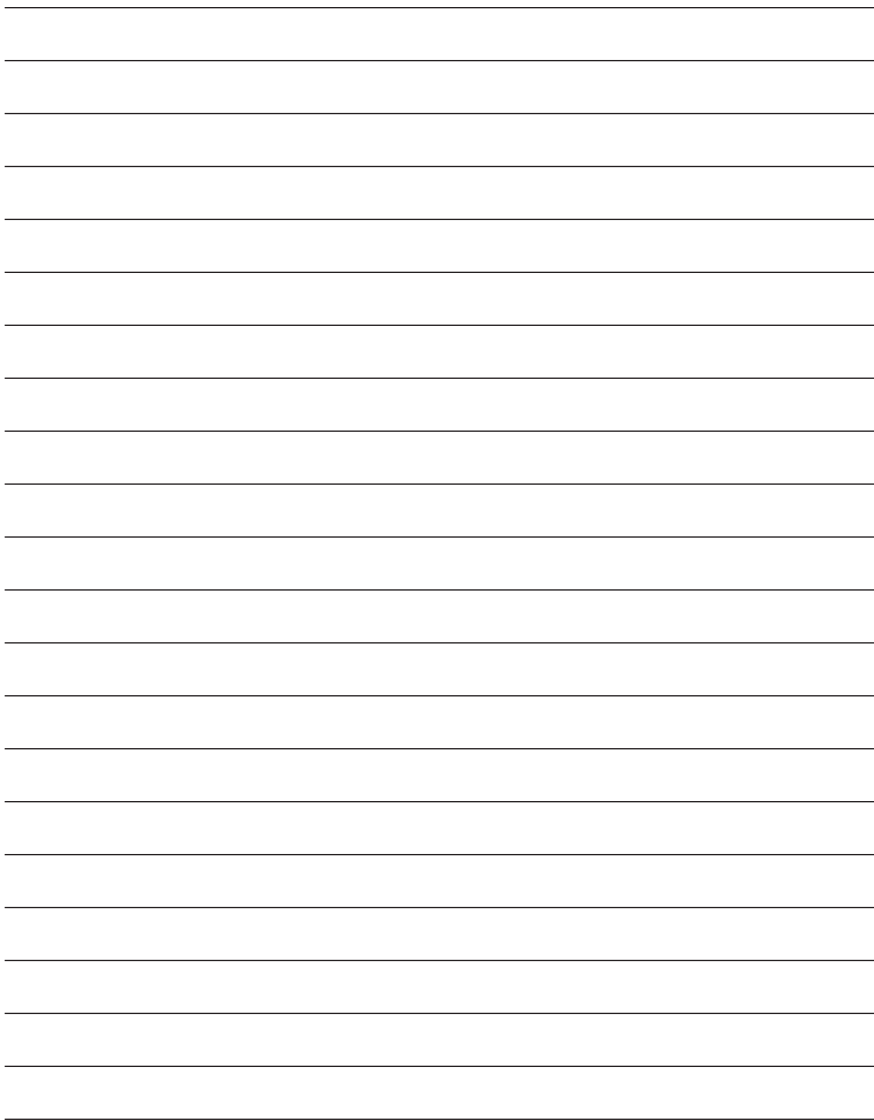
1 - Calculated envelope when using the strength criterion (2);

2-approximation by the trend line envelope 1;

3- calculated envelope when using the strength criterion (10).







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国际科学大会的材料

（2019年3月26日，中国北京）

编辑A. A. Siliverstova

校正A. I. 尼古拉耶夫

2019年3月26日印刷版。格式60 × 84/ 16。  
USL。沸点：98.7。 订单277. 流通450份。

在编辑和出版中心印制  
无限出版社

