



# 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

Proceedings of the  
International Conference

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参与者的英文报告

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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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## 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*

## 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”

俄罗斯小型企业中就业的优缺点  
**ADVANTAGES AND DISADVANTAGES OF EMPLOYMENT IN  
RUSSIAN SMALL BUSINESS<sup>1</sup>**

**Toksanbaeva Mairash Seitkazyevna**

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抽象。在俄罗斯，小企业发展的重要性是模棱两可的。一些专家认为它被低估了，另一些专家则认为——肥大。这些问题是根据小企业就业的优缺点考虑的。就部门结构而言，与大中型企业相比，小企业的就业与后工业模式更为一致。俄罗斯的高水平就业主要是由于其发展。但是，关于小企业的显着有效性的说法尚未得到证实。而且，在俄罗斯和国外，新型工业化的任务正在实现，这与后工业化模式和小企业的扩张不符。因此，其发展前景与加强俄罗斯内部和国家间大中型企业的合作有关。

关键词：小型企业，企业家精神，企业，就业，工业化后，经济部门，资格，体面工作。

**Abstract.** *The importance of small business development in Russia is ambiguous. Some experts consider it underestimated, others - hypertrophied. These issues are considered in terms of the advantages and disadvantages of employment in small business. In terms of the sectoral structure, employment in small businesses is more consistent with the post-industrial model than in large and medium-sized enterprises. The high level of Russian employment is provided mainly due to its development. But the statement about the significant effectiveness of small businesses is not confirmed. Moreover, both in Russia and abroad, the task of new industrialization is being actualized, which is not consistent with the post-industrial model and the expansion of small business. Therefore, the prospects for its development are associated with the strengthening of cooperation with large and medium-sized enterprises both within Russia and at the intercountry level.*

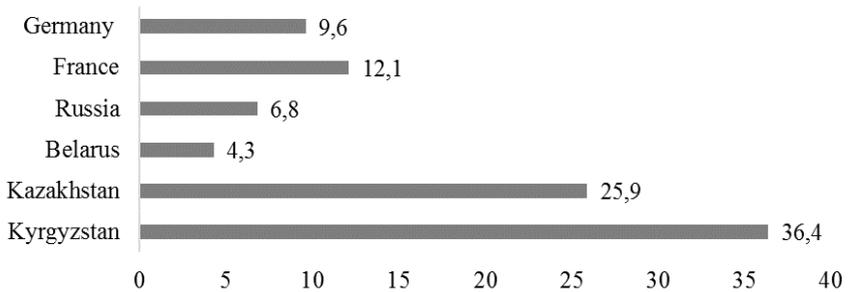
**Keywords:** *small business, entrepreneurship, enterprise, employment, post-industrialization, economic sector, qualifications, decent work.*

<sup>1</sup>The research is carried out with the financial support of the Russian Foundation for Basic Research (project № 20-010-00142).

In Russia, the development of small business (small enterprise) has been one of the socio-economic priorities for more than two decades. During this time, a large group of economists has developed, actively supporting this priority (their name is Legion). Their main arguments can be summarized as follows. First, Russia lags far behind developed countries in terms of the number of people employed in small business and in terms of its contribution to gross domestic product (GDP). This is seen as a lag behind the reference models, in the quality of which the adherents of small business have recognized the characteristics of various aspects of its activities in developed economies. Second, the expansion of small business leads to the creation of new jobs and thereby compensates for the release of workers from large and medium-sized businesses. Thirdly, small business contains great potential for post-industrial development in terms of guarantees of decent work and the development of creative qualities of personnel, as well as through the development and implementation of innovations. Its innovative potential can provide closer cooperation with other forms of business, including foreign actors.

You should agree with some of the features of small business mentioned. For example, this refers to the fact that in Russia it is less common than in developed economies, which can be illustrated by data from the Federal State Statistics Service of the Russian Federation (Rosstat). Since the accounting standards for small businesses in different countries do not coincide, a more uniform indicator of self-employment was used for comparison (employers, own-account workers, members of production cooperatives and helpers in a family enterprise). This type of employment is typical for small business, especially for its small forms. In larger businesses, the functions of employers are usually hired management. Of course, a significant part of small business workers are employed, but the chosen indicator more correctly identifies those employed in it.

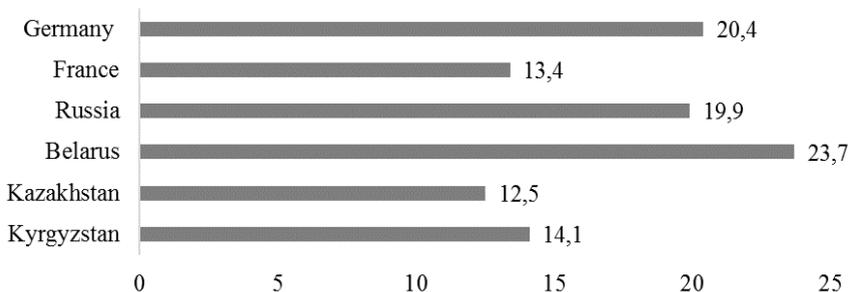
For the sake of completeness, the comparison is made for countries that are members of the organization of intercountry economic cooperation. These include not only developed but also transitional and developing economies. Among the developed countries - members of the European Union, such economic leaders as Germany and France were selected. The states with economies in transition are represented by the former republics of the USSR. Russia and Belarus are united as members of a union (Russian-Belarusian) state, and Kazakhstan and Kyrgyzstan are members of the Shanghai Cooperation Organization (SCO). Although cooperation within the SCO is still very limited, it is more promising than in the amorphous and rather inert Commonwealth of Independent States (CIS), which includes most of the republics of the former USSR. Self-employment in the listed countries is shown in fig. 1.



**Figure 1** - Self-employment in a number of developed and transitional countries in 2019,%

Source: Rosstat website: <https://rosstat.gov.ru/>

Fig. 1 shows that in comparison with developed countries, the level of self-employment in Russia and Belarus is indeed noticeably lower than in Germany and France. But it is even lower, and at times, in the selected SCO countries, which cannot be classified as developed. These differences are largely due to the fact that in the development of small business it is possible to single out non-coinciding tendencies, which we have designated as postindustrial and deindustrial [1]. Both of them lead to an increase in employment in this type of business under the influence of its reduction in industrial production. This can be traced by the share of workers in this production (fig. 2).



**Figure 2** - Industrial employment in a number of developed and transitional countries in 2019,%

Source: Rosstat website: <https://rosstat.gov.ru/>

Fig. 2 show that employment in Germany, Russia and Belarus can probably be attributed to the post-industrial type. In the rest of the states, its rather deindustrial type is observed. In France, this is caused by a more significant transfer of a significant part of industrial production to developing countries than in Germany, and in the SCO countries - by the consequences of the collapse of the post-Soviet economic space, which hit industrial sectors. It can also be said that the difference in the indicator of self-employment between Russia and Germany is most likely smaller, since in Russia a part of small business is in the "shadow", that is, it has no legal status, and therefore is not recorded by official statistics.

Another positive feature of small business is the creation of additional jobs and, as a consequence, the relaxation of tension in the labor market. In Russia, an increase in employment and a decrease in unemployment (before the COVID-19 pandemic) was indeed provided mainly at its expense. In addition, the structure of employment in small business, according to some criteria, is more consistent with the post-industrial type than in large and medium-sized businesses. In particular, this applies to the sectoral structure of employment (for three large sectors of the economy - extractive, industrial and service sectors). The post-industrial type is usually associated with the domination of the production of services, in which more than 70% of workers are employed in developed economies, and in some of them - up to 80%.

Based on information from Rosstat (before the pandemic), it was determined that almost 70% of employees of small corporate enterprises worked in the service production sector. This is more than the average in the Russian economy (two thirds of employees), as well as in large and medium-sized businesses. For example, in medium-sized enterprises this indicator was only 36%. In the unincorporated segment of small business, that is, in individual entrepreneurship, employment in the production of services exceeded 80%. Moreover, about a quarter of the personnel of small enterprises and one in ten self-employed workers worked in the segment of business and professional services. This segment is distinguished by a significant concentration of highly qualified specialists and a demand for creative workers.

The information provided does not include "shadow" entrepreneurship. Employment estimates in it are still controversial. According to a selective questionnaire survey of small business workers conducted with the participation of the author in Moscow in 2015 (sample size - 822 observations), approximately 10-15% of respondents were employed in "shadow" entrepreneurship. At the same time, there is reason to believe that the data obtained are underestimated. This survey (hereinafter referred to as the Moscow survey) showed that about 75% of the "shadow" respondents were self-employed, including those providing highly qualified services (specialists in the field of high technologies and consulting, teachers, designers, etc.). That is, employment in creative types of labor in small businesses is higher than official sources show.

As for the contribution of small business to GDP and innovation potential, these advantages in declaring its priority are considered a “trump card”. However, they are increasingly causing serious doubts. Since the analysis of these advantages is not relevant to the topic of the article, the opinion of authoritative researchers is presented. So, even 20 years ago, when euphoria was observed in Russia about the development of small business, it was justified that the main producer of technological and organizational innovations are not small firms. This function is performed by large corporations, which translate their achievements into a business of a different status [2]. Small businesses either imitate them or supplement them with more modest innovations. This requires close cooperation of small business with large and medium-sized enterprises, which in Russia remains a “weak point” of small business and a factor of its insufficient efficiency in comparison with developed countries.

At the same time, the question of the relatively high efficiency of small business, including in developed countries, is debatable and covers the broader problem of labor productivity in the service sector of the economy (production of services). There is no convincing evidence that this sector provides a significant increase in labor productivity [3]. The same can be said about all small business, including its service part, and the opinion about the potential and real effectiveness of small business remains unproven [4]. In addition, at present, both in Russia and in developed countries, the task of new industrialization, based on scientific and industrial development, has been set [5]. This task becomes even more urgent in the context of a pandemic and undermining the process of globalization. A demand is being formed to increase the self-sufficiency of national economies, which is impossible without the development of the industrial sector. And small business, unlike medium and partially large enterprises, does not specialize in it. This suggests a possible change in priorities in terms of both sectors of the economy and business statuses.

The hopes for small business as a sphere of advanced development of decent work (in accordance with the criteria of the International Labor Organization) are also not justified [6]. This, for example, concerns the professional development of workers as one of the key characteristics of post-industrial employment. According to our calculations based on Rosstat information, in small business, in comparison with large and medium-sized enterprises, the share of highly skilled labor is lower and the share of low-skilled labor is higher. According to the Moscow survey, in small business, especially in individual entrepreneurship, there is a significant proportion of respondents with excessive vocational education. This is largely due to the fact that in small corporate and non-corporate enterprises, along with highly qualified services, services are created that do not require skilled labor (trade, minor household repairs, courier services, etc.).

The most serious complaints about small business are caused by the problems of social protection of hired labor, which is much weaker than at large and medium-sized enterprises. Thus, in small businesses, the practice of informal labor relations is more widespread, which do not guarantee work in accordance with the Labor Code of the Russian Federation. These include oral employment contracts and disguised employment relationships. According to the Moscow survey, about 7% of respondents worked under oral contracts in small enterprises, 24.7% in individual entrepreneurship, and all employed in the "shadow" business. Disguised labor relations (registration of employees as self-employed) were revealed in small enterprises in 5% of respondents and in almost 30% in individual entrepreneurship. The social status of such workers is not protected by labor legislation and is completely dependent on employers. In terms of many parameters of wages, regimes and working conditions, it contradicts the idea of decent work [7].

Another problem, which is related not only to small businesses, concerns the growing popularity of the hypothesis about the expansion of surplus (useless) labor in conditions of post-industrial development. Presumably, it is concentrated in the sphere of speculative intermediation, simulative consumption, part of leisure activities that does not develop personality, etc. [8]. But so far the problem has been poorly studied and has not been translated into instrumental estimates. The redundancy of a part of trade intermediation, including in small business, is mainly assessed. In small enterprises, they employ about 30% of workers, in individual entrepreneurship - almost 60% (in medium-sized enterprises less than 15%). But with modern economic instability and a decrease in the standard of living of the population, hypothetically excessive services become such in fact. Some symptoms have already appeared. So, in small business during a pandemic, according to expert estimates, the overconsumption and leisure industry suffered to a greater extent. This led not only to a reduction in staff, but partly to the closure of the relevant enterprises due to the uncertainty of their even immediate prospects.

Thus, employment in Russian small business has both certain advantages and serious disadvantages that are inconsistent with the notions of post-industrial employment. Moreover, the growing need for new industrialization comes into conflict with the concept of post-industrialization and thus calls into question the priority of the development of small economic forms. For a more successful development of small business, it is important to strengthen its so far weak cooperation with medium and large enterprises and thereby build it into new strategic priorities. This will open a wider road for small business to domestic and international cooperation, which will allow it to achieve a significant cooperative effect of activity. Currently, intercountry cooperation covers mainly large and partially medium-sized enterprises and is successful mainly in the field of industry and production infrastructure.

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经济, 大流行, 气候变化: 问题的原因之一 - 解决的可能性  
**ECONOMY, PANDEMIC, CLIMATE CHANGE: ONE CAUSE OF PROBLEMS – ONE POSSIBILITY FOR SOLUTION**

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*Doctor of Economic Sciences, Full Professor*

*Rostov State Economic University*

**Katerinin Stanislav Pavlovich**

*Director*

*School of Spiritual Development LLC "Planet SHAM"*

抽象。 经济危机, 冠状病毒感染大流行和地球上的气候变化有一个起源, 即行星尺度振动的变化, 分别是太阳, 月亮, 地球, 应该有一种方法可以解决这些问题。 在这项工作中, 通过方法论和历史方面, 研究了经济发展, 冠状病毒与气候变化之间的关系, 并提出了使用咸海水资源和邻近地区气候的实际例子, 并指出了可能性 显示了同时解决这些问题的方法。 结论是, 人类能源信息活动使发展抗危机经济, 预防流行病和大流行病以及形成某个地区的气候成为可能。

关键词: 经济, 关系系统, 货币, 经济危机, 冠状病毒, 大流行, 气候变化, 咸海, 振动, 能源信息活动, 生态系统。

**Abstract.** *The economic crisis, the coronavirus infection pandemic and climate change on Earth have one source of origin - a change in vibrations of a planetary scale - the Sun, Moon, Earth, respectively, there should be a single method for solving these problems. In this work, through the methodological and historical aspects, the relationship between economic development, coronavirus and climate change is investigated, and a practical example of working with the water resources of the Aral Sea and the climate of adjacent territories is presented, and the possibility of simultaneously solving these issues is shown. It is concluded that human energy-informational activity makes it possible to develop a crisis-resistant economy, prevent epidemics and pandemics, and form the climate of a certain area.*

**Keywords:** *economy, system of relations, money, economic crisis, coronavirus, pandemic, climate change, the Aral Sea, vibrations, energy-information activities, ecosystem.*

Currently, there are many definitions of the concept of "economics", formulated in dictionaries and encyclopedias. Basically, all of them are aimed at understanding the economy as a process of economic activity of society aimed at the production of goods, as well as a set of relations that develop in the system of production, distribution and exchange.

However, today the position of Aristotle has been forgotten, who shared and opposed the concept of economics to the concept of chrematistics, that is, human activity aimed at extracting benefits, enriching, accumulating money and property as an end in itself. Aristotle contrasts the concept of chrematistics with economics, which should be aimed at satisfying the natural needs of man.

Based on the Aristotelian understanding, we can conclude that the current state of what we call economics is chrematistics, where money is at the forefront, and this substitution of concepts leads to economic crises.

However, the place of money is clearly indicated in the Russian balance sheet, where the senselessness of their accumulation is visible. The indicator "Cash", which is in the asset of the balance sheet, reflects the property of the organization, and not the source of economic activity, and the property that "does not work", that is, does not create any benefits, but is only a means of payment. The real assets that produce products (works, services) are fixed assets, intangible assets, stocks, that is, production potential. The source of the formation of all types of assets is the capital, reflected in the liability of the balance sheet.

But what is capital? And what is the source of the formation of the capital itself? Both equity and borrowed capital is formed through a system of relations.

So, equity capital, formed mainly from the authorized capital and retained earnings, is the relationship of the founders and the system of relations between the head (managers) of the enterprise with suppliers and buyers, personnel and other participants in the economic process, which makes it possible to form profit as a natural increase in property for further reinvestment.

Debt capital is a system of relations between the head (managers) and banks, with the state (in terms of taxes and fees), with counterparties (accounts payable), etc.

Thus, the possibility of capital formation as a source of economic activity is the ability to create a system of relevant relations.

This was clearly demonstrated by the history of successful business: Soihiro Honda (Honda), Steve Jobs (Apple), Henry Ford (Ford) and many others. Moreover, the initial motivation of such leaders of successful firms was not at all making money. So, for example, "in the head of the company S. Honda combined talent of an engineer and boundless self-confidence, but the commercial side of the matter did not interest him. He perceived the firm as a means of expressing his technical abilities ... real success came to it (the firm) only after T. Fujisawa joined the team

in 1949 and took over the management of finance and marketing." [2] Thus, the establishment of a system of relations between at least two people with clearly manifested individual qualities made it possible to create an enterprise that has been producing high-quality products that are in demand for decades.

Based on accounting instruments and reporting forms, from the history of economic development, it is clear that money is, in fact, an adapter, a transformer of the system of relations between managers into production potential, and the formation of a fetish of money in the last quarter of the XX century and in the XXI century began to break the natural process and form the psychology of the consumer (instead of the psychology of the employee).

Accordingly, any economic crisis is a crisis of relations, and it is necessary to look for its causes, in our opinion, in this very sphere. Why are we currently observing this process? On the one hand, the regimes of self-isolation and lockdowns created by mankind against the backdrop of a pandemic severely inhibit and destroy many social ties, and this naturally affected the economy. But, on the other hand, the social ties of the outstanding leaders of strong companies should not be subject to this process and should be able to maintain and develop the system of socio-economic relations in any conditions.

However, we observe that this is not the case in most cases. What is the reason?

In our opinion, the possibility of developing strong economic ties is due to a person's ability to cooperate, to build a system of relations at different levels of manifestation - with his own organism, with nature, with other people - to live in accordance with the laws of nature and society.

Until recently, this correspondence was observed: a stable climate, a healthy person with strong immunity, a healthy economy.

And practically "in one day" everything collapsed. The spread of the coronavirus and climate change have become the key problems that have captured all of humanity. These two problems have completely changed the habitual foundations of life, change the functioning of all social systems: health care, economic, educational system and others.

Currently, active work is underway to combat viruses, but viruses did not appear today.

Viruses, being one of the active biological life forms, are the most numerous biological objects on Earth. [4] The presence of viruses is inherent in all ecosystems: humans, animals, plants, aquatic ecosystems. Moreover, their number exceeds millions of species in each ecosystem. For example, their concentration reaches 10 million viruses per 1 milliliter of the sea surface [3], and a small spoonful of sea water contains about millions of viruses [5].

Accordingly, most viruses are in a dormant state and, under the influence of certain factors, various viruses wake up, activate and mutate. Mankind is current-

ly observing these processes in the coronavirus COVID-19, which is aggressive today.

For the first time, the type of coronavirus Alphacoronavirus (HCoV-229E) was detected in the mid-1960s, then Alphacoronavirus (HCoV-NL63) was identified in the Netherlands in 2004. Betacoronavirus A (HCoV-OC43) was detected in 1967, BetacoronavirusA (HCoV-HKU1) was discovered in Hong Kong in 2005. A series of mutating viruses that give rise to a number of diseases: the SARS-CoV virus, the causative agent of SARS [7], the manifestation of which was in 2002, the MERS-CoV virus, the causative agent of the Middle East respiratory syndrome that arose in 2012 and manifested itself in a violent outbreak in 2015.

Roughly in the same period, in the mid-1970s, climate change processes began to awaken, which at that time were expressed in an insignificant increase in air temperature and atmospheric pressure. At that time, the person had not yet felt the impact of these changes. The gradual increase in these processes further caused economic and political resonance and in 1992 more than 180 countries of the world signed the UN Framework Convention [6] on the general principles of action by countries on climate change (entered into force on March 21, 1994).

In the period of 2010-2019, the problems of climate change are increasing. This is not only global warming, but also typhoons, tornadoes, hurricanes, floods, forest fires that occur in various parts of the world. 2020 is full of almost daily natural and climatic disasters.

Thus, the development of the situation with the economy, with coronavirus and with climate change is identical in terms of both timing and scale of manifestation.

This raises the question of the possibility of one source of these processes.

All living organisms, living systems can change under the influence of vibrations occurring in the solar system: vibrations of the Earth, the Sun and the Moon. That is, the solar system itself changes its vibrations, which affect the Earth, humans and all ecosystems.

The change in the vibrations of the solar system is associated with its movement on the scale of the galaxy. The solar system was moving from the center of the Galaxy to the periphery, while emitting vibrations generated by centrifugal forces. At the end of the 70s of the twentieth century, the processes of a gradual change in the direction of motion of the solar system towards the center of the Galaxy began, and since 2020, the movement of the solar system has completely changed its direction, and it began to move towards the center of the Galaxy, emitting vibrations generated by centripetal forces. That is, the vector of action of forces on a planetary scale has radically changed. Naturally, these changes require adaptation of living systems, tuning to the perception of new forces.

This large-scale planetary process did not take place at one time, and lasted approximately 45-50 years. This is how the gradual restructuring of vibrations of

all ecosystems took place: man, animal world, Earth.

This process consists in tuning the vibrations of ecosystems to the vibrations of the Sun and Moon. In this case, there is a correspondence of the current vibrations of man, the animal world, etc.

New vibrations of the solar system awaken one of the varieties of viruses, in the current situation - coronavirus.

Adjusting human vibrations to the current vibrations of the Sun and Moon makes all human systems healthy and active. An active immune system produces antibodies to any virus that is currently aggressive for humans.

The flora and fauna, far from technogenic processes, readily enough readjusted to new vibrations of a planetary scale. The human population has not readjusted itself so clearly. People living in rural areas and small towns, where the relationship with nature has not yet been lost, perceive new vibrations and practically do not get coronavirus or carry it in a mild form, that is, the immune system of these people is active and easily copes with the aggressive virus. As for the inhabitants of big cities, isolation from nature and its vibrations does not allow coping with new processes. That is, a person with old natural vibrations tries to live in new vibrations, a person does not correspond to the current time and a person cannot build economic ties, form a strong immunity, tune in to climate change.

The question arises: is it possible to tune a person to the perception of new current planetary vibrations, thereby activating the immune and other systems. It turns out it is possible. So, by bringing the vibrations of people into line with planetary vibrations, it becomes possible to form ecosystems of various levels: man (formation of strong immunity), nature (formation of climate), society in general and the economy in particular (creation and development of enterprises that provide a high standard of living for citizens).

This work is carried out due to the formation of energy-information fields and the transmission (broadcast) of the energy-information flow of the solar wind into the energy-information flow of the ecosystem, that is, in fact, the vibrations of the Sun and the Moon are transmitted to the vibrations of the Earth and man.

Currently, there is already a practice of such work, aimed at the revival of the Aral Sea and the formation of the climate of Central Asia. [1]

Thus, the awareness of a single source of processes of economic crises, activation of viruses and climate change makes it possible to solve the problem of a holistic, integrated process of interaction between man and nature through the perception and transmission of vibrations on a planetary scale and the correspondence of man and nature to the current moment in time. This allows you to form a strong human immune system and avoid natural disasters and cataclysms, and develop a sustainable economy.

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循环作为压力测试的基础  
**CYCLES AS THE BASIS FOR STRESS TESTING**

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抽象。 该研究的主要思想是尝试分析商业周期理论的演变，以便确定进行压力测试时需要考虑周期性特征。 分析了研究经济法则的科学家-经济学家的科学著作。 本文介绍了现有周期性概念的主要鲜明特征。 最后，强调了考虑压力测试的周期性和形成反危机措施的重要性。

关键词：周期，周期性，压力测试，经济状况。

**Abstract.** *The main idea of the study was to try to analyze the evolution of the theory of business cycles in order to identify the need to take cyclical features into account when conducting stress testing. The analysis of scientific works of scientists-economists, who researched economic laws, is made. The article presents the main distinctive features of the existing concepts of cyclicity. In conclusion, the importance of taking into account the cyclical nature of stress testing and the formation of anti-crisis measures is emphasized.*

**Keywords:** *cycles, cyclicity, stress testing, economic conditions.*

Throughout the long history of the formation and development of economic relations, objective laws of transformation of financial systems are observed, which are subject to a pronounced cyclicity. Despite numerous attempts by regulators, government agencies, and entrepreneurs to achieve a crisis-free state of the banking industry, as a key one in any financial system, such an economic state still seems to be illusory, since crises return with varying frequency, forcing us to be convinced every time that the analysis and forecasting of market shifts is an important aspect in the preventive assessment of risks and financial condition of any credit institution.

In the current crisis conditions of the development of the Russian banking system, strengthening the stability of banks, banking groups, increasing the adequacy of their capital and liquidity, as well as an increase in real capitalization is possible, among other things, by taking into account the cyclical nature of the internal and external processes of banks. Countercyclical measures can also become part of

anti-crisis management, which, in an unstable economic environment, will make it possible to quickly switch to an "innovative track" and get ahead of competitors.

Since business cycles cover almost all spheres of life [1], it is important to consider the theory of the cycle of different schools and their explanatory abilities before investigating supervisory stress testing, which is also based on the foundation of cyclical patterns.

Changes in market conditions are cyclical. Within each cycle, the national economy moves from one level of macroeconomics to another. An economic cycle is usually understood as a certain period of time for the development of the country's economy between successive breakpoints (peaks). During each cycle, there is an alternation of periods of growth and decline in business and economic activity, however, which slightly deviates from the long-term growth line of the country's economy.

At the end of the XVIII - beginning of the XIX century, the regularities of the cyclical nature of economic development were revealed for the first time [2]. During the first revolution in the industrial market, a clear interconnection was noted between all sectors of the market economy that do not depend on subsistence farming.

Further, this pattern began to spread to all types of economic systems, despite the fact that the specificity of a particular system may manifest itself in certain non-standard deviations of the cyclical amplitude of fluctuations in business and economic activity (for example, a transitional economy). But even in these cases, the interconnection of the elements of the economic system, characteristic of an industrial society, is not a guarantee for someone that a crisis (or, for example, an increase in inflation) can be prevented. As an example, we can take the USSR [3]. The economy of the USSR cannot be definitely called "cyclical", but the crisis also affected this country. The industrial crisis in 1923-1924 occurred due to an unjustified rise in prices for industrial products. In 1927-1928, due to the rupture of relations between the city and rural authorities, a "grain crisis" ensued in the country. Further, a large number of different crises were observed in the country:

- famine in 1932, which was accompanied by the transformation of all agriculture;
- military crisis in 1941-1942;
- economic recession in 1952–1953, coupled with a political reshuffle in the country;
- crisis in 1963;
- depression in 1972 as a consequence of the growing inability of the political leadership to ensure progress in the social sphere;
- recession in the late 1980s - early 1990s. as the first signs of complete system collapse.

However, after major changes in 1991-1994 in Russia, the economic situation has stabilized, but the decline in GDP in 1998 became an additional test for the Russian economy.

One of the most basic characteristics of cyclicity is movement not in a circle, but in a spiral, from which it follows that cyclicity is a form of progressive development. Only a cyclically developing economy can be considered effective. In countries in which cyclicity is artificially suppressed (for example, the USSR, in which state intervention in the non-market economy was at a very high level), one can only count on extensive growth.

A correct forecast of the economic situation can be correct only if the economic theory can find a scientific basis for the fundamental reasons for the cyclical development of the economy. But today in the world there is no single opinion on this matter. Thus, the followers of the neoclassical school believe that the imbalance between aggregate demand and aggregate supply - with certain deviations in the volume of output from the maximum possible level - is not natural and is most often limited in duration.

[4-8]. The combination of flexible prices, wages and interest rates with free competition (in the absence of interference from the state and trade unions in economic life) can have a restorative effect on the disturbed equilibrium, offsetting the effect of external shocks on the economy. Continuing this topic, monetarists associate large emissions in the dynamics of the economic environment with erroneous actions on the part of the state on the regulation of money circulation (namely, with fluctuations in the growth rate of money supply), and not with instability, which is one of the components of the market economy [9- 13]. The leader of the monetarists M. Friedman associates the deepest shock of the market economy (the Great Depression) with the Fed's erroneous monetary policy, which led to the fact that the American economy did not have a sufficient level of money [14, 15]. Based on the above, the neoclassicists conclude that there is a need for softer regulation of the economy by the state (in order to avoid mistakes on the part of the authorities) or for a significant improvement in the quality of this regulation, for example, in the monetary sphere.

The theory of Keynesianism changed the focus of the theoretical study of the problems of only crises to the problems of the cycle as a whole [16, 17]. It was concluded that crises are an integral part of the development of the market system, and despite the fact that they carry a certain danger, one should not forget about the "overheating" of the conjuncture, which is always accompanied by an increase in the level of inflation, which in turn is a prerequisite for the onset of a new crisis. Keynesians believe that crises are not accidental, and they also do not consider crises to be the result of errors in economic policy or monetary problems. They associate cyclical fluctuations with changes in the external environment and

consider these fluctuations to be an integral part of the market economy [18-20].

Based on the above, the classical theory of cycles is external, i.e. it implies that the main causes of fluctuations are due to external factors that are not part of the economic system. These factors include:

- wars, political revolutions, secession from international unions, as well as other political upheavals;
- development of new raw material deposits, which changes the structure of export/import, as well as entailing migration of the population and the development of new territories by the population;
- new production technologies;
- environmental and climatic factors.

All these factors can serve as drivers of both economic recovery and economic recession, and it will take some time to return to a stable state of the economy.

Among the Caseians, the theory of cyclicity appears to be internal. The basis of this theory is the objective mechanisms that are within the economic system and stimulate cycles for endless reproduction. It should be noted that the main driving force is the changes in demand for consumer and investment goods. As the most sensitive part of total costs to change, investments fluctuate regularly in space and time.

Apparently, the truth is somewhere at the intersection of internal and external theories. Any economic cycle can be compared to a rocking chair: although it swings due to random external shocks, it has a frequency and amplitude of oscillations, which largely depend on its internal factors, namely, on size and mass [3].

In order to assess the state of the economic environment and the decline or the emergence of the next cycle, it is necessary to consider not some individual indicators, but their totality. This kind of set of macroeconomic indicators is considered when forming a scenario for stress testing of financial institutions. Modeling the development of a particular economic situation, analyzing various cycles during stress testing will help develop a set of anti-crisis measures, which will make it possible to survive any crisis that comes back again and again with a cyclical pattern in the least painless way.

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符拉迪沃斯托克的免费港口：问题与发展前景  
**THE FREE PORT OF VLADIVOSTOK: PROBLEMS AND  
DEVELOPMENT PROSPECTS**

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抽象。 本文分析符拉迪沃斯托克自由港的功能。 根据发现的问题，提出了进一步发展符拉迪沃斯托克自由港的建议。

关键字：符拉迪沃斯托克（海参div），自由港，经济特区。

**Abstract.** *This article analyzes the functioning of the Free Port of Vladivostok. Based on the problems identified, recommendations for further development of the Free Port of Vladivostok are offered.*

**Keywords:** *Vladivostok, free port, special economic zone.*

The relevance of the topic of this article stems from the fact that Russia's emergence as a transit power connecting East and West is inevitable: the most profitable transport routes pass through Russian territory, and the volume of freight traffic is only increasing every year. The ability to provide transport and logistics opportunities for foreign companies is a serious challenge for the domestic industry, which, however, opens up great prospects for the development of the entire country and the Far East in particular.

The proximity to countries in the Asia-Pacific region and China, one of Russia's main foreign trade partners, gives the Far East unique logistical advantages. Due to its geographic location, the Far East has traditionally played the role of a transit region in Russia and is gradually increasing the turnover of its own exports. However, at present not all of its opportunities are being used due to insufficiently

developed transport infrastructure. At the same time, over the past few years the Far East has seen a significant increase in the number of projects related to the development of transport and warehouse logistics. This process is facilitated by the regimes of advanced development areas, free ports and other projects initiated by the federal center and regional authorities.

Let us take a closer look at the Free Port of Vladivostok (FPV), which is a free economic zone that enjoys special customs, investment, allied and tax regulation regimes. It occupies an important place in the system of logistical relations with neighboring countries and development of entrepreneurial activity in Primorsky Krai. Table 1 shows a number of preferences provided by the Free Port of Vladivostok regime for its residents. A resident of the Free Port of Vladivostok means an individual entrepreneur or a legal entity, which is a commercial organization, whose state registration has been carried out in the territory of the Free Port of Vladivostok.

*Table 1 - Preferences provided to SPV residents*

<b>Financial preferences for SPV residents</b>
7,6% - insurance premiums for 10 years;
0% - profit tax during the first 5 years (the next 5 years - 12%), except for Kamchatka Territory. The size of the regional income tax rate in Kamchatka Territory is 5% for the first 5 years
0% property tax for the first 5 years (0.5% in the following 5 years)
0% - land tax during the first 5 years.
<b>Administrative preferences</b>
The right to lease land plots (without bidding, at cadastral value);
Permission for foreign labor: up to 20% - for all residents. Over 20% - by decision of the supervisory board (without quotas);
Reduced time for scheduled inspections (not more than 15 days);
Reduced time for unplanned control inspections (not more than 15 days)
<b>Customs preferences</b>
Absence of payment of customs duties;
Lack of application of non-tariff regulation measures in relation to foreign goods;
No application of prohibitions and restrictions with regard to goods of the Customs Union.
<b>Simplified visa regime</b>
The Free Port of Vladivostok provides for a simplified visa regime. Foreign nationals arriving in the Russian Federation through checkpoints located on the territory of the Free Port of Vladivostok may stay in the Russian Federation for up to 8 days without a visa.

The Free Port of Vladivostok provides for a simplified visa procedure for foreign citizens. In addition, residents of the Free Port of Vladivostok will be provided with additional protection: the management company of the Free Port will have the right to represent and protect the interests of residents who apply to it in court, to bring claims in cases arising from administrative and other public legal relations, to protect the rights and legitimate interests of an indefinite number of legal entities and individual entrepreneurs with resident status. To date, the SPV brings together 540 residents. This is quite a large number, given that the first resident joined the SPV only on March 16, 2016.

In developing the draft law on the free port, best practices of creating free ports in the Asia-Pacific region were used, while new mechanisms were developed, making the focus on the integration of Russia and the Asia-Pacific region more and more real.

The investment success of the Far East against the background of other federal districts is largely due to the active promotion in the region of development institutions and investor support instruments. Food-processing, fish-processing and timber-processing industries, as well as the machine-building industry, are of interest to partner countries. The largest investors in the Far Eastern economy are China, Japan and the Republic of Korea. However, their activity is restrained by such factors as: underdeveloped communications and logistics, insufficiently qualified labor force, uncertainty in the supply of raw and materials. It is obvious that the potential of the FPV for foreign investors is not used to the fullest extent. This is partly due to the fact that the state program "Economic and Social Development of the Far East and the Baikal Region for the Period until 2025" only touches upon the development of the ASEZ in passing. It should be noted that along with the visible benefits of Russia's entry into the APR trade and transport arena, there is also increased competition with these countries. It is especially acute when compared with the neighboring ports of China, the Republic of Korea and Japan. For example, throughput capacity of the Far East ports in 2020 was 112.94 million tons, while during the same period in the port of Shanghai 812 million tons of diverse cargoes were handled. This is due to both insufficient material and technical base of the port of Vladivostok, and lack of highly qualified workers.

According to paragraph 2 of Article 284.4 of the Tax Code, an SPV resident has the right to apply preferential rates to the tax base only if income from activities carried out under agreements to carry out activities in the SPV territory constitute at least 90% of all income taken into account when determining the tax base for income tax. In this regard, some existing companies prefer to register a new legal entity just to make it easier to become an SPV resident, so that they do not have to justify and prove the legitimacy of applying the special preferential regimes provided by law in the future. However, it is worth noting that a lesser per-

centage would be much more attractive from the point of view of an already existing business becoming a resident of the Free Port. Кроме того, широкий спектр налоговых льгот, которые предоставляет Свободный порт своим резидентам, недостаточно выгоден для малого бизнеса или предприятий, находящихся на упрощенной системе налогообложения, либо работающих по патенту.

A separate problem of the FPV is the inconsistency of the existing transport and logistics infrastructure of Vladivostok and Primorsky Krai with the requirements and demands of the free port, as well as the lack of adequately trained workforce. Despite its important geopolitical role, Vladivostok and other Russian ports, unfortunately, noticeably lag behind other Asian ports in economic and port infrastructure development.

If we consider the tourist potential of the NSR, then Vladivostok, despite its geographical attractiveness for cruise companies, cannot technically receive all vessels wishing to enter the port because of the insufficient depth of the berths of the sea port. Despite its geographical attractiveness for cruise companies, Vladivostok cannot technically receive all vessels wishing to enter the port, due to insufficient depth of the berths of the sea station. The largest cruise ship, Diamond Princess, called at the port of Vladivostok, had a draft of 8.5 meters and a length of 280 meters. Larger liners cannot be accommodated at the port of Vladivostok.

Another problem, restraining the development of cruise tourism in Primorye is a complicated procedure of border clearance of passengers and crew, which takes most of the time of the ship in the port of Vladivostok. It is proposed to speed up this process by sending border guards to the port of departure of this or that cruise liner, who could clear passengers on their way to the port of Vladivostok.

However, one of the prospects for the development of the FPV in order to strengthen the region's industrial base in traditional sectors, it would be advisable to consider the possibility of including the Dalnegorsky District and the Terneisky MP within the borders of the FPV. Inclusion of these territories in the Free Port of Vladivostok will significantly increase the region's investment potential, create new industries and attract people to the northern sparsely populated areas of Primorsky Krai.

It should be noted that the transport system of the Free Port should be prepared for export growth. For this purpose, first of all it is necessary to pay attention to development of large transport hubs and their interaction with the enterprises - residents of the free port. Creation of a modern international transport and logistics complex in Primorye on the basis of the FPV will significantly improve the economic image of the Far Eastern territories in the eyes of potential foreign investors.

At the same time, we should not forget about the threat of uncontrolled exports of resources from the territory of Russia. Further development of the legislative and organizational mechanism for SPV functioning should provide not only for

the development of export-oriented raw material activities, but also for conditions and opportunities for the creation of processing industries that produce high-end products, including knowledge-intensive ones.

Thus, the analysis of the Free Port of Vladivostok regime, as well as the problems of its functioning, identified in the course of this analysis, allow us to formulate the following general recommendations for its further development:

1. To carry out the berthing dredging of the port of Vladivostok;
2. To exempt from value added tax producers of bunker fuel intended for sale in SP water areas;
3. Create a modern international transport and logistics complex in Primorsky Krai on the basis of the SPV;
4. Consider sending border guards to the port of departure of this or that cruise liner in order to process documents on the way to Vladivostok;
5. Increase the utilization of the existing facilities of the port of Vladivostok from 40% to 80%;
6. To equip special facilities for issuing visas at checkpoints;
7. Facilitate the conditions for acquiring the SPV resident status for companies "with a history".

The above-mentioned measures, according to the authors, will increase the volume of cargo traffic, increase investment inflow into the Primorsky Krai economy and ensure competitiveness of the FPV in the global maritime freight market.

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使用分类法评估矿业公司的财务稳定性  
**ASSESSMENT OF THE FINANCIAL STABILITY OF A MINING  
COMPANY USING THE TAXONOMY METHOD**

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抽象。考虑使用一种基于分类学分析的方法来评估财务稳定性水平。对股份公司“MMC“诺里尔斯克镍””的财务稳定性进行了评估。

关键词：企业，财务比率，技术发展，会计，财务稳定性，分类分析。

**Abstract.** *The application of a methodological approach to assessing the level of financial stability based on taxonomic analysis is considered. The assessment of the financial stability of OJSC "MMC "Norilsk Nickel" was carried out.*

**Keywords:** *enterprise, financial ratio, technological development, accounting, financial stability, taxonomic analysis.*

In market conditions, the guarantee of survival and the basis for the stable position of an enterprise is its financial stability. If an enterprise is financially stable, solvent, then it has a number of advantages over other enterprises of the same profile for obtaining loans, attracting investments, in choosing suppliers and in the selection of qualified personnel. The higher the stability of an enterprise, the more it is independent of an unexpected change in market conditions and, therefore, the less the risk of being on the brink of bankruptcy.

The financial side of a business is one of the main criteria for its competitiveness. Based on the financial assessment, conclusions are made about the investment attractiveness of a particular type of activity and the company's solvency is determined. The financial services of the company are responsible for assessing the financial situation and developing measures to improve financial stability.

The financial situation in general terms is determined by the degree of fulfillment of the financial plan and the degree of its replenishment from profit and other sources, if provided by the plan, as well as the speed of rotation of production as-

sets and, in particular, working capital. Thus, competent financial planning based on the analysis of financial indicators is the key to a good financial position.

Financial position is the most important characteristic of a company's economic activity. It determines the competitiveness of an enterprise, its potential in business cooperation, is an assessment of the degree of ensuring the economic interests of the enterprise itself and its partners in financial and other relations.

A stable financial condition is formed in the course of all production and economic activities of the enterprise. Its definition for a specific date answers the question of how well the company managed its financial resources during the reporting period. However, partners and shareholders are not interested in the process, but in the result, that is, the indicators themselves and assessments of the financial condition, which can be determined on the basis of official public reporting data.

Currently, many methods for assessing the financial condition of an enterprise have been developed and are used, including the methodology of Sheremet A.D., Kovalev V.V., Dontsova L.V., Nikiforova N.A., Stoyanova E.S., Artemenko V.V. G., Belendira M.V. et al. The difference between them lies in approaches, methods, criteria and conditions of analysis. Let's calculate the assessment of financial stability of the company OJSC "MMC "Norilsk Nickel" using the taxonomy method.

Table 1 shows the initial data for the enterprise for 3 years for taxonomic analysis and construction of the observation matrix.

**Table 1**  
*Initial data for taxonomic analysis to assess the financial stability of OJSC "MMC "Norilsk Nickel"*

<b>Indicators</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>
X1 - autonomy ratio	0.28	0.19	0.27
X2- financial risk ratio	0.39	0.24	0.37
X3- current liquidity ratio	1.92	1.93	1.21
X4 - return on sales	0.26	0.27	0.47
X5 - FOC supply ratio	-1.65	-1.59	-1.31
X6 - return on assets,%	0.13	0.18	0.32
X7 - the share of transportation, heat and energy costs in the cost price	0.08	0.09	0.10
X8 - share of the enterprise in the country's GDP	0.60	0.70	0.80

X9 - short-term debt ratio	0.15	0.18	0.28
X 10 - social development expenditures rub. bln.	17.70	30.9	27.60
X 11 - nickel production volumes, t.	217 112	218 770	228 687
X 12 - copper mining volumes, t.	401 081	473 654	499 119
X 13 - platinum mining volumes, thous. t. ounces	670	653	702.00
X 14 - palladium production volumes, thous. t. ounces	2 780	2 729	2 922
X 15 - volumes of state support,%	11.54	10.26	10.07
X 16 - wear factor	0.71	0.73	0.75
X 17 - net profit, million rubles	127 366	187 775	387 580

Let us construct a matrix of observations X, based on the dynamics of the values of indicators characterizing the financial condition of the enterprise in 2017 - 2019. The observation matrix is presented in tab. 2.

Next, we will standardize the elements of the observation matrix X and form a standard matrix Z. To this end, we determine the average value for each indicator:

$$j_1(X1) = (0.28+0.19+0.27)/3 = 0.25$$

$$j_2(X2) = (0.39+0.24+0.37)/3 = 0.33. \text{ Further calculations are presented in tab. 3.}$$

**Table 2**

*Observation matrix*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
X =	0.28	0.39	1.92	0.26	-1.65	0.13	0.08	0.60	0.15	17.70	217.112	401.081	670	2.780	11.54	0.71	127.366	
	0.19	0.24	1.93	0.27	-1.59	0.18	0.09	0.70	0.18	30.9	218.770	473.654	653	2.729	10.26	0.73	187.775	
	0.27	0.37	1.21	0.47	-1.31	0.32	0.10	0.80	0.28	27.60	228.687	499.119	702	2.922	10.07	0.75	387.580	

**Table 3**

*The average value of each indicator of the financial condition of the enterprise for the implementation of taxonomic analysis*

<b>Indicator</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Mean value	0.25	0.33	1.69	0.33	-1.52	0.21	0.09	0.70	0.20	25.40	221523.0	457951.33	675	2810.33	10.63	0.73	234240.33

Next, we calculate  $Z_{ij}$  for each indicator for each year. Then we form a matrix of standardized  $Z$  values.

$$Z_{11} = 0.28/0.25 = 1.14 \qquad Z_{12} = 0.19/0.25 = 0.77 \qquad Z_{13} = 0.27/0.25 = 1.09$$

**Table 4**

*Matrix of standardized Z values*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Z =	1.14	1.17	1.14	0.78	1.09	0.62	0.93	0.86	0.74	0.70	0.98	0.88	0.99	0.99	1.09	0.98	0.54
	0.77	0.72	1.14	0.81	1.05	0.86	0.98	1.00	0.89	1.22	0.99	1.03	0.97	0.97	1.02	1.00	0.80
	1.09	1.11	0.72	1.41	0.86	1.52	1.09	1.14	1.38	1.09	1.03	1.09	1.04	1.04	0.95	1.02	1.65

The construction of an indicator of the efficiency of use consists in determining the elements of the observation matrix and their standardization, after which the differentiation of features is carried out. In this case, all variables must be divided into stimulants and de-stimulators, which serves as the basis for constructing a vector - a standard (tab. 5).

**Table 5**

*Differentiation of indicators for stimulants and de-stimulators for constructing a vector - a standard for taxonomic analysis*

Indicators	Stimulant/ Distimulant
X1 - autonomy ratio	stimulant
X2- financial risk ratio	distimulant
X3- current liquidity ratio	stimulant
X4 - profitability of sales	stimulant
X5 - FOC supply ratio	stimulant
X6 - return on assets,%	stimulant
X7 - the share of transportation, heat and energy costs in the cost price	distimulant
X8 - share of the enterprise in the country's GDP	stimulant
X9 - short-term debt ratio	distimulant
X 10 - social development expenditures rub. bln.	distimulant
X 11 - nickel production volumes, t.	stimulant
X 12 - copper production volumes, t.	stimulant
X 13 - platinum production volumes, thous. t. ounces	stimulant
X 14 - palladium production volumes, thous. t. ounces	stimulant
X 15 - volumes of state support,%	stimulant
X 16 - wear factor	distimulant
X 17 - net profit, million rubles	stimulant

Thus, indicators X1, X3, X4, X6, X8, X11-X15, X17 are stimulants, since their increase will lead to an increase in the financial stability of the enterprise, and indicators numbered X2, X5, X7, X9, X10, X16, on the contrary are discouraging, that is, their growth will negatively affect the financial stability of the company.

The next step in taxonomic analysis will be the construction of a reference vector. To construct a reference vector, it is necessary to select the largest value of stimulants and the smallest value of detimulators for the entire study period from the matrix values respectively.

Thus, the reference vector for the enterprise will have coordinates:

$Z_0 = (1.14; 0.72; 1.14; 1.41; 0.86; 1.52; 0.93; 1.14; 0.74; 0.70; 1.03; 1.09; 1.04; 1.04; 1.09; 0.98; 1.65).$

Let us determine the distance between the elements of the matrix and the vector by the standard  $C_{i0}$  using the formula:

$$C_{2017/0} = \frac{\sqrt{(1.14 - 1.14)^2 + (1.17 - 0.72)^2 + (1.14 - 1.14)^2 + (0.78 - 1.41)^2 \dots}}{2} = 1.68;$$

$$C_{2018/0} = 1.72; C_{2019/0} = 0.969.$$

Thus, the largest distance value is observed in 2018, this is the worst value in 3 years. The obtained distances serve as a basis for calculating the indicator of the level of development.

Calculating the average distance between observations  $\overline{C_0} = 1.458$ .

Let's calculate the taxonomy coefficient by years (we will build an integral assessment of the financial stability of the enterprise, taking into account the selected indicators). Let's define the taxonomic indicator of the development coefficient. To do this, first calculate the indicators using the formulas:  $S_0 = 0.346$

$$C_0 = 1.458 + 2 * 0.346 = 2.15$$

$$d_{2017} = \frac{1.68}{2.15} = 0.78$$

$$d_{2018} = \frac{1.72}{2.15} = 0.80$$

$$d_{2019} = \frac{0.969}{2.15} = 0.45.$$

Let's determine the level of the taxonomy indicator in dynamics for 2017–2019:

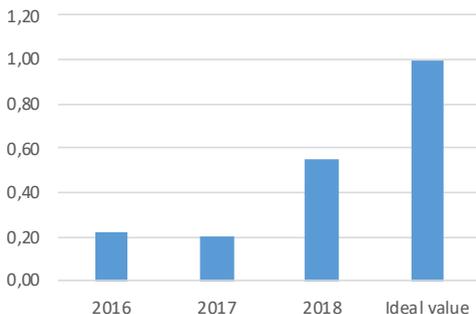
$$K_{2017} = 1 - 0.78 = 0.22$$

$$K_{2018} = 1 - 0.80 = 0.20$$

$$K_{2019} = 1 - 0.45 = 0.55.$$

Since in the above methodology, the factors of the internal environment were assessed according to the principle of maximizing stimulant factors and minimizing discouraging factors, the positive dynamics of development indicators shows an improvement in the financial situation in 2019 and a slight decrease in 2018 compared to 2017. The taxonomy coefficient for 3 years belongs to the interval [0, 1].

The graph of the dynamics of changes in the integral indicator of development is shown in the figure 1.



*Figure 1 – Dynamics of change in taxonomy coefficient of OJSC "MMC" Norilsk Nickel" for 2017–2019*

The complex integral indicator reflects the assessment of the level of financial stability of OJSC "MMC" Norilsk Nickel. It reflects all aspects of the company's activities, since it includes financial, production, social indicators, the importance of the company for the country's economy, its territorial remoteness, as well as the level of support from the state.

It should be noted that the taxonomy coefficient in the enterprise

OJSC "MMC" Norilsk Nickel" in 2017-2019 was far from the ideal value. The closer this indicator is to one, the higher the financial stability of the enterprise. Moreover, in 2018 it slightly decreased compared to 2017 and took the most boundary values in the area of low financial stability - 0.2. In 2019, there was a significant increase in this indicator to 0.55, which characterizes an improvement in financial stability, but this indicator is still insufficient and is at an average level.

The increase in the level of financial stability of the enterprise in 2019 was influenced by such factors as the growth of net profit, profitability of sales, an increase in production volumes and a reduction in social expenses. Nevertheless, the liquidity of the enterprise has worsened, the share of transport and expenses for heat and electricity has increased, which is due to the remoteness of the enterprise and the harsh climate, the enterprise's dependence on external lending remains high, despite the support of the state.

Thus, the proposed methodological approach made it possible to assess the level of financial stability of OJSC "MMC" Norilsk Nickel", as well as other enterprises, which can serve as the basis for the formation of a more effective strategy for the development of the enterprise in the long term.

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俄罗斯刑事诉讼中初步调查任务的定义和立法合并问题

**PROBLEMS OF DEFINITION AND LEGISLATIVE CONSOLIDATION  
OF THE TASKS OF PRELIMINARY INVESTIGATION IN RUSSIAN  
CRIMINAL PROCEEDINGS**

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抽象。 提出的工作分析了欧洲人权法院就俄罗斯联邦发布的决定以及刑事案件中初步调查的有效性标准的内容。

初步调查任务的制定对改善刑事案件审前程序的规范性管理具有重要的方法学意义。 在拟定初步调查的任务时，作者建议采用一种系统的方法，考虑到初步调查和审判任务的连续性，这将确保整个刑事诉讼的目的性。

关键词：初步调查，预审程序，刑事诉讼程序，调查员，阶段。

**Abstract.** *The presented work analyzes the decisions of the European Court of Human Rights issued in relation to the Russian Federation and the content of the criteria for the effectiveness of preliminary investigation in criminal cases.*

*The formulation of the tasks of the preliminary investigation is of major methodological significance for improving the normative regulation of pre-trial proceedings in criminal cases. When formulating the tasks of the preliminary investigation, the author proposes to use a systematic approach that takes into account the continuity of the tasks of the preliminary investigation and the trial, which will ensure the purposeful nature of the entire criminal proceedings.*

**Keywords:** *preliminary investigation, pre-trial proceedings, criminal procedure, investigator, stage.*

By the nature of the procedural actions performed, the decisions taken, the preliminary investigation occupies a special place in the system of stages of criminal proceedings. It is the preliminary investigation that creates the preconditions for a fair resolution of the criminal case. M.S. Strogovich wrote: "... the preliminary investigation is performed before the trial and for the trial" [1, p. 39,40]. It is the investigator and the interrogator who are obliged to collect good-quality evidence, formulate and substantiate the accusation as the subject of the forthcoming trial. The significance of the preliminary investigation stage for resolving a criminal

legal conflict in essence prompts the legislator to determine the optimal ways of developing criminal procedural legislation in terms of pre-trial proceedings, which becomes the subject of research by many authors. Meanwhile, any changes in the law must be conditioned by the objectives of criminal proceedings. The solution of the problems raised is of major methodological importance. It is the tasks that determine the main purpose of the activities of the subjects responsible for the investigation of crimes, their legal status, and make it possible to highlight the main directions of improving the legal regulation of pre-trial proceedings. Considering that the topic of reforming and increasing the efficiency of preliminary investigation is quite actively discussed in the theory and practice of the criminal process, the problem of defining the tasks of the preliminary investigation is one of the most urgent [2, p. 80-83; 3]. In the legal literature, opinions have been repeatedly expressed that the absence in the Criminal Procedure Code of the Russian Federation of the tasks of criminal proceedings in general and of preliminary investigation, in particular, negatively affects its effectiveness, makes all criminal proceedings unarmed, and the activities of the bodies conducting the process have no purpose [4, p. 81-87; 5, p. 22-27].

In the science of criminal procedure, there were various approaches to defining the tasks of the preliminary investigation. So, M.S. Strogovich attributed to the tasks of the preliminary investigation: 1) comprehensiveness and completeness, an exhaustive study of the circumstances of the case; 2) identification and exposure of all participants in the crime; 3) collection and verification of evidence; 4) protecting the innocent from unfounded accusations; 5) the establishment of the reasons and conditions that contributed to the commission of a crime or complicate its timely detection and suppression [1, p. 39, 40]. A similar opinion was expressed by A.P. Gulyaev [6, p. 3]. N.V. Zhogin and F.N. Fatkullin, the structure of the tasks of the preliminary investigation was supplemented with an indication of compensation for the material damage caused by the crime and the education of citizens in the spirit of unswerving observance of laws and respect for the rules of community [7, p.38-48]. With the adoption of the Code of Criminal Procedure of the Russian Federation, the relevance of the issue under consideration was not only not exhausted, but acquired particular urgency due to the absence of a procedural norm that enshrines even the general tasks of criminal proceedings. As for the tasks of the preliminary investigation, it should be noted that, on the whole, without rejecting the previously made proposals, the authors proposed to single out the following: 1) a preliminary legal assessment of an act with signs of a crime; 2) protection of the rights and legitimate interests of participants in criminal proceedings; 3) crime prevention. In turn, the first group of tasks is achieved by solving the following: 1) timely, comprehensive, complete and objective research of the circumstances of the case; 2) exposure of persons who have committed a

crime, as well as the formulation of a well-founded accusation; 3) creation of prerequisites for the participation of the suspect, the accused in the trial and his proper behavior in the criminal proceedings. The second group of tasks includes such as: 1) assistance in the implementation of the rights of participants in criminal proceedings and the performance of their duties; 2) ensuring compensation for harm caused by a crime, other property penalties, confiscation of property; 3) ensuring the safety of victims, witnesses and other participants in criminal proceedings, as well as their relatives; 4) identification of the circumstances that contributed to the commission of the crime, with the right to submit a submission to eliminate them; 5) assistance in instilling a respectful attitude towards laws and their strict observance by citizens. In order to orient the activities of inquiry officers and investigators, A.B.Sudnitsyn proposes to consolidate the specified list in Chapter 21 of the Code of Criminal Procedure of the Russian Federation and to title it "Tasks and general conditions of preliminary investigation" [8]. On the one hand, the detailed development of the tasks of the preliminary investigation is of great practical importance. S.P. Efimichev and P.S. Efimichev are right, noting that a clear definition of the tasks of the preliminary investigation will contribute to the creation of an exhaustive program of activities of the investigator and the interrogator in each criminal case, the development of the most optimal options for their resolution. The presence of tasks will greatly facilitate the prosecutor's office supervision over the preliminary investigation of criminal cases, since it will determine the degree of fulfillment of the tasks facing the bodies of the preliminary investigation [4, p.81-87].

On the other hand, the complexity and heterogeneity of the activities of the investigator and the interrogator makes it impossible to determine the final, orderly list of tasks, which, according to A.A. Cheburenkov can lead to the creation of complex systems of forensic recommendations for their achievement and disorient practitioners [9]. In this regard, in defining the tasks of the preliminary investigation, the most preferable is a systematic approach, which does not contradict the existence of both general tasks of criminal proceedings and specific ones characteristic of a particular stage of the criminal process. The presence of a system of tasks is determined by the existence of a system of stages of criminal proceedings, where they are all interconnected and aimed at achieving the objectives of criminal proceedings as a whole, therefore, one should agree with the opinion that at a particular stage of criminal proceedings they usually have a specific expression, taking into account their purpose specific stage. With such an approach, it is hardly possible to consider this or that task achieved if its solution continues in the subsequent stages of criminal proceedings [4, p. 81-87]. According to P.F. Pashkevich, the tasks of criminal proceedings overlap with the tasks of the preliminary investigation, including: prompt response of the investigative and judicial authorities to

the crimes committed; the establishment of objective truth in each case; ensuring the inevitability of responsibility for the crime committed; the appointment of a fair punishment for the guilty; inadmissibility of prosecution and conviction of an innocent person; achievement of the maximum disciplinary and preventive effect [10, p.8].

The tasks of the preliminary investigation cannot be considered in isolation from the purpose of criminal proceedings enshrined in art. 6 of the Criminal Procedure Code of the Russian Federation. It should be noted that the modern version of this norm, (art. 6 of the Criminal Procedure Code of the Russian Federation "Appointment of criminal proceedings"), significantly differs in content from the analogous norm that existed in the Criminal Procedure Code of the RSFSR. So, as the tasks of the Soviet criminal process, the law defined: "prompt and complete disclosure of crimes, exposure of the perpetrators and ensuring the correct application of the law, so that everyone who committed a crime is subject to just punishment and no innocent person is prosecuted and convicted." As you can see, along with the general direction of the criminal process, art. 2 of the Code of Criminal Procedure of the RSFSR, the tasks of the preliminary investigation were the quick and complete disclosure of crimes, the exposure of the perpetrators and the provision of the correct application of the law. In order to ensure the continuity of the tasks of the preliminary investigation and trial, and, accordingly, to impart a purposeful character to the criminal proceedings, it seems necessary to pay attention to the main content of the activities of the subjects carrying out the preliminary investigation, which follows from the norms of the Code of Criminal Procedure of the Russian Federation.

The specificity of the activities of the investigator and the inquiry officer is determined by the function of criminal proceedings assigned by the legislator. As parties to the prosecution, they are obliged to prosecute the perpetrators of the crime. To this end, the Code of Criminal Procedure of the Russian Federation provides for means and methods of proof, determines the subject of proof. Meanwhile, the analysis of the norms provided for by art. 73, 74, 86 of the Code of Criminal Procedure of the Russian Federation allows us to conclude that proof is the content not only of the preliminary investigation, but also of the trial. However, the special nature of the activities of the investigator and the inquiry officer significantly distinguishes the evidence carried out at the stage of preliminary investigation. When carrying out criminal prosecution, the subjects of preliminary investigation are obliged to solve the crime, i.e. to expose the suspect accused of committing a crime (par. 55 of art. 5 of the Criminal Procedure Code of the Russian Federation). The reference point for this activity is the circumstances to be proved, and is enshrined in art. 73 of the Code of Criminal Procedure of the Russian Federation, which involves a comprehensive and complete study of the

circumstances of the case. Therefore, among other tasks of criminal proceedings, the task of the preliminary investigation should be not the implementation of proof of the committed act, but the exposure of persons who have committed a crime through a comprehensive and complete investigation of the circumstances of the criminal case, which, firstly, includes the activity of collecting and checking evidence of the person's involvement in commission of a crime, secondly, will give direction to the preliminary investigation, and thirdly, will ensure its organic inclusion in the system of tasks of criminal proceedings. This task is implemented for each criminal case, regardless of the form of the preliminary investigation, the nature of the act committed, and the classification of the crime into a certain category. The exposure of persons who have committed a crime by establishing all the circumstances to be proved is the ultimate goal for the preliminary investigation stage, but not final for the entire criminal proceedings due to the principle of the presumption of innocence of the accused. As S.I. Vershinina rightfully notes, the task of establishing the guilt (exposure) of persons involved in the crime is also solved at the stage of the trial [11, p.28-30].

Thus, the exposure of the perpetrators of a crime through a comprehensive and complete investigation of the circumstances of the criminal case should be included in the system of tasks of criminal proceedings, which will make the activities of the preliminary investigation bodies more expedient and will become the starting point in improving the criminal procedural legislation regulating pre-trial proceedings in criminal cases.

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老师和心理学家参与未成年人调查

**THE PARTICIPATION OF THE TEACHER AND PSYCHOLOGIST IN  
THE INVESTIGATION OF MINORS**

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抽象。 本文探讨了与教师和心理学家的参与有关的未成年人调查相关的问题，为此，他们已经建立了特别的刑事诉讼程序。 法律理论家的正式法律，比较法律和概念条款等方法被用来全面研究该问题。 已经提出了许多建议以改善立法和执法实践。

关键词：刑事诉讼程序，未成年人，老师，心理学家，调查行为，审讯。

**Abstract.** *The article examines issues related to the involvement of a teacher and a psychologist for the investigation involving minors, for which a special procedure for criminal proceedings has been established. Methods such as formal-legal, comparative-legal, and conceptual provisions of legal theorists were used to fully study the problem. A number of proposals have been formulated to improve legislation and enforcement practices.*

**Keywords:** *criminal procedure, minor participant, teacher, psychologist, investigative actions, interrogation.*

Minors are a special category of participants in the process due to the fact that they are more likely than adults, due to their mental development, to be stressed, more aggressive, tense. This aspect of everyday life is directly related to the neuro-psychological development of the child, his emotional perception of the world around him.

The Declaration of the Rights of the Child states that "a child, due to his physical and mental immaturity, needs special protection and care, including adequate legal protection, both before and after birth" [1]. The norms of criminal procedure

legislation take into account these features when conducting investigative actions.

The CCP of the RF enshrines special methods of protection, providing for a special treatment of minors [2]. So, for example, the duration of interrogation of a minor is 2 times less than for adults. A certain specificity of the production of certain investigative actions in relation to the persons in question has been established, due to the mandatory or optional involvement of a teacher or psychologist.

These measures can be considered as a means of ensuring the rights and legitimate interests of persons under the age of majority, protecting them from possible negative impact on the psyche and upbringing.

So, for example, if we analyze the 6, 7 and 8 chapters of the CCP of the RF, then we will notice that they indicate all the persons involved in the criminal proceedings. However, the psychologist and the teacher as independent subjects do not appear in these chapters. The concept of "psychologist" is not legally enshrined only in p. 62 of art. 5 CCP. However, legitimate questions remain: who can be invited as a psychologist, teacher, what qualifications are necessary to establish contact with minors, these subjects should be unfamiliar to the minor or, on the contrary, should they be invited, for example, from the educational institution in which the minor is studying or used to study, if possible. So, for example, in the Federal Law "On Education", p. 21, art. 2 defines a teacher as a person who is in labor, service relations with an organization that carries out educational activities [3]. Due to the fact that the CCP of the RF does not indicate such a qualification requirement, then we believe that p. 21 of art. 2 of the Federal Law "On Education" should be applied together with the norm contained in p. 62 of art. 5 of the CCP of the RF.

Let's turn to art. 191 of the CCP of the RF and analyze it. Part 1 states that during interrogation, confrontation, identification and verification of testimony with the participation of a minor victim or witness who has not reached the age of sixteen or has reached this age, but suffers from a mental disorder or lags behind in mental development, the participation of a teacher or psychologist is mandatory. Upon reaching the age of sixteen, a teacher or psychologist is invited at the discretion of the investigator.

A natural question arises about the reasonableness and appropriateness of the indicated age division. In our opinion, the participation of a teacher or a psychologist can sometimes interfere with the performance of investigative actions for persons over fourteen or fifteen years old. This is due to the fact that at this age minors are most sensitive to the issue of confidentiality of information, they are more shy and the presence of unauthorized persons aggravates the contact with the person conducting the preliminary investigation, which prevents the creation of a trusting atmosphere. At this stage of personality formation, the desire for independence and the desire to get rid of the participation of adults in the life of minors is man-

ifested. Therefore, before the interrogation, you should find out from the minor in the presence of whom he would like to be interrogated [4, p.215].

Interrogation of a minor is considered one of the most difficult investigative processes because the case has to be with a person who has not reached the age of majority, that is, with a person, in most cases, with an unformed psyche [5].

The specifics of interrogation with the participation of a minor victim and witness are established by Article 280 of the CCP of the RF. As for the procedure for interrogating a juvenile accused, a suspect, in p. 3 art.425 of the CCP of the RF stipulates the obligatory participation of a psychologist or teacher in the interrogation of a minor suspect, who has not reached the age of sixteen or has reached this age, but suffers from a mental disorder or is mentally retarded.

At the same time, it is not entirely clear how the person conducting the interrogation, without providing medical documents or an expert opinion, can find out about these circumstances necessary for the participation of a teacher or psychologist. This can lead to the fact that the requirements of art. 425 of the CCP of the RF may be violated, and, accordingly, the testimony obtained during the preliminary investigation will be inadmissible, since the rules of the CCP of the RF will be violated. This is confirmed by examples from judicial practice.

Thus, in particular, a person registered with a psychiatrist was questioned without a psychologist and a teacher. The testimony obtained at the hearing was rejected by the court [6].

In 2013, in Art. 5 CCP of the RF was amended and p. 62, introduced by the Federal Law of 02.07.2013 № 185-FZ, according to which: "a teacher is a pedagogical worker who performs in an educational organization or an organization providing training, the duties of teaching and educating students." It is not clear why this paragraph does not enshrine as a qualification requirement for a teacher whether he has pedagogical experience of working with minors or not. We believe that in this matter, preference should be given to persons with at least one year of work experience. Note that article 5 still does not contain a clause on the psychologist.

In this regard, we believe that for the art. 5 of the CCP of the RF, it is advisable to add clause 63 and rewrite it as follows: "*A psychologist is a person with special knowledge in the field of child, adolescent and youth psychology, practical experience as a psychologist and involved in the conduct of investigative actions in the manner prescribed by this Code, in relation to or with the participation of minors.*"

We consider it expedient to make a number of proposals regarding the interrogation of minors. For example, it is necessary to provide an opportunity to communicate with a teacher, a psychologist with a minor before the interrogation, in order to determine the system of psychological techniques that will be most ef-

fective when interrogating this category, explain to him the essence of procedural actions, prepare the child for them. After the conversation, you can find out whether he is ready to answer questions and only after that proceed to the production of the investigative action. The participants in the process should support the child in overcoming the uncertainty and embarrassment that arises during the interrogation or other investigative action.

It is important to note that legal representatives have the right to be present during the interrogation of a minor, as well as, with the permission of the investigator, during other investigative actions. If involved, a psychologist or teacher should explain to parents that the feelings and emotions that they show during the interrogation of their children can significantly affect the general condition of the child.

It is necessary to resolve the issue of allowing all persons involved in investigative actions against minors to suppress various kinds of pressure, both from the investigator and from other persons conducting the preliminary investigation.

A clear regulation is needed in which cases the participation of a teacher is provided, and in which a psychologist. For example, I.A. Makarenko believes that, first of all, the teacher should participate, and only in those cases when the crime in which the minor is accused was committed with special cynicism, audacity, for tactical reasons it is possible to invite a specialist in the field of adolescent and youth psychology [7, p.108-109]. It is believed that this issue should be decided by the person conducting the investigation, guided by the personality traits of a particular minor [8, p.405].

Thus, in order to ensure the rights and legitimate interests of a minor, it is necessary to supplement art. 5 of the CCP of the RF with clause 63, which will disclose the concept of "psychologist", indicate the qualification requirements that are necessary for a teacher and psychologist to establish contact with minors, as well as to provide an opportunity to suppress various kinds of pressure against minors by the participants in the preliminary investigation. In our opinion, the proposed amendments will help not only fill the gaps in modern criminal procedure legislation, but also to a greater extent ensure the effective protection of a minor at the stage of preliminary investigation.

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结合高水平游泳者身体和技术训练的协同方法

## A SYNERGISTIC APPROACH TO COMBINING PHYSICAL AND TECHNICAL TRAINING OF HIGHLY QUALIFIED SWIMMERS

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**Abstract.** *The purpose of the research is to study the possibilities of conjugation of physical and technical training of highly qualified swimmers using a synergistic approach. The study involved 26 athletes of qualifications for CMS, MS, MSMK, divided into 2 groups - control and experimental, 13 people each. Methods were used: computer video analysis, dynamometry, mathematical statistics, pedagogical experiment. In the control group, the exercises were carried out according to the generally accepted method, while training the athletes of the experimental group, exercises and methods of conjugate impact on land and in water were used, aimed at local correction of the stroke elements. Exercises were selected that had a conjugate effect on the indicators of physical and technical readiness of swimmers. Analysis of biomechanics of movements in water and when working on a simulator revealed similar values of kinematic parameters. As a result of studying the dynamic characteristics, a close relationship was found between indicators on land and in water. In the course of the pedagogical experiment, an unreliable dynamics of characteristics in athletes of the control group and reliable changes in the studied indicators in the experimental group were revealed. The results of the experiment proved that the indicators of both the technical and physical components of the swimmer's training with the conjugate use of specially selected means, due to their synergy, demonstrate a higher increase, providing a higher swimming speed. Using a synergistic approach, it is possible to optimally integrate these types of training in the training process.*

**Keywords:** *technical and physical training, swimmers of high qualification, synergy, conjugation of influences, means of training.*

## **Introduction**

The training process is a complex, multi-component system in which all types of athlete training are integrated. When constructing a training, in addition to the ratio of the volumes of each of the types of training and their variations in the structure of the training cycle, it is necessary to take into account their possible mutual influence - both negative and positive. For the implementation of the strategy of sports training, aimed at achieving the maximum sports result, a synergetic approach will be promising, when the effect of the use of means and methods of one of the types of training will contribute to an increase in the effectiveness of another [5].

Without considering here the possible correlations and mutual influences of the components of each type of training, we note that in terms of the combination of training types of qualified swimmers, physical and technical training is most often considered as having the greatest volume in the structure of the training cycle [2, 3, 4]. The main contradiction in the issue of pairing the means of physical and technical training of swimmers is the availability of the possibility of using a synergistic approach, which provides the maximum possible effect and the absence of a scientifically grounded technology of such a combination. The data on integral training in swimming, found in the special literature, indicate that this issue is unfairly deprived of the proper attention of specialists. The conducted research mainly determines the need to expand the used special means by adding exercises in the gym and in the water to the training process, which in conjunction affect both the special physical and technical readiness of swimmers.

**Purpose of the study:** examining the possibilities of conjugating physical and technical training of highly qualified swimmers using a synergistic approach.

## **Research methodology and organization**

Methods of computer video analysis of swimmer's movements, dynamometric methods using the SwimForceTest hardware complex, and computational statistical methods were used in the work. The study, conducted in October - December 2019, involved 26 swimmers (CCM, MS and MSMK). The athletes were divided into 2 groups of 13 people each, in one of which (control group - CG) the training process took place according to the traditional scheme, and the training programs of another group (experimental group - EG) included exercises on land and in local water. impact on the stroke structure. The means were selected according to the parameters of the power of movements when simulating a stroke on land and the power of a stroke in water, as well as taking into account the peculiarities of the kinematic structure of the stroke. The training work on land was carried out using the VASA ERGOMETER simulator, the movements on which (according to the manufacturer's statement) are as close as possible to the conditions of the aquatic environment.

### Research results and discussion

Based on the fact that the leading physical quality of a swimmer is speed-power endurance [3], we believe that the power component should be effectively implemented in the working phases of the cycle. We have selected exercises on land and in water that locally affect the structure of the stroke. When analyzing the kinematics of movements in water and when working on the VASA ERGOMETER simulator, similar kinematic indicators were indeed revealed [1]. As a result of studying the dynamic characteristics, a close relationship was revealed between indicators on land and in water, such as the instantaneous power of the stroke in the pull-up phase, the instantaneous force in the pull-up and push-off phases - on land, the speed and acceleration of hand movement in the pull-up and push-off phases - in water ( $r =$  from 0.94;  $p < 0.05$ ). In terms of the search for biomechanical points of conjugation between the physical and technical training of swimmers, a study was carried out, which made it possible to determine the synergy in the structure of the swimmer's training. For this, a model experiment was carried out during a mesocycle (three months), where exercises on land and in water with local effects on the stroke structure were included in the EG training programs. The means were selected according to the parameters of the power of movements when simulating a stroke on land and the power of a stroke in water, as well as taking into account the peculiarities of the kinematic structure of the stroke. As a result of the comparative analysis of kinematic parameters in athletes of both groups, a heterogeneous dynamics of characteristics was revealed. So, in the CG athletes during the intermediate - second testing, insignificant changes in stride length were revealed that did not reflect the improvement in the quality of swimming technique, while in the EG swimmers, this indicator increased from  $1.92 \pm 0.01$  m to  $2.12 \pm 0.05$  m ( $p < 0.05$ ). At the same time, the pace of athletes of both groups significantly decreased from  $54 \pm 2.12$  mov/min to  $48 \pm 1.27$  mov/min ( $p < 0.05$ ) in the EG and from  $52 \pm 1.78$  mov/min to  $46 \pm 2.42$  mov/min ( $p < 0.05$ ) in CG. After the experiment, the inversely proportional dependence of the "step" length on the pace of movements, reflecting the quality of the technique and its efficiency, was found only in EG athletes. When analyzing other kinematic characteristics of the technique using the method of computer video analysis of the swimmer's movements, the athletes of the experimental group showed a significant increase in the trajectory duration values in the pull-up phases from  $0.29 \pm 0.04$ s to  $0.37$ s  $\pm 0.01$ s ( $p < 0.05$ ) and repulsion  $0.17$ s  $\pm 0.02$ s to  $0.25$ s  $\pm 0.01$ s ( $p < 0.05$ ), in athletes from the control group, the duration of the phase composition of the stroke affected only the capture phase, where the indicator slightly decreased.

When analyzing the spatio-temporal parameters of the swimming technique, the main characteristics that affect the swimming speed in general are the speed and acceleration of the hand movement in each of the three working phases of the

stroke. Thus, the speed of hand movement in the repulsion phase among athletes from the experimental group increased by 32% (by 7% in the control group), and in the pull-up phase it decreased by 12% (by 2% in the control group), while the hand slowed down in the phase pull-ups by 25% (5% in the control group) and accelerated in the take-off phase by 30% (by 5% in the control group), which indicates a high-quality implementation of the power phase of the stroke and the appearance of the so-called "overlap" in athletes, which has influence on swimming speed in general.

When analyzing the dynamic parameters of the swimming technique, it was revealed that with a purposeful impact on the stroke phase using conjugate means on land and in the water, the EG athletes' instantaneous stroke power in the pull-up phase increased from  $123.25 \pm 1.25$  watts to  $139.52 \pm 2.57$  watts ( $p < 0.05$ ) and repulsion  $223.01 \pm 2.02$  watts to  $281.71 \pm 7.01$  watts ( $p < 0.05$ ). At the same time, no significant changes were found in the CG. The stroke power indices also directly affect the total traction force in the water, where the athletes of the experimental group demonstrated a significant increase in the parameter from  $189.24 \pm 0.57$  kg/s to  $199.67 \pm 2.01$  kg/s. The increase in swimming propulsive power in EG athletes is associated with the correct selection of specific exercises on land and in water. With the traditional construction of the training process, in CG athletes, the dynamic indicators increased, although the gain was insignificant.

We assume that, in addition to the selection of training means, methods of pedagogical influences should play a significant role in the synergetic approach to the combination of types of training. However, this aspect requires further study.

Swimming speed was analyzed as an integral indicator of training during this study, as a tool for assessing the effectiveness of the means and methods used, based on the synergetic mechanism of its construction.

Thus, athletes of both groups were offered a 4x50 meter freestyle test, where the average test speed was recorded, and at the end of the study, the swimmers took part in control competitions, where the average competitive speed was recorded at a distance of 200 meters. As a result of a comparative analysis of the test and competitive speeds in the athletes of the experimental group, the indicator increased by 3% and 4% ( $p < 0.05$ ), respectively, while the swimmers of the control group had an increase in the test speed by 2%, and in the competitive group by 1% ( $p > 0.05$ ). The obtained data testify to the incomplete realization of the potential by the athletes of the control group.

**Conclusion** Thus, the work revealed a synergistic mechanism for pairing the means of technical and physical training of swimmers. The results of the experiment proved that the indicators of both the technical and physical components of the swimmer's training with the conjugate use of specially selected means, due to their synergy, demonstrate a higher increase, providing a higher swimming speed.

Using a synergistic approach, it is possible to optimally integrate these types of training in the training process.

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外语教学中语法技能的监控和控制方法  
**MONITORING AND WAYS OF CONTROL OF GRAMMATICAL  
SKILLS IN TEACHING A FOREIGN LANGUAGE**

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抽象。 文章探讨了外语教学中的控制问题，其主要目的是提高教育质量。 作者关注监控语法技能的方法，并讨论了其形成模型。 本文还根据学生语法知识的形成水平来描述测试任务的水平。

关键字：外语，语法，语法技能的形成，教育质量，控制，技能发展，现代技术。

**Abstract.** *The article deals with the problem of control in teaching foreign languages which main purpose is to improve the quality of education. The authors pay attention to the methods of monitoring grammatical skills and discuss the model of their formation. The article also describes the levels of test tasks depending of the level of formation of students' knowledge of grammar.*

**Keywords:** *foreign language, grammar, formation of grammar skills, quality of education, control, skills development, modern technologies.*

As you know, learning a foreign language gives an opportunity to expand the picture of a person's world, to change the outlook on the whole. With the help of a foreign language, you can discover the national characteristics, culture and lifestyle of other nations. Modern technologies make the path to mastering any foreign language as easy as possible.

Among the advantages that explain the popularity of learning English, one can single out its versatility. This language is used almost everywhere, even in everyday Russian speech you can find English words that you cannot understand without possessing certain knowledge [ 6, p. 5 7 ].

Another benefit of speaking English is the ability to communicate with foreigners while traveling. It should be noted that English is spoken in most countries of the world, using it especially for communicating with tourists. Often, while

staying abroad, a person is often embarrassed because he does not understand foreign speech. Knowledge of English will help to solve this problem.

Nowadays, a modern society, as well as employers, make high demands on specialists of various professions. The higher the level of a specialist, the higher he is in demand in the labor market; he has more highly paid positions and status. The fundamental basis for training specialists are educational institutions of secondary vocational and higher vocational education, which are responsible for the level of both theoretical and practical training of students. The development of international relations stimulates the improvement of the quality of education, including teaching foreign languages. But if there are many programs for training students of language faculties, then the main reason for the poor knowledge of foreign vocabulary by students of non-language faculties is the insufficient development of some issues of methods of teaching a foreign language [1, p. 237].

Any modern language - whether Russian, English or French - regularly changes and continues to live an active life: simply put, it acquires new words and expressions. Some are formed as a response to current events, others appear as if out of nowhere - but regardless of their origin, hundreds of new words are added to the dictionary every year, reflecting the evolution of the language.

Grammar is one of the important layers in the system of any language. This determines its leading role in teaching foreign languages. Thus, an important direction in teaching foreign languages is the formation of grammatical skills.

The stages of the formation of grammatical skills were studied in the works of A.E. Kustova, E.I. Passova, N.I. Filatova, S.F. Shatilova. So, and proceeding from the opinions of these authors, the formation of grammatical skills of a foreign language takes place in three stages: familiarization, training, and speech practice.

This structure, as well as the study of the conceptual apparatus, made it possible to develop a model for the formation of grammatical skills. Modeling as the main method was chosen as the most suitable for providing information, as well as a method that allows you to cover a large amount of information. Model put is such a mental representation or materially implemented system which, by displaying or reproducing an existing or projected object of research, has the ability to replace it so that its study gives us new information about the object [4, p. 66].

Today, modeling is widely used in pedagogy, as a method of theoretical research, and as a special way of working consciousness, imagination and logic, focused on solving traditional problems with non-traditional ways, and as a teaching means.

A model as a way of creating the original is a mental, logical schema of the expanded holistic pedagogical activity. The model of the formation of grammatical skills concentrates ideas about what should be built (goal) and under what conditions (means).

As already noted, the formation of grammatical skills in a foreign language

takes place in three stages. In general, these stages do not describe the entire process of forming these skills, so we have identified the blocks:

1. *Diagnostics of grammatical skills of a foreign language.* Based on the diagnostics, the teacher makes a conclusion about the level of formation of grammatical skills, since most of the students have a language base (knowledge gained during schooling). Based on the diagnostic results, a program is developed.

2. *Program for the formation of grammatical skills of a foreign language.* The program includes the following stages: (orientational- preparatory, situational- stereotyping , variable situational. The implementation of the program allows you to start the process of forming grammatical skills.

3. *Analysis of the results of the formation of grammatical skills of a foreign language.* Both hidden and open forms of control are used. The results of this control are analyzed, if students have reached a sufficient level of formation of grammatical skills, then teaching a foreign language continues in the same direction. If the required level is not reached, then it is advisable to adjust the program and continue working .

Thus, the proposed model of the formation of grammatical skills of a foreign language among students of a non-language faculty involves the implementation of such blocks as: diagnostics of grammatical skills of a foreign language, a program for the formation of grammatical skills of a foreign language, analysis of the results of the formation of grammatical skills of a foreign language.

So, in the conditions of intensive training, when the goal and ensuring efficiency is the integrated development of all types of speech skills and abilities, it is important to constantly monitor the effectiveness of training. Control has the same basic functions: revealing the degree of possession of any skill, identifying possible lagging behind, as well as the correlation of possession of various speech skills.[ 3, p. 97].

Depending on the level of formation of students' knowledge of grammar, three levels of test tasks can be distinguished: training; developing; creative.

So, for example, at the first level, test tasks of this nature are used: choosing the correct answer from several suggested ones, restoring what was missed, correlating actions and times. At the second level, it is necessary to analyze the grammatical scheme and extract verbal elements from memory, for example, form the interrogative and negative forms of the sentence, which is given in the affirmative form; open the brackets and insert the verb into the sentence in the desired type of tense. At the third level, translations from Russian into English are offered, which requires knowledge of both vocabulary and grammar and the ability to build sentences, paying attention to the correct word order.

While making up the test tasks we take into account the following requirements: clear formulation of tasks accurately orients students to perform an action;

the purpose of assignments (should be focused on the control of typical grammatical difficulties); with observance of the principle of gradual increase in difficulties; the need to take into account the level of formation of skills and abilities of students in English grammar [ 5, p. 1 0 6].

Test assignments are evaluated in points. After a careful analysis of all student mistakes, it is necessary to outline ways to eliminate them. As a result of the use of test tasks, students have a deeper knowledge of grammar, which allows them to master the skills of speaking and reading more successfully.

In conclusion, we would like to note that teaching foreign languages is focused on achieving the goal of practical knowledge of colloquial speech and the business language for special purposes, as well as translation of foreign texts of a professional orientation.

As a result of mastering the “Foreign language” discipline, the student must know: the grammatical minimum required for reading and translating (with a dictionary) foreign texts of a professional orientation and specific purposes.

Despite the fact that the necessary level of grammatical knowledge, abilities and skills must be formed in the basic school, it must be constantly maintained and developed. Depending on the type of speech activity, exercises are selected for the development of certain skills. When reading, the skill of recognizing various grammatical means is very important.

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关于选择外语教学和方法内容最优模型的问题  
**ON THE QUESTION OF CHOOSING THE OPTIMAL MODEL  
OF EDUCATIONAL AND METHODOLOGICAL CONTENT IN A  
FOREIGN LANGUAGE**

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注解。 本文讨论了创建电子教育课程的细节。 简要介绍了讲座和教育内容的组合模型，以及远程学习模型，并得出了关于组合模型作为“外语”学科最佳内容模型的选择的结论。 给出了针对“外语”学科的教育和方法论内容中所包含块内容的描述。

关键字：内容，模型，教材，块，信息，模块。

**Annotation.** *The article discusses the specifics of creating electronic educational courses. A brief description of the lecture and combined model of educational content, as well as the distance learning model is given, and a conclusion is made about the choice of the combined model as the optimal content model for the "Foreign language" discipline. A description of the content of the blocks included in the educational and methodological content for the discipline "Foreign language" is given.*

**Keywords:** *content, model, educational material, block, information, module.*

Currently, there is an acute issue of the development and application of educational and methodological content. The content is considered in principle as educational material presented in electronic form [Rozhkova 2015], which is of particular importance in the context of a sharp reduction in classroom hours while maintaining high requirements for the results of foreign language learning. When developing content for a specific course, it is necessary to initially determine the target group, the goal of training and analyze the training content.

In the work of I.K. Voitovich, which is devoted to the topic of the specifics of creating electronic educational courses, it is noted that the algorithm for creating electronic educational courses is based on a number of necessary components, which include the selection or creation of educational course material for its pres-

entation in electronic form, as well as the definition models of an electronic training course, taking into account the didactic and methodological principles of its construction. In the scientific and methodological literature, various models of e-learning courses are considered, since their classification is based on various principles and approaches. In the works of R. Tinker, in our opinion, three main models of e-learning courses are considered [Tinker 2001]. These include: a lecture model, which is a one-way delivery of high quality content to a large number of students and, accordingly, does not imply a high degree of interactivity or interaction, since interaction with the teacher is limited. The lecture model of the course is more suitable for motivated and disciplined students, or can be used as one of the components of a combined content model.

The next model under consideration is the model of distance learning through electronic correspondence, which involves written communication between a student and a teacher. This model, according to the author, contains less educational material, but more tests and tests, and it has a common drawback with the lecture model, namely, limited interaction both between students and between students and the teacher. Finally, the third model, which is most used in the system of basic university education, is an additional one, we prefer to call it a combined model, in which Internet resources are used by the teacher both in the traditionally classroom in the form of assignments, tests, discussions, and in remote access in the form of reading materials and self-study. It seems to us that the optimal model for teaching students the discipline "Foreign language" is precisely the combined model, which as one of the components can include two others.

After choosing the appropriate content model, the problem of selecting and / or creating material for educational content arises. When developing an e-learning course, a teacher has two possibilities of filling it with educational material: using ready-made digital or electronic resources, including the Internet, or creating author's material [Voitovich 2015]. The use of audio and video materials in a foreign language from Internet resources is absolutely necessary, since this provides learners with access to authentic texts, dialogues and polylogies. The use of video recordings and sometimes modern songs in the target language creates conditions for the additional formation of the socio-cultural competence of students, and also, due to the emotional impact of music and images, ensures the interest of students and thereby increases their motivation to study the culture and language of other countries. However, the need to take into account the professional interests of future specialists, the level of their initial language training, the specific goals facing them, as well as the conditions of the educational process (in particular, the lack of classroom activities and the predominance of students' independent work) requires mainly the creation of copyright material that would ensure that the above requirements and ensured constant monitoring of the assimilation of educational material.

Electronic learning resources created by university teachers must necessarily meet the requirements of higher education. The main documents for the selection of the training content for future bachelors or masters are state standards of higher education and those competencies that should be formed in the course of training. When creating content, it is also necessary to take into account the curricula of a particular university, including those in the main specialties of students. In addition, the content of the e-learning course and its material are largely determined by the individual characteristics of the contingent of student groups, including the level of their training. The success of training depends to a significant extent on student satisfaction with classes, their involvement in work, on the achievement of the set educational goals, their self-esteem, as well as marks on tests or exams. Due to this, with the possibility of partial use of materials gleaned from the Internet, mainly educational content is filled with copyright material. Preparing textual information for students is more creative work, since the interest of students depends on how interesting, and sometimes intriguing, this information will be presented. Naturally, when compiling educational content, it is useful to use illustrations, slides, audio and video materials [Lazarev 2009].

Content development is a very time consuming and complex job as it includes many components that must be clearly structured. Educational content, as a rule, consists of several blocks, which are interconnected. So, in relation to educational and methodological content in the discipline "Foreign language", the content includes a Reference block containing 1) an index of the main and additional literature; 2) a list of the resources of the information and communication network of the Internet necessary for mastering the academic discipline, as well as 3) a terminological dictionary (glossary) of terms in the main specialty of students. Further, the content includes an Information block containing a brief description of the academic discipline indicating its place in the educational process and its code, as well as the code of the main specialty of students.

In addition to these blocks, the content contains Educational-methodical and Theoretical blocks. These blocks provide an abstract of the curriculum indicating the goals and objectives of the academic discipline, the place of the academic discipline in the structure of the main professional educational program, the planned learning outcomes in the academic discipline, the volume of the academic discipline, including the student's contact work with the teacher and the student's independent work, the forms of certification and assessment materials based on the results of mastering the modules, the curriculum, educational and methodological and information support, material and technical conditions for the implementation of modules and organizational and pedagogical conditions for the implementation of the curriculum.

The content also includes the Block for the formation of competencies, which

indicates the modules for the gradual mastering of the academic discipline, indicating for each module phonetic, grammatical and lexical material. Phonetic material includes an explanatory part, as well as practical tasks that allow you to control the assimilation of phonetic material. The grammatical material also includes an explanatory part with a presentation of grammatical material and practical tasks. The lexical material includes words and phrases for active assimilation, a text on the topic of the module and practical tasks designed to ensure the assimilation of vocabulary.

In addition, the educational content provides for the availability of material (test items) for midterm control at the end of each module, as well as final control tasks (tests). The test for midterm control must contain at least 60 tasks on lexical and grammatical material, 3-5 answers per task. Tests for the initial modules include tasks on phonetic material. The final control test contains 100 items.

When drawing up practical assignments, one should rely on the following didactic principles:

- objectivity, scientific character;
- connection of theory with practice;
- consistency, consistency;
- accessibility with the required degree of difficulty;
- visibility, which increases motivation to study the educational material;
- variety of methods;
- student activity;
- the strength of the assimilation of knowledge, skills and abilities combined with the experience of creative activity.

Thus, the importance of the content cannot be underestimated, since it allows working with students not only directly in the classroom, but also using distance learning tools, which is especially important in a pandemic.

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## INTERPRETATION OF THE CONCEPT OF "WORLDVIEW" IN THE MODERN SCHOOL

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注释。 这篇文章提供了有关在学校教育系统中形成科学世界观的过程的重要性的信息。 在自然科学的许多学校学科的研究中使用综合学习涉及形成学生对世界的科学了解以及形成世界观。 给出了术语“世界观”的定义，世界观的类型。 提供有关世界观类型的信息。

关键字：世界观，主题，学科，概念，学童，现代学校。

**Annotation.** *The article provides information on the importance of the process of forming a scientific worldview in the school education system. The use of integrated learning in the study of a number of school disciplines in the natural sciences involves the formation of a scientific picture of the world in students and the formation of a worldview. The definition of the term "worldview", types of worldview are given. Information on the types of worldview is provided.*

**Keywords:** *worldview, subject, discipline, concept, schoolchildren, modern school.*

The modern general education school, being one of the most important social institutions of society, is developing as a "variable" school, striving to meet the educational needs of the child, the family, and the state. In this regard, to solve social and pedagogical problems, to form a scientific worldview and spiritual and moral values of schoolchildren, a modern school is designed, the main purpose of which is to promote the personal and professional self-determination of a growing person.

Many researchers from secondary school subjects secondary schools allocated subjects - physics, chemistry, biology. As one of the main integrated results of mastering this set of disciplines examined the formation of students' understanding of holistic scientific picture of the world and, as a consequence, the formation of a scientific dialectical materialistic worldview. In this regard, in the context of

the search ways of forming a scientific worldview in modern school studies of that time are of significant interest and today.

For the first time, the term "worldview" began to be used in classical philosophy. But, naturally, the idea of the existence "of some higher generalized knowledge, the most valuable and difficult to comprehend, the possession which makes a person wise, teaches him to live correctly, to coordinate their actions and behavior with the timeless laws, dominant in the world" began to take shape much earlier [1].

The word "worldview" consists of two words "world" and "view." Therefore, in the most general terms, "worldview" is a kind of a specific form of human consciousness, a person's views on the surrounding world and yourself in this world.

Every person, regardless of education, status in society and etc., there is a worldview, because everyone has their own ideas and views, a certain attitude towards nature, oneself, what is happening in nature and society. But different people who have a worldview may differ qualitatively. In philosophy, depending on the content of the worldview and its connection with scientific knowledge, from religious affiliation and life experience, it is customary to denote several types of worldview: - scientific; - religious; - mythological.

"Scientific worldview" is a kind of worldview that relies on the scientific picture of the world, on the conclusions and generalizations made based on scientific analysis and theoretical understanding of the cause investigative ties characterizing the development of natural and social phenomena" [2]. Both the worldview in general and the scientific worldview, in particular, can be viewed objectively and subjectively. Objectively, for example, it is legitimate to talk about scientific the worldview of the era, which is based on a certain picture of the world, ideals and norms of scientific research, the style of scientific activity and etc.

In a subjective sense, we are talking about the scientific worldview of a specific person who develops during his life under the influence of various factors, including the educational factor.

When defining the essence of the scientific worldview, it is meant that it is a science that is the source of the formation of the worldview of both the epoch as a whole and a particular person. Speaking about different types of worldviews, modern researchers agree that it would be a mistake to say that only a formed scientific worldview allows a specific person to navigate in life, build their life path, achieve success, etc. However, the school, as it was noted above, is designed to contribute to the formation of a scientific worldview, using for this the features of the content of education and the possibilities of the educational process. In addition, scientific worldview, due to the fact that it is based on scientific knowledge, which is inherent in objectivity, in conditions of ambiguity and inconsistencies of the modern world can play the role of a "fulcrum" when solving a variety of problems.

In this regard, it is customary to consider the three most important functions worldview [3]:- information and reflective;- orientational and regulatory;- estimated. The information-reflective function is as follows.

Worldview, according to I.F. Kharlamov, plays the role of a peculiar prism that refracts all external influences. Man with a scientific worldview in the perception and assessment of any complex phenomena reality will seek to find objective (material and social) reasons for these phenomena. The orientational and regulatory function of the worldview is that a person with an established scientific worldview has stable beliefs and attitudes that predetermine his actions and actions. The evaluative function of the worldview is expressed in the fact that everything with which a person faces, he evaluates based on his beliefs and views. Thus, the scientific worldview is essential for the life and behavior of a person, his self-determination, his development consciousness.

In studies devoted to the problem of worldview, the concept is concretized as follows: "under the worldview follows to understand the specific form of human consciousness, which includes a generalized system of his knowledge, views, beliefs, and ideals, in which expresses his attitude to the development of nature and society and which determine its socio-political and moral aesthetic position and behavior in various spheres of life"[4,5].

Based on the foregoing, it follows that the formation process worldview should affect all its components - both knowledge and beliefs and attitudes and ideals. This leads to the search for such opportunities in the content of education and such ways of forming a scientific worldview that affects and involves not only the cognitive but also the emotional and volitional sphere of a person. The formation of a scientific worldview, in other words, involves the activity of the student himself, the creation of conditions in the educational process for students to search for personal meanings of worldview knowledge and - through activity - access to the formation of beliefs, views, and ideals.

Correlation of all that has been said about the worldview with the three blocks expected educational outcomes, shows that the formation of a worldview correlates not only with personal but also with two other blocks of results. Therefore, it is natural to talk about that the formation of the scientific outlook of students should permeate the entire educational process of the school - at all levels training, through education and training, through a system of additional education and organization of student leisure.

The formation of the scientific outlook of students covers the entire learning process, starting with primary school age and ending with senior management. Also, the given process must go through and through education, a system of electives, and extracurricular activities.

Of course, the concept of "worldview" plays a certain role in the system of

formation of the scientific worldview.

The understanding of science as a complex of knowledge is based on the knowledge of the surrounding reality in many aspects. The upbringing and formation of a personality with a broad outlook are especially significant today when the process of socialization of student youth is taking place in conditions of a radical change in value orientations and ideals. The consciousness of young people is significantly influenced by the extremely low standard of living of a significant part of the population, social stratification of society, broken relations between generations, and insufficient attention to issues of upbringing in school.

The educational process at school is often structured in such a way that students are not sufficiently involved in the real everyday life of society, and sometimes they are simply cut off from real-life problems. In this regard, the formation of a scientific worldview is an important point in the upbringing of a personality with a deep understanding of the realities of the surrounding life and contributes to the personal and professional self-determination of a growing person.

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远程教育的主要方面

THE MAIN ASPECTS OF DISTANCE EDUCATION

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抽象。 本文讨论与当前教育趋势有关的问题，尤其是远程教育形式。 重点介绍了各种形式的远程教育和远程教育中使用的技术类型。 强调了远程教育的积极和消极方面。 指出了辅导员在实现学生预期目标中的作用。 还应注意远程教育中存在的差距和困难。

关键词：远程教育，技术，互联网，老师，学生。

**Abstract.** *This article discusses issues related to current trends in education, in particular, the distance education format. Various forms of distance education and types of technology used in distance education are highlighted. Both positive and negative aspects of distance education are emphasized. The role of tutors in achieving the intended goal of the student is noted. Attention is also paid to the gaps and difficulties that exist in distance education.*

**Keywords:** *distance education, technology, internet, teacher, student.*

Currently, among the new terms that have firmly entered the pedagogical vocabulary, it is worth highlighting such concepts as "distance education", "technology".

Distance education first appeared in Western countries, it is based on education on television, as well as forms of distance education and education by correspondence. Over time, it received sufficient development and today there are different forms of distance education.

A. A. Andreev gave the following definition: "Distance education is a synthetic, integral, humanistic form of education, based on the use of a wide range of traditional and new information technologies and their technical means, which are used to deliver educational material, study it independently, and organize a dialogue exchange between the teacher and students, when the learning process is not critical to their location in space and time, as well as to a specific educational institution" [1].

Among the forms of distance education the following can be distinguished: asynchronous, synchronous. "Distance education, asynchronous, when a student and a teacher are separated in space, but simultaneously coexist in time; synchronous distance education-student and teacher are in a joint local space, and educational products (textbooks, videos, super-tutors) are created and sent from one center to all local points (educational institutions, branches, individual student) [2].

Let's turn to the very term learning technology. So, teaching technology is a set of methods and means of processing, representation, changing and presenting educational information, on the other hand, it is the science of how the teacher influences students in the learning process using the necessary technical or informational means. In teaching technology, the content, methods and means of teaching are interconnected and interdependent [3].

Sometimes the teacher-master uses elements of several technologies in his work, applies original methodological techniques, in this case we should speak about the "author's" technology of the given teacher. Every teacher is a creator of technology, even if he deals with borrowing. Creation of technology is impossible without creativity. For a teacher who has learned to work at a technological level, the cognitive process in its developing state will always be the main reference point [4].

Remote technologies are implemented using information and telecommunication networks, excluding personal contact between the student and the teacher.

Note that distance technologies allow for continuous education of students in cases of quarantine or when it is not possible to attend classes for various reasons, as well as expand the educational program by including additional materials to broaden the horizons of students.

So, distance learning corresponds to modern education trends and allows you to include modern information and telecommunication technologies in the educational process.

Let's highlight a number of distance technologies (DT).

A teleconference is a network service that allows organizing a joint discussion of users of a computer network. The user can send and receive articles from other participants in this discussion. Videoconference is a communication session in which two or more network users, both corporate and global, take part, they can be at a sufficiently large distance from each other and at the same time not only hear, but also see each other, that is, in this DT form, participants can work together. E-mail is a technology and service for sending and delivering e-mails (messages) to users of a computer network. Hypertext is a set of documents connected by hyperlinks that allow you to quickly switch from one section to another or move from one page to another.

*Positive aspects:* a flexible system that allows participants in the process to

choose a time convenient for everyone for classes; the opportunity to improve the professional level, taking into account the needs of each individual (student); visibility of teaching, which allows you to effectively present material with the inclusion of interactive elements; psychological distance learning develops independence, mobility, responsibility.

*Negative aspects:* lack of direct contact between teacher and students; the need for appropriate technical equipment; access to the Internet; the problem of authentication in the control of knowledge and skills of students.

*Problems:* not everyone has the technical training aids. In addition to the absence of a personal computer, the Internet itself may not exist; students, especially in primary grades, are not ready for long-term independent work in this form; it is difficult for high school students to process and interpret a large amount of information. And also many note among the main disadvantages of distance learning, first of all, the lack of direct, live contact between the student and the teacher. In this regard, of course, there are no emotional prompts, characteristics of the actions performed by students, that is, there is no additional stimulus, which is a significant drawback. Self-discipline is also necessary, because the result directly depends on the timely access to the network.

Informatization is one of the most important components of modern society, which has a direct impact on all spheres of life and leads to cardinal changes in professional activity in various areas, including educational. "One of the aspects of informatization of society has become the convergence of full-time and part-time forms of education on the basis of information and communication technologies, which was expressed in the emergence and development of a new form of education - distance education." [5]

A new social order is being formed. The actors are: state, organization, personality.

a) The state is interested in the quality of training a highly qualified specialist, preferably a universal one

- retraining based on current requirements

b) Organizations, enterprises, institutions

- training a specialist of a certain profile

- conducting advanced training and without work interruptions

c) Personality

- quality education through the system of continuous education

- increasing social status

- at the place of residence

- the possibility of studying abroad

*Among the essential characteristics of distance learning, the following are distinguished:*

Flexibility, that is, the ability to study in a convenient place and at a convenient time

Modularity - the ability to form an individual curriculum (personal or for a group)

Parallelism-combine with work or other studies

Long range-distance doesn't matter

The mass-quantity of the student is not critical

Affordability - economic efficiency

Sociality - equal access regardless of place of residence and social status

Internationality - educational services can be both exported and imported.

Thus, fulfilling the social order of modern society, distance learning is an additional form to the classical, traditional form of education.

The development of e-learning courses (ELC) is one of the laborious types of classes for a teacher.

Among the ELC *forms*, the most common is, of course, an electronic textbook, which contains visual material in the form of illustrations, tables, multimedia presentations, simulators, laboratory works, and tests are drawn up to check and control knowledge. An electronic textbook can have independent topics-modules and allows you to choose a training option, that is, training a full course or a specific topic [6].

Among the acute problems of distance learning, it is especially worth highlighting the creation of new teaching methods and technologies that would meet the modern, rapidly changing requirements of the telecommunications environment in which a large number of people communicate. After all, students should not be passive consumers of incoming new information. In the course of study, students need to acquire not only new knowledge, but to be able to also create an independent, that is, their own understanding of the subject. And therefore, a new model is currently being formed, where "the student is at the center of this learning technology; the essence of technology is the development of self-learning ability; the learner plays an active role in learning; the basis of educational activity is cooperation" [7].

However, the situation was difficult in rural areas and in small towns, where there was no adequate technical equipment. And even in medium and large cities, it is sometimes observed on a poor Internet signal, as well as congestion on educational platforms. Authors Saprykina D.V., Volokhovich A.A. in their work Problems of transition to distance learning in the Russian Federation through the eyes of teachers emphasize that "problems associated with emotional stress, increased health complaints, irregular working hours and overload with reports" [8].

Of course, there are factors that influence the further improvement of distance learning:

- \*multimedia - voiced video and slide films, animation, graphics;
- \*rich interactivity, including mathematical models of processes and phenomena;
- \*use of streaming audio and video;
- \*variety of control and test tasks;
- \*large amount of educational material, which, thanks to multimedia, is easy to digest.

Teaching activity, which is based on distance learning technology, will become effective, provided that the teacher is able to master not only the methods of didactic design of the educational process itself, but is able to combine its implementation in interaction with the student, that is, “encourages him to implement problem-search approach to teaching (search approach of practical, cognitive orientation and theoretical and cognitive orientation). The connection between these components of the problem-search approach to teaching should be achieved through the use of such teaching aids as telecommunications, interactive TV, the Internet, glossaries, etc. [8].

Tutors also play an important role. Today tutoring is one of the most discussed topics, it was studied by many scientists, among them N.Yu. Belyakova, T.M. Kovaleva, N.V. Rybalkina and others. Based on their works, we can say that "a tutor as: a teacher-mentor, a teacher-consultant; mentor, educator, curator of the student group; as an individual supervisor of students, educator in an educational institution; individual scientific advisor of the student"[9]. So, the activities of the tutor are aimed at supporting self-determination, as well as creating appropriate conditions for testing oneself, as well as organizing the student's activities, that is, in the end, we can say that the tutor assists the student in obtaining knowledge and its use in real life.

Thus, it should be noted that, in general, the situation currently looks more optimistic when compared with the first days of the transition to distance learning due to quarantine due to coronavirus.

Distance education cannot completely replace the classical learning process, but it nevertheless allows you to broaden the horizons of students striving for knowledge. Distance learning is not as the main form, but to a greater extent can act as an additional form of education.

Of course, as Internet technology develops, it is necessary to develop and improve the process of online learning itself, paying attention not only to new forms and types and, of course, to the content part. Still, distance learning cannot replace "live" communication "between participants in the educational process.

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表达时间观念时的言语错误类型 (基于中国学生的错误)

**TYPES OF SPEECH ERRORS WHEN EXPRESSING THE IDEA OF TIME (BASED ON THE MISTAKES OF CHINESE STUDENTS)**

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抽象。 本文专门分析用俄语表达时间观念时出现的语音错误。 作者在一个简单的句子层次上比较了俄语和汉语时态类别的功能特点, 分析了中国学生学习俄语作为外语的交流失败的原因。

关键字: 语言类型, 语音错误, 时间性, 单词的形态。

**Abstract.** *The article is devoted to the analysis of speech errors that arise when expressing the idea of time in Russian. The author compares the features of the functioning of the tense category in Russian and Chinese at the level of a simple sentence, analyzes the reasons for the communication failures of Chinese students studying Russian as a foreign language.*

**Keywords:** *language type, speech error, temporality, morphological form of the word.*

It is obvious that language as a semiotic system interprets the surrounding world through linguistic units. Moreover, the cognitive categories of reality are embodied in the language system. However, only those meanings that are important for representatives of a certain linguoculture acquire grammatical form. All this leads to a mismatch in the systems of mental categories for speakers of different languages and explains the differences in the set of grammatical categories in the language systems themselves. So, "languages belonging to different linguistic types will differ in the forms of organization of semantic content transmitted in their systems" [1,8].

The dissimilarity of linguistic structures becomes the reason for the special cognitive "blindness" of foreigners when teaching Russian as a foreign language, since the assimilation of a foreign language always takes place on the basis of the native language in the mode of conscious and subconscious comparison of units and structures of two languages. This problem was developed by L.V. Shcherba, A.A. Leontiev, L.S. Vygotsky, N.I. Zhinkin, R.O. Yakobson, B.V. Voronin, T.A. Zimnyaya, G.V. Eiger, A.E. Karlinsky and others.

So, the object of this study was the idea of time in Russian and Chinese languages, and the subject was communicative errors in expressing the idea of time. The material was speech errors (520 examples) of Chinese students studying at the Siberian Federal University.

The universal idea of time is embodied in the grammatical category of temporality. It is characterized by the following features: (a) temporal orientation (absolute and relative time); (b) taxis (simultaneity and sequence of actions); (c) aspectuality (processuality and semantics of the limit). The category of temporality was studied in Russian by L.V. Shcherba, V.V. Vinogradov, A.V. Bondarko, G.A. Zolotova, Yu.S. Maslov, in Chinese - A.A. Dragunov, S.E. Yakhontov, V.M. Solntsev, N.V. Solntseva.

Temporality is embodied both in Russian (hereinafter RL) and in Chinese (hereinafter CL) languages in the following grammatical forms:

- 1) prepositional-case system (in RL) and postpositional system (in CL);
- 2) verb tense (the form of the present, past, future tense in two languages);
- 3) aspectuality - the category of the form (in RL and CL);
- 4) adverbial participle as a verb form (only in Russian).

Since Russian and Chinese languages belong to different types of languages (inflectional and agglutinative), their typological features turn out to be decisive in expressing the idea of time. So, in Russian (a) the word must be morphologically formalized; (b) grammatical indicators are required; (c) the dominant type of communication is coordination and morphologically expressed control. In the Chinese language, we observe (a) optional grammatical indicators; (b) the leading role of context and lexical actualizers (*в детстве, вчера, тогда* and etc.).

The largest number of errors occurs in **prepositional and case forms** (for example, *в понедельник, после урока, в пяти до семи* and etc.). Chinese students ignore the model (preposition + noun), preferring the Chinese model without a preposition to it (*понедельник* – instead of *в понедельник*), with a postposition (*обед после* – instead of *после обеда*) or verb-object combinations (*есть + еда + перед* – instead of *перед обедом*). The most common mistakes are:

1) **ignoring a preposition:**

*Он приехал \_\_понедельник.*

If in the Russian language the preposition, the morphological form of the verb and the lexical meaning of the noun participate in the formation of the informatively sufficient content of the syntaxeme to be distinguished, then in the Chinese language the main role is assigned to the position of the word in the sentence and the function that it performs. Therefore, students sometimes omit the preposition in the prepositional-case constructions of the Russian language, considering them informatively sufficient without it.

2) **choice of case form** with a preposition is an undoubted difficulty for a Chi-

nese student, since there is no case category in Chinese:

Через получасу после звонка.

После три часа можно купить билеты на завтра.

Они хотели пойти в цирк на прошлую неделю.

В апреля 1993 была на две месяца здесь.

Он был основан в конце девятнадцатом веке.

3) **inability to distinguish between nouns and adverbs:** *лето – летом, зима – зимой, весна – весной, осень – осенью and etc.:*

Лето мы уезжать в Китай

Вчера вечер я учил уроки, потом писал письмо домой.

Он часто учится в ночи.

4) **borrowing native language models.** What is represented by the prepositional-case form in Russian, in the Chinese language can be a verb-object phrase, formed by a postposition:

*После урока* – xia ke yi hou (lit. finish+lesson+after)

*Перед обедом* – chi fan qian (lit. eat+food+before)

*До университета* – shang da xue qian (lit. enter + university + before)

Therefore, it is sometimes difficult for students to reformat the models of their native language and present the event "in Russian". The phenomenon of interference occurs not only at the initial stage of training, but also in the second and third years of training:

Поступить в университет я жить Китай. (before university, before entering university)

When formalizing the **verb tense**, the Chinese student chooses:

1) **analytical forms** (unformed verb with a lexical actualizer: *на прошлой неделе, в 2 часа, в 80-ые годы*):

Мы прочитать эту книгу на прошлой неделе.

Мы встретиться в 2 часа.

В восьмидесятые годы наша жизнь начать меняться

2) **relative temporal orientation instead of absolute:** students put the verb in the present tense form with the lexical actualizer (*в прошлом году, в детстве, когда автобус придёт*), since they comprehend the situation not in relation to the moment of speaking, but in relation to the indicated time, i.e. as simultaneous with the specified moment:

В прошлом году я еду в Пекин со своими друзьями.

В детстве у меня есть мечта.

Когда автобус придёт, я сйду в автобусе.

So, in the Chinese language, constructions *института, перед обедом, после обеда, спустя год* are used with a relative temporal orientation, which is what students do, speaking in Russian:

*До института он работает на заводе.*

*Спустя два года я еду домой.*

In addition, students often choose **models of the Chinese language**: a verb in the past tense can become a temporal reference point for the next action: the idea of precedence of events in a temporal sequence relative to each other:

*Я прекрасно отдохну, если я слышала музыку* (first I will listen, then I will be well rested).

*Я пойду в кино, если я сделала упражнение* (first I did it, then I will go there).

*Мы поужинали и пойдём в театр* (first we had supper, then we will go).

When choosing a **form** (perfect and imperfect form of the Russian verb), mistakes are of two types:

**1) lack of knowledge of form pairs** (cases of asymmetry of form and meaning at the level of sentence construction):

*Мы посмотрели телевизор весь вечер.*

*Ты долго прочитаеть эту книгу.*

*Каждый день я позвоню родителям.*

*Каждое утро куплю газеты.*

**2) expression of simultaneity and sequence of actions in polypredicative constructs** (so, when expressing simultaneity, imperfective verbs should be used, and when expressing a sequence, perfective verbs):

*Я писал письмо своему другу и отправил его.*

*Мы покупали билеты и вошли в кинотеатр.*

As a result of the study, the **following conclusions** can be drawn:

The idea of time in Russian has a high degree of morphology; it is presented in the prepositional-case and verbal systems of the language. The difficulty for students is primarily the morphological form of the Russian word:

1) at the level of the prepositional-case system, the choice of a preposition and case form (all Russian cases are involved in the formation of time, so the student faces a difficult task);

2) at the level of the type-temporal system of the verb, the choice of the form of the verb tense (and not the infinitive), knowledge of the type pair (perfect or imperfect form), the expression of absolute or temporal orientation (present, past or future), the expression of relations of simultaneity and sequence in polypredicative constructions (type selection).

Chinese students most often ignore the peculiarities of Russian grammar, preferring an analytical approach (that is, the lack of formalization of a word based on context), optional grammatical indicators ("lose" prepositions). They tend to avoid the verbal participle as a class of words, since this part of speech is not in their native language. All this testifies to the fact that Chinese students lack the "sense"

of grammatical form that is characteristic of native speakers of European languages. Therefore, the teacher of Russian as a foreign language is faced with the task of forming a new for him idea of the grammatical form of a word in the student.

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航空术语的特殊性, 从俄语翻译成英语  
**PECULIARITIES OF AVIATION TERMS TRANSLATION FROM  
RUSSIAN INTO ENGLISH**

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抽象。 本文考虑了俄罗斯航空术语的结构和语义特征以及将其翻译成英语的方式。 由于国际贸易和科学关系的广泛发展, 研究术语翻译变得越来越重要。 事实证明, 俄罗斯航空术语的结构和语义会影响将这些术语转换为英语时使用的翻译策略, 最有效的翻译技术是计算, 寻找功能类似物或等同物以及各种词法语义和结构变化。

关键词: 复合词, 翻译转换, 计算, 功能类似物, 词汇语义变化。

**Abstract.** *The article considers structural and semantic features of the Russian aviation terminology and ways of its translation into English. It is becoming highly relevant to study terminology translation due to extensive development of international trade and scientific relations. It is proved that the structure and semantics of Russian aviation terms influence translation strategies used when rendering those terms into the English language, the most productive translation techniques being calquing, looking out functional analogues or equivalents, and various lexical-semantic and structural changes.*

**Keywords:** *compound term, translation transformation, calquing, functional analogue, lexical-semantic changes.*

Modern industrial communication is characterized by two multidirectional vectors of development: on the one hand, it is becoming highly specialized, and on the other hand, it is increasingly crossing state, cultural, and ethnic borders, bringing together representatives of different linguistic cultures. In the context of international trade and distribution of goods and services, special-purpose texts such as installation and use instructions, user manuals and other types of technical

documentation are translated more often, often into several languages at once. As a result, there is a need to take a fresh look and evaluate such a key component of production communication as technical translation in general and translation of production documentation in particular.

The given article focuses on a genre that plays an important role in the supply and use of technical products, that is, instructional texts aimed at helping users to operate and service civil helicopters. These texts come in the form of instruction manuals, user guides, operating or maintenance instructions. Drawing on examples, the authors of the article discuss some common translation issues when dealing with aviation terms.

Let us consider some cases of translation of technical documentation to identify the peculiarities of the aviation terms translation from Russian into English.

*Вертолет выполнен по **одновинтовой схеме** с рулевым винтом.*

*The helicopter is made according to a **single-rotor scheme** with an anti-torque rotor (www.rostvertol-avia.ru).*

The excerpt outlined above contains an example of a compound aviation term “*одновинтовая схема*”, which coincides in its form and meaning with the corresponding English term. In many cases, such terms are translated by calquing.

*Вооружение вертолета включает управляемое и неуправляемое ракетное вооружение, а также **подвижную пушечную установку**, которая оснащена пушкой 2А42 калибра 30 мм.*

*It includes guided and unguided rockets and a **mobile gun mount** equipped with a 2А42 30 mm cannon (www.rostvertol-avia.ru).*

In this sentence we find another example of an aviation compound term “*подвижная пушечная установка*”, which is translated into English by means of complete calquing: every component of the term is rendered with a corresponding element in the English language. However, this case represents an example of a situation, when a term which has an equivalent in the target language is translated word by word.

***Вычислитель траекторного управления** VTU-123 является дополнительным устройством, которое совместно с вычислителем навигационной системы, автопилотом и **триммерными механизмами** обеспечивает автоматическое **траекторное управление** вертолетом Ми-172 и его модификациями по каналам крена, тангажа, направления и общего шага при полете по курсу, заходе на посадку, вертикальных и горизонтальных маневрах вертолета, что существенно снижает нагрузку на экипаж.*

*The VTU-123 **trajectory control computer** is an additional device that together with the director-control system computer, autopilot and **trim mechanisms** provides the automatic **trajectory control** of the Mi-172 helicopter and its modifications by roll, pitch, yaw and collective channels during the flight on heading,*

*landing approach, vertical and horizontal maneuvers, which essentially reduces the crew work load* (www.aviaavtomatika.ru).

Compound aviation terms which can be found in the given sentence are translated by calquing, as every component of each term finds a lexical equivalent in the target language. It should be noted that the term “*вычислитель траекторного управления*” was grammatically transformed as part of the translation which resulted in rearrangement of the term’s components.

*Вертолет оснащен современным комплексом навигации и электронной индикации с многофункциональными цветными дисплеями, обзорно-прицельной системой, включающей в себя тепловизионный и телевизионный канал, лазерный дальномер и пеленгатор.*

*The helicopter is equipped with modern navigation equipment and multi-functional colour displays, a **surveillance and targeting system** that includes a thermal vision and television channel, a laser range finder and a location finder* (www.russianhelicopters.aero).

Let us take a look at another compound term “*обзорно-прицельная система*”, which is rendered by means of calquing, with every component of the original term being translated with its lexical equivalent in the English language. However the translator did not take into account that this term has a full equivalent in the target language: *target sight system*.

Thus, having analyzed some examples of aviation terms translation from Russian into English, through full or partial calquing, we can conclude that this type of transformation is used to render compound terms without formal equivalents in the target language.

Further, we shall analyze examples of aviation terms translation from Russian into English through the choice of equivalent or functional analogues, as well as lexical-semantic changes in translation.

*Для механизации **погрузочно-разгрузочных работ**, грузовая кабина оборудована тельферами грузоподъемностью до 5 тонн и двумя грузовыми лебедками.*

*In order to mechanize **handling operations** the cargo compartment is equipped with telfers that have hoisting capacity up to 5 tons and with two cargo winches* (www.rostvertol-avia.ru).

In the sentence given above, we are particularly interested in the translation of the Russian compound term “*погрузочно-разгрузочные работы*”. When translating this term, the English analogue was chosen, which resulted from a lexical transformation namely generalization, since the English term “*handling operations*” has a meaning broader than the Russian variant.

*Конструкция и оборудование вертолета позволяет эксплуатировать его при **автономном базировании** на необорудованных площадках.*

*The construction and the equipment of the helicopter enable to operate it during **independent landing** on unequipped grounds.* (www.rostvertol-avia.ru)

In the forecited excerpt, we see another compound term, whose general meaning coincides with the general meaning of its English counterpart. However, if we pay attention to the components of the terms, we can notice some differences. In the Russian term “автономное базирование”, the noun has a broader meaning than in the English term “*independent landing*”. Thus, we can conclude that when translated into English, the term is subjected to concretization, acquiring a narrower meaning.

***Многоцелевой, тяжёлый транспортный вертолёт Ми-26Т** – вертолёт третьего поколения, продолжающий линию развития тяжёлых транспортных вертолётов, предназначенный для транспортировки грузов внутри кабины и на внешней подвеске общей массой до 20 тонн.*

*Mi-26T **multipurpose heavy lift helicopter** is the third generation helicopter, which continues the development of heavy lift helicopters and is designed for the transportation of freight inside the cabin and for its transportation with the use of external load sling system. The total weight of the freight can be up to 20 tons* (www.rostvertol-avia.ru).

The sentence above contains an example of translation of a compound aviation term, whose general meaning, again, coincides with a similar English term, but some of their components differ. The translator resorted to the method of selecting the English equivalent. If we take a closer look at the English version of this term-phrase, we can notice a partial syntactic transformation, since a literal translation of the Russian term would not satisfy the rules of compatibility of the English language. Thus, choosing the term “*heavy lift*”, which means “with a large load capacity”, the translator achieved an adequate translation of the term into English.

*Всепогодный круглосуточный боевой вертолёт нового поколения Ка-52 предназначен для уничтожения бронированных и небронированных наземных целей, малоскоростных воздушных целей и **живой силы** противника на переднем крае и в тактической глубине, для решения задач разведки и управления группой боевых ударных вертолётов.*

*New generation all-weather day-and-night combat helicopter Ka-52 is designed for killing enemy hard and soft ground targets, low-speed aerial targets and **personnel** at the front line and in tactical depth, for surveillance missions and control of attack combat helicopter team.* (www.russianhelicopters.aero)

Above is an example of a compound Russian term that denotes the reality of the Russian army, which is absent in the English-speaking world. The translator used the English term “personnel” with a much narrower meaning than the Russian equivalent “*живая сила*” (part of the armed forces (or units) consisting of people and animals), thus resorting to such a lexical transformation as concretization.

Let us now analyze translation of international aviation terms from Russian into English.

*Для механизации погрузочно-разгрузочных работ, грузовая кабина оборудована **тельферами** грузоподъемностью до 5 тонн и двумя грузовыми лебедками.*

*In order to mechanize handling operations the cargo compartment is equipped with **telphers** that have hoisting capacity up to 5 tons and with two cargo winches. (www.rostvertol-avia.ru)*

The sentence above contains an international term “*тельфер*”. The translator uses the method of equivalent selection, transcribing it into English: *telpher*.

*Габариты грузовой кабины, находящейся в центральной части **фюзеляжа**, позволяют перевозить различные виды техники и крупногабаритных грузов.*

*The size of cargo compartment, situated in the central part of the **fuselage**, makes it possible to transport different kinds of technical equipment and bulky cargos. (www.rostvertol-avia.ru)*

In the excerpt quoted above, again, we can observe an example of the use of the international term “*fuselage*”. It does not present any difficulty to translate this term into English, since its form is directly related to the form of the English term, and the equivalent is used in translation.

*К другим особенностям Ка-62 можно отнести **пятилопастной несущий винт**, наличие **второго контура гидросистемы**, **колесное шасси повышенной энергоемкости**, усиленную конструкцию фюзеляжа и узлов крепления основных агрегатов и амортизационные кресла для экипажа и пассажиров.*

*Other features include a **five-blade rotor**, **secondary hydraulics circuit**, **energy-efficient wheeled landing gear**, strengthened fuselage and fuselage attachment points and shock-absorbing seats for the crew and passengers. (www.russianhelicopters.aero)*

The sentence given above contains several compound aviation terms that have been translated using equivalents or analogues with the help of certain transformations. Consider the first example: “*пятилопастной несущий винт*”. In this case, translation was carried out by means of selecting an equivalent that fully reflects the meaning of the Russian term in the text. However, a syntactic transformation took place, which resulted in a two-component term (whereas in the Russian text we see a three-component term), since in English the term “*rotor*” means “the main rotor of a helicopter”. The second term “*второй контур гидросистемы*” was translated by means of a morphological transformation: one of the components of the term, namely, the component element “*гидросистема*” was replaced by “*hydraulics*”, while retaining its meaning (hydraulic system). Another example of a

compound term translation is “*колесное шасси повышенной энергоемкости*”. In this case, the English equivalent was chosen, with the components containing elements of description (landing gear), omission and morphological transformation (*повышенной энергоемкости* – *energy-efficient*).

Thus, we have analyzed multiple examples of aviation terms translation from the Russian language into English. We can come to the conclusion that the descriptive method is rarely used, which is due to the significant development of aviation terminology, both in Russian and in English. Such translation methods as selection of an equivalent or a functional analogue, as well as the use of lexical-semantic and other transformations in the translation process are relevant and widely used. Moreover, a whole complex of the listed translation techniques is used as a rule, when compound aviation terms are translated from Russian into English.

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用乌兹别克语和英语表达亲属关系的一些方法  
**SOME WAYS TO CONVEY KINSHIP TERMS IN UZBEK AND  
ENGLISH**

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Comparative typological study of languages provides valuable material for their general theory, helps to determine the place of each in the system of the world's languages. It is also used to resolve such an important problem as the patterns of their development and interaction.

The close attention of linguists to comparative typological studies of languages of various types, which has intensified recently, is quite justified. This is a kind of response to the ever-increasing development of the globalization process in all areas of the material and spiritual life of the world community. Translation issues, an information service, the task of creating various dictionaries and reference books, improving the methods of teaching a non-native language - all this is one of the urgent tasks facing the comparative typology. It was this aspect that prompted us to choose the terms of kinship in the Uzbek and English languages as the object of dissertation research.

It should be noted right away that consideration of the evolution of the development of the compared English and Uzbek languages is not the main task: we are faced with a more modest task - the comparison of one specific lexical layer of these languages.

As is known, the comparison of separate layers of vocabulary of different system languages is a very time consuming task. The complexity of the comparative study of the vocabulary of unrelated languages was rightly pointed out by A.A. Potebnya: "I do not reject the differences in the internal structure of languages, even closer to each other, and adverbs of the same language, but I know that the more similar languages are, the more difficult it is to determine their fundamental differences" [9, 36].

One of the leading representatives of comparative historical linguistics, "the founder of historical grammar" J. Grimm writes that "... language is the main

witness to the history of a people, whose advantage is higher than bones, objects and cemeteries. Language is the breath of the human spirit" [11, 61]. This definition of J. Grimm about language is supplemented by academician N. Ya. Marr. He notes that " ... language is the same creation of man, like all other parts that make up culture, with the difference that language at the same time reflects in itself all the stages of creative evolution in the development of mankind and reflects in precise formulas, words, how they are folded and how they are used in one sense or another" [8, 8].

In the study of facts equivalent to each other in unrelated languages, the comparative typological method was usually used, which still retains its important role, allowing one to determine similar and different phenomena in compared languages.

Traditional methods, in turn, are not devoid of certain drawbacks, which consist mainly in the fact that with their help not all tiers of the language are subjected to the same study, for example, using the comparative (historical) method, only comparative phonetics and morphology of languages included in one language family. When studying materials of semantics and syntax, this method is applied passively [9, 177].

The systematic study of language materials is largely associated with the method of component analysis, which arose in the 50s of the XX century. The component analysis method is based on the hypothesis that the value of each unit consists of components, which are called seme or sign [78, 233-234]. So, for example, the meaning of the word *дядя* consists of five semes, or signs: 1) a male person, 2) a relative, 3) consanguinity along a horizontal line, 4) an older or younger brother of a father or mother, 5) a relative of the first generation. Similar signs are inherent in the meanings of the kinship term - *дедушка*: 1) male, 2) parent, 3) parent along the vertical line, 4) blood parent, 5) parent of the second generation [7, 261-262].

The synchronous-comparative method, together with the systemic method, is very convenient and fruitful in the study of the system of kinship terms in different-structured languages. In foreign linguistics, there are a number of works in which the terms of kinship are studied on the material of the Germanic languages in a comparative historical sense. In the middle of the XIX century, this issue was investigated by the German scientist Jacob Grimm, later by Delbrück, Schuf, M.M. Gukhman and others [4, 93-115].

Jacob Grimm noted in some Germanic languages the presence of two categories of terms denoting "father", "mother", and tried to give this phenomenon his own explanation. He writes that " ... apparently, those kindred peoples ... who once possessed the form *vater*, *mutter*, *bruder*, *schwester*, found other terms during their invasion of Europe, some of them borrowed, others, on the contrary, penetrated from them to to their neighbors". As an illustration, J. Grimm cites the

Gothic *atta*, "father" and *aipei* "mother" and, according to him, rare cases of use among the High German tribes *azo* and *eidī* [3, 97].

In the article by M.M. Guchman "Pre-Indo-European kinship terms in Germanic languages" notes that "... in subsequent works, as Germanists, in a broader sense, were forced to reckon more and more with the presence in Indo-European languages, in addition to the well-known group of kinship terms, other terms, more primitive in form and at the same time common to more than one Indo-European language."

Delbrück ... specially distinguished these second ones, similar in structure: basically a reduplication of one syllable such as Sanskrit *tata*, German dialectal *deda*, *nenā*, *muhme*, sometimes with truncation of the first consonant *ata*, *ama*, *ane*, etc. M. M. Gukhman further writes that ... the researchers were struck by two circumstances: 1) the extreme prevalence of these complexes throughout the world, their presence in absolutely, it would seem, alien and dissimilar languages; 2) the vagueness of the semantics of each complex, denoting all the time in one, or in closely adjacent languages "father", "mother"; "father", "grandfather"; "mother", "maternal aunt", etc. M.M. Gukhman also testifies that "... dialectal dictionaries revealed the presence of these complexes in almost all dialects of the German language, both southern and northern [3, 97-98].

M.M. Guchman believes that many of the terms of kinship, denoting the relationship of blood kinship between people, are "national, international" in nature, and they arose through the duplication of one syllable and the truncation of the first consonant. He supports Pott's definition that reduplication is more widespread among world languages as universal for different linguistic stages of word formation and inflection. In the above work, M.M. Gukhman notes that "... by means of reduplication, kinship terms such as *tata//tate*, *dade* are formed with the meanings "father", "paternal uncle", "grandfather"; *muhme*, *meme* with the meanings "mother", "mother's sister"; *nahna*, *nanne*, *nanna* with the meanings "father", "mother", "grandmother", "grandfather"; by truncating the first consonant, *atta*, *ette*, *ade* with the meanings "father", "paternal uncle", "grandfather"; *ama*, *amma* - "mother", "mother's sister"; *an*, *en*, *ano* - "father", "mother", "grandmother", "grandfather" [3, 112].

Concerning the question of the appearance of kinship terms with the meanings "uncle" and "aunt", Morgan believes that in the kinship system reflecting the *пуналуа* ("Turanian kinship system"), the mother's sister is both the mother, and the father's brother is the father, while the mother's brother is considered uncle, and father's sister - aunt. In contrast to the later system, these terms exist initially only for the mother's brother and for the father's sister, since the mother's sister in the form of the *пуналуа* family is the mother and the father's brother is the father [3, 112].

At one time, F. Engels noted that " ... the system of terms of kinship, being conservative, often does not correspond to the family relations existing in a given nation, but reflects the previous stage of social development." As an example, F. Engels cites the terms of kinship among the Iroquois of North America. They were dominated by the "pair family". Hence, one would expect that the terms "father", "mother", "son", "daughter", "brother", "sister" in their meaning correspond to this form of family. В действительности оказалось не так. "The Iroquois calls his sons and daughters not only his own children, but also the children of his brothers, and they call him father ..., the Iroquois calls the children of his sisters, like their own children, their sons and daughters, and they call her mother, children of brothers, like children of sisters, call each other brothers and sisters" [9, 239]. Further V.I. Abaev testifies that " ... in the Ossetian language the terms "father" (*fud*) "mother" (*mad*), "son" (*furt*) are familial, i.e. are applied to intrafamilial kinship relations in our modern understanding" [9, 240]. The above facts indicate that some of the terms of kinship in almost all languages of the globe have a multifunctional, polysemantic nature. So, in Uzbek and English *бобо*//*grandfather* "paternal grandfather", *ака*//*elder brother* "older brother", *амаку*//*uncle* "paternal uncle", in addition to their own meanings, are also used in the meanings "father's elder brother", "father's younger brother"; Uzbek – *ака* "older brother", *мова* "maternal uncle" – used in the meanings "mother's elder brother", "mother's younger brother". Another term *ома* "father" in the Uzbek language can be used in the meanings of "grandfather", "elder brother of the father", "uncle on the mother's side", "elder brother of his own father", "uncle on the side of the father", "elder brother of his own mother", generally "relative, older than the father", etc., which is typical for their English equivalents. In such uses (in improper meanings) in the semantic structure of the term *ома*//*father* "father" one of its main features is neutralized, sem is the feature (seme) "parent". This is also observed in the meanings of the term *она* – "older sister". *Она*, besides its own use, has several meanings, for example, "mother", "aunt on the father's side", "aunt on the mother's side", "the wife of an older brother", "stepmother", "an older relative (older than me)", "every woman, older than the speaker", in which the sign "blood relative along the horizontal line" is neutralized.

When kinship terms are used in improper meanings, "non-standard" synonymous series arise between two or more kinship terms. For example, the kinship term *ака*//*elder brother* with the meaning elder brother is synonymous with the term *ома*//*father*; meaning "grandfather", synonymous with the term *бобо*//*grandfather* ("paternal and maternal grandfather"); the term of kinship *она*//*elder sister* with the meaning "mother" is synonymous with the term *она*//*mother* ("mother"); with the meaning "paternal aunt" is synonymous with the term *амма*//*aunt*; with the meaning "maternal aunt" is synonymous with the term *хола*//*aunt*,

etc. In such cases, the semantic structure of terms acquires new seme-attributes that are not characteristic of their own meanings. For example, in the semantic structures of the terms *aka//elder brother* with the meaning "father", *ona//elder sister* with the meaning "mother", the attribute "blood parent" appears, and so on.

The main goal of our research is the synchronous-comparative study of the terms of kinship between the Uzbek and English languages.

As we know, the terms of kinship form a kind of microsystem of the vocabulary of each language.

A comparative study of the terms of kinship contributes to a reliable understanding of the related and unrelated genesis of languages belonging to the same language family. Jacob Grimm, defining the kinship of Indo-European languages, cited four groups of terms that were indicative of the establishment of the kinship of languages.

These include:

- 1) the system of numbers;
- 2) pronouns;
- 3 verbum substantivum;
- 4) kinship terms like "father", "mother", "sister", "brother", "daughter" (39, 94).

According to the just statement of M.M. Guchman, the terms of kinship " ... are indeed a favorite material, used especially widely to prove the firmness of the foundations of comparative studies" [3, 132].

Kinship terms are being explored in many other languages. E.V. Sevortyan writes in his lexicographic work that " ... the study of kinship terms creates some difficulties. They consist in the fact that the commonality of the basic kinship terms in different language families needs an explanation, in which it is necessary, apparently, to exclude the genetic commonality of all these lexical categories. Otherwise, the question arises about the genetic relations between the language families themselves" [10, 57].

Terms in the scientific sense are words that have a scientific concept that serve the professional and labor needs of people. The meaning of the term in comparison with the meanings of common words is strictly conceptual, i.e. informs about the concept, expresses the concept, participates in the formation of the concept. The pure conceptual nature of the lexical meaning of the term deprives it of some of the syntagmatic and derivational properties inherent in common words. Terms cannot, for example, freely enter into syntagmatic connections that create figurative, in particular, metaphorical meanings, although such connections are not excluded. As a rule, terms do not contain suffixes of subjective assessment, do not participate at all in the formation of derivative words with the meaning of expression and modality" [7, 265-266]. In addition, the terms in the scientific understanding

"constitute a special layer of literary vocabulary and, as highly specialized words, are opposed not to terms, but to words of general use" [2, 118].

It should be noted that the terms of kinship constitute a special layer of the vocabulary of the living folk language, they are most likely not literary in comparison with the terms in the scientific sense.

In English, there is a different system of addressing a husband to his wife, a wife to her husband. The British widely use various combinations, such as, for example: *My honey*, *My sweet*, *My dear*.

In addition, in English, when addressing, the marital status of a woman is very clearly differentiated, when an unmarried woman is addressed as *Miss*, and a married woman is addressed as *Missress*.

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关于古代俄罗斯时期的学习和教育问题  
TO THE QUESTION OF LEARNING AND EDUCATION IN THE  
ANCIENT RUSSIAN PERIOD

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抽象。 这篇文章涉及的是俄罗斯古代的基辅时代。 关于其中存在的吠陀智慧，以精神和道德知识，具体知识和信仰的体系表示。 关于一种旨在掌握这种智慧的教学，使人们有能力以一种整体的方式感知世界，它渗透到存在的本质中，不仅使他们熟悉常规的，具体的历史，而且还熟悉无条件的，永恒的和真理。

有人说，在弗拉基米尔·鲁斯受洗之后，宗教学校日渐普及，其中的教育是以旨在研究教会书籍的教会教学的形式呈现的。 那是单方面的。

关键词：旧俄时期，斯拉夫原始，基辅时期，吠陀教，教学，正直，单面，宗教教学，学校。

**Abstract.** *The article deals with the Old Russian, Dokievian period. About the Vedic wisdom that existed in it, represented by a system of spiritual and moral knowledge, concrete knowledge and faith. About a teaching aimed at mastering this wisdom, which endowed a person with the ability to perceive the world in a holistic manner, penetrate into the essence of being, familiarize not only with conventional, concrete historical, but also unconditional, timeless and truth.*

*It is said about the religious schools that became widespread after the baptism of Vladimir Rus, that education in them was presented in the form of church teaching aimed at studying church books. That it was of a one-sided character.*

**Keywords:** *Old Russian period, Proto-Slavic, Kiev periods, Vedism, teaching, integrity, one-sidedness, religious teaching, school.*

Official sources indicate that in the ancient Russian period<sup>1</sup>, on the Slavic-Russian land, Rurik formed a state called Kievan Rus, with which all the main socio-political processes are associated, in the conditions of which teaching and education begins.

But the ancient period of Russian history does not begin with Kievan Rus, as is commonly believed. In Russia and before Rurik there was statehood, there were princes<sup>2</sup>, there was their own vision of the world, their own knowledge. Prior to the southern, Kiev state, there was a North Russian state, represented by such cities as Ladoga (princely residence from 862 to 866), Veliky Novgorod (capital from 862 to 882). Kiev was the capital from 882 to 1237 (the year 1169 is also considered to be the end - the year of the destruction of Kiev by A. Bogolyubsky).

And before them there was a Proto-Slavic, Slavic-Aryan state, which had different names - Tartaria, Russenia, Ruskolan, etc. (their capitals were Asgard, Troy, Ur, Kiyar, Pyatigorye, Tmutarakan), which, unfortunately, do not appear in official history.

Most likely, the author of "The Tale of Bygone Years" knew about this. But to the question: "Where did the Russian land come from, and who began to rule in it first," the chronicler replies: Rurik. For Nestor, a monk of the Kiev Pechersk Lavra, this question had not so much historical, national self-conscious significance: when Russia developed its own culture, statehood, as religious: when the light of Christian teaching shone in Russia.

This is probably why Nestor begins his chronicle not with Tartary, not with Russenia, Ruskolani, not from the Trojan Ages, not from Busov's time, not from the time of the Russian singer-storyteller Boyan<sup>3</sup>. He begins it with Rurik, who was baptized in 826,<sup>4</sup> with Askold and Dir, who were baptized in 860, leaving all the previous rich Proto-Slavic history outside the framework of his narrative.

In the pre-Slavic period, Vedic doctrinal wisdom prevailed. Vedism is usually seen as a derivative of the word "Vedat", that is, to know. The role of knowledge is important, but focusing only on it is evidence of a one-sided approach that narrows and impoverishes ancient wisdom.

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<sup>1</sup>The Old Russian period in literature is represented by the pre-Mongol period (862-1238) and the Mongolian period (40s of the XIII century - mid-XV century). The end of appanage Russia in the pre-Mongol period is associated with 1238. This year, a battle took place on the Sit River, which ended in the defeat and enslavement of the Vladimir-Suzdal principality, the last Russian sovereign political entity independent of the Tatars.

<sup>2</sup>In "The Tale of Igor's Campaign", for example, it is said about the Antic prince Bus, who lived in the IV century.

<sup>3</sup>See: A. Nikitina. In Search of Boyan // Science and Religion. 1993. № 9.

<sup>4</sup>It is assumed that his baptismal name was the name Jörg, Jorgen. The resulting sound George became a popular name among Russian princes (Yaroslav the Wise, Yuri Dolgoruky in baptism took the name of George). Perhaps this explains the construction of St. George's Cathedral in Staraya Ladoga. This event is more often attributed to Yaroslav the Wise.

Vedic wisdom<sup>5</sup>, based on the perception of the surrounding, manifested and unmanifested, material and spiritual world, as a whole, was a system of spiritual and moral knowledge, concrete knowledge and faith<sup>6</sup>. The word "Vedat" consists of two syllables - "ve" and "dat". The syllable "ve" means vision-knowledge, faith. "Vera" is the guidance of light: the syllable "ra" means light, radiance.

This wisdom is consonant with the ideas of the thinkers of Ancient India, Ancient China, Ancient Greece. Thus, the idea of the unity of the world and, accordingly, a single path that embodies the truth, underlies the views set forth in the Bhagavad Gita, Confucius, Lao Tzu, Mencius, Plato.

They also did not reduce ancient wisdom to knowledge. Chinese thinkers, for example, have used the word understanding. The child has little knowledge, but he has more understanding. An adult has many knowledge, but he has little understanding, said Chen Jiju, a XVII century Chinese painter, writer and calligrapher.

Modern technically trained people have great knowledge in the field of information and communicative means of communication, but they have little or no understanding associated with knowledge, with wisdom.

Of course, understanding is a more appropriate word, but it is also not quite adequate to wisdom, its depth and penetration into life itself. Emphasizing this depth, Chinese thinkers argued: consciousness is not objective, but functional, it is devoid of quantitative characteristics, it is fused with the outflow of life itself. It can be assumed that, having formulated the principle of non-action, Lao Tzu wanted to say that one should not spoil the natural state of a person through excessive reasoning.

The syllable "dat" means to give knowledge, knowledge about this original pure light and its manifestations. It is necessary to give knowledge about the unity of the world, the integrity of being, about harmony, constancy, measure, limit. Knowledge is needed about the variety of things and their properties, about honor, conscience, justice, conscientiousness, responsibility - qualities that a person should have, about what should be created and not appropriated, create and not boast, be an elder and not command, and many others. knowledge.

Comprehension of ancient wisdom was aimed at nourishing the soul, at the ascent and spiritualization of man. Spiritualization, according to Vedic knowledge,

<sup>5</sup>Information about ancient knowledge is contained in oral folk art, in parables, legends, epics, commandments, myths, Words, Epistles. See, for example, A.N. Afanasyev. *Mythology of Ancient Rus. Poetic views of the Slavs on nature*. M. 2005. It is contained in religious, philosophical literature, in the annals. The "Tale of Bygone Years" speaks of Slavic literacy, their own government, reign, customs, traditions, habits, the way of life of the Slavs before the formation of the Kiev state. It is contained in archaeological data, in other written sources. See: A. Asov. Note to the book of Veles; Demin V.M. *From Aryans to Rusichs (From Ancient Aria to Russia)*. Ancient history of the Russian people. M., Omsk. 2007. Later Vedic knowledge was presented in the Indian Vedas. See: Yu.V. Mizun, Yu.G. Mizun. *Vedic Rus. M.*, 2003.

<sup>6</sup>See: *The Hyperborean Faith of the Rus. M.* 2003.

expands the capabilities of a person, his consciousness, it allows him to be not only physical, conditional, temporary, but also super-psychological, super-temporal, participatory, visionary. An intuitive comprehension of the logic of higher conduct can be accessible to such a consciousness. In it, there can be a correlation between thought and this logic. Such a consciousness of E.N. Trubetskoy called logical consciousness in the proper sense of the word<sup>7</sup>.

This activity is the highest in terms of the level of thinking, sensory, figurative, intuitive perception, which can penetrate into the existing and what is proper, internal and external, an understanding of their unity, which is capable of comprehending both the conventional, concrete historical, and unconditional, timeless truth.

Cognition of the due, embodying the unconditional truth contained in God, is the comprehension of the ideal, the image, that which should serve as the main guideline in the life of an individual, his upbringing, education, and the entire state-organized society.

Cognition of what exists as a manifestation of God in the external world, including the social world and man, is the knowledge of conventional truth, which is necessary for the organization, fair arrangement and preservation of this life. It is necessary to streamline human interaction with their own kind, with the state, with nature.

Ancient knowledge was acquired in the process of observing the surrounding and one's own nature, through comprehending their essence. Comprehension of one's own nature presupposed working with the physical body, with the sense organs, with emotions, consciousness, thoughts, intuition, soul, spirit, aimed at identifying and using their properties, correlations to bring the whole human body into harmonious sound, filled with the energy of all its components. The most important Taoist postulate says: all beings contain yin and yang, are filled with qi and form harmony. Knowledge was acquired through the perception of the experience of previous generations and the teachings of the elders, the carriers of this experience.

For ancient Chinese thinkers, self-observation is explained by the fact that the measure of everything is in oneself (Lao Tzu). The fact that all things are complete in themselves, they are present in our heart, therefore there is no greater joy than peering into ourselves (Mencius). Observing others, comprehending the experience of the past is necessary in order to know the future. Lao Tzu advised to watch the one going out in order to know the incoming one, i.e. of the one who will come. In Plato, self-knowledge is the basis for the cognition of integrity.

Ancient knowledge was passed on by sages, wise men, elders, philosophers. They were given by teaching, in the process of direct communication between the

<sup>7</sup> See: Trubetskoy E.N. Selected works. Rostov-n-Don. 1998. P. 261-270.

teacher and the student, aimed at the formation of both worldview and specific knowledge. The ancients understood the meaning and role of this communication. Therefore, the teacher in a broad sense and the student are the main characters in the conditions of Ancient Russia of the Proto-Slavic period, Ancient India, Ancient China. Therefore, in ancient Greece, the school of Plato, training was carried out through disputes, in which philosophers participated.

The peculiarity of the ancient Vedic doctrine was also that it was carried out by feeling, punishment (telepathy), that is, the ability to comprehend the world and communicate without words. This method is also indicated in ancient Chinese philosophy. Lao Tzu says that teaching is carried out silently, that the path cannot be comprehended in words.

Formed in the process of such a teaching, reduced by the ratio of all energy forces into a harmonious sound, the inner state of a person was a determining factor in comprehending the essence, the true goal of life, cognition of the righteous path, the path of Rule and following it<sup>8</sup>. This is the origin of the "know thyself" attitude, which is attributed to Socrates. A person who did not engage in knowledge of himself, the world around him, did not walk the righteous path, was called scampish, dissolute.

It is believed that the possession of Vedic knowledge, the use of them and the laws of nature gave a person intellectual, emotional, energetic power, which made it possible not only to improve, but to create oneself and one's social life, aiming them at righteousness, justice, virtue.

As a result of climate change, a shift in the direction of the earth's axis, the accomplishment of the Neolithic revolution: the transition from appropriating to a producing economy, the relationship in understanding the spiritual and material world was violated. There was an exaltation of the material world, its recognition as a determining factor in worldview, consciousness, knowledge, education.

In the Old Russian period, there was a transition from the Proto-Slavic to the Slavic-Russian way of life, from the Vedic wisdom to the Christian perception of the world. The Vedic doctrinal knowledge, the methods of its transmission, teachings, including punishments, have disappeared. The ancient language, alphabet, writing system disappeared. Active use of words began, largely borrowed.

These changes are synchronized with a set of actions, almost simultaneously aimed at introducing a new dynasty, designed to substantiate the legitimacy of the power<sup>9</sup>, seized by adherents of Western ideology, a new religion, a new written

<sup>8</sup> See: Slavic-Aryan Vedas. Word of Wisdom of Magus Velimudr. Asgard-Omsk. 2002. P. 47-51.

<sup>9</sup> This assumption is expressed in the literature (B. Grekov, V. Nikolaev). The authors say, in order to prove the legal, hereditary right to rule in Russia, which seized power of the Varangian-Byzantine party, the chronological order in the early history of Kievan Rus was significantly changed. For this, in their opinion, the rule of Rurik was pushed back more than 100 years ago.

language<sup>10</sup>. They were supposed to serve the formation of Russian statehood in the European-Christian version.

This affected the understanding of teaching, education, and the acquisition of knowledge. It is believed that education became widespread after the baptism of Vladimir Rus. It was presented in the form of church teaching aimed at studying church books. The word proclaimed in Holy Scripture as the basis of being, knowledge of the world and God, began to be used on Russian soil to instill a passive way of life, the ability to obey, and not resist foreign power<sup>11</sup>.

Baptism was not accepted by the military elite, in their eyes it was tantamount to submission to the Byzantine Empire<sup>12</sup>. Therefore, Vladimir planted both baptism and church teaching by force. He took from specific peoples<sup>13</sup> their children<sup>14</sup>, placed them in closed schools<sup>15</sup>, in which there was a special daily routine and strict supervision.

A similar practice developed in the times of Peter the Great. According to the Peter's decree of 1723, there was a directive to enroll in schools priest's, deacon's and clergy's children, all those who can and who do not want to "have them in schools" involuntarily.

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<sup>10</sup>Cyril and Meffody replaced the ancient Vedic writing with the Church Slavonic alphabet, necessary for church services. Before each letter had a certain IMAGE: AZ-Man; G-God; B-Know; O-Likeness; Ra-Radiance, Light of the Supreme, etc. The concept of the primary meaning of the image was the basis of a person's education, this knowledge gave him strength, made him powerful.

They removed the letters that conveyed throat and nasal sounds. The loss of vocal sounds led to the loss of special vibration. The loss of nasal sounds negatively affected the functions of the pituitary gland, which is the center of the will. The alphabet was deprived of imagery under Peter I, Nicholas II. 33 letters remain in the toga (it was 49). In the post-Soviet period, the spelling system, hyphenation rules are changing, and foreign words are being actively introduced. The alphabet and the Russian language, which are the basis of education, are becoming more and more shapeless.

<sup>11</sup>See: Eusebius Pamphil. A word to Tsar Constantine on the occasion of the thirtieth anniversary of his reign. Op. V.2. SPb., 1849. P. 357-358; Epistle to the Romans of the Holy Apostle Paul. 13; 1.2; John Chrysostom. Conversations on the Epistle to the Romans // Creation of our holy father John Chrysostom in 12 volumes. SPb., 1895-1906. V. 12. Book. 2.P. 775.

<sup>12</sup> Similarly, at present, in the eyes of the nationally oriented part of the population, the adoption of the liberal-democratic ideology of the West is seen as submission to it.

<sup>13</sup> The chronicler imply "peoples" like household members, children from the circle close to the sovereign, from "his own", newly baptized, from whom Vladimir intended to forge a Christian educated elite of a new type. V.O. Klyuchevsky's "deliberate child" is the best people, urban and industrial nobility.

<sup>14</sup> Mothers wept for them as if they were dead, because in taking their children into the church estate they saw the way to a different, incomprehensible life, and in the church teaching of the monks - as a departure from life in general.

In the XIV century, according to the life of Sergius of Radonezh (1314-1392), it will become known that the boyar of the Rostov principality Kirill and his wife Maria voluntarily gave all their sons - Stephen, Bartholomew (the future Monk Sergius) and Peter to go to school.

<sup>15</sup>It is believed that the term "school" appeared in 1382, when, according to European tradition, it began to denote an educational institution where they taught crafts and gave special knowledge.

In the second half of his reign, Vladimir began to avoid violence. He opened schools, but, as before, with the obligatory teaching of church books. Since 1096, such establishments have been opened at monasteries and temples throughout Russia.

Yaroslav opened the first public school in Novgorod, in which there were 300 youths<sup>16</sup> – the children of Presbyters (priests) and Elders. They did not alienate themselves from the family, they acquired the knowledge necessary mainly for the Holy Order<sup>17</sup>, and to some extent for the civil service.

Libraries appeared at monasteries and churches. Yaroslav founded a library in St. Sophia of Kiev, in which there were at least 950 books, mainly church ones, as well as on philosophy, astronomy, and geography. They wrote on birch bark - white birch bark.

During this period, a teaching class of people was formed who had ordination and continued to serve in the temple. Their main purpose was church education. All this determined the one-sided nature of education. Knowledge, the experience of acquiring rational, emotional, energetic and other knowledge and their practical use, disappeared from it.

In the New and subsequent times, a one-sided view was preserved, in which the dominance of a secular character and a rational approach to the organization and content of education was established. This situation exists in modern Russia.

Rapid technicalization, the struggle for world domination, for the redivision of the world, and other factors have led to the emergence of numerous geopolitical and national problems, the solution of which has no serious scientific basis in Russia. This requires a significant change in attitudes towards science and education. This requires directing human evolution, which has moved away from the evolution of nature under the influence of modern civilization, into the mainstream of world co-evolution, i.e. joint development of a person and everything that surrounds him. This requires a holistic approach to understanding and implementing true teaching and education.

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<sup>16</sup> It is not known what enrollment was in Vladimir's school, but 300 boys for the then Novgorod is a large number. Moscow Slavic-Greek-Latin schools, which were called Academies at the time of their heyday, will become proud of this number.

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现代俄罗斯青年形成媒体行为过程中的信息和通信技术  
**INFORMATION AND COMMUNICATION TECHNOLOGIES IN THE  
PROCESS OF FORMING MEDIA BEHAVIOR OF MODERN RUSSIAN  
YOUTH**

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抽象。 呈现的作品探讨了在COVID-19传播的背景下现代俄罗斯青年的特征及其媒体行为，这有助于人们在日常生活中更积极地使用信息和通信技术（ICT）。 基于社会学和市场营销研究的结果，本文考察了有助于现代俄罗斯青年实现最有效的远程人际和社会互动特征的最受欢迎的信息和通信技术及解决方案，并考察了其作为Z代代表的特征。

关键词：现代俄罗斯青年，Z世代，信息和通信技术（ICT），互联网，交互的距离形式，媒体行为。

**Abstract.** *The presented work examines the features of modern Russian youth and their media behavior in the context of the spread of COVID-19, which contributed to the more active use of information and communication technologies (ICT) in their daily life. Based on the results of sociological and marketing research, the article examines the most popular information and communication technologies and solutions that contribute to the most effective remote interpersonal and social interaction characteristic of modern Russian youth, examines its features as representatives of generation Z.*

**Keywords:** *modern Russian youth, generation Z, information and communication technologies (ICT), the Internet, distance forms of interaction, media behavior.*

In the context of countering a viral infection and implementing socially significant measures to prevent its spread (limiting mobility, limiting contact interpersonal and social communication, within which information and communication interaction takes place, etc.), new opportunities have opened up for using ICT in the formation of new models of media behavior. The active use of ICT and the possibilities of the Internet space, social networks, mobile applications, "connected solutions", artificial intelligence, e-commerce, models of "contactless" social

interaction had a significant impact on the process of shaping the media behavior of modern youth. It should be noted that not everything that modern information and communication technologies offer has a beneficial effect on the younger generation. The growing commercialization of modern information and communication technologies, the degree and nature of their influence on the process of shaping the media behavior of modern youth should become the subject of separate additional research, and the presented work makes only a small contribution to its study.

As part of our study, an attempt was made to consider modern information and communication technologies and their impact on the media behavior of generation Z youth. To achieve the goal of the work, it is necessary to solve a number of tasks: to reveal the essence and specifics of modern information and communication technologies; consider the features of modern youth media behavior and the qualitative characteristics of generation Z youth.

In modern scientific research literature, the problems of studying information and communication technologies and media behavior are interdisciplinary and are considered in the works of psychologists, sociologists, teachers such as A.I. Chernykh, Yu.N. Dolgova, I. V. Zhilavskaya, V.P. Kolomiets, G.N. Malyuchenko, G.S. Melnik, I.V. Chelysheva, N.N. Bogomolova, E.E. Pronina and others. In the works of these researchers, modern information and communication technologies are considered as technologies for the formation of not only media behavior, but also worldview, public consciousness, ideas about the social reality of modern youth in a consumer society. Many researchers note that with the help of information and communication technologies "the values of the mass consumption society are successfully embedded in the mass consciousness of Russians through advertising, mass media, fashion, branding. Consumption becomes an element of everyday life, capable of structuring society in a new way, uniting or separating individuals" [1. p. 25]. In this situation, modern youth is especially sensitive to the change in media behavior models and the use of information and communication technologies.

The works of American psychologists F. Zimbardo and N. Colombe examine the impact of ICT not only on media behavior, but also on gender roles, the institution of marriage and family, as well as on demographic trends. In the work "Man Disconnected", the authors note the complication of information and communication technologies and note their negative impact on the process of formation and development of the personality. F. Zimbardo and N. Colombe pay attention to the problem of the loss of the ability of the human brain to long-term memory due to the expansion of the use of working memory, which allows working in multitasking conditions, but destroys the ability to concentrate and deep analysis.

The works of American researchers and authors of the "theory of generations" N. Hove and W. Strauss are of research interest. The theory of generations is based

on repetitive with a certain cyclical patterns of human behavior on the scale of history and the values that they share. Within the framework of this theory, the authors define a generation as a set of people who are born every 20 years and proceed from the assumption that the average life expectancy is 80 years and consists of four periods of 20 years (childhood, youth, middle age, old age).

According to their theory, people born in 1996-2017 belong to generation Z, and the study of representatives of this generation is of practical value, since the direction of development of Russian society depends on them. The fundamental difference between Generation Z is that it is the first generation in world history that does not know what a world without computers and the Internet is. Information and communication technologies for generation Z and their active media behavior contribute to blurring the line between online and offline and the formation of their own relevant media content.

When solving research problems, we used the results of research of modern youth of Sberbank PJSC together with the Validata agency (2016), the results of a study conducted by the All-Russian Center for the Study of Public Opinion (VTsIOM) (2019) and the report of the global marketing research company Ipsos – "Flair Russia 2021: Moving forward". It should be noted that the initiators of research on modern youth and its media behavior are most often commercial organizations. This is no coincidence, in modern conditions there have been changes not only in the field of interpersonal, social, but also commercial interaction. The use of information and communication technologies has contributed to the remote activity of young people in all spheres. Working, studying, resting, playing sports, socializing, shopping are possible without leaving home, and modern commercial companies needed to immediately respond to new conditions and look for optimal solutions in order to satisfy their consumers and preserve their income.

The organization of one's own media behavior, one's own life and the life of society online were the most important problems not only for each individual socially active individual who is able to purposefully use information and communication technologies (from a schoolchild to a representative of a particular professional or some other community), but also for all social institutions (family, state, law, education, science, church, mass media and mass communications). An important role in the process of shaping the media behavior of generation Z youth and organizing life online is played by the information that they receive with the help of modern information and communication technologies from social media, news sites and electronic media. Social networks are an effective way of building interpersonal and social communication, help to contact friends and family, but only every tenth - regularly, and every fifth - from time to time participate in news discussions or publish relevant content on social media, that is, demonstrate active media behavior.

The use of information and communication technologies in a pandemic required a more responsible approach to the organization of media behavior, that is, a more careful selection of relevant and reliable information. 49% of respondents are confident that they are able to independently recognize fake news [2].

According to Ipsos research, the restrictive measures that were introduced in Russia had a positive effect on the level of weekly TV audience, which increased from 73% in 2019 to 79% in the first half of 2020. At the same time, 23% of Russians living in large cities with a population of 100 thousand watched TV programs via the Internet. The desire for personalization (video on demand), interactive content and the growing popularity of streaming services already now enable viewers to watch the TV content that they are interested in, in a convenient place, at any time and in the most appropriate way, which affects media behavior, including and young people [2], since the short-term viewing of television content by young people in the future may serve as an argument for them in favor of watching television programs over the Internet. The growing popularity of online formats has led to the fact that already in the first half of 2020, more than 90% of the country's population over 16 years old used the Internet at least once a week in Russia, the time of its use has grown in all age groups, the number of users of news and educational portals, social networks, video platforms (Skype, Zoom and others) and sites of public services has grown.

The smartphone remains the main device for accessing the Internet - 81% of Russians use it. 79% of the population uses computers and laptops, tablets - 17%, other devices (players, e-books, etc.) - 5% [2].

The use of information and communication technologies, the penetration of the Internet into all spheres of life contribute to the formation of media behavior focused on a more effective perception of media content, the creation and broadcast of our own media content.

Social networks and niche platforms (TikTok, Twitch) and interest groups play a special role in the formation of media behavior in modern conditions. At the present stage, social networks are actively expanding their functionality for online sales (for example, "Store 2.0" VKontakte, in which all functions are now available in one-window mode, or the ability to place an order button in the Instagram account profile), etc.

In the first half of 2020, the Russian audience of TikTok grew by almost one and a half times in three months - from 10% to 14%. The demographic composition of the TikTok audience can no longer be called adolescent: users 25-54 years old make up 57% of the weekly audience of this social network (data from RosIndex 2020/2Q, Russian cities 100 thous. +).

The media behavior of the radio audience has also changed: the number of those who turn on the radio at home has increased, which opens up opportunities

for immediate involvement in some actions (for example, online orders); With the help of modern information and communication technologies, different audiences consume radio audio content in different ways. For the younger generation Z (16-24 years old), aggregator sites and smartphones with corresponding applications are relevant.

Considering the impact of modern information and communication technologies on media behavior, it should be noted that as the introduction of 5G and 6G networks continues and data transfer rates increase, the time frame for mass diffusion of innovations will decrease. How, under these conditions, not only media behavior will change, but also the person himself, remains the most important question. It can be assumed that in the context of an increase in the volume of processed information, thematic services and "information filters" will play a special role, and the consciousness of an audience ready to perceive innovations and test new technologies and products will be formed. Such an audience with an active media behavior, open to the perception of innovations, is distinguished by flexibility of thinking, a penchant for creativity, it is easy to learn and master new information and communication technologies, has high communication skills, with an active media behavior, inclined to stand out from the mainstream, share online what is happening in their lives, but their ability to have the above-mentioned qualities off-plan and to use them in conditions of direct social interaction remains in question.

In the conditions of self-isolation, many of the representatives of young behavior answered: "I spent time with benefit for myself" 62% agreed (RosIndex, 2Q/2020, coronavirus). Today's youth is characterized by an active model of media behavior "for them online is the leading definition of reality, which forms trends." In accordance with the results of studies conducted from 2016-2020, trends in the perception of information by young people were identified: young people more effectively perceive short and visual information, the average concentration period of a representative of generation Z on one object is eight seconds; information is consumed in small volumes, while visual information (icons, emoticons and pictures) replaces the text; attention is drawn to the absence of long-term trends in a rapidly changing environment.

Generation Z, also called "digital natives", is a youth born in 1996-2010. Every fourth inhabitant of the Earth (25%) belongs to this generation, and in Russia every tenth (11%). Youth born during this period in the future will make up 75% of the future labor market. 2020 is a year of crisis, which revealed not only negative manifestations of the development of human society as a whole, but also presented new opportunities for such a socio-demographic group as youth. Studies have shown that young people in crisis conditions did not experience much anxiety, since they have a "safety cushion", that is, help and support from their parents.

At the same time, young people were the most sensitive socio-demographic group to the crisis.

The main values of the media active youth were: health, safety and empathy. Generation Z are active users of modern information and communication technologies, this is the first digital generation, whose maturation is inseparable from information and communication technologies. They are fundamentally different from millennials in their online habits, values and behavior. Gen Z youth spend significantly more time on the Internet, particularly on social media, watching videos and playing online games. Young people from 16-24 years old spend on the Internet, which for them is the main place of communication, a source of information and entertainment for about 5 hours a day using a smartphone.

Devices such as smartphones, tablets and personal computers remain relevant for solving many problems in the solution of which new gadgets with an Internet connection (smart watches, glasses, smart speakers, personal electronic assistants, applications for Smart TV or VR helmets, etc.) that enrich the familiar ecosystem of devices and promote more active media behavior among young people. Young people aged 16 to 24 are more media active than representatives of the older generation and take an active part in creating online content and disseminating information, they feel the need to immediately respond to all updates and new messages, it is important for them not to miss the moment and be in constant social interaction. It should be noted that "today's teenagers are absolutely the same as ten years ago. They live the same way of growing up: school, relationships with the opposite sex, with peers, with parents. The main thing is communication, self-realization and finding yourself. Who am I and what place do I occupy in society? This is the foundation." [3].

At the same time, it should be noted that "over 10 years the world has really changed and what is available today was not available before. Vkontakte and Odnoklassniki were already there, but there was no Instagram and TikTok yet. Mobile Internet has become more accessible, the development of mobile applications and games. Hence the differences in everyday pastime" [6], that is, differences in media behavior.

Thus, modern radio is a quality product that can flexibly respond to changes in people's lifestyle and deliver its content to listeners in accordance with their lifestyle and media consumption habits.

Under the influence of the realities of the information society, there has been a transformation of the media behavior of the audience of generations Z, which is focused on creating products, which are primarily characterized by the characteristics of multichannel and interactivity, which are necessary to attract and retain the audience of the multitasking generation. The formation of a new media reality stimulates the emergence of feedback tools, transforms the ways of creat-

ing and consuming information: the user can actively participate in the process of individual design of the media space both at the level of assessing and correcting information, and at the level of distributing his own content through social media, blogs and communities, which modifies mass media from sources of information into a means of communication. Each participant in such interaction and active media behavior broadcasts his own system of values: the "generation Z" value system, which is just being formed. According to the "theory of generations" by N. Hove and W. Strauss, one can only assume that "generation Z" is capable of repeating the features of the behavior of the "silent generation" born in the period from 1923 to 1943 and will withdraw into itself, protecting itself from the external environment, will go into virtual reality.

Thus, as a result of our research, we have identified the most relevant information and communication technologies that have a significant impact on the media behavior of modern youth. The so-called reality imitation technologies are rapidly improving and becoming more realistic, widespread and generally available. Such technologies include social media, news sites, educational portals, video platforms, online television, websites of organizations and government services, video communication services with the ability to conduct video conferencing - Skype, Zoom and others. The peculiarity of these information and communication technologies is personalization (video on demand), interactive content that is accessed as it is convenient for the user. Further implementation and development of modern information and communication technologies, the creation of 5G-, 6G-ecosystems, achievements in the field of Augmented, Virtual and Mixed Reality AR/VR/MR, the Internet of Things will become new channels for the transmission of media content and the further formation of media behavior.

Within the framework of our research, media behavior is considered not only as the ability to navigate the information obtained with the help of modern information and communication technologies, but also as the ability to form their own media content and its distribution on the Internet. Such a feature and qualitative characteristic is possessed by modern youth, which belongs to the so-called generation Z, the fundamental difference and marker of which is its digitalization. Today's youth is able to interact in the online environment on an instinctive level, using modern information and communication technologies in their media behavior. A feature of the media behavior of modern youth is a high degree of its activity, aimed at blurring the line between online and offline environments, a high degree of personalization and the formation, promotion of their own relevant media content.

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欧亚空间的整合动力学  
DYNAMICS OF INTEGRATION IN THE EURASIAN SPACE

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注解。 文章揭示了在欧亚空间中的整合是动力学过程。 应当指出的是，它是根据运动的逻辑而发展的，这种运动是从具有大量参与者的协会和正式的地方发展到数量较小的团体，但意义更大且更具约束力。

关键词：一体化欧亚空间欧亚经济共同体多边合作

**Annotation.** *The article reveals integration in the Eurasian space as a process in dynamics. It should be noted that it develops according to the logic of movement from associations with a large number of participants and somewhere formal to smaller in number, but significantly more meaningful and binding.*

**Keywords:** *integration, Eurasian space, Eurasian Economic Community, multilateral cooperation*

In our opinion, dynamics of development of integration processes in post-Soviet space has been defined by the evolution of centripetal and centrifugal, i.e. integrating and disintegrating factors.

Since the collapse of the USSR, we can distinguish three stages of economic integration: the first stage (1991 - 1995), the second stage (1995 - 2000), the third stage (2000 - 2014), and the fourth stage (2014 – till present).

The first stage directly relates to establishment of CIS. The Commonwealth has occupied its niche in the integration cooperation of its countries, being, in the opinion of some experts, not only “a form of an orderly divorce”, but, primarily, in our opinion, a special format of a dialogue between states.

The specificity of the first stage is an attempt of the member countries to “over-run”. In autumn 1993, countries with an intention to create a single economic space have signed the Treaty establishing Economic Union. It is apparent that due to a number of objective factors, it was impossible to implement the Treaty. Failures directly relates to contradictions between the members, differences in willingness of the countries due to the levels of their economic development,

and lack of a well-designed mechanism for implementing of decisions. Problems of institutional nature prevail here. In particular, Interstate Economic Council established in October 1994 especially as a body for the economic union has no respective super-national powers through making decisions, implementation control whereof would be imposed on national authorities. In fact, this is a consulting body decisions whereof have a declarative nature.

The Commonwealth had to go a difficult way of establishment, which included a search for the best forms of cooperation, and adaptation of its institutions and mechanisms to the requirements of new multilateral interaction.

In the legal sense, CIS is an amalgamation of sovereign states with a wider range of joint cooperation. Common objectives and principles, competences, and fields of mutual and common interests of the Commonwealth have been agreed and have a contractual basis. Such basis is represented by foundation documents: Charter of Commonwealth (January 22, 1993) and multilateral acts (treaties, agreements, resolutions etc.) adopted within CIS.

Supreme bodies of the Commonwealth are Council of Heads of States (CHS) and Council of Heads of Governments (CHG). This has been enshrined in the Charter of CIS. These bodies coordinate activities of the Commonwealth member states in the field of their share interests and make decisions on critical issues of domestic and foreign policy. This is also evidenced by objectives fixed in the Strategy for Economic Development of the Commonwealth of Independent States for the period before 2020 and establishment of special institutions for industrial cooperation.

Among objectives and special bodies established for them, we should note the following:

- establishment of a common energy market of the Commonwealth (Electric Power Council)
- establishment of a single transportation and logistical system (Council on Railway Transport, Coordinating Transportation Conference)
- establishment of a single agricultural market of CIS (Intergovernmental Council on Issues of Agricultural Sector)
- liberalization of the market of public purchases in CIS countries (Interstate Council on Antimonopoly Policy)

Based on the instruments signed within CIS, other cooperation bodies have been established, including those industrial designed to promote integrative cooperation between CIS countries. Thus, CIS created a model of different-format and different-level cooperation which assumes flexibility and elective participation of the states in their commitment to determine a consensus.

However, implementation of the above directions of integration reflected in agreements signed by CIS members is still very slow. Within the Commonwealth,

the development of integration process immediately depends on the level of readiness of the economic system of CIS member countries for integration. Meantime, according to the international practice, integration structures established have successfully developed due to the internal market which includes over 300 million consumers. In the case of CIS, the market includes 282 million consumers, which also indicates positive capacities. In our opinion, the volume of the market had an effect on implementation of the Agreement on Free Trade in CIS. In recent years, the figures indicate a positive dynamics of mutual trade between CIS member states. The volume of mutual trade between state parties of the Agreement in 2017 has increased in comparison with 2016 by 25.1% [1]. The countries have achieved agreement on the issue of the mechanism for resolution of disputes and have fulfilled commitments undertaken in relation to export duties, and they also work on an agreement on free trade of services. Though CIS countries are still mainly focused on the external market, nevertheless, certain growth in mutual trade indicates strengthening of objectives of integration by actual interests of countries interested.

Many politicians and experts estimated the situation that had been created by mid-1990s as “crisis of the Commonwealth”, though, due to the fact that bilateral relations had integration capacity. Active directions of cooperation in certain types of cooperation or in cooperation with the most consistent partners ensured initiation of further promotion of the integration processes. It must be emphasized that development of relations with CIS countries, including multilateral integrative interaction therewith, is a critical component of practical policy of all branch of the Government of the Republic of Kazakhstan.

Kazakhstani approach to multilateral cooperation within the Eurasian space is based on the concept of variable-speed integration originating from capacity for establishment of a group of countries bound by a closer integration. Fragmentation of economic and political space of the Commonwealth observable over decades is reflected in processes of such “variable-speed integration”.

At the same time, Kazakhstan permanently advocates an open nature of activities of sub-regional associations within the Eurasian space and maintenance of objectives and practical activities within the common direction of development of CIS. The main task of Kazakhstan is to strengthen efficient and mutually beneficial integrative interaction in the post-Soviet space.

When assessing establishment of integration groups similar to those in CIS, some experts forecasted collapse of CIS. However, when analyzing activities of CIS, we can notice that processes of interaction between the CIS countries and attempts to preserve relations between nations have not been suspended.

From the perspective of such optimistic estimation of these processes, one can talk about discussion and conceptual elaboration of concepts of cooperation on the

CIS platform to be later successfully implemented in the format of sub-regional groups consisting of a limited group of members, i.e. they may be an impetus for deepening of integration. As properly assessed by A. Stoppe “existence of integration formats in some way duplicating each other in composition of members and fields of interest (CIS, EurAsEC, Customs Union, EEU, CSTO, SCO, Union State) reflects current wish of the states formed within post-Soviet space to find their place in regional cooperation to define the level of their participation in integration processes”[2].

As a result of a new configuration in the post-Soviet space, new sub-regional communities with different principles of interaction by types of field of cooperation, and bilateral and multilateral associations have emerged. Initiators of deeper integration between CIS member states have been Russia, Belarus and Kazakhstan. First of all, political agreements between the leaders of these countries have been efficient. These countries due to their economic potential regularly have played an active role of drivers of integration processes for two decades. In particular, in 1995 they attempted to give a new impetus to integration processes; an agreement on Customs Union of Russia, Belarus and Kazakhstan has been concluded. The process was joined by Kyrgyzstan in 1996 and by Tajikistan in 1999. The process of establishment of the Customs Union indicates the beginning of *the second stage* of integration in the post-Soviet space. The agreement canceled tariff and quantitative restrictions in trade for CU members. However, Eurasian Economic Community was established on its basis soon. Establishment of EurAsEC, associated with the beginning of *the third stage* of integration, took place on October 10, 2000 (the agreement was enforced on May 30, 2001). Global international changes highlighted the necessity for a brand new level of regional integration. Intensification of efforts of external forces in the post-Soviet space trying to involve certain countries in their influence area required counteractions to prevent disintegration. The major feature of this stage of cooperation of new independent states is focus on adoption of a super-national method to settle interaction problems.

In December 2003, the organization was granted an observer status at the UN General Assembly. This international economic organization was established to form a common market for member states: Belarus, Kazakhstan, Kyrgyzstan, Russia and Tajikistan. Uzbekistan joined EurAsEC in 2006, and as early as in 2008 suspended and actually canceled its membership in the organization. Observers were Armenia, Moldavia and Ukraine.

As noted by V. Putin, the President of the Russian Federation, when establishing the Eurasian Economic Community, it was about transforming of integration to a comprehensible, attractive for people and business, sustainable and long-term project independent of variations in current political and any other environment [1].

The main difference of EurAsEC from CIS is a greater coordination of powers. Interstate interaction of the countries within EurAsEC is implemented through Interstate Council, Integration Committee, Inter-Parliamentary Assembly, Court of Community, and Customs Union Commission. Besides, EurAsEC has established a stricter system of sanctions for violation of its obligations, including exclusion from the Community upon resolution of the Interstate Council.

The supreme body of the Eurasian Economic Community is *the Interstate Council* which included heads of states and governments of the community had clearer law-making powers. The main executive body is *the Integration Committee* which is a permanent body of the Eurasian Economic Community. It included deputies of heads of governments of EurAsEC. The main mission of the Integration Committee is to maintain interaction between bodies of EurAsEC. Within the Integration Committee, decisions are taken by majority of two thirds of votes. Number of votes in taking decisions within the Integration Committee corresponded to contribution of each country to the budget of the Community: Russia: 40 votes; Belarus: 15 votes; Kazakhstan: 15 votes; Kyrgyzstan: 7.5 votes; Tajikistan: 7.5 votes. Decisions have been taken on the basis of consensus.

Thus, when speaking of integration within the Eurasian space as a process in dynamics, it is recognized that it has been developed logically from shifting from association with a greater number of members which is to some extent formal, to that lesser in quantity and significantly more substantial and binding. Establishing of EAEC in 2015 has significantly accelerated processes of actual association of the economies of the countries in Eurasian region. Eurasian integration played a valuable role in the process of convergence of legal systems [3].

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借助新的生殖技术出生的儿童的健康状况  
**THE HEALTH STATUS OF CHILDREN BORN WITH THE HELP OF  
NEW REPRODUCTIVE TECHNOLOGIES**

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抽象。 本文介绍了对体外受精后妇女的回忆，妊娠和分娩过程进行研究的结果，分析了儿童出生后第一年的身体和神经心理发育参数以及发病率。

关键词：不育，体外受精，新生儿，随访。

**Abstract.** *The article presents the results of studying the anamnesis, the course of pregnancy and childbirth in women after using in vitro fertilization, analyzes the parameters of the physical and neuropsychic development of children in the first year of life, and morbidity rates.*

**Keywords:** *infertility, in vitro fertilization, newborn, follow-up.*

### **Introduction**

Infertility is a problem that is becoming increasingly important every year. [1,3,4]. In the treatment of female and male infertility, new methods are increasingly used, including in vitro fertilization (IVF), which significantly increased the number of pregnancies and childbirth in this contingent of women [1-3]. There are not many systematic studies on the health of children obtained with the help of assistive technologies in Russia. A number of authors argue that the state of health of children born using this technology differs significantly from the general population indicators [2,4]; according to other authors, the condition and morbidity of newborns does not differ significantly from children born after a naturally occurring pregnancy [6].

Purpose of the work: To assess the physical and psychomotor development of children, to study the follow-up of children born with the help of new reproductive technologies.

### Materials and research methods

A retrospective analysis of 67 histories of child development, extracts from maternity hospitals was carried out according to data from children's clinics in the city of Volgograd for the period 2012 - 2019. 2 groups were formed. The main group 35 (group 1) included children born with the help of assisted reproductive technologies. The control group (group 2) consisted of 32 children from spontaneous pregnancy. The state of health of the mother before the onset of pregnancy, the course of pregnancy and childbirth, the somatic and gynecological status of the mother, gestational age at birth, the state of the child at birth, indices of weight and body length at birth and in dynamics were assessed with an assessment of the follow-up data.

Statistical processing of the factual material was carried out using licensed packages Microsoft Office, Stat Soft Statistica 6.0. Parametric and nonparametric statistical methods were used. The critical level of significance when testing statistical hypotheses was taken  $p < 0.05$ .

### Research results

The average age of parents in the studied groups was not comparable ( $p > 0.05$ ), in the main group it exceeded 30 years, the overwhelming number of which was distributed in the age group from 33 to 38 years. The maximum age in the group of IVF children for mothers was 34 (average  $34.24 \pm 1.52$ ), for fathers - 55 years (average  $44.98 \pm 2.55$ ). In the control group of children, mothers of younger age prevailed,  $24.4 \pm 1.52$  (34.4% of women were between 25 and 30 years old). There were 22 first-pregnant women in the main group (62.8%), the rest had repeated pregnancies, in the comparison group, the first pregnancy.

Analysis of maternal health showed that in the main group, 8 (22.9%) had primary infertility, secondary infertility in 3 (8.9%) chronic inflammatory diseases of the reproductive system - 18 (51.4%), reproductive system anomalies 3 (8.6%), habitual miscarriages in 6 (17.1%). Among somatic pathologies - obesity was noted in 7 (20%), thyroid pathology in 10 (28.6%), cardiovascular diseases in 11 (31.4%), chronic infectious diseases in 9 (25.7%). In the control group, the health status of mothers differed from the main group for the better: endocrine pathology was significantly less common (obesity in 3 - (9.4%), in 6 - (8.6%) thyroid pathology; arterial hypertension in 6 (18 %) women.

The most frequent complication of pregnancy was the threat of termination of pregnancy in the early stages - up to 5 weeks of pregnancy and at 12-14 weeks, which was detected in 21 women (60%) percent of cases in the main group. In the control group, this indicator was significantly lower and amounted to 8 (25%). In the second trimester, the risk of spontaneous interruption significantly decreased and was already 6 (17.4%) and 4 (12.5%), respectively, 10.3% of women in the

study group (in a smaller number in the control group - 5.7%) persisted throughout the entire period of pregnancy.

In both study groups, full-term pregnancy prevailed.

In the comparison group - 4.3% of children were born prematurely; at 41-42 weeks of gestation, 7.0% of children were born. Of the 35 children of the main group, 23 (65.7%) were born full-term, 12 (34.3%) were born premature. By gestational age: at 28 - 34 weeks 4 (11.4%), 35 - 38 weeks 8 (22.9%), at term - 23 (65.7%). Three (8.6%) were born of triplets, 26 (65.7%) twins, 6 (17.1) children. Birth through the vaginal birth canal took place in 7 (20%), 29 (82.6%) ended in an operative way. In the comparison group, operative delivery was observed in 5 (15.6%).

Weight distribution of newborns in the main group: from 1500 to 2000 grams, 4 (11.4%) children were born, from 2001 to 3000 - 8 (22.9%) children, over 3000 grams were born 23 (65.7%) children. With an Apgar score of 5-7 points, 4 (11.4%) children were born, 6-7 points - 9 (25.7%), 7-8 points - 22 (62.9%). In the comparison group: with an Apgar score of 5-7 points, 2 (6.25%) children were born (all before gestation), 6-7 points - 10 (31.5%), 7-8 points - 20 (62.5%).

Neurological pathology was detected - 15 (46.9%), anemia 7 (21.9%), prolonged jaundice 8 (25.0%). Neurological disorders: hypoxic damage to the central nervous system was diagnosed in 11 (34.4%), tight cord entanglement around the neck was recorded in 5 (15.6%) newborns. In the comparison group, hypoxic-traumatic CNS damage was observed in 14 (43.7%) newborns, which is significantly higher than in the main group of newborns.

Anomaly in the form of a false notochord of the left ventricle in 7 (21.9%), an open oval window in 4 (12.5%), renal pyeloectasia in 3 (9.4%), dropsy of the testis in 3 (9.4%). In the comparison group, a minor heart anomaly in the form of a false chord of the left ventricle was significantly more common in 11 (34.3%). At the second stage of nursing, there were 4 (11.4%) children - these are all children born at a gestational age of 28 weeks. Children in the study groups were breastfed in 32 (91.4%) and 30 (93.7%), respectively. Most children were vaccinated in all study groups.

The assessment of the condition of children under the age of 1 year was carried out in accordance with the decreed terms. The indicators of the dynamics of body weight and length, indicators of neuropsychic development, the number of colds per year, and the nature of feeding were evaluated.

Growth and weight indicators were assessed using centile tables taking into account the standards. In the main group, children born at 28-34 weeks of gestation reached the required weight and body length by 3 months and did not significantly differ from the indicators of the control group, by 10 months, children of both groups had the required indicators.

The main group consisted of 24 (68.6%) children registered with a neurologist,

16 of them (45.7%) for muscular dystonia syndrome, 5 (14.9%) increased neuroreflex excitability syndrome, vegetative-visceral disorders 4 (11.4%) children, which is comparable to the control group. At the age of 1 year, children of both groups did not have significant differences in psychomotor development, with highly harmonious development in the main group, there was a greater percentage of children 12 (34.5%) compared to the comparison group 9 (28.1%). An open oval window was preserved by 1 year in three (85.7%) children of the main group, in the control group 2 (6.25%). Mild anemia was observed in 2 (5.7%) children. The frequency of acute diseases per year was more than 5-6 times a year, in children from multiple pregnancies, this figure was more than 6 times a year.

In the control group, 9 (28.1%) children were observed by a neurologist. At the age of 1 year, 2 (6.2%) children were registered with a cardiologist for LLC. At the age of 1 year, they did not differ from 4 boys with a surgeon for dyspadias. The frequency of acute diseases in the control group was no more than 2-3 times a year and significantly ( $p < 0.05$ ) differed from the main group.

### Conclusions:

1. The course of pregnancies achieved with the help of new reproductive technologies does not differ from naturally conceived pregnancies.
2. The physical development of children born with the help of new reproductive technologies corresponds to the age norm and does not differ from that of children conceived naturally.
3. The psychomotor development of children born with the help of new reproductive technologies is within the age range and does not differ depending on the methods of fertilization.
4. Children born with the help of new reproductive technologies have a higher morbidity and need more active immunoprophylaxis and restorative therapy.

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成人烧伤疾病毒血症期间自主神经的昼夜节律  
**CIRCADIAN RHYTHM OF AUTONOMIC TONE DURING TOXEMIA  
OF BURN DISEASE IN ADULTS**

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抽象。 在第一天，所有烧伤患者的交感神经反应增加了30-40%。 在毒血症期间，在第1组中发现最明显的交感神经反应，比老年人高20%和40%。 在毒血症期间，第2组中昼夜节律的自主神经张力（AT）每小时指标平均 和3显著低于组1的指标平均17-25%。 仅在第1组的年轻患者中观察到了对全身炎症反应的高交感神经反应。交感神经系统活动的增加总是伴随着心肌需氧量的增加以及烧伤伴烧伤时血流动力学的高动力类型的形成。 年龄在35-70%之间。 在第1组和第3组中发现了最明显的自主神经不稳定性，这是毒血症时期14天后普遍存在的情况。

关键词：昼夜节律自主神经毒血症烧伤

**Abstract.** *All burned patients on the first day had a sympathotonic reaction increased by 30-40%. During the period of toxemia, the most pronounced sympathotonic reaction, 20% and 40% higher than in older people, was found in group 1. Average for the period of toxemia hourly indicators of autonomic tone (AT) in the circadian rhythm in groups 2 and 3 were significantly lower than the indicator in group 1 by an average of 17-25%. The hypersympathotonic response to the systemic inflammatory response was observed only in young patients of group 1. An increase in the activity of the sympathetic nervous system is invariably accompanied by an increase in myocardial oxygen demand and the formation of a hyperdynamic type of hemodynamics in burns with an area of 35-70%, regardless of age. The most significant autonomic instability was found in groups 1 and 3, prevailing after 14 days of the toxemia period.*

**Keywords:** *circadian rhythm, autonomic tone, toxemia, burn disease*

**Relevance.** *The period of toxemia in severe burns occurs within a few hours or within the first day after receiving a burn. Along with the pain factor during this period, the phenomena of intoxication of the body come to the fore. The duration*

of toxemia depends on the severity of the lesion and the general condition of the body. Usually, the beginning of the period of toxemia coincides with the onset of fever in the patient, and the end with clinically pronounced suppuration of the burn wound [1-3].

Due to the lack of information on the differentiated assessment of the severity of the condition, the characteristics of the stress reaction of the autonomic nervous system, depending on the characteristics of the organism in different age groups, we considered it necessary to study the data of monitoring the autonomic tone, to determine the connection with the systemic inflammatory response, the peculiarities of the autonomic reaction inherent in age groups, including old age in order to increase the effectiveness of treatment, optimize the prognosis.

**Purpose of the work.** To study the circadian rhythm of autonomic tone during the period of toxemia of burn disease in adults.

**Material and research methods.** The results of monitoring the indicator of autonomic tone, infusion therapy of 25 patients admitted to the Department of Cambustiology of the Republican Scientific Center of Emergency Medicine due to burn injury were studied. After recovery from shock, anti-inflammatory, anti-bacterial, infusion therapy, correction of protein and water-electrolyte balance disorders, early surgical, delayed necrectomy, additional parenteral nutrition, syndromic, symptomatic therapy were performed. The systemic inflammatory response was studied by monitoring the hourly continuous recording of body temperature, autonomic tone in patients with severe thermal burns in three age groups - 1 group 12 patients aged 20-40 years, group 2 - 7 patients aged 41-60 years, 3 group 6 patients - 61-78 years old. The division into groups was dictated by the well-known characteristics inherent in each age group, described in detail in the literature. The state of the autonomic tone was assessed by the formula  $AT = \frac{PBP_{health} \times HR_{health}}{PBP_{unhealth} \times HR_{unhealth}}$ , where PBP - pulse blood pressure, HR - heart rate. An increase of more than 1 was regarded as a sympathotonic reaction [4].

**Table 1**  
*Patient characteristics (25)*

	Age, years	Height, cm	Weight, kg	Total burn area, %	Burns of 3B grade	IF, units	Days in the ICU
Group 1	27.3±5.6	174.9±5.7	73.0±22.2	59.4±13.5	21.3±13.3	119.4±38.4	22.4±14.6
Group 2	50.7±7.1	165.8±6.3	73.8±14.3	54.3±16.5	11.9±8.9	92.5±20.8	13.3±2.4
Group 3	71.3±7.0	165.3±8.4	73.3±8.9	40.8±5.8	21.7±6.7	86.7±12.8	18.8±9.5

As can be seen from table 1, the age groups were significantly different and averaged 27.3 ± 5.6 years in group 1, 50.7 ± 7.1 years in the second, and 71.3 ± 7.0 years in the third. The total area and area of deep skin burn lesions did not differ significantly between the groups. The highest IF index was revealed in group 1,

which determined the longest duration of intensive therapy in ICU conditions in the youngest group. Thus, the most pronounced burns in terms of area and depth were found in patients in group 1.

**Results and discussion.**

**Table 2**

*Dynamics of the mesor of the circadian rhythm of the autonomic tone during the period of toxemia in adults, in units*

Days	Group 1	Group 2	Group 3
1	1.31±0.05	1.42±0.16	1.21±0.10
2	1.37±0.07	1.17±0.06	1.27±0.08
3	1.36±0.06	1.16±0.05	1.37±0.09
4	1.59±0.04*	1.39±0.08	1.33±0.07 ◡
5	1.55±0.06*	1.47±0.07	1.21±0.11 ◡
6	1.60±0.07*	1.49±0.11	1.28±0.07 ◡
7	1.67±0.07*	1.49±0.08	1.37±0.06 ◡
8	1.71±0.08*	1.37±0.07	1.25±0.07 ◡
9	1.64±0.08*	1.42±0.05	1.29±0.11 ◡
10	1.65±0.06*	1.18±0.05	1.26±0.13 ◡
11	1.60±0.10*	1.32±0.10	1.55±0.13*
12	1.60±0.09*	1.24±0.05	1.21±0.15 ◡
13	1.51±0.10*		1.37±0.15
14	1.79±0.14*		1.30±0.13 ◡
15	1.61±0.08*		1.23±0.19 ◡
16	1.76±0.08*		1.06±0.08 ◡
17	1.80±0.09*		0.99±0.09 ◡
18	1.78±0.11*		1.17±0.08 ◡
19	1.80±0.06*		1.33±0.13 ◡
20	1.71±0.07*		1.29±0.14 ◡
21	1.77±0.13*		1.06±0.07 ◡
22	2.01±0.09*		1.20±0.16 ◡
23	1.72±0.10*		1.14±0.13 ◡
24	1.77±0.13*		1.51±0.26
25	1.71±0.07*		1.08±0.21 ◡
26	1.60±0.15*		1.17±0.11 ◡
27	1.65±0.07*		1.14±0.18 ◡
28	1.66±0.09*		0.97±0.13 ◡
29	1.76±0.11*		1.17±0.15 ◡
30	1.60±0.08*		1.14±0.15 ◡

\*- reliable relative to the indicator in 1 day  
 ◡- reliable relative to the indicator in group 1

As shown in table 2, on the first day, the burned patients showed a hypersympathotonic reaction, an increase in AVT by 30-40%. The further state of autonomic activity turned out to be different in age groups. So, in group 1, starting from the fourth day and throughout the entire observation period, a significant hypersympatotonic reaction was found, manifested by an increase in the mesor of the circadian rhythm AT by 59-60%, and at a later date - by 8, 14, 16, 17-25, 29 day by more than 70% ( $p < 0.05$ , respectively) relative to the norm. It should be noted that at the same time intervals in the oldest group 3 did not differ from the moderately increased AT mesor index detected on day 1, with the exception of day 11, when the AT mesor of the circadian rhythm was 28% higher than the initial value ( $p < 0.05$ ). On the remaining days, the mesor (fig. 1) of the circadian rhythm of the AT indicator was significantly lower than in patients of group 1 on days 4-15 on 16; 22; 20; 12; 26; 21; 23; 26; 27; 23% ( $p < 0.05$ , respectively). Moreover, in the next 16-30 days, this difference increased to 45% on the 17th day, 40% - on the 21.22th day, by 41% on the 28th day ( $p < 0.05$ , respectively).

Thus, the most pronounced hypersympathotonic reaction was observed at the age of  $27.3 \pm 5.6$  years, corresponding to a larger area of  $59.4 \pm 13.5\%$  of a more pronounced degree of damage to the skin surface 3B degree of  $21.3 \pm 13.3\%$  and the severity of IF  $-119.4 \pm 38.4$  units. Of the three age groups, the minimum deviation from the normative data was found in group 1 (fig. 1), when the daily indicator of the mesor of the circadian rhythm AT was less than in group 1 by 20-40%, most likely, it was not so much the result of a comparatively lower stress reaction on a burn of the total area  $40.8 \pm 5.8\%$ , grade 3B  $21.7 \pm 6.7\%$ , IF  $-86.7 \pm 12.8$  units, how many age-related features of the autonomic nervous system, which has significant morphological and functional differences in patients at the age of  $71.3 \pm 7.0$  years.

Dynamics of the mesor of the circadian rhythm of the autonomic tone during the period of toxemia in adults, units

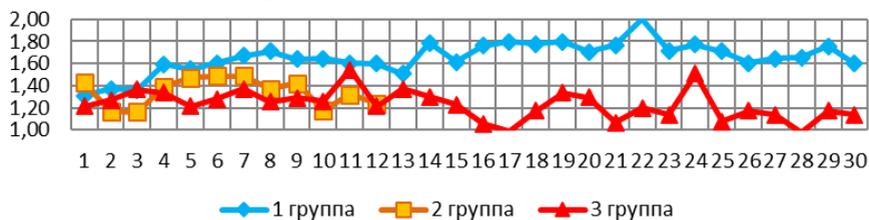


Fig.1

Hourly monitoring of daily fluctuations in the mean for the period of toxemia in the mesor of the circadian rhythm AT revealed significant hypersympathotonia with an increase in AT by 60-70% in the daytime and at night, regardless of the time of day in patients of group 1, while in group 2, the AT indicator was increased by 30-40%, and in group 3, the increase in sympathetic influences did not exceed 20-30% (fig. 2). Moreover, the hourly AT indices in circadian ritis in groups 2 and 3 were significantly lower than in group 1 ( $p < 0.05$ , respectively) by an average of 17-25% (tab. 3).

**Table 3.**  
*Average values of the mesor of AT in the circadian rhythm  
for the period of toxemia*

Hours	Group 1	Group 2	Group 3
8	1.6±0.1	1.4±0.1	1.2±0.2*
9	1.6±0.1	1.3±0.1*	1.2±0.1*
10	1.7±0.1	1.4±0.2	1.2±0.2*
11	1.6±0.1	1.4±0.1	1.2±0.1*
12	1.6±0.1	1.3±0.1*	1.2±0.1*
13	1.6±0.1	1.3±0.1*	1.2±0.1*
14	1.6±0.1	1.3±0.1*	1.2±0.2*
15	1.7±0.2	1.3±0.1*	1.2±0.1*
16	1.7±0.1	1.3±0.1*	1.3±0.2*
17	1.7±0.1	1.4±0.1*	1.2±0.2*
18	1.6±0.1	1.4±0.1	1.3±0.2
19	1.7±0.1	1.4±0.1*	1.3±0.2*
20	1.7±0.1	1.3±0.1*	1.2±0.2*
21	1.7±0.1	1.4±0.1*	1.3±0.2*
22	1.6±0.1	1.3±0.1*	1.2±0.2*
23	1.6±0.1	1.4±0.1	1.3±0.2
24	1.6±0.1	1.3±0.1*	1.2±0.1*
1	1.7±0.1	1.4±0.1*	1.3±0.1*
2	1.7±0.1	1.3±0.2*	1.2±0.2*
3	1.7±0.2	1.3±0.1*	1.2±0.2*
4	1.7±0.1	1.4±0.1*	1.3±0.2*
5	1.7±0.2	1.4±0.2	1.2±0.2*
6	1.7±0.1	1.3±0.1*	1.2±0.2*
7	1.7±0.2	1.3±0.1*	1.2±0.2*

\*- reliable relative to the indicator in group 1

Average values of the AVT mesor  
in the circadian rhythm for the period of toxemia, units

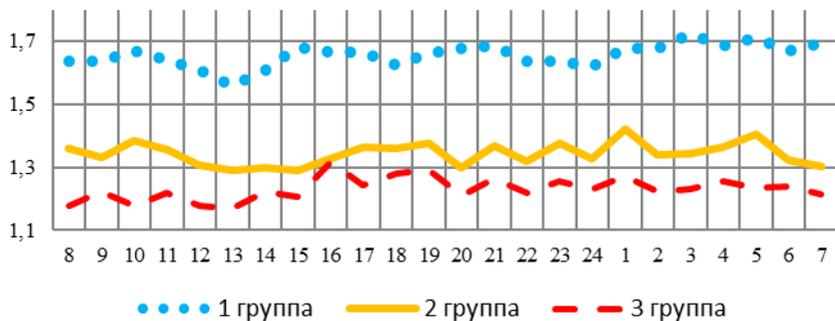


Fig.2

Dynamics of the amplitude of daily fluctuations of the autonomic tone

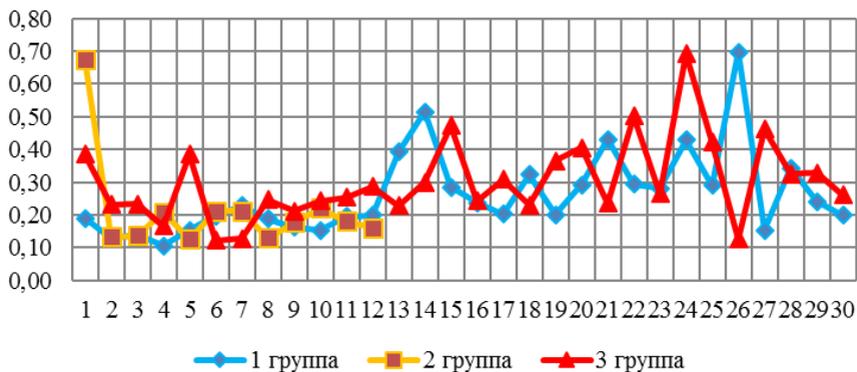


Fig.3

Changes in the amplitude of diurnal fluctuations during toxemia were wavy in nature. It draws attention to the fact that on days 2-11 the amplitude of fluctuations was insignificant in groups 1 and 2. On the following days, on days 14-28 in group 1, an increase in the amplitude of fluctuations to 0.5 on 14 and 0.7 on days 26 was revealed, indicating a pronounced instability of autonomic regulation. An increase in the same degree of the amplitude of oscillations was found in the oldest group 3 from 15 to 29 days. Thus, the most significant autonomic instability was revealed in groups 1 and 3, prevailing after 14 days of the toxemia period.

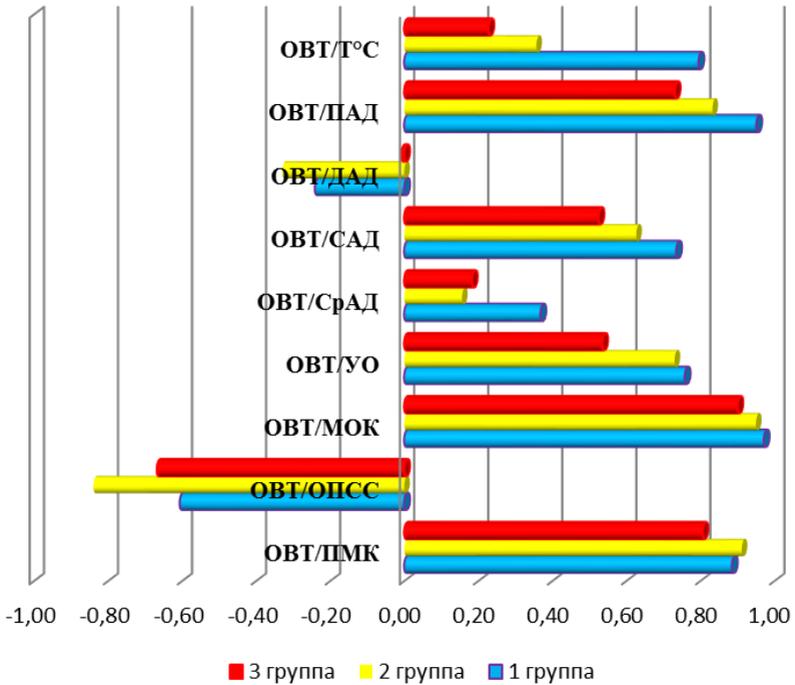
**Table 4.**

*Correlation of autonomic tone with hemodynamic parameters*

Groups	AVT/ MVP	AVT/ TPVR	AVT/ CO	AVT/ SV	AVT/ AvBP	AVT/ SBP	AVT/ DBP	AVT/ PBP	AVT/ T°C
1	0.89	-0.61	0.97	0.76	0.37	0.73	-0.24	0.95	0.79
2	0.91	-0.84	0.95	0.73	0.16	0.63	-0.33	0.83	0.36
3	0.81	-0.67	0.90	0.54	0.18	0.52	-0.01	0.73	0.23

A strong direct correlation was found in all patients between autonomic tone and MVP, that is, hypersympathoonia is invariably accompanied by an increase in myocardial oxygen demand regardless of age (0.89; 0.91; 0.81, respectively, by group). The revealed direct correlation between AVT and CO change characterizes the stimulating effect of autonomic activity on CO (0.97; 0.95; 0.90, respectively) and SV (0.76; 0.73) in groups 1 and 2, and in group 3 weakens to 0.54.

Correlation relationships of autonomic tone in the studied parameters

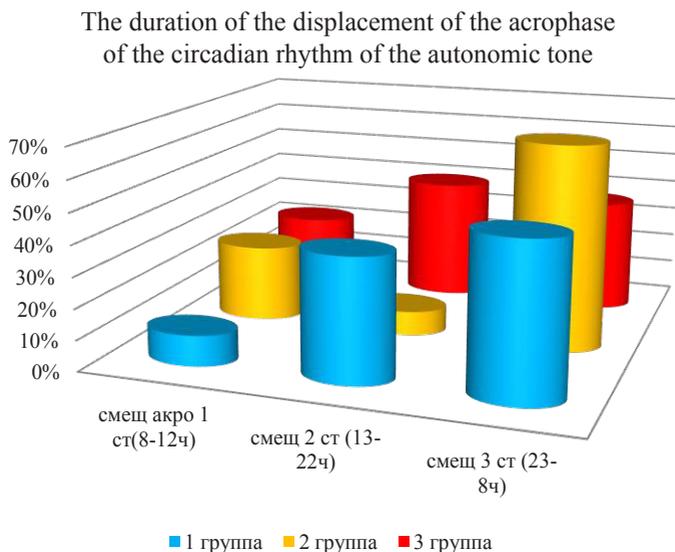


**Fig.4**

That is, in response to an increase in sympathetic influences, the cardiac function responds inadequately to stress, possibly due to a decrease in adaptive resources at the age of  $71.3 \pm 7.0$  years. The direct strong correlation between AT and PBP allows for an increase in PBP to assess the hypersympathotonic response to stress (0.95; 0.83; 0.73, respectively, for groups). Revealed hypersympathotonic response to the systemic inflammatory response was observed only in young patients of group 1 (0.79), while in older and old age this relationship was significantly weakened (0.36 and 0.23) (fig. 4).

A negative correlation between AT and TPVR indicated a decrease in peripheral resistance in response to sympathotonia only in group 2 (-0.84), while in groups 1 and 3 only a tendency was indicated (-0.61; -0.67, respectively) to a decrease in the total peripheral resistance.

The longest for the period of toxemia was the shift of acrophase to the night hours (inversion of the AT circadian rhythm) in patients of group 2 (fig. 5).



**Fig.5**

**Conclusion.** All burned patients on the first day had a 30-40% hypersympathotonic reaction increased by 30-40%. During the period of toxemia, the most pronounced sympathotonic reaction was detected in group 1, 20% and 40% higher than in older persons. The hourly AT values averaged over the period of toxemia in the circadian rhythm in groups 2 and 3 were significantly lower than that in group 1 by an average of 17-25%. The hypersympathotonic response to the sys-

temic inflammatory response was observed only in young patients of group 1. Hypersympathotonia is invariably accompanied by an increase in myocardial oxygen demand and the formation of a hyperdynamic type of hemodynamics in burns with an area of 35-70%, regardless of age. The most significant autonomic instability was found in groups 1 and 3, prevailing after 14 days of the toxemia period.

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根据临床和放射学变化对横扁平脚的元件进行手术矫正的策略

## TACTICS OF SURGICAL CORRECTION OF ELEMENTS OF TRANSVERSE FLAT FEET DEPENDING ON CLINICAL AND RADIOLOGICAL CHANGES

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抽象。 本文探讨了横扁平脚患者的手术治疗中的术前计划问题。 回顾了横向扁平足可能出现的畸形。 考虑临床诊断和特定测试的功能。 单独地，该文章对背足底投影中的X射线图像进行了分析。 已对测量指标与参考值可能存在的偏差进行了比较评估。

关键词： 扁平足， 拇外翻， 射线照相， meta骨， 术前计划。

**Abstract.** *The article deals with the problem of preoperative planning in the surgical treatment of patients with transverse flat feet. A review of possible deformities with transverse flat feet is made. The features of clinical diagnostics and specific tests are considered. Separately, the article provides an analysis of X-ray images in the dorso-plantar projection. A comparative assessment of possible deviations of the measured indicators from the reference values has been made.*

**Keywords:** *flat feet, hallux valgus, radiograph, metatarsal bones, preoperative planning.*

Severe deformities of the feet, especially of the anterior part, cause a significant violation of the biomechanics of the lower extremities. The transverse flatness of the forefoot is found everywhere [1,4,5].

Despite the advances in forefoot surgery, many unresolved and controversial questions remain. An important factor in the successful correction of deformity is preoperative planning based, among other things, on the analysis of radiographs [2,5,6].

The most common forefoot deformities include:

- valgus deviation of the first toe (Hallux valgus);
- "hammer-like" deformities of the toes;
- taylor deformation

Less common:

- Rigid deformity of 1 toe on the background of osteoarthritis of the 1 metatarsophalangeal joint (Hallux rigidus)
- Varus deformity of 1 toe (hallux varus)
- A complex of deformities developing with an adducted foot
- A complex of deformities that develops in rheumatoid arthritis and other systemic diseases
- A complex of deformities that develops in diabetic polyneuropathy

Surgical treatment of forefoot deformities begins with diagnosis and determination of indications for a specific operation. In addition to clinical examination and specific tests, X-ray diagnostics plays a leading role in additional research [3,4].

For correct diagnosis, it is necessary to take pictures under stress (standing) in a direct projection (dorso-plantar projection) in lateral, oblique projections. In doubtful cases, the use of non-standard layings is indicated, for example, an axial projection of the forefoot is indicated to assess the displacement of the sesamoid bones, and to assess the rotation of the first metatarsal bone.

Standard oblique projection at an angle allows visualization of exostoses of the head of the first metatarsal bone, deformation of the joints and bones.

When analyzing radiographs, their visual assessment is primarily carried out. The severity of signs of joint osteoarthritis is assessed; the presence, size, location and nature of exostoses; displacement of the sesamoid bones; the presence of dislocations and/or subluxations in various joints; deformation of the bones.

Further, a more thorough analysis of radiographs is required with the construction of angles and a numerical assessment of the relative position of the bones.

#### **Basic X-ray angulometric parameters of the forefoot**

Methodology for measuring the most significant indicators. Their reference values:

1. Angle of hallux valgus - formed by the axes of the first metatarsal bone and the proximal phalanx of the first toe. The normal value of this parameter is within  $8—16^\circ$ , it characterizes the degree of hallux valgus of the first toe.

2. The angle of varus deviation of the first metatarsal bone is formed by the axes of the first and second metatarsal bones. The physiological value of this indicator is  $5—8^\circ$ .

3. The angle of the interphalangeal hallux valgus of the first toe is determined by the axes of the proximal and distal phalanges of the first toe (the norm is  $—$ up to  $8^\circ$ ). It should be borne in mind that in cases of severe deformity against the background of rotation of the first toe, on the roentgenogram of the foot in the dorso-plantar projection, we see the finger in projection  $3/4$ , which does not allow adequately assessing the magnitude of the hallux valgus.

4. PASA (Proximal articular set angle) or DMAA (Distal metatarsal articular angle) — reflects the angle of inclination of the articular surface of the M1 head in relation to the M1 axis. The normal angle corresponds to 3—6°. Ignoring this indicator is the most common reason for the recurrence of deformity after surgery.

5. DASA (Distal articular set angle) — the angle between the axis of the proximal phalanx of the first toe and the perpendicular to the plane of the effective articular surface of the base of the same phalanx. Normally, it is 0-5°, characterizes the degree of deformation of the proximal phalanx and, accordingly, the very first toe.

6. The angle of inclination of the articular surface of the medial metatarsal joint (C1M1) — is the angle between the line of this joint and the perpendicular to the tangent of the medial edge of the medial sphenoid bone (C1). Its value normally varies from 0 to 20°.

7. The angle of the fifth metatarsal hallux valgus (M4M5) — is measured between the lines drawn through the axes of the fourth and fifth metatarsal bones. Normally, it is 6° — 8°.

8. The angle of varus deviation of the fifth toe is formed by the axes of the fifth metatarsal bone and the proximal phalanx of the fifth toe. The normal value of this parameter is in the range of 0 — 7°.

9. Angle of opening of the foot. The angle is measured between the axes of the first and fifth metatarsal bones.

#### **Parabola of Lelievre and parameters of Maestro**

In most cases, the metatarsal bones differ in length as follows: the second is the longest, the sizes of the third and fourth are almost the same, the fifth is the shortest. The relative position of the heads of the metatarsal bones in the horizontal plane form the so-called Lelievre's parabola. In accordance with Lelievre's theory, Maestro proposed a scheme for calculating the optimal length of the metatarsal bones from the dorsal-plantar radiograph of the forefoot. The main points to which the Maestro criteria are oriented are the two most fixed structures of the foot - the second metatarsal bone and the lateral sesamoid bone, which are stably fixed to each other. There are two important axes of the foot - the sagittal one, corresponding to the line connecting the center of the head M2 and the middle of the articular surface of the head of the talus, and the transverse, passing through the center of the lateral sesamoid bone and being perpendicular to the sagittal axis (SM4).

Normally, the transverse axis passes laterally through the center of the M4 head. In relation to this axis, the relative length of the metatarsal bones is calculated in each case individually, while the following indicators are analyzed:

- distance between SM4 and M4 (distance between the transverse axis of the foot and the center of the M4 head);
- the length of the heads of all metatarsal bones in relation to the transverse axis of the foot, which makes it possible to calculate the M1/M2 index (head length

M1/SM4 - head length M2/SM4) and three Maestro criteria (criterion 1 = head length M2/SM4 - length M3/SM4 heads, criterion 2 = M3/SM4 head length - M4/SM4 head length, criterion 3 = M4/SM4 head length - M5/SM4 head length);

Taking into account the data obtained, the parameters of the forefoot are distinguished, according to which four groups of foot morphotypes are classified:

- group 1: normal foot (line SM4 passes through the centers of the lateral sesamoid bone and the center of the M4 head; the difference in lengths M2-MZ-M4-M5 differs by a factor of 2-3.6.12 mm);
- group 2: long M2 and M3 (the SM4 line passes through the centers of the lateral sesamoid bone and the center of the M4 head, but the geometric progression is disturbed - excessive lengths of M2 and M3);
- group 3: hypoplasia M4 and M5 (SM4 line passes through the center of the lateral sesamoid bone, but distal to the center of the M4 head);
- group 4: other.

Other, unmeasurable X-ray findings mainly relate to the condition of bones and joints - arthrosis, dislocations, bone defects and deformities due to previous operations, osteoporosis, the presence of metal structures.

Thus, the choice of a patient's treatment method should be reasonable, based on anamnesis, the results of an objective examination and correspond to the real possibilities of the medical institution.

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放射碘疗法治疗甲状腺毒症远程结果的主要预测因子  
**THE MAIN PREDICTORS OF REMOTE RESULTS IN TREATMENT  
OF THYROTOXICOSIS BY RADIOIODOTHERAPY**

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**摘要。** 该研究包括96例中毒性甲状腺肿患者，其中57例被诊断为Graves病，39例以多结节性甲状腺肿为代表的甲状腺功能自主性。所有患者均接受<sup>131</sup>I治疗，然后对其进行动态观察。研究表明，在Graves病中，指定<sup>131</sup>I（400 MBq）的标准活性与甲状腺毒症复发的高风险（40.3%）有关。放射性碘治疗长期结果的主要预测因素是甲状腺疾病，以及在格雷夫斯病引起的自身免疫性甲状腺毒症中甲状腺刺激激素受体的抗体水平。

**关键字：**格雷夫斯病，多结节性甲状腺肿，甲状腺毒症，<sup>131</sup>I治疗，甲状腺刺激激素受体抗体。

**Abstract.** *The study included 96 patients with toxic goiter, among whom 57 were diagnosed with Graves' disease, and 39 – functional autonomy of the thyroid gland, represented by multinodular toxic goiter. All patients received <sup>131</sup>I therapy, after which they were observed dynamically. It was shown that the appointment of standard activity of <sup>131</sup>I (400 MBq) is associated with a high risk of thyrotoxicosis recurrence (40.3%) in Graves' disease. The main predictors of the long-term results of radioiodine therapy are thyroid volume and the level of the antibodies to the thyroid stimulating hormone receptor in thyrotoxicosis of autoimmune origin caused by Graves' disease.*

**Keywords:** *Graves' disease, multinodular toxic goiter, thyrotoxicosis, <sup>131</sup>I therapy, antibodies to the thyroid stimulating hormone receptor.*

Thyrotoxic forms of goiter, due to both diffuse toxic goiter and nodular forms, occupy a leading place in the structure of thyroid pathology. In young people, the main cause of thyrotoxicosis is diffuse toxic goiter of autoimmune origin, while in people over 60 years of age living in regions of iodine deficiency, the most common cause of thyrotoxicosis is the development of functional autonomy (FA) against the background of a long-term multinodular euthyroid goiter.

Currently, three main methods of treating thyrotoxicosis are used: pharmacotherapy (thyrostatic drugs), a surgical method, and radioactive iodine therapy. The main disadvantage of thyrostatic therapy is a rather high risk of developing thyrotoxicosis relapse after its cessation and, accordingly, a relatively low probability of persistent remission [1]. Surgical treatment due to the high cost and risk of complications (paresis of the recurrent nerve, hypoparathyroidism) is used less and less in the world. The most promising treatment for hyperthyroidism syndrome is radioiodine therapy (RIT) [4].

Purpose of the study – to evaluate the significance of some clinical and laboratory parameters as predictors of long-term results of  $^{131}\text{I}$  treatment and to optimize the RIT method for outpatient conditions.

### **Materials and methods**

The study included 96 patients with two main pathogenetic forms of toxic goiter: 57 patients with Graves' disease (GD), 39 patients with multinodular toxic goiter (MNTG). The average age of patients with GD was  $42 \pm 0.64$  years, patients with MNTG –  $59.89 \pm 0.72$  years; duration of thyrotoxicosis – 18 [10; 52] months.

When conducting RIT, an isotonic aqueous solution of sodium iodide taken per os was used. A fixed activity of  $^{131}\text{I}$  was assigned – 200 MBq, twice, with an interval of 2 months (total activity 400 MBq). In the absence of euthyroidism, upon reaching 6 months, a third course of RIT was performed.

Prior to RIT, all patients underwent drug euthyroidism and underwent standard research, including thyroid function (TR) function assessment: thyroid stimulating hormone (TSH), free thyroxine ( $\text{fT}_4$ ), antibodies to thyroid stimulating hormone receptor (AB r-TSH); assessment of TR size by ultrasound. A second study of these indicators was carried out 6 months after RIT.

Statistical analysis was performed using the STATISTICA 6.0 program and the application software package. The data obtained in the tables and in the text are presented as relative values – (%), as well as ( $M \pm m$ ), where M is arithmetic mean value, m is the standard error of the mean. The significance of differences was determined using Student's t-test for paired variables. Differences were considered significant at  $p < 0.05$ . To assess the relationships between the studied phenomena, we used a correlation analysis (the square method) with an assessment of the reliability of the obtained correlation coefficients.

### **Results and discussion**

Analyzing the outcome of treatment, it should be noted that the overall RIT efficiency indicator was 66.7%. In GD, positive results (hypothyroidism, euthyroidism) were observed in 59.7% of cases: hypothyroidism occurred in 27 patients (47.4%), euthyroid state was observed in 7 patients (12.3 %). The persistence of thyrotoxicosis after two courses of RIT was determined in 23 patients with GD (40.3%). The rather high frequency of the absence of the effect of RIT in GD can

be explained by the more severe course of thyrotoxicosis due to the autoimmune nature of this disease and the diffuse nature of the TR lesion [2,3].

In the group with MNTG, persistent euthyroid state was observed in 17 patients (43.6%), hypothyroidism was achieved in 13 patients (33.3%), i.e. favorable treatment outcomes with this pathogenetic variant of thyrotoxicosis were noted in 76.9%. In the group of patients with MNTG 6 months after RIT, thyrotoxicosis persisted only in 9 patients (23.1%).

The thyrotoxicosis persisting 6 months after RIT in some patients indicated insufficient <sup>131</sup>I activity and required re-administration of the radiopharmaceutical, resulting in a total <sup>131</sup>I activity of 600 MBq in this group. The overall treatment results are presented in table 1.

A clear link between the initial TR volume and the RIT results should be noted. According to our observations, a large volume of TR in GD was a risk factor for the recurrence of thyrotoxicosis after <sup>131</sup>I therapy, which is consistent with the literature [5,6]. In patients with favorable RIT outcomes (hypothyroidism and euthyroidism), the initial volume of TR was significantly lower than among patients in whom thyrotoxicosis continued ( $21.71 \pm 0.62 \text{ cm}_3$  and  $38.13 \pm 1.32 \text{ cm}_3$ , respectively) ( $p < 0.05$ ). A similar pattern was found for patients with MNTG.

The main marker of thyrotoxicosis of autoimmune genesis is an increase in the titer of p-TSH antibodies [1]. According to the results of the study, in the group of patients with favorable RIT outcomes (hypothyroidism and euthyroidism) ( $n = 34$ ), the p-TSH AB titer in 100% was within the reference values ( $< 11 \text{ U/L}$ ), which indicates immunological remission of GD and may be seen as a predictor of a favorable outcome for RIT. In the group of patients with relapse of thyrotoxicosis ( $n = 23$ ), in contrast, in 93% of cases, a significant increase in the titer of p-TSH AB was detected ( $> 11 \text{ U/L}$ ), which indicated the absence of immunological remission and was a risk factor for the relapse of thyrotoxicosis after RIT.

**Table 1.** RIT results by a two-stage course depending on the genesis of thyrotoxicosis after 6 months

Disease	Number of patients	Hypothyroidism		Euthyroidism		Relapse		Overall performance indicator
		Abs.	%	Abs.	%	Abs.	%	%
GD	57	27	47,4	7	12,3*	23	40,3	59,7
MNTG	39	13	33,3	17	43,6*	9	23,1	76,9
Total	96	40	41,7	24	25,0	32	33,3	66,7

Note: significance of differences in outcomes in two pathogenetic variants - \* $p < 0,05$

During the study, a correlation analysis was performed between the initial volume of TR and the level of TSH 6 months after RIT, which established the presence of a reliable correlation negative weak link  $r = -0.36$  ( $p < 0.05$ ). In addition, a correlation analysis was performed between indicators of thyroid status (TSH level 6 months after RIT) and a titer AT of p-TSH in the group of patients with GD, which established the presence of a reliable negative mean connection  $r = -0.64$  ( $p < 0, 05$ ).

Thus, the absence of immunological remission was a risk factor for the development of thyrotoxicosis recurrence during RIT in the group of patients with GD. The results of the study suggest that the increase in the level of p-TSH AB is an independent marker of long-term RIT results.

### Conclusions

The autoimmune variant of thyrotoxicosis due to Graves' disease requires the appointment of higher  $^{131}\text{I}$  activities in comparison with functional autonomy against the background of MNTG.

The main predictors of long-term RIT results are the TR volume for both thyrotoxicosis variants and the level of antibodies to the thyroid stimulating hormone receptor in thyrotoxicosis of autoimmune origin caused by Graves' disease.

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牙科手术后老年患者术后早期使用止痛药的效果评估  
**EVALUATION OF THE EFFECTIVENESS OF THE USE OF PAIN  
MEDICATIONS IN THE EARLY POSTOPERATIVE PERIOD, IN  
ELDERLY PATIENTS AFTER DENTAL SURGERY**

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抽象。一项针对32位老年和老年患者使用Ketorol-express和布洛芬的药物的疗效比较研究的结果，这些患者接受了手术干预以在下颌完全没有牙齿的情况下增加口腔前庭的深度颌骨被提出。

目的。在完全没有牙齿的前庭整形手术后，对老年和老年患者术后早期使用Ketorol-express (Dr. Reddis) 的疗效和安全性进行评估。

方法。在一项对36名老年和老年患者术后早期的比较研究中，评估了疼痛强度水平。

结果和结论。该研究结果使我们得出结论，在手术后的疼痛期开始时以分散形式使用酮咯酸表达可显著降低初始手术疼痛的严重性，安全且无效，不会对手术造成负面影响老年人和老年患者的总体躯体状态。

关键词：速效角蛋白表达，前庭整形术，术后麻醉，老年和老年

**Abstract.** *The results of a comparative study of the effectiveness of the use of the drug Ketorol-express and ibuprofen in 32 elderly and senile patients who underwent surgical interventions for increasing the depth of the vestibule of the oral cavity in the complete absence of teeth in the lower jaw are presented.*

**Purpose.** *Evaluation of the efficacy and safety of the use of Ketorol-express (Dr. Reddis) in the early postoperative period in elderly and senile patients after vestibuloplasty operations in the complete absence of teeth.*

**Methods.** *In a comparative study of the early postoperative period in 36 elderly and senile patients, the level of pain intensity was assessed.*

**Results and Conclusions.** *The results of the study allow us to conclude that the use of ketorol-express in a dispersible form at the beginning of the painful period after surgery can significantly reduce the severity of the initial surgical pain, is safe and ineffective, does not negatively affect the general somatic state of elderly and senile patients.*

**Keywords:** *ketorol-express, vestibuloplasty, postoperative anesthesia, elderly and senile age*

According to Rosstat, with reference to the British edition of The Spectator Index, in 2019, 14% of Russians who crossed the age threshold of 65 years old were registered in Russia, who suffer from not only somatic, but also dental health [1].

The complete absence of teeth significantly reduces the quality of human life and directly affects a huge range of his life, causing disorders, up to the loss of chewing, which affects the process of digestion, and is also often the cause of exacerbation of somatic diseases.

Special preparation of the prosthetic bed is essential for ensuring a long-term positive prognosis of orthopedic treatment for this category of patients.

Often, orthopedic surgeons, taking into account the age of patients and their somatic diseases, try to minimize the volume of surgical interventions. However, there are clinical situations when, in order to obtain a positive prosthetic result, it is impossible to do without surgical reconstructive interventions.

The postoperative period, from the patient's point of view, is characterized by the intensity of pain, swelling of soft tissues, and from the objective side - the severity of metabolic, hormonal, respiratory and other disorders. Pain syndrome that cannot be eliminated means not only physical and emotional suffering, but also serious disorders of homeostasis [2,3].

The objectives of anesthesia after surgery are mainly to reduce the suffering caused by pain, improve the quality of life of patients after surgery, reduce the incidence of complications after surgery and accelerate postoperative functional activity. One of the most important roles in tissue inflammation is the mechanisms of peripheral and central sensitization, which necessitates the inclusion of non-steroidal anti-inflammatory drugs in the treatment regimen for postoperative pain.

Today, the use of non-steroidal anti-inflammatory drugs, which play an important role in the correction of pain in the early postoperative period, is the gold standard.

**The purpose of the study** was an assessment of the efficacy and safety of the use of Ketorol-express (Dr. Reddy's) in the early postoperative period in elderly and senile patients after vestibuloplasty operations in the complete absence of teeth.

**Material and research methods.** This prospective, randomized study involved 32 patients aged 68 to 77 years, of which 19 were women and 13 were men. The inclusion criteria for the study were: patients with complete absence of teeth in the lower jaw with unfavorable clinical conditions of the prosthetic bed - type 2-3 edentulous jaw according to Oksman, who applied for repeated orthopedic treatment with full removable plate prostheses. The exclusion criteria for the on-

going clinical study were: the presence of severe concomitant somatic pathology in the stage of decompensation. Taking into account the elderly and senile age of the patients participating in the study, and the presence of somatic diseases in them, they were referred for consultation to their general practitioners and cardiologists. Conclusions were obtained from all patients allowing surgical intervention in the oral cavity. The surgical stage of treatment was carried out after the signing of a voluntary informed consent before surgery from each patient.

The patients were divided into 2 groups: the main group, which included 16 patients, and the comparison group, consisting of 16 patients. All patients, regardless of the distribution into study groups, underwent surgical interventions for deepening the vestibule of the oral cavity using open techniques. Control over the condition of patients was carried out by clinical observation on the 2nd, 5th and 10th days. The main criterion for assessing the intensity of pain in the area of the postoperative wound was the use of a verbal descriptive pain scale (Gaston-Johanson F., Albert M., Fagan E et al., 1990). When using this method of assessing pain in a patient after the end of the local anesthesia (based on oral questioning), on the 2nd, 5th day, we found out if he was experiencing any pain right now. If there was no pain, then the patient's condition was assessed as 0 (zero) points. If pain was observed, then the question was asked: "Could you say that the pain intensified, or the pain is unimaginable, or is this the most severe pain you have experienced?" If the patient confirmed, 10 points were given. If the patient did not agree, then we further clarified: "Can you say that your pain is weak, medium/moderate, tolerable/mild, strong/sharp or very strong/unbearable." Based on these answers, 6 options for assessing pain are possible: 0 - no pain, 2 - mild, 4 - moderate, 6 - strong, 8 - very strong, 10 - unbearable. Evaluation of the effectiveness of treatment was carried out on the basis of the time of relief of pain syndrome, as well as the presence of side effects from taking drugs. Baseline average pain intensity was measured 30 minutes after weakening of the anesthetic. Measurement of such general clinical parameters as blood pressure and heart rate was carried out before the start of surgery and 15-20 minutes after taking analgesics in the postoperative period.

### **Results of the study.**

In previous studies of postoperative pain, it was found that 1-2 hours after surgery, the maximum intensity of pain syndrome was recorded. In connection with these data, the patients of the main group received the first administration of the dispersed form of the drug Ketorol-express at a dosage of 10 mg (1 tablet) immediately after surgery against the background of weakening of the anesthetic. I would like to note that the general condition of the patients of the main group did not suffer in the postoperative period, the patients did not notice an increase in the intensity of the pain syndrome during this period, and there was no exacerbation of somatic background diseases. The meal took place as usual. The effectiveness of

analgesia was determined subjectively on a 10-point scale. The study showed that the effectiveness of pain relief in patients who used the dispersible form of Ketorol-Express after surgical dental interventions, in 100% of cases, was assessed by them as "good" and "adequate". Patients in the comparison group - 64%, who took Ibuprofen as a pain-reducing drug, on the basis of an oral survey indicated persistence of moderate pain (4 points on the VAS scale) during the first 2 days after surgery and in 36% of patients in this group pain of mild intensity persisted within 3 days after surgery.

Clinical evaluation of the early postoperative period showed that on the 2nd day after the operation, both the main and the comparison group had moderately pronounced edema of the surrounding soft tissues; an increase in body temperature in both groups was not recorded. On the 5th and, respectively, 14th days after the operation, no edema of the surrounding soft tissues and an increase in body temperature were detected.

Before surgery, when measuring such parameters as blood pressure and heart rate, there were no significant differences in both groups. In the postoperative period, while taking Ketorol-express in the main group, no changes were recorded in the dynamics of an increase in blood pressure and an increase in heart rate. In the comparison group, 3 patients showed an increase in blood pressure against the background of a weakening of the effect of the anesthetic.

**Conclusion.** The results of the study allow us to conclude that the use of the dispersible form of Ketorol-express at the beginning of the onset of the painful period after surgery can significantly reduce the severity of initial operative pain, it is safe and does not negatively affect the general somatic state of elderly and senile patients. Thus, we can recommend Ketorol-express (Dr. Reddis) as the first choice drug for the prevention of postoperative pain.

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阳离子两亲物与环丙沙星的抗菌活性  
**ANTIBACTERIAL ACTIVITY OF CATIONIC AMPHIPHIL  
CONJUGATES WITH CIPROFLOXACIN**

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**抽象。** 本文致力于基于1, 4-二氮杂双环[2.2.2]辛烷与环丙沙星的季盐对革兰氏阴性和革兰氏阳性微生物的阳离子两亲物的体外和体内抗菌活性的合成和初步评估。在体外对革兰氏阴性病原体表现出高抗菌活性，对金黄色葡萄球菌中等，对粪肠球菌低。体内对金黄色葡萄球菌和铜绿假单胞菌的活性与环丙沙星相当 (*S. Aureus*) 或更高 (*P. Aeruginosa*)。获得的结果表明了基于抗生素与合成阳离子两亲物结合物的新型抗菌药物设计的前景。

**关键词：** 环丙沙星，阳离子两亲物，抗菌活性，金黄色葡萄球菌，铜绿假单胞菌，粪肠球菌。

**Abstract.** This article is devoted to the synthesis and primary evaluation of the antibacterial activity *in vitro* and *in vivo* of cationic amphiphiles based on quaternary salts of 1,4-diazabicyclo [2.2.2] octane with ciprofloxacin against gram-negative and gram-positive microorganisms. Shown high antibacterial activity *in vitro* against gram-negative pathogens, moderate against *Staphylococcus aureus* and low against *Enterococcus faecalis*. The *in vivo* activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa* was comparable (*S. Aureus*) or higher (*P. Aeruginosa*) that of ciprofloxacin. The results obtained indicate the prospects for the design of new antibacterial drugs based on conjugates of antibiotics with synthetic cationic amphiphiles.

**Keywords:** *ciprofloxacin, cationic amphiphiles, antibacterial activity, Staphylococcus aureus, Pseudomonas aeruginosa, Enterococcus faecalis.*

### **Introduction**

The widespread introduction of antibiotics into medical and veterinary practice leads to an increase in the number of infectious diseases caused by antibiotic-resistant bacteria throughout the world. In this regard, the problem arises of finding new effective both synthetic and natural antimicrobial agents, which is being pursued in various directions. In particular, low-molecular-weight cationic peptides (AMPs), which are, as a rule, natural amphiphiles, are being intensively studied [1]. The main obstacle to the use of AMPs in clinical practice is their high cost, sensitivity to the action of proteolytic enzymes, as well as the hemolytic effect inherent in many AMPs [2]. We have previously shown that synthetic amphiphilic polycationic compounds based on quaternary salts of 1,4-diazabicyclo [2.2.2] octane (DABCO) have a similar spectrum of biological activity (antibacterial, antiviral and antifungal) and can serve as a basis for the search for new antibacterial drugs, which are an alternative to modern antibiotics [3,4].

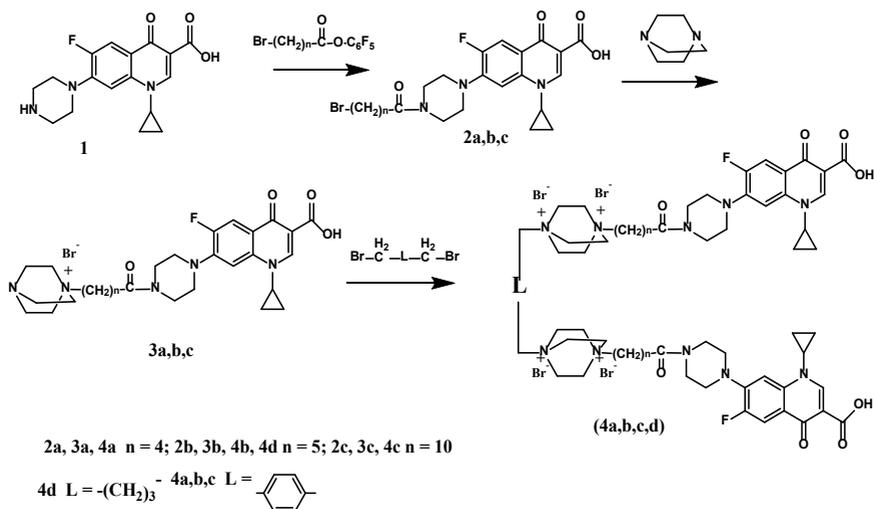
Several examples of modification of known antibiotics with fragments of cationic amphiphiles have been described in the literature. Thus, the work [5] describes the synthesis and antibacterial activity of amphiphils, the structure of which includes the antibiotic linezolid. The synthesis and antibacterial activity of a number of amphiphiles based on aminoglycazide antibiotics (neomycin, kanamycin, amiksin), in which the cationic part of the amphiphile is an integral part of the antibiotic, has been described [6-8].

In this work, we obtained hybrid structures including the widely used antibiotic ciprofloxacin and tetracationic DABCO derivatives, which previously showed a wide spectrum of antimicrobial activity [3,4], and also conducted primary studies of their antibacterial activity against gram-positive and gram-negative microorganisms *in vitro* and *in vivo*.

### **Chemical synthesis**

The general scheme for the synthesis of polycationic compounds based on DABCO conjugated with ciprofloxacin is shown in figure 1. We have previously shown that the antibacterial activity of tetracationic compounds based on DABCO depends on both the type of linker group connecting two diazabicyclooctane residues and the length of the alkyl residue [4, 5]. Antibacterial properties are most fully manifested when the length of the alkyl residues is 10-14 carbon atoms. In order to establish whether the antibiotic residue can act as a hydrophobic part of the cationic amphiphile, we synthesized compounds with an alkyl chain length of 4, 5, and 10 methylene fragments. To assess the effect of the linker group (L, fig. 1), compounds with flexible (4d) and rigid linker groups were synthesized.

The structures of all the obtained compounds were confirmed by NMR ( $^1\text{H}$ ,  $^{13}\text{C}$ ) and mass spectroscopy.



**Figure 1.** General scheme for the synthesis of polycationic compounds based on DABCO conjugated with ciprofloxacin.

### Determination of the minimum inhibitory and minimum bactericidal concentrations

To assess the antibacterial activity, strains of 2 gram-positive (*Staphylococcus aureus* ATCC 25923, *Enterococcus faecalis* ATCC 51299) and 5 gram-negative (*Pseudomonas aeruginosa* ATCC 9027, *Proteus mirabilis* ATCC 6380, *Citrobacter freundii* ATCC 8090, *Salmonella enterica* ATCC 14028, *Escherichia coli* ATCC 259220) microorganisms sensitive to ciprofloxacin were selected.

Determination of susceptibility to drugs was carried out by the method of serial dilutions in 96-well plates according to the recommendations of the European Committee for the determination of susceptibility to antimicrobial drugs [10]. The results are shown in table 1.

As can be seen from the presented data, the antibacterial activity was comparable to the antibacterial activity of the control antibiotic. In this case, the activity decreased with an increase in the length of the hydrophobic fragment connecting the polycationic part with ciprofloxacin. Earlier it was shown that the antibacterial activity has a bell-shaped character depending on the size of the hydrophobic fragment [4]. According to the literature, the optimal length of the alkyl chain is

12–14 carbon atoms, while compounds with an n-alkyl chain length of less than 4 or more than 18 carbon atoms are practically inactive [4, 10, 11]. The maximum activity, with the same structure of the linker group (compounds 4a-c), was observed with the smallest number of methylene units between ciprofloxacin and the polycationic part of the conjugate, which is probably due to the presence of a hydrophobic moiety in the antibiotic molecule. The noticeably lower activity against gram-negative microorganisms may also be due to the sub-optimal length of the hydrophobic fragment. Thus, when designing hybrid antibacterial drugs, it is necessary to take into account the hydrophobic properties of the antibiotic molecule.

Table 1.

Test connection		<i>S. aureus</i> 2,0×10 <sup>5</sup> CFU/ml	<i>E. faecalis</i> 7,0×10 <sup>5</sup> CFU/ml	<i>S. enterica</i> 2,0×10 <sup>5</sup> CFU/ml	<i>P. aeruginosa</i> 1,7×10 <sup>5</sup> CFU/ml	<i>C. freundii</i> 7,0×10 <sup>5</sup> CFU/ml	<i>E. coli</i> 1,0×10 <sup>5</sup> CFU/ml	<i>P. mirabilis</i> 2,0×10 <sup>5</sup> CFU/ml
4a	MIC	25	100	6.3	25	3.2	1.6	12.5
	MBC	12.5	>100	6.3	25	3.2	3.2	25
4b	MIC	12.5	100	6.3	25	6.3	3.2	12.5
	MBC	12.5	>100	3.2	50	6.3	3.2	12.5
4c	MIC	25	100	12.5	25	12.5	6.3	25
	MBC	25	>100	12.5	50	12.5	12.5	25
4d	MIC	6.3	25	1.6	6.3	0.8	0.4	0.8
	MBC	12.5	50	1.6	12.5	3.2	0.4	1.6
Cip	MIC	3.2	3.2	3.2	3.2	3.2	0.1	3.2
	MBC	3.2	3.2	3.2	3.2	3.2	0.1	3.2

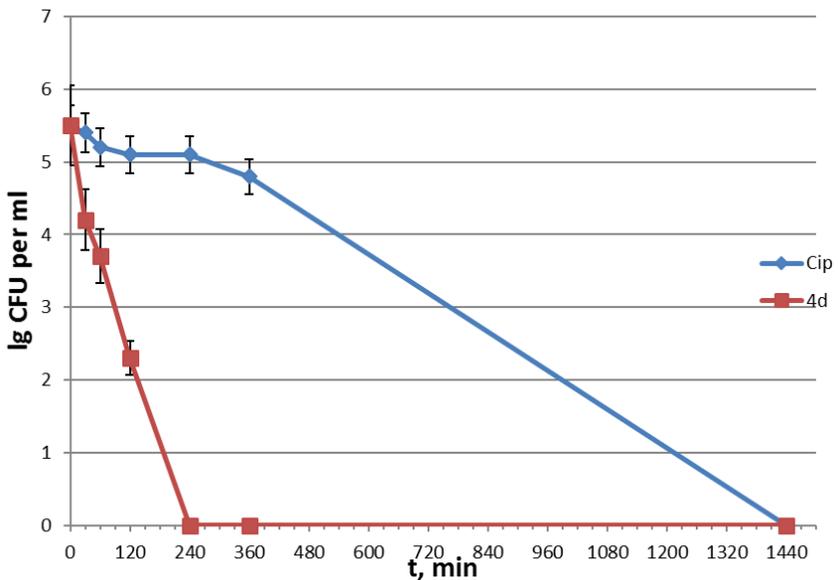
In [3], it was shown that polycationic amphiphiles based on DABCO containing linker groups L, similar to those used in this work, have the same antibacterial activity against both *Staphylococcus aureus* and against a representative of the natural human microflora - *Enterococcus faecalis*. We obtained similar results for ciprofloxacin. However, in the case of conjugates of cationic amphiphiles with an antibiotic containing a rigid linker group, a significantly lower activity is observed both against gram-positive and against all tested gram-negative microorganisms.

#### Kinetics of drug action in vitro.

For compound 4d, which showed the highest efficiency, the antibacterial activity was investigated depending on the time of exposure using the example of

suppression of *S. aureus* ATCC 25923, similar to [12]. The results are shown in figure 2.

As can be seen from the presented results, compound **4d** begins to show activity almost immediately after administration. After 4 hours, 100% death of microorganisms is observed. While in the case of ciprofloxacin, approximately 10% of bacteria die in 4 hours. Since cationic amphiphiles are capable of disrupting the cell membranes of microorganisms, it can be assumed that the significantly higher rate of death of *S. aureus* under the influence of compound **4d** may be due to the more rapid penetration of the conjugate into microorganisms. However, additional studies are required to unambiguously establish the mechanism of action of the conjugates.



**Figure 2.** Kinetics of growth inhibition of *S. aureus* by compound **4d** and ciprofloxacin.

### Investigation of the antimicrobial activity of compound **4d** *in vivo*

To assess the effectiveness of antibacterial compounds *in vivo*, white outbred mice (ICR), males and females weighing 20-25 g, 6 animals per group were used. The maintenance and handling of animals was regulated by standard operating procedures developed in accordance with the requirements of GOST R 33044-2014 (Principles of Good Laboratory Practice) and Guide for the care and use of laboratory animals, Eighth edition. The tests used healthy animals with a confirmed health status, certified equipment and validated measurement methods.

To create an experimental model of bacterial infection, two types of microorganisms were used: a strain of gram-positive bacteria *Staphylococcus aureus* (ATCC 25923) and a strain of gram-negative bacteria *Pseudomonas aeruginosa* (ATCC 9027), which were previously used in *in vitro* experiments. In preliminary experiments for these strains, a model of infection of mice with the emergence of a generalized reliably identifiable infection was developed.

After simulating a bacterial infection and administering drugs, the animals were observed for 5 days, weighed daily and their physical condition was assessed. Then the mice were sacrificed, the liver and spleen were removed, the microorganisms were inoculated onto an agar nutrient medium by the imprint method, the infection was assessed by the number of colonies and the composition of the bacterial lawn. A similar procedure was carried out in the dead mice.

Control groups: Group 0 - intact mice, group I - infected mice without drugs.

Compound **4d** and ciprofloxacin at concentrations of 2 mg/ml were administered to experimental animals once orally (through a catheter) at a dosage of 10  $\mu$ l per 1 g. the body of the mouse.

*Staphylococcus aureus* infection.

Under conditions of generalized infection (a single injection of *S. aureus* suspension with a titer of  $2.5 \times 10^{10}$  CFU/ml) in group I, all mice developed a generalized infection, leading to the death of 2/3 of the mice on the first day and to 100% death of the animals during the subsequent two days. With the introduction of compound 4d or a control antibiotic, mortality decreased by 2 times on the first day, 1/3 of mice from both groups were viable for three days, and after 5 days in groups III and IV, 2 mice survived and recovered (33.3%).

In the prints of all the dead mice, *S. aureus* was sown in a continuous lawn; in some individuals, an additional enterobacterial infection was additionally detected. In surviving mice, single colonies of staphylococcus were present in the prints.

The change in weight was not significant in all experimental groups.

*Pseudomonas aeruginosa* infection:

Under conditions of generalized infection (single injection of *Pseudomonas aeruginosa* suspension with a titer of  $3.2 \times 10^9$  CFU/ml), 100% lethality of animals in the control group was observed on the first day. When compound **4d** was administered to animals on the first day, 50% of the animals died, and 2 of them were active; after 5 days, 1 mouse survived and recovered (16.7%).

When using ciprofloxacin, two-thirds of the mice died during the first day, only one mouse with obvious signs of infection survived until the fourth day, after 5 days the lethality was 100%. In the organ prints of dead animals, *P. aeruginosa* was sown in a continuous lawn in 100% of cases. In the only surviving mouse from group III, no microorganisms were found in the spleen, and 3 colonies of the introduced pathogen grew in the liver print.

Weight loss in all experimental groups was approximately the same and insignificant due to the rapid death of the animals.

Thus, primary studies of the antibacterial activity of synthetic amphiphile conjugates based on quaternary salts of 1,4-diazabicyclo [2.2.2] octane with ciprofloxacin demonstrated the promising approach to the creation of new antibacterial drugs by combining two antibacterial compounds with different mechanisms of action in one structure.

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部门多样化, 目的是确定某种类型的游客空间系统中的对象列表  
**SECTORAL DIVERSIFICATION WITH THE PURPOSE OF  
DETERMINING THE LIST OF OBJECTS IN THE SYSTEM OF A  
CERTAIN TYPE OF TOURIST SPACE**

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抽象。 为了克服旅游和休闲自然管理的社会生态矛盾, 有必要改善旅游服务的空间结构。 为此, 建议创建专门的休闲区, 其主要任务是将无组织的旅游业从传统休闲区转移出去, 并将新资源用于旅游服务的生产。 结果, 形成了有利的游客流量激励结构, 同时消除了NP之外的部分娱乐负荷, 使游客群体绕开了宝贵而独特的自然景观, 并防止了过多的人为因素在SPNA上加载。

关键字: 专用休闲区, 多样化, 优先事项, 自然核心, 路线类型, 自然保护网络。

***Abstract.** To overcome the socio-ecological contradictions of tourist and recreational nature management, it is necessary to improve the spatial structure of tourist services. For this purpose, it is proposed to create specialized recreational zones, the main task of which is to divert unorganized tourism from traditional recreation areas and to involve new resources in the production of tourist services. As a result, the formation of a favorable motivational structure of the tourist flow, at the same time, the removal of part of the recreational load outside the NP, the conduct of tourist groups bypassing valuable and unique natural complexes and the prevention of excessive anthropogenic load on the SPNA.*

***Keywords:** Specialized recreational areas, diversification, priorities, natural core, route types, nature conservation network.*

To overcome the socio-ecological contradictions of tourist nature management in order to develop organized ecological tourism, it is necessary to improve the spatial structure of tourist services in specially protected natural areas (SPNA) by means of analyzing the resource bases of national parks (NP), as having the most complete territorial complex resource diversity. [3; 4]

For this purpose, it is proposed to create specialized recreational zones, the main task of which is to divert unorganized tourism from traditional recreation sites and to involve new resources in the production of tourist services. [2]

At the same time, the capacity of the newly created routes should balance the contradiction between the volume of organized demand and supply. [1; 12] The situation is such that to meet the existing demand it is necessary to develop a very large number of routes.

As shown by the study carried out in the Naroch NP, for example, 36 new routes are required (tab. 1). This is a significant reserve for managing tourist flows, in particular, in order to reduce the load on the coastal zone of the lake Naroch. At the same time, the routes will help guide tourist groups bypassing valuable and unique natural complexes, as well as transfer part of the recreational load outside the NP.

However, the creation, in particular, of the Naroch system of trails and routes corresponding to tourist demand is hardly possible in NP conditions. [8]

On the one hand, a dense network of routes will contradict the nature protection functions of NP, and on the other, its creation is fully constrained by the psychocomfortable capacity of the natural tourist complex (NTC), since the terrain for the construction of routes of diverse routes that would start in places of concentration of organized vacationers, in Naroch NP are limited. [2] In this situation, it is of paramount importance to distract the tourist flow from the park to alternative territories (for example, in the NP "Braslav Lakes") by creating looped routes.

**Table 1.**

*NP's need for additional tourist and excursion routes.*

Types of routes	National parks		
	Narochansky	Braslav lakes	Bialowieza Forest
Ecological trail			
- two hour	6	9	5
Hiking			
- seven day	1	3	1
- five day	2	2	3
- three day	3	4	5
- two day	3	6	6
Water hiking			
- five day	3	3	1
- three day	5	7	3
- two day	3	9	2

Cycling			
- three day	2	4	1
- two day	3	6	4
- one day	4	7	7
- two hour	1	5	11
Total	36	65	49

Assessment based on data on the unmet demand of organized tourists, through statistical studies. [6]

Thus, on the one hand, the analysis of the ratio of supply and demand for services of tourist and excursion routes for both organized and unorganized tourists makes it possible to determine a number of measures for organizing their specialized services, and on the other hand, it indicates the need to create alternative recreation sites (landscape tourist parks), where a network of tourist routes would be developed, since the natural resources of the NP to meet the existing demand are limited. [5;12]

**Table 2.**

*Demand from unorganized tourists for the services of tourist routes and tourist camps, thousand people - hours in the summer season*

Types of routes	National parks		
	Narochansky	Braslav lakes	Bialowieza Forest
Sports and tourist	345	219	98
Sightseeing	693	512	820
Eco-cognitive	468	346	412
Camps and bivouacs	1901	2182	-

Assessment based on statistical data on the size of the unorganized tourist flow and the results of a survey of unorganized tourists in NP. [6]

The formed recreational areas include lands of intensive recreational use (occupied by year-round and seasonal medical and recreational and tourist institutions) and related recreational use (recreational areas: beaches, forests, parks, glades, forest edges), where the bulk of tourists are concentrated. Territories of this type are located in plots on the northwestern, southwestern and southeastern coast of Naroch and on the northern coast of Rudakovo (tab. 3). These places of concentration of organized tourists are currently the nuclei of the recreational zone. With the help of functional zoning, their impact on natural complexes and recreational

areas cannot be limited. [7] Here is the field of activity of specialists in landscape architecture, whose task is to increase the sustainability of recreational areas. [9] These cores are adjoined by lands of episodic recreational development by amateur tourists: the NP Narochanskiy autocamp (south-western coast of Naroch) and a tent camp near the village of Antonisberg. These recreational areas do not have permanent structures and exist thanks to steady recreational flows to the places of permitted camp sites. By identifying alternative recreational sites, it is possible to reorient the amateur tourist flow and eliminate these dangerous recreational facilities. [10] Therefore, it is advisable to designate a recreational zone near the village of Zanaroch in order to transfer the Narochanskiy autocamping and exclude the coastal area near the village of Antonisberg from recreational use. In order to reorient the flow of unorganized tourists, it is necessary to allocate additional recreational zones that would be able to intercept it, distribute the recreational load more evenly across the park, and would allow more full use of the NP recreational potential. [6] These territories belong to the category of promising ones, among which the following varieties are distinguished by specialization:

- health mass recreation,
- fishing and sports and amateur trades (picking mushrooms, berries),
- sports and tourist routes,
- ecotourism.

The recreational zone of mass recreation is allocated for the creation of car campings, tent camps, yacht clubs. Taking into account the geography of tourist flows and the tasks of recreational zoning, the most promising are the creation of a campsite and a yacht club with a total capacity of 500 places near the village of Kochergi on the coast of Myastro, an autocamping for 200 places near the village of Shilovichi Batorino, an autocamping for 100 places near the village of Peregrad on the southern shore of Myadel.

**Table 3.**  
*Recreational areas of the NP "Narochansky" zone*

Site name	Attraction water body	Area, ha	Specialization
1. Established recreational areas			
1. c.s. Naroch	Naroch	178	Medical and health-improving stationary rest and mass use of recreational grounds
2. Borovoe	Naroch	23	Medical and health-improving stationary rest
3. Zubrenok	Naroch	50	Mass health-improving stationary rest

4. Pines	Naroch	39	Medical and health-improving stationary rest
5. Narochanka	Naroch	45	Mass health-improving stationary and unorganized rest
6. Rudakovo	Rudakovo	24	Mass health-improving stationary rest
7. Konstantinovo	-	26	Health-improving stationary rest
8. Shvakshty	V. Shvakshty	17	Health-improving rest, recreational fishing activities
2. Promising recreational areas			
9. Smolka	Svir, river Smolka	3	Mass health-improving unorganized rest
10. Peregrad	Myadel	3	Mass health-improving unorganized rest
11. Kochergi	Myastro	6	Mass health-improving unorganized rest
12. Shikovichi	Bathorino	12	Mass health-improving unorganized rest
13. Kochergi	Myastro	17	Agroecotourism

The territories of fishing and sports and amateur crafts are intended for the organization of camping lots and shelters for fishing tourists. For this purpose, the recreational zone includes the southwestern coast of Bolduk, the southeastern and eastern coasts of Velikiye Shvakshty.

The territories of the sports and tourist routes include trails and camping places for various types of hiking. Camping places are point objects located within the zone of regulated use on the shores of lakes: Myastro - 2 camping, Beloe - 5, Myadel -2, Svir -2, one each - Rossokhi, Volchino, Jlotviny, V. Shvakshty, Bolduk. In addition, it is recommended to organize camping one by one at Shemetovskie ponds, near the village of Malaya Syrmez and the village of Olyievo, as well as in the depths of the forest, halfway between the village of Shemetovo and the village of M. Syrmez. Such a network of camping sites is a system of nodal points to which various tourist routes (walking, water, cycling, horse), starting in the cores of intensive recreational use, should be linked. In addition, the camping sites can also be used by tourists vacationing in rural settlements (agro-ecotourists). One of the tasks of the network of tourist camps is to divert part of the recreational load from traditional recreation sites. [8] Therefore, it is not recommended to settle on the banks and in the coastal part of the Naroch.

Thus, the allocation of a recreational zone and its specialized areas in NP allows laying the foundations for the diversification of tourist services and territorially outline the main priorities for the development of tourist functions in order to further stimulate them. [11]

At present, it is advisable to supplement the SPNA system with new types - a landscape-tourist park and a recreational reserve (resort area), the main functions of which are the protection and rational use of natural recreational resources. [3]

After complementing the nature conservation network [3] with new types of SPNA, its spatial structure will significantly improve: the natural representativeness of protected areas and the ecological sustainability of the nature protection framework will increase; to a greater extent, the territorial proportions of natural and transformed landscapes will be fixed, especially in the areas of agroforestry landscapes (agricultural lands make up 35 - 45%), which is an important condition for the formation of a cultural landscape; In the field of the demographic potential of Belarus, a gradual increase in the areas of SPNA and a more uniform concentration of them in the direction from the centers of urbanization to the areas of the natural environment will be noted.

National parks, as nature conservation areas performing recreational functions, more than other SPNAs face a number of problematic situations arising from tourist nature management. To reveal problematic situations, it was proposed to analyze the socio-ecological contradictions of tourist nature management and divide them into three groups: recreational-ecological (between tourist activities and nature protection), social (between tourists and the local population) and utilitarian-ecological (between the activities of the local population and protection nature). [7]

Expanding the range of offered ecotourism services in accordance with the structure of modern demand, in this case, will help to reduce critical recreational loads and should become the leading area of activity of national parks in the field of tourism, with a strict ranking of anthropogenic load. [3].

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使用微藻处理哈萨克斯坦西部地区的生物废水  
**BIOLOGICAL WASTEWATER TREATMENT IN WEST  
KAZAKHSTAN REGION WITH THE USE OF MICROALGAE**

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抽象。 在对环境的人为影响不断增加的背景下，污染和自然水质恶化的问题是最紧迫的问题之一。 在现代工业废水处理厂中，不会进行完全的废水处理。 在过去的十年中，研究人员的注意力吸引了光养生物-蓝细菌，藻类和高等水生植物，这些植物由于光合作用而使氧气丰富了水生环境，从而加速了氧化过程和有机杂质的矿化。 我们研究了西哈萨克斯坦地区的水资源，调查了西哈萨克斯坦地区的水资源污染和废水中污染物的排放，提出了在废水处理中使用小球藻的方法，确定了在废水处理中使用小球藻的经济效率。

关键词：生态学，废水，净化，藻类，小球藻。

**Abstract.** *In the context of the constantly increasing anthropogenic impact on the environment, the problem of pollution and deterioration of the quality of natural waters is one of the most urgent. In modern industrial wastewater treatment plants, complete wastewater treatment does not occur. In the works of the last decade, the attention of researchers is attracted by phototrophic organisms - cyanobacteria, algae and higher aquatic plants, which, due to photosynthesis, enrich the aquatic environment with oxygen, thereby accelerating oxidative processes and mineralization of organic impurities. We studied the water resources of the West Kazakhstan region, investigated the pollution of water resources and discharges of pollutants with wastewater in the West Kazakhstan region, proposed the use of chlorella in wastewater treatment, determined the economic efficiency of using chlorella in wastewater treatment.*

**Keywords:** *ecology, waste water, purification, algae, chlorella.*

Water is the only mineral on land that occurs in liquid, solid and gaseous states and easily passes from one state to another. Due to the diversity of the relief of Kazakhstan, inland waters are also unevenly distributed. There are few lakes and rivers in the desert and semi-desert zones. The territory of Western Kazakhstan belongs to this area.

Under the conditions of the constantly increasing anthropogenic impact on the environment, the problem of pollution and deterioration of the quality of natural waters is one of the most urgent [1].

In modern industrial wastewater treatment plants, complete wastewater treatment does not occur. Data on the study of the chemical composition of wastewater showed that the concentrations of various toxicants exceed the maximum permissible.

In the works of the last decade, the attention of researchers is attracted by phototrophic organisms - cyanobacteria, algae and higher aquatic plants, which, due to photosynthesis, enrich the aquatic environment with oxygen, thereby accelerating oxidative processes and mineralization of organic impurities [2].

Purpose of the work: To study and recommend the use of chlorella as a biological wastewater treatment in the West Kazakhstan region.

The main waterways of the region are the Ural, Chagan, Derkul, Ilek rivers.

More than 80% of the population of the West Kazakhstan region lives in the basin of these rivers. Over the past decades, due to low water levels, the Ural River and its main tributaries, the Chagan and Derkul, have become heavily silted up, the water level near the settlements has dropped and does not provide the population's water needs.

The ecological problem of the Ural River basin is the preservation of its ecosystem by increasing water availability and improving the hydrological regime.

In connection with the intensive growth of development of microdistricts and outskirts of the city, the volumes of wastewater flow to the existing city waste water treatment plants (hereinafter referred to as WWTP) are increasing [3].

The state of pollution of surface waters in the river basin. Ural in 2019-2020 characterized by the following indicators given in table 1.

*Table 1. Ural River, the main waterway of the region*

Indicator, mg/l	MPC mg/l	Average annual concentration		2019		2020	
		2019	2020	min	max	min	max
BOD <sub>5</sub>	3.0	1.79	1.64	1.0	3.79	0.53	2.93
Phenols	0.001	0.0012	0.00103	0.001	0.0014	0.001	0.00135
Petroleum products	0.10	0.039	0.032	0.030	0.046	0.006	0.050
Ammonium saline	2.0	0.10	0.23	0.05	0.20	0.05	0.48
Nitrite	3.3	0.023	0.018	0.003	0.038	0.006	0.29
Chromium	0.05	0.036	0.034	0.01	0.06	0.010	0.055

Basically, the waters of small rivers are characterized by an increased content of salts, such as chlorides, sulfates, calcium, magnesium.

In general, in the region, the 6 largest water users discharge wastewater into the environment [4].

All enterprises that have a discharge have developed draft MPD standards, the observance of which is monitored during state and industrial control.

There are enterprises in the region that have wastewater treatment facilities with subsequent discharge onto the terrain, accumulators and filtration fields: KPO b.v., OJSC "Condensat", JSC "Zhaykteploenergo", UMG "Uralsk", CJSC "Intergas Central Asia". Table 2 shows data on the pollution of water resources, the volume of wastewater discharge [5, 6].

**Table 2.** Pollution of water resources, volume of wastewater discharge

Information on the actual volumes of discharges		During the reporting period, 2019	For the previous year, 2020
Industrial discharges	Water disposal volume, thous. m <sup>3</sup>	3446.869	3691,063
	Volume of pollutants, thous. tons	12.4	11,314
Domestic waste water	Water disposal volume, thous. m <sup>3</sup>	6567.066	7760,3
	Volume of pollutants, thous. tons	2.3	2,24
Emergency and unauthorized discharges	Water disposal volume, thous. m <sup>3</sup>	-	0,001
	Volume of pollutants, thous. tons	-	0,003
Discharges to surface water	Water disposal volume, thous. m <sup>3</sup>	7569.5	7638,551
	Volume of pollutants, thous. tons	0.831	0,851

There are two outlets of conditionally clean water in the Ural River: from the drinking water treatment station of "Batys Su Arnasy" LLP and from the cooling system of turbine № 2 PR-10/35 of the Ural CHPP.

There are three wastewater storage tanks, including two for the accumulation of wastewater from the city of Uralsk and one for wastewater from the city of Aksai.

Waste water from the city of Uralsk (domestic and industrial) is mechanically treated at sewage treatment facilities, natural biological treatment at artificial ponds and discharged into storage tank № 2.

According to operational data, it is known that in the region the volume of industrial discharges in 2020, compared to last year, slightly decreased (by 7%). The decrease in discharge volumes is associated with a decrease in the consumption of industrial water in the process of treating produced water, the absence of discharge of rain and melt wastewater from the uncontaminated areas of KPO b.v. on the terrain and an increase in secondary use, in accordance with the technological regulations.

The current purification of wastewater from heavy metals by chemical, physical, electrochemical methods is expensive and cumbersome, and a high degree of purification is not always ensured.

Wastewater treatment is based on bacterial activity. In this case, a necessary condition is the bubbling of activated sludge in aeration tanks with air, from which bacteria absorb oxygen for their vital activity, and emit carbon dioxide into the environment. The viciousness of this purification system lies in the colossal consumption of oxygen for bacterial processes of destruction of organic and mineral substances in wastewater.

Chlorella and other filamentous algae have a high bactericidal activity, reduce the content of unwanted saprophytes in water by tens, and sometimes hundreds of times, inhibit the development of dysentery bacillus, etc. Due to the high ability to mineralize organic matter in water, algae can be used as a biosorbent for wastewater treatment livestock farms, drainage and polluted surface waters, this is the conclusion made by scientists for the protection of nature [7].

Within a few days, the green microalga becomes the dominant microalga, saturating it with oxygen and removing excess carbon dioxide, organic and inorganic substances from it, and prevents the "bloom" of water. This destroys all pathogenic microflora. An increase in the level of dissolved oxygen in water promotes the oxidation of heavy metals [8].

The studies were carried out on the basis of the Biotechnology Research Center of the West Kazakhstan Innovation and Technological University, using a model of a pond in the form of a glass container (aquarium) with artificial round-the-clock lighting at room temperature, to which air was supplied by a compressor. The experiments were carried out on a simulated wastewater, which was prepared on the basis of tap water with the addition of various substances, such as ammonium chloride  $\text{NH}_4\text{Cl}$  (25 mg/l), sodium nitrite  $\text{NaNO}_2$  (20 mg/l), and calcium dihydrogen phosphate  $\text{CaH}_2\text{PO}_4$  (20 mg/l).

Chlorella was mixed with water in a ratio of 20-100 mg per liter. The duration of the experiment is 7 days. Analyzed on days 3, 5, 7. The cells were stirred 1-2 times a day using a stirrer.

Environmental technologies offer their own way of treating wastewater with different concentrations of pollutants using a specific strain of microalgae. This

is ecologically justified by the fact that algae consume carbon dioxide and emit oxygen for their life. *Chlorella* microalgae strain, which can be used for biological purification, additional purification and disinfection of all known categories of wastewater: household, chemical and pharmaceutical plant, galvanizing workshop, etc. In this case, a decrease in the concentration of polluting elements by more than 90% is achieved, and disinfection - approximately 100%.

With this strain, a high degree of chemical and complete bacteriological purification is achieved, regardless of the type and pathogenicity of microorganisms. The use of this strain does not require reorganization or capital construction of new treatment facilities.

Table 3 shows the indicators of the composition of the studied wastewater after the cultivation of the microalgae *chlorella* in them.

*Table 3. Results of analysis of waste water before and after cultivation*

Name	Concentration, mg/l	After cultivation, mg/l	Utilization rate, %
pH	6.5	7.6	-
Smell	4.0	none	100.0
Colour	brown	colorless	100.0
Phosphates	75	2.5	97.0
Ammonia nitrogen	75	7.0	90.0
COD	2500	80.0	96.0
Total bacteria count (mln./ml)	6.0	none	100.0

The results of the studies showed that the system of treatment facilities with green mass for 7 days leads to a significant improvement in water quality: a decrease in the concentration of nitrogen and phosphorus, suspended solids, oxidizability, BOD<sub>5</sub>, an increase in the content of dissolved oxygen, an increase in water transparency, normalization of sanitary conditions and the disappearance of unpleasant smell.

Wastewater treatment using microalgae is a way to create a cost-effective, continuous, waste-free, low-cost technology based on a consortium of new microalgae strains to solve production and economic problems of urban utilities, industrial and agricultural industries.

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牛白血病中PCR特异引物的选择和合成  
**SELECTION AND SYNTHESIS OF SPECIFIC PRIMERS FOR THE  
PERFORMANCE OF PCR IN BOVINE LEUKEMIA**

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抽象。 根据NCBI网站上国际数据库中病毒基因组的核苷酸序列或单个RNA片段的选择, 鉴定了牛白血病病毒的大量序列, 这些序列存储在基因库中, 并每天更新。 新数据。

使用各种计算机程序进行符合所需参数的引物设计, 其中主要是MUSCLE, UGENE V. 36.0, Primer-BLAST, Oligo Analyzer等。

然后根据设备随附的说明在Expedite 8909寡核苷酸合成仪上合成设计的引物。

作为实验的结果, 我们选择并合成了特定的合成寡核苷酸PCR\_POL\_1F和PCR\_POL\_1R, PCR\_POL\_2F和PCR\_POL\_2R, 用于在牛白血病中设置PCR。

关键词: RNA, 牛白血病病毒, 引物, 合成

**Abstract.** *Based on the selection of nucleotide sequences of the genome or individual RNA fragments of the virus from the international database at the NCBI website, a large number of sequences for the bovine leukemia virus were identified, which are stored in gene banks and are updated daily with new data.*

*The design of primers in compliance with the required parameters is carried out using various computer programs, the main of which are MUSCLE, UGENE V.36.0, Primer-BLAST, Oligo Analyzer and others.*

*The designed primers were then synthesized on an Expedite 8909 oligonucleotide synthesizer according to the instructions supplied with the device.*

*As a result of the experiments, we have selected and synthesized specific synthetic oligonucleotides PCR\_POL\_1F and PCR\_POL\_1R, PCR\_POL\_2F and PCR\_POL\_2R, for setting PCR in bovine leukemia.*

**Keywords:** *RNA, bovine leukemia virus, primer, synthesis*

Bovine leukemia is a chronic lymphoproliferative disease that is asymptomatic, and its manifestation is also possible in the form of lymphocytosis and malignant neoplasms in blood and other organs and tissues. Bovine leukemia virus infects cattle all over the world, and is one of the problems in the veterinary medicine of the Republic of Kazakhstan and firmly occupies one of the leading positions among infectious diseases [1].

The causative agent of the disease is an RNA containing virus of bovine leukemia, which belongs to the Retroviridae family. The structure, molecular composition and genome of the pathogen have been studied in sufficient detail by the authors [2]. The lipoprotein outer envelope of the virion is covered with glycoprotein peplomers, which hides the icosahedral nucleocapsid. The nucleocapsid contains two identical molecules of viral RNA, represented by the enzyme revertase and fragments of cellular RNA [3].

The length of the complete sequence of the bovine leukemia virus is 8714 bp. [4]. It should be noted that the ends of the integrated provirus of bovine leukemia, as in many retroviruses, are sequences called long terminal repeats (LTR). To date, 7 alternatively spliced RNAs have been identified, as well as 8 open reading frames, such as gag, prt, pol, env, tax, rex, RIII, GIV [5].

The pol gene is translated using a frame shift into a 145 kDa precursor protein. Pr145 contains peptides of the gag protease, thus representing the elongation product - PR66gag-pol [6]. The pol gene encodes a 89 kDa reverse transcriptase - RNA-dependent DNA polymerase. Also, this gene encodes a 32 kDa integrase. It should be noted that triphosphate analogs of nucleotides are inhibitors of the human immunodeficiency virus, so the reverse transcriptase of the bovine leukemia virus is not sensitive to them, and therefore has a higher specificity. In turn, the action of integrase is similar to that of endonuclease, which can cut double-stranded DNA at certain sequences, as well as attach to the ends of the proviral DNA and is responsible for the integration of the viral genome into the DNA of the host cell [7].

For PCR, it is important to choose a good primer, which can lead to the appearance of a nonspecific amplification product due to the formation of a "primer dimer". The primer dimer is a byproduct of amplification in the form of a double-stranded fragment arising from primer annealing followed by their extension [8, 9]. The specificity of the primer is extremely important. In the event that their specificity is insufficient, then most likely undesirable processes, such as the synthesis of nonspecific DNA, will occur in the test tube with the reaction mixture. When carrying out electrophoresis, nonspecific DNA is detected in the form of heavy or light additional bands, sometimes bruises, in the form of continuous smears in an agarose gel. Also, some primers and dNTPs can be spent on the synthesis of nonspecific DNA, which leads to a significant loss of sensitivity [10].

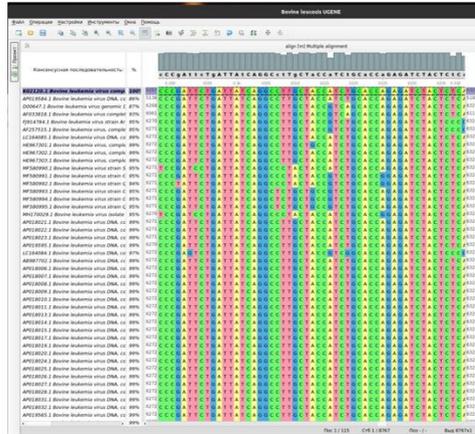
The purpose of this article is the selection of primers and the synthesis of spe-

cific oligonucleotides for working out the conditions for setting RT-PCR, used for the diagnosis of bovine leukemia.

**Materials and research methods.** The search for the nucleotide sequences of the complete genomes of the bovine leukemia virus was performed in the international database at the NCBI website. The alignment was performed using the MUSCLE program included in the UGENE v.36.0 software package. Specific oligonucleotide primers used for the detection of BLV by RT-PCR were selected using the Primer-BLAST program (<https://www.ncbi.nlm.nih.gov/tools/primer-blast/>). The check was carried out using the OligoAnalyzer program (<https://www.idtdna.com/calc/analyzer>). Computer-simulated primer sequences were further synthesized on an Expedite 8909 oligonucleotide synthesizer, Applied Biosystems. DNA synthesis was performed according to the protocols supplied with the device. The resulting oligonucleotides were eluted from the columns with concentrated ammonia solution and evaporated in a CentriVap Concentrator, LABCONCO vacuum evaporator. The primer precipitate was dissolved in TE buffer and reprecipitated with ethanol. The synthesized primers obtained in this way were used to test the RT-PCR setup.

**Research results.** As a result of the search for the nucleotide sequences of BLV, 119 complete genome sequences were obtained for different strains.

The next step was the alignment of the obtained sequences in order to determine the conserved regions suitable for the selection of primers. The alignment showed that the similarity between the complete BLV genomes is 86 to 99%. The alignment results are shown in figure 1.



**Figure 1.** Alignment of nucleotide sequences of complete BLV genomes using UGENE 36.0 software

For the selection of primers, regions encoding the pol gene were selected. Genome with GenBank ID: K02120 was used as a reference sequence. As a result, 10 pairs of primers were selected for the pol gene (table 1).

**Table 1 - Combinations of different primer pairs per BLV genome**

№	Direct primer	Reverse primer
1	TTCAGAGGGCGGAGAAACAC	TGAAGGCTTTCAGCAAACGC
2	CTGGAGCTACTCATGCCTCG	AGGGAAACTCCGAAGTCTG
3	GCCAGACCTTACCGCTATCC	ACTTGCGAAGAGGTTCTCTG
4	TGGCATAAGCTCACCCACTG	CGAGGCATGAGTAGCTCCAG
5	CAGCAGTTCGGAGTTTCCT	GTGTTTCTCCGCCCTCTGAA
6	TTGTGGCCCCAGATTTCCTC	ATTACAGGTTTCAGGCGGGG
7	TCAGACCCCTTGACTGACA	TCCTGTAGCCCCGTCCTAA
8	TTAGTGACGGGGCTACAGGA	GGTACGGGGTCAGGTTGAAG
9	ACAGTTCACCTACGCTCTGC	CTCCGAACTGCTGGCAAAC
10	CCCCGCCTGAACCTGTAAAT	GTCCAGGCAGAGATACGTG

In this case, a preliminary selection of the pool of primers was also carried out according to the main criteria for PCR. First of all, the length of the oligonucleotide should not exceed 22 nucleotides, had an acceptable percentage of GC - bases - 40-70%, the melting temperature and the predicted size of the PCR product being in the range of 150-400 bp. At the first stage, five pairs of primers for PCR development were selected from the pool of designed primers for further studies. figure 2 shows the sequences and characteristics of the matched primer pairs.

**Detailed primer reports**

Primer pair 1							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	TTGAGAGGGGAGGAACAC	Plus	20	4644	4663	59.97	3.00
Reverse primer	TGAAGGCTTTCACCAACGC	Minus	20	4619	4800	59.97	3.00
Product length	176						
Primer pair 2							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	TGGCATAAICTACCCACTG	Plus	20	4209	4229	60.04	4.00
Reverse primer	CGAGCGGTGATGAGCTCCAG	Minus	20	4275	4256	59.97	4.00
Product length	267						
Primer pair 3							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	GCCAGACTTACCCCTATCC	Plus	20	2529	2540	59.97	4.00
Reverse primer	ACTTGCGGAGAGGTTCTCT	Minus	20	2782	2743	59.99	6.00
Product length	234						
Primer pair 4							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	TTTGTGGCCGAGATTTCCTC	Plus	20	3205	3224	59.96	3.00
Reverse primer	ATTTCAGGTTGAGGGGGG	Minus	20	3783	3764	60.03	3.00
Product length	279						
Primer pair 5							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	TTAGTGACGGGACTACAGGA	Plus	20	3632	3651	59.96	3.00
Reverse primer	GGTACGGGGGTCAAGTTGAG	Minus	20	3863	3844	60.04	4.00
Product length	232						
Primer pair 6							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	GAGCATCTCTGCTGGGAC	Plus	20	4061	4060	59.99	4.00
Reverse primer	GGCTCCAGAGAGGCGTCAT	Minus	20	4325	4306	60.03	4.00
Product length	265						
Primer pair 7							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	CCCCGCTGAACCTGTAAT	Plus	20	2194	2183	60.03	5.00
Reverse primer	GTCCCGACGAGATACGTC	Minus	20	4080	4061	59.99	4.00
Product length	317						
Primer pair 8							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	GGACCAATGAGGGCTCTCT	Plus	20	4201	4220	60.04	3.00
Reverse primer	GGGTGATGTGTGATCTCC	Minus	20	4629	4620	60.11	4.00
Product length	329						
Primer pair 9							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	GTRGCCGAGATTCCTCTC	Plus	20	3507	3526	60.11	4.00
Reverse primer	GAAAGCAAGCTCCGAAACT	Minus	20	3847	3828	59.99	4.00
Product length	341						
Primer pair 10							
Sequence (5'→3')	Template strand	Length	Start	Stop	Tm	GC%	Self complementarity
Forward primer	GCGACCCMTTGCTCCCTG	Plus	20	3944	3963	60.11	4.00
Reverse primer	CGAGGCGTGGTGAAGTCT	Minus	20	4234	4215	60.04	3.00
Product length	291						

Figure 2. Sequences and characterization of matched primer pairs

In further work, the thermodynamic and structural characteristics of the selected oligonucleotides were checked. Primers should not form refractory hairpins, homo- and heterodimers. Primers should not have a  $\Delta G$  less than -6 kcal/mole. In the course of checking the primers we selected, primers with self-dimers  $\Delta G$  of -9.28 and -6.34 were found, such dimers can complicate the RT-PCR reaction, so we excluded them.

The next step was to check the specificity of the selected primers using the BLAST program; the primers should be 100% specific for the BLV genome. An example of such an analysis is shown in figure 3.

select all 100 sequences selected		GenBank	Graphics	Distance tree of res	
Description	Max Score	Query Cover	E value	Per. Ident	Accession
<input checked="" type="checkbox"/> Bovine leukemia virus BLV_BL3.1 proviral DNA_complete genome	40.1	100%	0.54	100.00%	gi18065002531_C436098.1
<input checked="" type="checkbox"/> Bovine leukemia virus BLV_BL2M3 proviral DNA_complete genome	40.1	100%	0.54	100.00%	gi18065002371_C433846.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3034	40.1	100%	0.54	100.00%	gi16101016931AP019568.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3032	40.1	100%	0.54	100.00%	gi16101016731AP019596.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3031	40.1	100%	0.54	100.00%	gi16101016651AP019595.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3030	40.1	100%	0.54	100.00%	gi16101016551AP019594.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3028	40.1	100%	0.54	100.00%	gi16101016351AP019592.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3027	40.1	100%	0.54	100.00%	gi16101016251AP019591.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3018	40.1	100%	0.54	100.00%	gi16101015371AP019582.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3015	40.1	100%	0.54	100.00%	gi16101015071AP019579.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3014	40.1	100%	0.54	100.00%	gi16101014971AP019578.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3011	40.1	100%	0.54	100.00%	gi16101014671AP019575.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3010	40.1	100%	0.54	100.00%	gi16101014571AP019574.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3009	40.1	100%	0.54	100.00%	gi16101014471AP019573.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3008	40.1	100%	0.54	100.00%	gi16101014371AP019572.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3007	40.1	100%	0.54	100.00%	gi16101014271AP019571.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvA3004	40.1	100%	0.54	100.00%	gi16101013971AP019568.1
<input checked="" type="checkbox"/> Bovine leukemia virus isolate 56F15_complete genome	40.1	100%	0.54	100.00%	gi14461096951MH170028.1
<input checked="" type="checkbox"/> Bovine leukemia virus strain QH2_complete genome	40.1	100%	0.54	100.00%	gi13364730781MF580995.1
<input checked="" type="checkbox"/> Bovine leukemia virus strain G53_complete genome	40.1	100%	0.54	100.00%	gi13364730771MF580994.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvAN015	40.1	100%	0.54	100.00%	gi11714445061AP018032.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvAN014	40.1	100%	0.54	100.00%	gi11714444941AP018031.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvAN013	40.1	100%	0.54	100.00%	gi11714444801AP018030.1
<input checked="" type="checkbox"/> Bovine leukemia virus DNA_complete sequence_strain: cvAN011	40.1	100%	0.54	100.00%	gi11714444631AP018029.1

Figure 3. Testing the specificity of primers using the BLAST program

The experiments on the selection of a pair of primers showed that the primers PCR\_POL\_1F and PCR\_POL\_1R, PCR\_POL\_2F and PCR\_POL\_2R turned out to be optimal, allowing the production of a PCR product with a size of 267 bp. and 340 bp., respectively.

Automatic synthesis of oligonucleotides was carried out using special devices - DNA synthesizers. Primer synthesis was carried out by stepwise completion of the nucleotide according to its nucleotide sequence.

**Conclusion.** Thus, as a result of the studies carried out, a search for the complete nucleotide sequences of the pol gene was carried out. Comparative analysis and multiple alignment of the complete nucleotide sequences of the gene were performed. And based on the analysis of the BLV gene sequences, using the OligoAnalyzer program, primers were selected for the specific detection of the virus. We also synthesized specific primers in the required amount on an oligonucleotide synthesizer, according to the manufacturer's protocols.

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液化气存储的结构和技术创新  
**STRUCTURAL AND TECHNOLOGICAL INNOVATIONS IN THE  
STORAGE OF LIQUEFIED GASES**

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抽象。目前，用于存储液化气（LG）的等温罐（IT）的最可靠，最安全的设计是具有悬浮式透气屋顶的地基绝热全密闭罐的设计。

第一个创新解决方案涉及IT设计。建议使用壁之间的中空空间作为应急和备用容量。在这种情况下，隔热层位于外箱的外表面上。壁之间的空间不断冷却，可占用储罐容积的37%，而壁之间最多增加2 m（对于IT，其直径与壁高之比等于1）。

第二个建议涉及LG的存储方法，归结为直接在罐中液化气体的蒸气相并保持低温存储模式，而不将罐外的蒸气除去以进行冷凝并使它们返回液相。该过程在闭环中进行。该过程涉及制冷气体机（RGM），蒸发器-冷凝器，低温泵和制冷剂-液氮，其温度低于产品的储存温度。在热交换过程中，气相LG冷凝，制冷剂蒸发，并且在气相状态下进入RGM，RGM在制冷剂中循环-气态氮，其温度低于氮气蒸气的温度输入它。此外，在机器机头中，氮气蒸气被冷凝并通过低温泵反馈到蒸发器-冷凝器。当储罐完全注满后，蒸发器-冷凝器将浸入产品中，并对其表面进行过冷，从而停止蒸发。当产品水平下降时，产生的蒸汽上升，并与安装在吊顶下的蒸发器-冷凝器接触，将在热交换管的表面冷凝，然后向下排放。

关键词：地基全密闭等温箱，壁之间的中空空间，应急箱，制冷和燃气机，等温箱内的液化天然气蒸气的冷凝，中间制冷剂，蒸发冷凝器，低温泵。

**Abstract.** *At present, the most reliable and safe design of an isothermal tank (IT) for storing liquefied gases (LG) is the design of a ground-based heat-insulated full containment tank with a suspended gas-permeable roof.*

*The first innovative solution concerns the IT design. It is proposed to use the hollow space between the walls as an emergency and reserve capacity. In this case, thermal insulation is located on the outer surface of the outer tank. The space between the walls is constantly chilled and can take up to 37% of the volume of the tank with an increase of up to 2 m between the walls (for IT with the ratio of the diameter to the height of the wall equal to 1).*

*The second proposal concerns the LG storage method and boils down to liquefying the vapor phase of the gas directly in the tank and maintaining a low-temperature storage mode without removing vapors outside the tank for condensation and returning them back in the liquid phase. The process is carried out in a closed loop. The process involves a refrigerating gas machine (RGM), an evaporator-condenser, a cryogenic pump and a refrigerant - liquid nitrogen, the temperature of which is lower than the storage temperature of the product. In the process of heat exchange, the vapor phase LG condenses, and the refrigerant evaporates and, in the state of the gas phase, enters the RGM, where its refrigerant circulates - gaseous helium, which has a temperature lower than the temperature of nitrogen vapor entering it. Further, in the machine head, nitrogen vapors are condensed and fed back to the evaporator-condenser by a cryogenic pump. When the tank is completely filled, the evaporator-condenser is immersed in the product and, supercooling its surface, stops its evaporation. When the product level drops, the generated steam rises and, in contact with the evaporator-condenser installed under the suspended roof, will condense on the surface of the heat exchange tubes and then drain downward.*

**Keywords:** *ground-based full containment isothermal tank, hollow space between the walls, emergency tank, refrigeration and gas machine, condensation of liquefied natural gas vapors inside the isothermal tank, intermediate refrigerant, evaporator-condenser, cryogenic pump.*

**Conclusions:** The implementation of the proposed structural and technological innovations will provide the isothermal tank building with economic efficiency, energy saving, as well as industrial and environmental safety of structures.

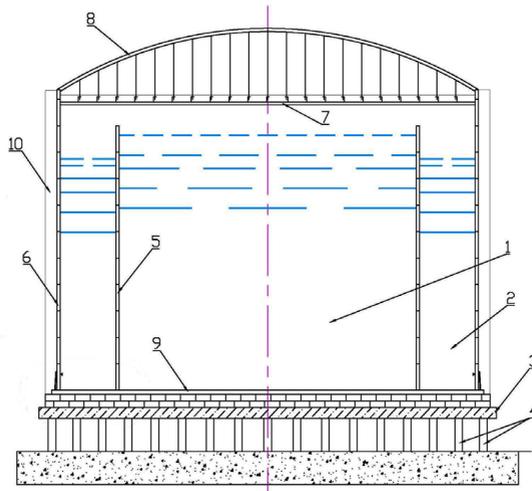
The storage of liquefied gases (LG) is an important part of the production, processing, consumption chain. The most effective storage method is isothermal at the boiling point of the stored product and a slight overpressure (close to atmospheric).

Currently, in the world and domestic practice of isothermal tank construction,

the most reliable and safe design is the construction of a ground-based insulated isothermal tank (IT) of complete containment with two all-metal shells and a suspended gas-permeable roof (up to 60,000 m<sup>3</sup>) or a combined structure with an inner metal shell with a suspended roof and prestressed reinforced concrete outer shell [1-3].

Technical solutions of LG storages as part of their liquefaction and processing plants, as well as individual storage terminals, may provide for the presence of backup IT in their structure. The storage tanks are operated without product in a refrigerated position, ready to receive storage products at any time. This requires considerable economic costs and additional storage space. The authors propose to use the cavity of the inter-wall space as a reserve IT, and to mount the heat-insulating structures on the outside of the tank. The proposal is patented [4].

The essence of the proposal is that the walls of the tank 5 and 6 are made of equal strength, and there is no thermal insulation in the inter-wall space 2, for the main (1) and emergency (2) tanks a single bottom 9 is used (fig. 1).



1 – main storage tank; 2 – interwall (reserve) space or emergency reservoir;  
 3 – reinforced concrete grillage; 4 – piles; 5 – inner wall of the main and emergency tanks; 6 – outer wall of the emergency tank; 7 – internal suspended roof of the device; 8 – external domed self-supporting roof of the device; 9 – common bottom of the device; 10 – external thermal insulation

**Figure 1** – Isothermal storage tank for liquefied gases

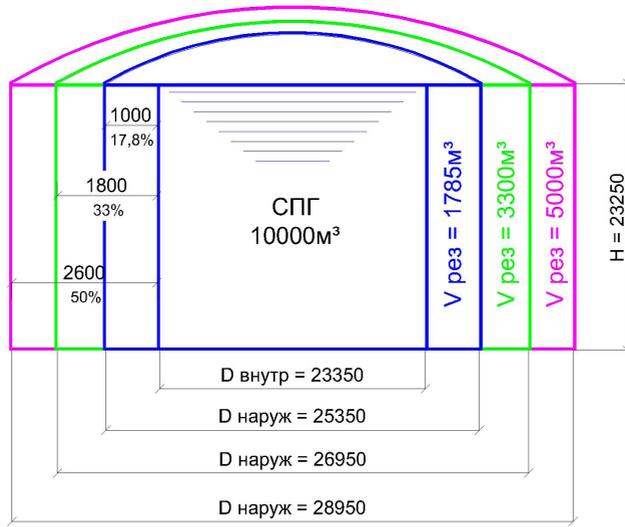
A single vapor-permeable heat-insulated suspended roof 7 above the inner tank and the inter-wall space serves to reduce the free space above the mirror of the product, while reducing its evaporation. Thus, the proposed design can perform two functions: to hold the contents of the main tank in the event of an emergency product leakage, thereby eliminating the costs associated with the development and organization of measures to promptly release IT from the product; at the same time, the inter-wall space 2 can serve as a reserve tank, which is able to receive the product from neighboring tanks in the event of an accident or when the volume of product shipment exceeds the volume of its receipt. In addition, the safety of IT operation is increased, as the volume of the gas space and the rise time of dangerous overpressure in the event of failure of the safety valves increase.

The design (see fig. 1) also allows, thanks to free access to the outer surface of the tank 1, to monitor in real time the actual technical condition of the external thermal insulation 10, as well as sensors and an acoustic emission monitoring system (if equipped with IT) installed at the points of the IT structure that are most dangerous from the point of view of pressure increase (the joints of the wall with the roof and bottom, anchors, as well as the points of insertion of technological nozzles).

A significant part of the economic benefit from the implementation of the proposed design is illustrated by the following simple calculations. Take, for example, an IT structure with an equal to one ratio of the inner diameter ( $D_{in}$ ) to the height ( $H$ ) equal to 1 (fig. 2).

Then, in a park consisting of six ITs, one of which serves as a reserve, it is sufficient to leave five ITs, provided that the width ( $h_{int}$ ) of the inter-wall space 2 (see fig. 1) is equal to 1 m (as is constructively accepted at the present time). And as applied to a terminal consisting of three main ITs, you can do without the fourth IT reservoir by increasing the  $h_{int}$  for the three remaining ITs to only 1.8 m (see fig. 2). Emergency release of one IT-10000 for LG storage will require 153 tanks (or 8 routes), which is associated with significant time costs, incompatible with the concept of emergency release.

Technological features of production, storage and shipment of LG may be associated with a change in the geometric parameters of the tanks, which affect the volume of reserve (emergency) storage. Table 1 shows the change in  $V_{int}$  absolute,  $m^3$ , and relative, %, values depending on the values of  $h_{int}$  and  $K$  for a tank of constant volume equal to 10000  $m^3$ .



$D_{ex}$  - outer diameter of IT, m

**Figure 2** – Change in the relative (%) and absolute ( $m^3$ ) volume of the inter-wall space  $V_{int}$  depending on its width for IT - 10000 with the ratio  $K = D_{ex}/H = 1$ .

**Table 1.** Change in the volume of the interwall space depending on its width for a constant volume 10000  $m^3$ :

$N_{vn}$  - number of IT with a reserve volume, replace the full number of IT in the fleet  $N_{total}$

$D_{in}/H=K$	29.6/14.5=2			26.6/18=1.48			23.35/23.35=1.0			21.7/27.1=0.8			19/35.3=0.54		
<b>D out, m</b>	31.6	34.2	36.3	28.6	30.7	32.6	25.35	26.9	28.6	23.7	25.0	26.6	21	21.9	23.3
<b>h int., m</b>	1.0	2.3	3.3	1.0	2.0	3.0	1.0	1.8	2.6	1.0	1.7	2.4	1.0	1.5	2.1
<b>V int., <math>m^3</math></b>	1393	3300	5000	1568	3300	5000	1785	3300	5000	1934	3300	5000	2217	3300	5000
<b>V reserve., %</b>	13.7	33	50	15.6	33	50	17.9	33	50	19.3	33	50	22.2	33	50
<b>Nec/ Ntotal</b>	6/7	3/4	2/3	6/7	3/4	2/3	5/6	3/4	2/3	4/5	3/4	2/3	4/5	3/4	2/3

Legend:

$H, m$  – height of IT;  $D_{in}, D_{out}$  - inner and outer diameters IT;  $h$  – inter-wall.,  $m$ - the size of the inter-wall space;  $V, m^3$  - volume of inter-wall space;  $V$  reservoir;

% - tank space capacity in%;  $Nec./Ntotal$ - number of IT with a reserve volume replacing the full number of IT in the park.

Achievement of the same value  $V_{int}$  with an increase in the ratio  $K$  to 2 increases the value of  $h_{int}$  by 1.2 ... 1.27 times, and a relative increase in the IT height to  $K = 0.54$  decreases  $h_{int}$  by 1.2 ... 1.24 times (see table 1). These data can be used to select the most optimal IT geometrical parameters that make up the storage terminal.

The next proposal also aims to improve the reliability and economy of LG storage by reducing energy losses. So, at present, LG storage systems use compressor and refrigeration units located next to IT. In such installations, condensation of LG vapors takes place, taken from the tank, with the subsequent supply of the liquid phase back to the IT.

The essence of the LG storage scheme proposed by the authors (fig. 3) is as follows:

Refrigeration and gas machine (RGM) 5 for generating cold, operating according to the reverse refrigeration Stirling cycle, located on the IT roof, is connected to a heat exchanger - an evaporator-condenser 4, fixed inside the tank to a suspended roof at the height of the upper level of the stored product, and a cryogenic liquid pump 6 circulates the refrigerant in the liquid phase when it is supplied to the evaporator-condenser, which is a system of hollow ribbed tubes (fig. 4).

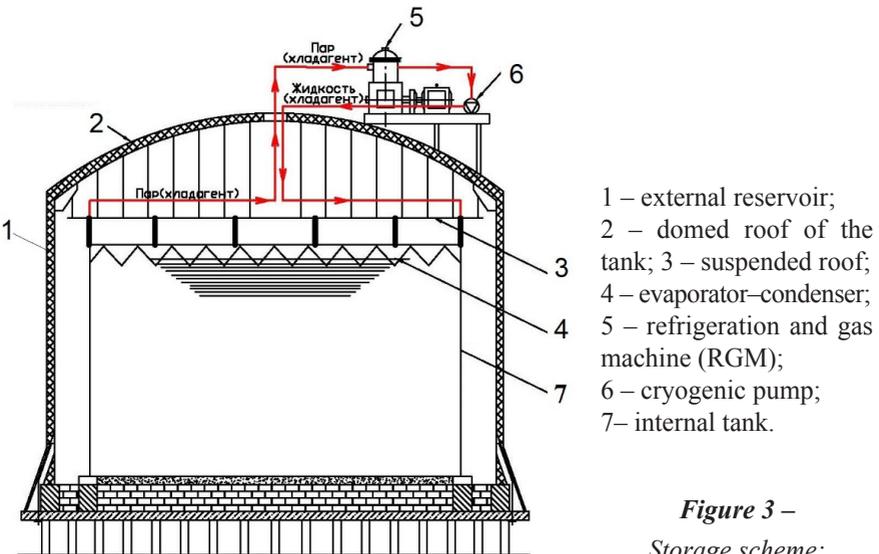
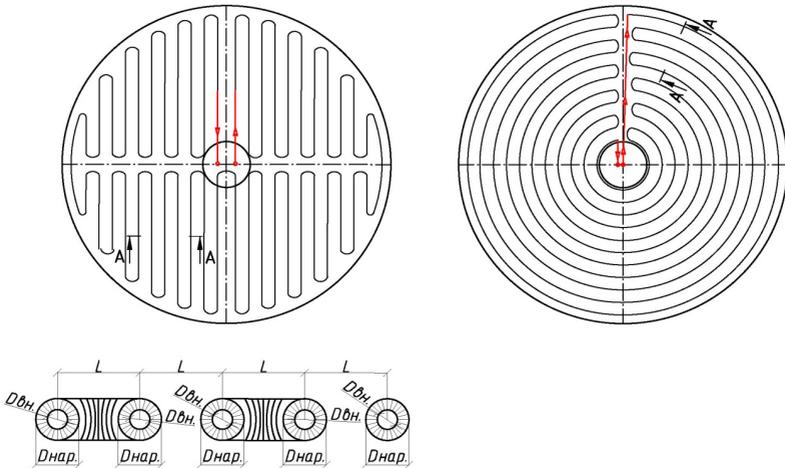


Figure 3 –  
Storage scheme:

A scheme of the design options for the evaporator - condenser is shown in fig. 4.



**Figure 4** – Diagram of design options for the evaporator – condenser 4 (see fig. 3)

The proposed device (see fig. 3 and 4) implements the condensation of LG vapors during liquefaction of the LG vapor phase directly in the tank by maintaining the required low-temperature storage mode of LG without the need to remove vapors outside the tank 1 for condensation in a third-party refrigeration unit and drain again in liquid phase into reservoir 7. This proposal received the Decision to issue a patent for the invention of a device for condensation of vapors of liquefied hydrocarbon gases in isothermal metal tanks [5]. For safety reasons, during the operation of tanks, both an increase in internal pressure relative to the regulated one and a decrease in pressure below atmospheric are not allowed.

As an example, consider the process of condensation of the vapor phase of liquefied natural gas (LNG) stored in a tank at a temperature of minus 163°C. The process is carried out in a closed loop. The evaporator-condenser 4 (see fig. 3 and 4) is supplied with liquid refrigerant by means of a cryogenic pump 6. Liquid nitrogen with a temperature of minus 196°C is used as a refrigerant. In the process of heat exchange, the vapor phase of LNG condenses due to the lower temperature of the refrigerant, on the surface of the evaporator-condenser, and the refrigerant during heat exchange evaporates and in the state of the vapor phase enters the RGM 5, where the vapor turns into a liquid, which is fed back to the cryogenic pump 6. evaporator-condenser 4 for cooling and condensing LNG vapors. In the RGM, operating on the reverse Stirling refrigeration cycle, its refrigerant circulates, which is used as gaseous helium filled into the machine, which has a temperature below the temperature of the nitrogen vapor entering it and during the heat exchange in

the machine head, nitrogen vapor condenses and turns into a liquid, constantly withdrawn by a cryogenic pump.

The proposed system allows to provide the process of condensation of LG vapors when the levels of the stored product in the tank 7 change. The intensity of vapor condensation will depend on the storage level of the product. When the level of the stored product drops down to the permissible lower limit, the resulting steam rises to the upper part of the tank 7 and, in contact with the evaporator-condenser 4 installed under the suspended roof 3, condenses on the surface of the heat exchange tubes. The resulting liquid phase in the form of drops flows down onto the surface of the stored liquid product. In storage mode, with the tank completely full, the evaporator-condenser will be immersed in the product, supercooling its surface. This will stop the evaporation of the product.

At the same time, the basic principle of heat and mass transfer must be observed: in the process of condensing LG vapors and maintaining the required low-temperature storage mode in IT, it is necessary to use cold from an intermediate refrigerant having a temperature below the temperature of the stored product.

In specific conditions, an RGM machine of appropriate cooling capacity and power should be used, using technical gases (air, nitrogen, helium) to obtain cold in it, reaching a temperature in a running machine below the dew point of the intermediate refrigerant vapor sent to the evaporator-condenser.

The proposed technology and device for condensing LG vapors directly in isothermal metal tanks has the following advantages in comparison with traditional methods of vapor condensation using compressor and refrigeration units located outside IT LG:

- there is no need for constant removal of LG vapors outside the tank for their condensation in an external refrigeration unit and supply again in the liquid phase to IT;
- the need for the construction of a compressor and refrigeration unit on the territory occupied by IT LG is completely eliminated;
- the cost and operating costs of the facility operating LG storage systems are reduced;
- the industrial and environmental safety of the LG storage system is increased.

The implementation of the above innovative technologies in one facility will provide the isothermal tank construction with an increase in economic efficiency in terms of energy conservation, use of the warehouse area, etc., as well as the industrial and environmental safety of facilities.

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预制整体建筑的安装技术

INSTALLATION TECHNOLOGY OF A PREFABRICATED ONE-PIECE BUILDING

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抽象。 在本文中，作者描述了组装工厂生产的单元素预制建筑物的技术。 安装是在预先准备好的基础上分阶段进行的。 预制的一件式玻璃建筑由用螺栓固定在一起的相同建筑元素组成。 鉴于恐怖行为，人为和自然灾害的威胁越来越大，应在各种设施上充分注意人们的安全和健康问题。 建筑物火灾仍然是最可怕的灾难，威胁着其中的人的生命。 消防安全措施是设施设计，建造和进一步运行的重要组成部分。

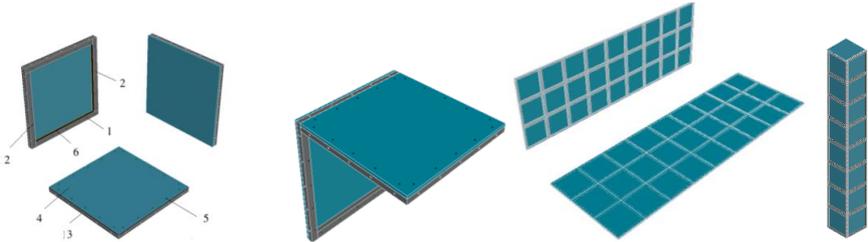
关键字：面板框架系统，大面板系统，体积块系统，大面板系统，框架整体系统，节能建筑，预制建筑物，高速安装，玻璃，金属结构，立面系统，封闭结构。

**Abstract.** *In this article, the author describes the technology of assembling a single-element prefabricated building of factory production. Installation is carried out in stages on a pre-prepared foundation. The prefabricated one-piece glass building consists of identical building elements that are bolted together. In view of the increased threat of terrorist acts, man-made and natural disasters, considerable attention should be paid to the issues of safety of life and health of people at various facilities. Fires in buildings remain the most dire calamities that threaten the lives of those in them. Fire safety measures are an important component in the design, construction and further operation of facilities.*

**Keywords:** *panel-frame system, large-panel system, volume-block system, large-panel system, frame-monolithic system, energy efficient construction, prefabricated buildings, high-speed installation, glass, metal structures, facade systems, enclosing structures.*

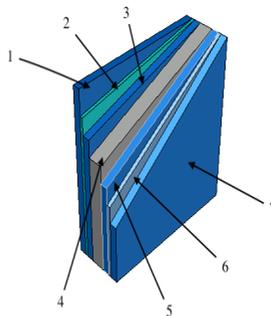
Figure 1 shows a general view of the main single-element element for the construction of buildings from different angles, the connection of two typical elements, finished walls, floors and columns from typical elements, a conceptual staircase from typical elements for a single-element flat building system of high-

speed installation, an example of a possible planning solution for a building based on a one-piece flat building system for high-speed assembly of multi-storey pre-fabricated buildings.



**Fig. 1** General view of the main element for the construction of buildings from different angles.

The glass component of the element is made using triplex technology, which is widely used all over the world. The element glass is supposed to be produced according to the multilayer formula: 9 mm glass + 1.5 mm film + 9 mm glass + 16 mm argon air gap + 9 mm glass + 5 mm fire pad + 9 mm glass. The total thickness is 5.85 cm. The outer layer is thermally reflective. The inner layer of the glass is tempered, which makes it possible to impart special strength to the glass, and in case of damage it minimizes the number of fragments. The choice of argon as the air gap is due to the fact that the thermal conductivity of this gas is 0.68 of air. The structure of the glass component of the element is shown in Fig. 2.



**Fig 2.** The structure of a glass unit. (1-glass 9 mm, 2-film 1.5 mm, 3-glass 9 mm, 4-krypton 16 mm, 5-glass 9 mm, 6-fire filler 5 mm, 7-glass 9 mm).

Characteristics of the experimental object:

- The building is five-storey, two-spanned from typical factory elements.
- Building length - 36 m.
- The width of the building is 18 m.
- Span width - 9 m.

Taking into account the maximum weight of the system element equal to 3.9 tons, the reachstacker model Kalmar DRF 100-54S6 with a maximum lifting capacity of 8 tons was chosen. The maximum possible height of the construction of buildings according to the proposed system is 17 meters, taking into account the height of one floor of 3 meters, it is possible to erect five-storey buildings. The lifting height of the reachstacker Kalmar DRF 100-54S6 is 18.7 meters.

Figure 3 shows a general top view of a conceptual building measuring 36 meters by 18 meters.

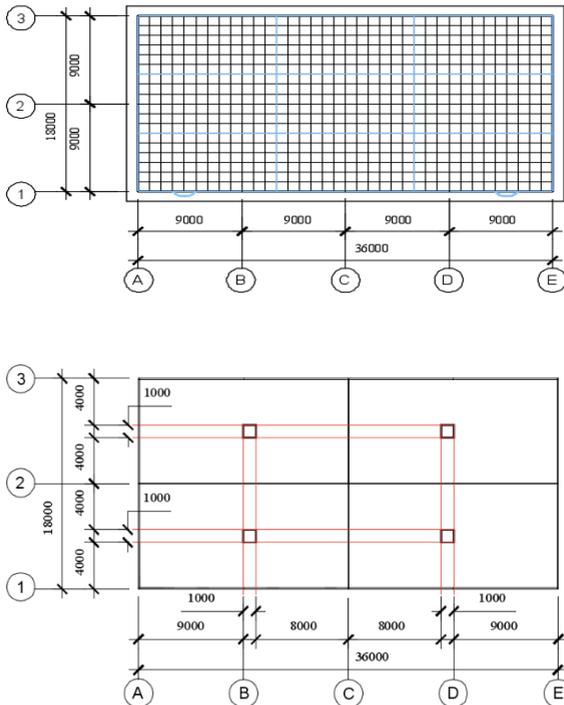
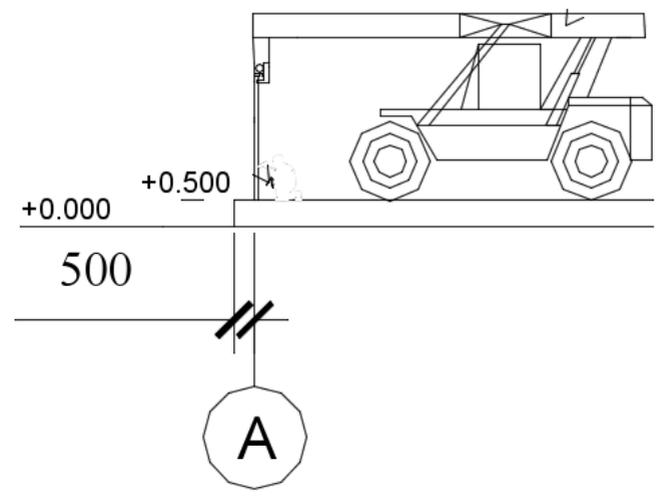


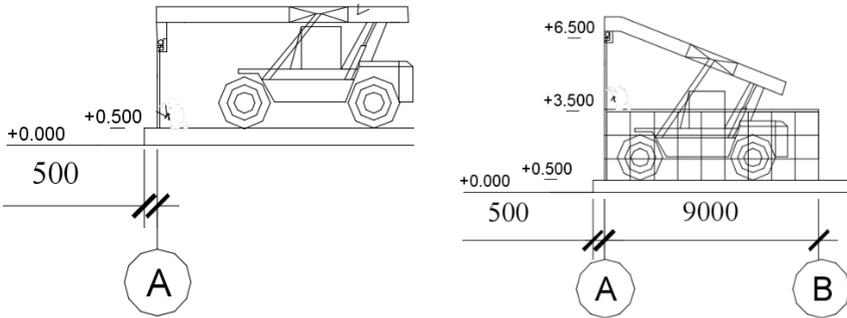
Fig. 3. General top view of a conceptual building measuring 36 by 18 meters.

In fig. 4 shows a flow diagram of the installation of a single-element construction system using a reachstacker.



*Fig. 4. Schematic diagram of installation of SSK-1 using telescopic lifts*

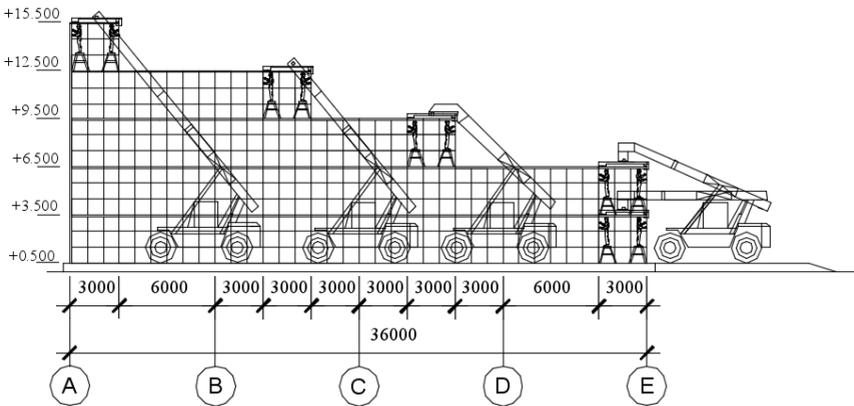
At the first stage, the extreme and middle walls of the first section of the building are mounted on a pre-prepared foundation slab by floor. Installation of extreme and middle walls is shown in Fig. 4. The walls are installed in the design position using reachstackers, then using high-strength bolts, the installers fix the elements to the foundation slab. After the installation of high-strength bolts, the joints of the elements are sealed in order to reduce the thermal conductivity of the structure. Installation of the middle walls of the first floor of the building is carried out in a similar way. The walls of the first section form a U-shape.



**Fig. 5.** Installation of the walls of the building on the first and second floors

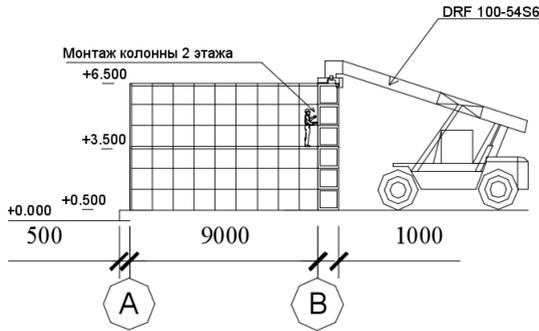
At the second stage, the floor slabs are installed. Installation of floors is shown in Fig. 5. The overlap is set to the design position using a reachstacker. Installers fix the floor to the load-bearing walls using high-strength bolts. The installers work on building scaffolds located at a height of 1.6 m. After fixing the floor, the seams are filled in to reduce the thermal conductivity of the structure.

The assembly of the prefabricated building is carried out continuously and mechanically, namely, the preliminary assembly of the building modules is carried out using a telescopic lift. Installation of elements of subsequent floors is carried out in a similar way.



**Fig. 6.** Installation of slabs using telescopic lifts

After assembling the elements of the first section, the columns of the first floor, located in the second section, are installed. Installation of the first column element in the design position is carried out using a reachstacker. The installers secure the column to the prepared foundation using high-strength bolts. After securing the column, the engineering networks are laid inside the column, followed by the sealing of the seams in order to reduce the thermal conductivity of the structure.



*Figure: 7. Installation of the column using a telescopic lift.*

The proposed generic steel and glass element has the following distinct advantages:

- prefabricated buildings and structures, erected on the basis of the proposed elements, do not need finishing of the facade and interior finishing of premises, as it can be produced at the manufacturer's plant;
- manufacture of the element in the factory by 100%;
- the possibility of high-speed assembly of standard elements on the construction site;
- the ability to manufacture panels for buildings in different climatic conditions without changing production;
- variety of planning solutions.

Prefabricated energy efficient buildings from the typical elements proposed by the authors are characterized by cumulative characteristics, such as:

- panels made of glass and steel have a minimum number of typical sizes and can be used for the construction of objects for various purposes (low-rise housing construction, industrial, civil and agricultural facilities), performing the functions of load-bearing and enclosing structures, coatings and floors.
- the proposed elements are unified for walls and ceilings, which makes it possible to create reserves of pre-fabricated buildings and structures in case of an emergency and store them at the bases of the Ministry of Emergencies;

- uniformity of the proposed elements allows to reduce costs at the stage of production, transportation and installation of structures;
- at the stage of building installation, a spatial block is formed from the combined covering slabs and wall panels, which does not require the installation of vertical and horizontal ties.

The use of glass as filling in window openings has a number of differences from the design of translucent structures. When developing standard elements using glass for the construction of prefabricated buildings, it is necessary to take into account the features of the fire safety of the building, the nuances of fastening, and the economic feasibility of using. In addition to the main enclosing functions that modern glasses perform, it is necessary to give additional features: no reflective effect, resistance to UV radiation, increased strength, protection against overheating in summer and point, hidden adhesive and mechanical attachment to the frame.

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瓜品质的微生物指标

**MICROBIOLOGICAL INDICATORS OF MELON QUALITY**

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抽象。当前，开发用于健康饮食的产品的趋势已变得流行，其目的是填补天然植物脂肪，蛋白质，维生素和矿物质以及膳食纤维的消耗量不足。市场上瓜的季节性特性，再加上储藏和加工条件不足，已经限制了该国大多数人口的消费。

在这方面，对甜瓜微生物学的研究，对甜瓜的指标和特性的研究都具有重要意义。

研究甜瓜产品的稠度，保存性和营养价值。本文概述了世界流行病的情况以及消除瓜类微生物变质的方法。

关键词：微生物学，瓜类，细菌和微生物，中毒。

**Abstract.** *Currently, a trend to develop products for a healthy diet has gained popularity, which is aimed at filling the deficit in the consumption of natural vegetable fats, proteins, vitamins and minerals, as well as dietary fiber. The seasonal nature of melons on the market, combined with inadequate storage and processing conditions, has limited their consumption by the majority of the country's population.*

*In this regard, research on the microbiology of melons, the study of indicators and characteristics of melons are relevant.*

*Investigation of the consistency, preservation and nutritional value of melon products. The article provides an overview of the epidemiological situation in the world and ways to eliminate microbiological spoilage of melons.*

**Keywords:** *microbiology, melons, bacteria and microorganisms, poisoning.*

Melons are widely used in the human diet. Many varieties of melons are known. Melon consumption, production and international trade in melons have

increased over the past decade. In addition, melon-related foodborne illness has become common. A serious public health problem in some countries had significant negative impacts on trade in this product. Epidemiological evidence of foodborne illness associated with melons is based on outbreaks. Between 1950 and May 2011, 85 outbreaks were detected, mostly in North America, where *Salmonella* enterica (47.1%) was the most frequent causative agent, followed by Norovirus (22.4%), *Escherichia coli* O157: H7 (5.9 %), *Campylobacter jejuni* (3.5%), *Shigella sonnei* (2.4%), *Listeria monocytogenes*, *Cyclospora* sp. and the putative combination of *Staphylococcus aureus* and *Bacillus cereus*. The number of cases per outbreak ranged from 2 to 600, with the actual number of cases probably  $\geq 100$  times higher. Two deaths were reported in three cases of salmonellosis and one outbreak of listeriosis.

The epidemiological data highlight several points:

- investigation of diseases associated with melons is complicated by the variety of their culinary uses, their distribution and the presence of feedback
- the nature of melons and their popular use in food service, pre-cut and mixed with other foods, makes them vulnerable to contamination from the skin to the edible pulp through food processing and cooking media
- *S. enterica* is the most common etiologic agent of netted melons alone or mixed with other melons and other foods in meals / dishes. Most common melon in recorded outbreaks are netted melons.
- cross-contamination, poor wash quality, infected workers and poor hygiene, together with poor holding temperature control, contribute to outbreaks.

Melons have certain characteristics that are important for interacting with food. Pathogens and food safety risk management, namely:

- the topography of the melon rind affects the attachment and protection of microorganisms. The mesh crust on, for example, melon, provides a waxy and highly hydrophobic surface.

The matrix where microorganisms are attached can be protected from removal by rinsing and the effectiveness of disinfectants.

- foodborne bacterial pathogens can grow and / or survive on melon.
- it has been experimentally proven that microorganisms penetrate the root system, vine, melon fruits. The first is considered temporary and less important. In the field, the latter can occur due to negative temperature differences during immersion in polluted water, through wounds caused by physical damage or pests, cracks, stains on the ground and scars from the stem.

Melons can be contaminated throughout the food chain in the same way as other fresh foods.

Important points in primary production include:

- favorable conditions for the growth of melons are also favorable for the pres-

ence of pests that can feed in areas of cultivation due to the high sugar content of the fruit, therefore, pest control requires special attention;

- melon vines are grown along the ground, mainly where the melons are located directly or indirectly (irrigation water, heavy spray of rain) in contact with the soil;

The use of drip irrigation and risk assessment at harvest time (eg after rain) are required. After harvest, further contact with the soil should be avoided [1]. Field packaging equipment and sanitary design and sanitation programs for the packaging plant are critical to ensure the safety of melons leaving these melon production units should not be subject to increased microbial populations [2, 3, 4, 5]. Field packing equipment and packing plant operations can only be used seasonally and inactive for many months, making them vulnerable.

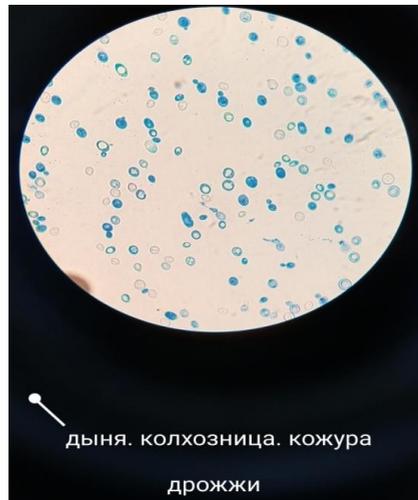
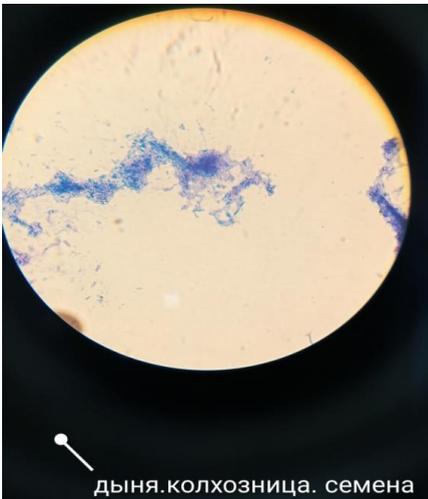
What you should pay attention to:

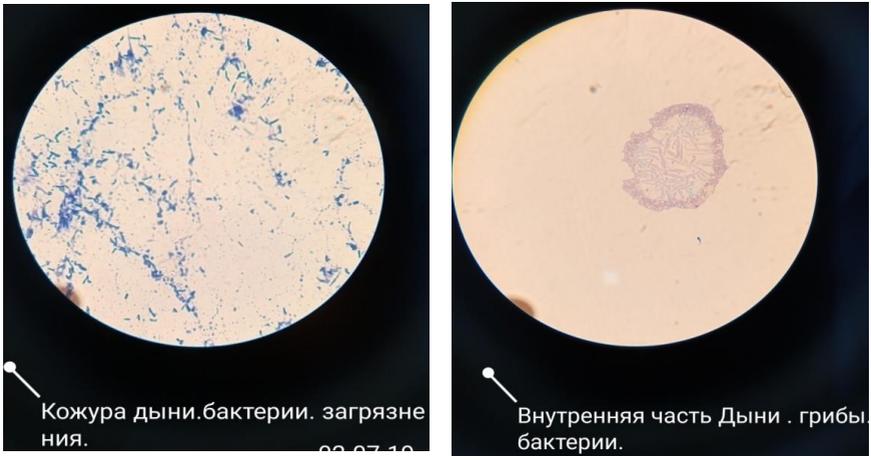
- The ability to inspect your packing house or field packing / harvesting procedures to ensure that melons are not exposed to microbial contamination or accumulate it during operation of this plant. The number of microbes must be equal or less than in the previous operation.

- Possibility to confirm that melon wetting and brushing are not a potential source of melon cross-contamination.

- Field packing equipment and packing plant operations that may be inactive for many months must be adequately protected from pest infestation.

- Field packaging and packaging equipment should be designed to facilitate sanitation. Melon contact surfaces, including packing, should be made of materials that can be easily cleaned and disinfected [6].





*Figure 1 – Microbiological indicators of melon on a trinocular microscope*

Although the purpose of post-harvest flushing is mainly to remove soil and clean up the melons, it can also contribute to contamination. In packing shops, fresh products may contain microorganisms with populations of  $10^4$ – $10^6$  CFU/g [7, 8, 9,]. For apples and tomatoes, a negative temperature difference (ie, the temperature of the wash water lower than the temperature of the fruit) has been shown to enhance the penetration of microorganisms into the subsurface tissue of the fruit [7, 8]. Likewise, if melons are immersed in colder water or are hydrocooled, changes in hydrostatic pressure can facilitate the penetration of *Salmonella* onto the crust surface of some varieties [9]. Intestinal microorganisms have been found in rinse water and hydrocooler water in several melon harvesting and packaging areas [10]. This problem can be further compounded by regional practices and environmental conditions.

Epidemiological and laboratory evidence of an outbreak of *E. coli* O157: H7 infections associated with cut melon suggest that contamination may occur not only by cutting the infected rind, but also by using infected cutlery [11]. Storing the cut melons at insufficiently low temperatures increases the safety risk, as the juice released from the cut tissue is a good breeding ground for foodborne pathogens. Cut melons are often displayed in grocery stores, farmers markets and ice salad bars, but the surface of the slices may be close to ambient temperatures [12]. In much the same way that ground beef, which is a mixture of meat from many carcasses, is more likely to contain pathogens in its interior than a single piece of steak, combining the cut melon pieces increases the likelihood of high levels of contamination [13].

Freshly cut melons have been linked to outbreaks of salmonellosis. Minimally processed freshly cut fruit has a limited shelf life due to deterioration caused by damage to microflora and physiological processes. The objectives of this study were to use a wet steam process to 1) reduce local spoilage microflora and inoculated populations of *Salmonella*, *Escherichiacoli* O157: H7 and *Listeriamonocytogenes* on the melon surface, and 2) reduce populations in fresh melon, cut into pieces after peeling and cutting. The average inoculum of *Salmonella*, *E. coli* O157: H7 and *Listeriamonocytogenes* was 10 (7) CFU/ml, and the populations recovered on the melon rind surface after inoculation averaged 4.5, 4.8 and 4.1 log CFU/cm (2), respectively. Whole melons were treated in a wet steam apparatus for 180 seconds, and the treated melons were stored at 5°C for 29 days. Bacterial populations were determined in freshly cut pieces prepared from treated and control samples stored at 5 and 10°C for up to 12 days, and color changes (CIEL\*, a\* and b\*) caused by treatments during storage were measured. The presence and growth of aerobic mesophilic bacteria and *Salmonella*, *E. coli* O157: H7 and *L. monocytogenes* was determined in samples of freshly cut melons. All treated melon surfaces immediately after processing and during storage showed no visual signs of physical damage. All freshly cut pieces of the treated melon rind surface were negative for bacterial pathogens even after the enrichment process. Steam treatment significantly ( $p < 0.05$ ) changed the color of fresh cut pieces. Minimal wet steam treatment of melon skins intended for fresh cut pieces will increase the microbiological safety of the fresh cut pieces by reducing the overall bacterial population. This process can significantly reduce the incidence of foodborne illness associated with fresh cut fruit [14]. The most recent outbreak of listeriosis associated with the consumption of freshly cut melons indicates the need to study the behavior of *Listeriamonocytogenes* in the presence of the native microflora of the melon pieces during storage. Whole melons were inoculated with *L. monocytogenes* (10 (8) -CFU/ml suspension) for 10 minutes and air-dried in a biosafety cabinet for 1 hour and then treated (unwashed, rinsed with water and rinsed with 2.5% hydrogen peroxide). Freshly cut pieces (~ 3 cm) prepared from these melons were left at 5 and 10°C for 72 hours and at room temperature (20°C) for 48 hours. Some freshly cut pieces were left at 20°C for 2 and 4 hours and then cooled at 5°C. Microbial populations of freshly cut pieces were determined by plate counting or by enrichment immediately after preparation. Aerobic mesophilic bacteria, yeast and whole melon mold, as well as inoculated populations of *L. monocytogenes* on the melon rind surface averaged 6.4, 3.3, and 4.6 log CFU/cm<sup>2</sup>, respectively. Treatment alone reduced the number of aerobic mesophilic bacteria, yeast and mold, as well as the *L. monocytogenes* population to 3.8, 0.9 and 1.8 log CFU/cm<sup>2</sup>, respectively. No populations of *L. monocytogenes* transferred from melon rind to freshly cut pieces were found. Elevated storage temperatures intensified the lag phases and growth of *L. monocytogenes*.

## Conclusions

The results of this study confirmed the need to store freshly cut melons at 5°C immediately after cooking to increase the microbial safety of the fruit.

According to the results of microbiological analysis, it was revealed that when processing melon fruits, it is recommended to cool the fruits before processing at a temperature of 5 degrees Celsius for at least 20 minutes.

With this method of processing mold fungi and yeast, the test samples were 10 times less.

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气候试验中永磁体感应温度系数的行为研究  
**RESEARCH OF BEHAVIOR OF THE TEMPERATURE COEFFICIENT  
ON THE INDUCTION AT PERMANENT MAGNETS AT CLIMATIC  
TESTS**

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抽象。显示了由于永久磁铁的热老化而消除的可逆变化。揭示了消除可逆变化的最佳时效温度。已经发现，对于硬磁合金的热稳定磁体，感应温度系数 (TCV) 降低  $(0.04 \div 0.01) \%/^{\circ}\text{C}$ 。结果表明，具有不同化学成分的同种磁体的感应温度系数值具有相似的动力学。

关键字：永磁体，感应温度系数，冷热试验。

**Abstract.** *The removal of reversible changes due to thermal aging of permanent magnets is shown. The optimal aging temperature for removing reversible changes has been revealed. It was found that for thermally stabilized magnets of hard magnetic alloys, the temperature coefficient of induction ( $T_{CV}$ ) decreases within  $(0.04 \div 0.01)\%/^{\circ}\text{C}$ . It is shown that the value of the temperature coefficient of induction has a similar dynamics for samarium-cobalt magnets with different chemical compositions.*

**Keywords:** *permanent magnet, temperature coefficient by induction, heat and cold tests.*

Permanent magnets from REM-Co alloys are widely used as a source of magnetic field in the creation of various instruments and special devices for civil and military purposes [1-2]. The qualitative parameters and the effectiveness of the use of such devices depend mainly on the characteristics of the navigation systems used in them, electric motors and drives (linear and rigid). One of the main characteristics is the magnetic flux created by magnets in the air gap (channel) of the system (device). It is its stability that ensures the reliable operation of the entire system. Magnetic induction ( $\mathbf{B}$ ) is responsible for the instability of the magnetic flux [3-7]. The change in  $\mathbf{B}$  of permanent magnets (PM) and magnetic systems (MS) depending on temperature is the main factor of device instability during operation, therefore it is advisable to control and ensure the preservation of this pa-

rometer. Of course, it is possible to introduce temperature compensation, however, a large spread in the values of the temperature coefficient, even for magnets from the same melt, does not allow ensuring the constancy of the magnetic induction to the extent that it is sometimes required. Therefore, in especially critical cases, it is necessary to investigate the temperature coefficient of magnets and systems and control it [8-11].

The effect of temperature appears directly on the change in **B**. As the temperature increases, **B** tends to zero and reaches it at the Curie temperature of the magnetic material. For REM-Co alloys, the Curie temperature lies in the range 750-800°C [12, 13]. The operating temperature of products for various purposes based on REM-Co alloys varies in the range from minus 60°C to + 350°C.

If PM or MS is heated to a certain temperature  $T_1$ , then the value of  $B_0$  will decrease to  $B_1$ , then this decrease ( $B_1 - B_0$ ) will reflect the total change in **B** when the temperature rises from room temperature to  $T_1$ . When cooled from  $T_1$  to room temperature, the magnetic induction will increase, but there is a possibility that the value of induction at room temperature  $B_{20}$  will not coincide with the initial value of  $B_0$  (i.e., without repeating the straight line), which will indicate irreversible changes. At the same time, the process of heating and cooling leads to the formation of reversible changes in magnetic induction, which can be taken into account using the temperature coefficient of induction

$$T_{CB} = \left| \frac{B_{1,2} - B_0}{B_0 \cdot (T_{1,2} - T_0)} \right| \cdot 100\% = \left| \frac{\delta_V}{(T_{1,2} - T_0)} \right| \cdot 100\%,$$

where  $\delta_V$  is the relative temperature change in magnetic induction.

In order to exclude irreversible changes in magnetic induction, aging must be carried out. There are only two types of material aging: magnetic and structural [13]. Structural aging can be obtained if PM, after heating to temperature  $T_1$  followed by cooling to room temperature, is subjected to re-magnetization to saturation. The magnetic characteristics of such PMs can only be restored by repeated heat treatment [14]. However, when using permanent magnets made of REM-Co alloy, the structural type of aging can be excluded, because up to 500°C, no structural changes are observed in these alloys that affect the value of **B**. Magnetic aging occurs under the influence of alternating magnetic fields, mechanical shock, vibration, radiation, etc. As a rule, irreversible changes during magnetic aging obey a logarithmic law, bright example is PM hysteresis.

It is worth remembering that there is also reversible magnetic aging. It can be achieved by subjecting the magnets magnetized to saturation to heat aging for 1-2 hours at a given temperature, or with partial demagnetization [13].

Therefore, the aim of this study is to estimate the temperature coefficient of

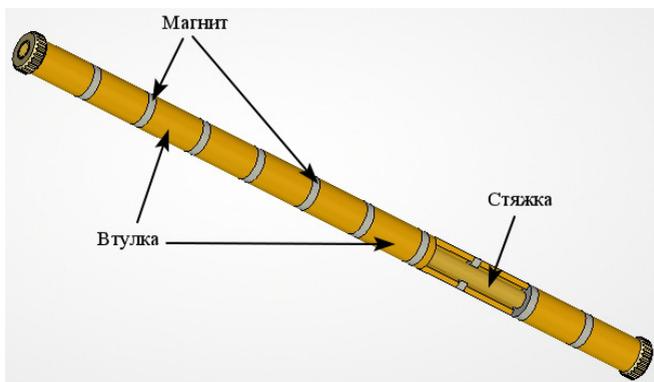
induction of PM under climatic test conditions.

As an object of research, we chose ring magnets with a size of  $\varnothing 12 \times 6$  mm and a height of 3 mm, made of materials KSGE37, KS37 and KS25DTS according to the technology proposed in [14]. To remove the reversible changes in  $\mathbf{B}$  and, accordingly, the preservation of the main parameters of the magnets, they were subjected to thermal aging for 2 hours at a temperature of 200°C or 250°C, followed by cooling to room temperature. The temperature in the furnace was kept constant; a deviation from the nominal value was allowed within  $\pm 1^\circ\text{C}$ . To stabilize the permanent magnets, we chose two temperatures (200°C and 250°C) in order to identify possible changes in the main parameters and subsequent determination with the required aging temperature.

For the study, 10 magnets were selected, close in magnitude to the magnetic induction on the ring axis ( $B_{CR}$ ) for each material. The aging of the magnets at 200°C, on average, resulted in a decrease in the  $B_{CR}$  value by 4%, 6%, and 2% for magnets from the alloy KS37, KSGE37, and KS25DC, respectively. When aging at 250°C, the average value of the magnetic induction decreased by 7.7%, 8.4% and 3.1%, respectively.

Magnets of one material were assembled on a tie with an inner channel of  $\varnothing 5$  mm and a wall thickness of 1 mm (fig. 1). To exclude the influence of their own demagnetizing fields, the magnets were placed at a distance of 20 mm from each other according to the principle of repulsion, for which bushings were used. The influence of the demagnetization factor on the behavior of the magnetic induction of such a system leads to the formation, in the object under study, of domain structures with different orientations of the magnetization vector, i.e. magnetic aging will take place, which we would like to exclude at this stage of the study. As a result, the presence of such structures will lead to inhomogeneity of the field and to its ambiguous behavior under conditions of changing the temperature range.

To eliminate the effect of magnetization from the tooling material (tie, sleeve), non-magnetic materials with high thermal conductivity (duralumin or brass alloys) were used. The  $B_{CR}$  was measured with a Hall-effect umbrella.



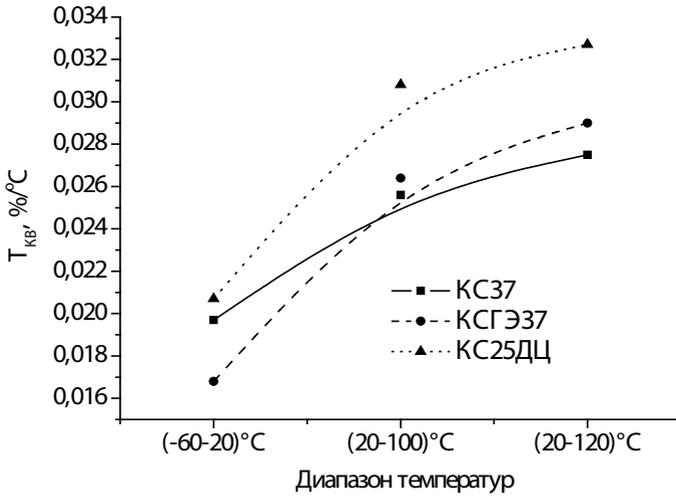
*Fig. 1. Breadboard assembly of magnets for thermal testing*

The following temperatures were chosen for climatic tests -  $60^{\circ}\text{C}$ ,  $+20^{\circ}\text{C}$ ,  $+100^{\circ}\text{C}$ ,  $+120^{\circ}\text{C}$ . Maintaining the temperature in the heat and cold chamber was ensured within  $\pm 3^{\circ}\text{C}$ . The mark  $t_0 = +20^{\circ}\text{C}$  was chosen as a control. To analyze the behavior of the temperature coefficient by induction, the following ranges were used:  $+20^{\circ}\text{C} \div (-60)^{\circ}\text{C}$ ;  $+20^{\circ}\text{C} \div (+100)^{\circ}\text{C}$  and  $+20^{\circ}\text{C} \div (+120)^{\circ}\text{C}$ .

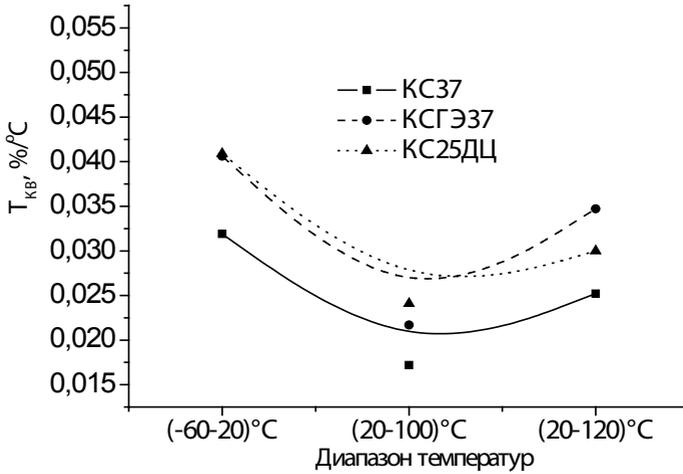
As a result of carrying out various modes of thermal tests, graphs of the distribution of the amplitude value of the magnetic induction on the axis of the magnets were obtained. For subsequent analysis, all  $B_{\text{CR}}$  values in subsequent tests were averaged for each test type and material, and  $T_{\text{CB}}$  values were calculated. The average value of the magnetic flux density on the axis of the permanent magnet reflects the topology of the magnetic field of the system and can serve as a characteristic of uniformity if the spread does not exceed  $\pm 5\%$ . The temperature coefficient of magnetic induction allows you to determine how much the induction will change depending on temperature.

After cold/heat tests, the  $B_{\text{CR}}$  returned to their original state - this once again proves that magnetic aging, which occurs during cold/heat, is reversible.

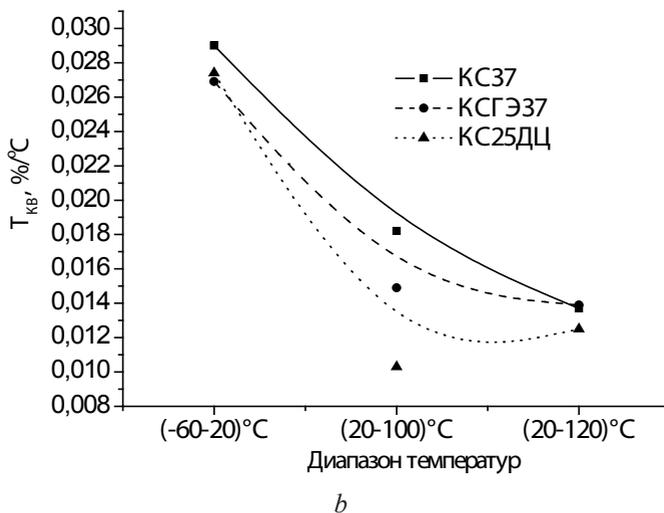
It follows from the data obtained that the absolute values of the temperature coefficients are in good agreement with the data of other authors and do not exceed the value of  $0.045\%/^{\circ}\text{C}$  [8, 12, 13]. The dynamics of  $T_{\text{CB}}$  change for different materials has a similar trend (fig. 2).



a



b



**Fig. 2.** Dynamics of  $T_{CB}$  change during climatic tests for PM: a - in technical saturation; b - past preliminary aging at  $t = 200^{\circ}\text{C}$ ; c - past preliminary aging at  $t = 250^{\circ}\text{C}$

In the case when the magnets were in technical saturation (fig. 2 a), then with an increase in temperature, the temperature coefficient also increases, which leads to instability of the magnets and, as a consequence, products assembled from them. In the case of preliminary thermal stabilization of the magnets, the temperature coefficient decreases, however, if you choose the aging temperature of the magnets, the author believes that it is better to give preference to  $t = 250^{\circ}\text{C}$ , since in this case  $T_{CB}$  will decrease with increasing test temperature (fig. 2c). Therefore, we can say that the system, assembled on the basis of thermally stabilized magnets, has the lowest  $T_{CB}$  value and is more reliable under conditions of sharp temperature changes.

Thus, when designing magnets or MS, it is necessary to have a margin of field induction on the axis, to ensure operability, within 5-10%. It can be assumed that the higher the test (operation) temperature, the greater the induction margin is required. It is also not advisable to use magnets in saturation, due to the presence of reversible changes that overestimate the  $T_{CB}$  values and distort the true nature of the topology of the magnetic field of the magnet or system. In addition, in our opinion, the aging temperature depends on the operational characteristics of the product, therefore, the minimum aging temperature is  $200^{\circ}\text{C}$  for systems in which the operating temperature (operating temperature) is in the range of  $60-120^{\circ}\text{C}$ , and  $250^{\circ}\text{C}$  - at the operating temperature more than  $120^{\circ}\text{C}$ .

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矿物硫化物的表面张力  
SURFACE TENSION OF SULFIDES OF MINERALS

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注解。在这项工作中，大多数发光矿物的硫化物的表面张力是通过发光方法实验和理论上估算的，该方法基于发光强度对矿物颗粒尺寸的大小依赖性。

关键词：矿物，硫化物，表面张力，发光。

**Annotation.** *In this work, the surface tension of sulfides of most minerals was estimated experimentally and theoretically by the luminescence method, which is based on the size dependence of the luminescence intensity on the size of the mineral particles.*

**Keywords:** *mineral, sulfide, surface tension, luminescence.*

Surface phenomena occur in any heterogeneous system consisting of two or more phases. Essentially, the entire material world is heterogeneous. Systems can be considered as homogeneous only in limited volumes of space. Therefore, the role of surface phenomena in natural and technological processes is extremely important.

The present work is devoted to measuring the surface tension of mineral sulfides. The foundations of the science of minerals are presented in a large number of textbooks and monographs [1-10]. We will dwell here only on certain points used in this work. The chemical composition of minerals is their main characteristic, as it determines the properties of minerals and their appearance. The composition is expressed by chemical formulas that are individual for each mineral species. This allows them to be classified:

- I Native minerals (sulfur S, graphite C, etc.).
- II Sulfides (pyrite FeS<sub>2</sub>, galena PbS, etc.).
- III Halides (halite NaCl, fluorite CaF<sub>2</sub>, etc.).
- IV Oxides and hydroxides (quartz SiO<sub>2</sub>, magnetite Fe<sub>2</sub>O<sub>3</sub>).
- V Carbonates (calcite CaCO<sub>3</sub>, dolomite CaMg [CO<sub>3</sub>]<sub>2</sub>, etc.).
- V Phosphates (apatite Ca<sub>3</sub>(F, Cl, OH)[PO<sub>4</sub>]<sub>3</sub>, etc.).
- VII Sulfates (gypsum Ca [SO<sub>4</sub>] 2H<sub>2</sub>O, anhydrite CaSO<sub>4</sub>, etc.).
- VIII Silicates (labrador (Na, Ca) [AlSi<sub>3</sub>O<sub>8</sub>], etc.).

Minerals are found in nature in all states of aggregation: liquid (water), gaseous (natural gases), but most minerals are solids. Sometimes a mineral is a disordered collection of molecules, atoms, or ions. These minerals are amorphous and look like glass or plastic. Such substances at each point of the sample exhibit the same properties (amorphous magnesite, opal). In most cases, mineral particles are arranged in a strict order and form crystal lattices. External form of mineral manifestations:

- crystals look like more or less symmetric closed polyhedrons. They grow at different rates in different directions, therefore, in appearance - habit - they are separated:

- a) isometric - evenly developed in three directions - length, width and height (halite, etc.);
- b) flattened developed in two directions (feldspars, mica, talc) - scaly, lamellar, leafy, tabular;
- c) elongated, most developed in one direction - columnar, needle-like, fibrous (gypsum, selenite, asbestos, quartz, etc.).

The surface tension of most of the sulfides presented in tables 1-10 was determined by the luminescent method [11-13]. The rest of the values were obtained by calculation based on the regularity -  $\sigma_{MeS} = \text{const } \sigma_{Me}$ .

**Table 1 - Surface tension of alkali metal sulfides**

Compound	$\sigma, \text{J/m}^2$ (T=300K)	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
Li <sub>2</sub> S	0,130	45,948	1,660	27,680	2,885	0,776	0,874	0,912	0,933	0,945
Na <sub>2</sub> S	0,076	78,046	1,856	42,050	2,562	0,796	0,886	0,921	0,940	0,951
K <sub>2</sub> S	0,053	110,263	1,805	61,087	2,596	0,794	0,885	0,920	0,939	0,951
Rb <sub>2</sub> S	0,037	203,002	2,912	69,712	2,068	0,829	0,906	0,936	0,951	0,960

**Table 2 - Surface tension of alkaline earth metal sulfides**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
BeS	0,672	41,078	-	-	-	-	-	-	-	-
MgS	0,355	56,371	2,860	19,710	5,610	0,641	0,781	0,842	0,877	0,899
CaS	0,452	72,144	2,590	27,855	10,095	0,498	0,665	0,748	0,798	0,832
SrS	0,408	119,690	3,650	32,791	10,727	0,482	0,651	0,737	0,789	0,823
BaS	0,385	169,400	4,250	39,858	12,304	0,448	0,619	0,709	0,765	0,803

**Table 3 - Surface tension of metal sulfides of the boron subgroup**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
Al <sub>2</sub> S <sub>3</sub>	0,305	150,161	2,020	74,337	18,180	0,355	0,524	0,623	0,688	0,733
Ga <sub>2</sub> S <sub>3</sub>	0,053	235,644	3,747	62,889	2,673	0,789	0,882	0,918	0,937	0,949
In <sub>2</sub> S <sub>3</sub>	0,103	325,838	4,648	70,103	5,790	0,633	0,776	0,838	0,874	0,896
Tl <sub>2</sub> S <sub>3</sub>	0,162	504,964	-	-	-	-	-	-	-	-

**Table 4 - Surface tension of sulfides of metals of the carbon subgroup**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
SiS <sub>2</sub>	0,519	92,217	2,020	45,652	18,998	0,345	0,513	0,612	0,678	0,725
GeS <sub>2</sub>	0,368	136,722	2,940	46,504	13,722	0,422	0,593	0,686	0,745	0,785
SnS	0,126	150,776	5,220	28,884	2,918	0,774	0,873	0,911	0,932	0,945
PbS	0,193	239,256	7,600	31,481	4,872	0,672	0,804	0,860	0,891	0,911

**Table 5 - Surface tension of metal sulfides of the copper subgroup**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
CuS	0,571	95,612	4,600	20,785	9,516	0,512	0,678	0,759	0,808	0,840
Ag <sub>2</sub> S	0,651	247,802	7,230	34,274	17,891	0,359	0,528	0,626	0,691	0,736
Au <sub>3</sub> S <sub>3</sub>	0,719	490,131	8,754	55,989	32,278	0,237	0,383	0,482	0,553	0,608

**Table 6 - Surface tension of zinc subgroup sulfides**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
ZnS	0,240	97,436	4,090	23,823	4,584	0,686	0,814	0,867	0,897	0,916
CdS	0,190	144,476	4,820	29,974	4,566	0,687	0,814	0,868	0,898	0,916
HgS	0,010	232,656	8,100	28,723	0,230	0,977	0,989	0,992	0,994	0,995

**Table 7 - Surface tension of chromium subgroup metal sulfides**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
CrS	0,980	84,062	4,100	20,503	16,111	0,383	0,554	0,651	0,713	0,756
MoS <sub>2</sub>	0,915	160,072	5,060	31,635	23,209	0,301	0,463	0,564	0,633	0,683
WS <sub>2</sub>	1,182	247,982	7,500	33,064	31,337	0,242	0,390	0,489	0,561	0,615

**Table 8 - Surface tension of metal sulfides of the manganese subgroup**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
MnS	0,980	87,000	3,990	21,806	17,134	0,369	0,539	0,636	0,700	0,745
Tc <sub>2</sub> S <sub>7</sub>	0,549	420,460	-	-	-	-	-	-	-	-
Re <sub>2</sub> S <sub>7</sub>	1,060	596,880	4,870	122,562	104,169	0,088	0,161	0,224	0,277	0,324

**Table 9 - Surface tension of metal sulfides of the iron subgroup**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
FeS	0,797	87,915	4,840	18,164	11,608	0,463	0,633	0,721	0,775	0,812
CoS	0,775	90,999	5,450	16,697	10,376	0,491	0,658	0,743	0,794	0,828
NiS	0,756	90,766	5,300	17,126	10,381	0,491	0,658	0,743	0,794	0,828

**Table 10 - Surface tension of lanthanide sulfides**

Compound	$\sigma, \text{J/m}^2$ ( $T=300\text{K}$ )	m (g/mol)	$\rho$ (g/sm <sup>3</sup> )	V (sm <sup>3</sup> /mol)	I/I <sub>0</sub>					
					d	r				
						10	20	30	40	50
1	2	3	4	5	6	7	8	9	10	11
Ce <sub>2</sub> S <sub>3</sub>	0,362	376,438	-	-	-	-	-	-	-	-
Pr <sub>2</sub> S <sub>3</sub>	0,415	378,014	5,040	75,003	24,958	0,286	0,445	0,546	0,616	0,667
Nd <sub>2</sub> S <sub>3</sub>	0,451	384,678	-	-	-	-	-	-	-	-
Sm <sub>2</sub> S <sub>3</sub>	0,472	396,918	-	-	-	-	-	-	-	-
Eu <sub>2</sub> S <sub>3</sub>	0,402	400,118	-	-	-	-	-	-	-	-
Gd <sub>2</sub> S <sub>3</sub>	0,566	410,698	3,800	108,078	49,049	0,169	0,290	0,380	0,449	0,505
Tb <sub>2</sub> S <sub>3</sub>	0,584	414,050	-	-	-	-	-	-	-	-
Dy <sub>2</sub> S <sub>3</sub>	0,604	421,198	6,080	69,276	33,550	0,230	0,373	0,472	0,544	0,598
Ho <sub>2</sub> S <sub>3</sub>	0,629	426,058	5,920	71,969	36,297	0,216	0,355	0,453	0,524	0,579
Er <sub>2</sub> S <sub>3</sub>	0,640	430,718	-	-	-	-	-	-	-	-

In conclusion, we note that in [12] we considered the nonequilibrium thermodynamics of a mineral with defects. Defects in a mineral or surface layer (dislocations, pores, etc.) are presented as a system of non-interacting particles immersed in a thermostat. Quantum transitions caused by the interaction of defects with a thermostat will be dissipative (with probability P), in contrast to interaction with an external field (with probability F). Dissipative processes lead to the fact that the secondary field (system response) is always less than the primary one, which causes the formation of defects. The response function of the system to external action

was obtained and a patent was obtained [13], on the basis of which the surface tension of sulfide minerals, presented in this work, was calculated.

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“里海depression陷东侧古生代复合体的断面类型”

**"TYPIFICATION OF SECTIONS OF THE PALEOZOIC COMPLEX OF THE EASTERN SIDE OF THE CASPIAN DEPRESSION"**

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抽象。本文着重介绍了里海盆地东侧的地质构造特征，沉积条件以及构造和构造因素对油气含量形成的影响。

根据里海depression陷东部沉积构造的地质构造特征和岩相特征，区分出相带，对应于特有的构造-构造带，其中发育了几种类型的古生界剖面。

里海盆地东部古生界剖面的比较比较表明，它是在各种自然碰撞过程中形成的。垂直相排的形成受构造因素和海平面波动的影响。

控制碳层深度的碳酸盐平台在沉积物质的分布中起着重要作用，它不仅影响岩石的岩性成分及其结构和结构特征。碳酸盐台地的存在也反映在剖面的完整性和下二叠系沉积物的厚度上，碳酸盐台地内的沉积物厚度远小于位于碳酸盐台地西面的相邻较深水区。在碳酸盐岩台地结构的形成过程中，逆冲构造非常重要，它控制着油气田和预期构造的位置。

关键词：里海depression陷，东部侧面，岩相带，结构相带，阿克秋宾斯克，Ostansuk-Dzhurunskaya, Temirskaya, Zhanazhol-Tortkolskaya, Tuskum-Kozhasayskaya, Borzher-Akzharskaya, Teresken带，陆源复合体，碳酸盐岩沉积，古生界。

**Abstract.** *This article highlights the features of the geological structure, sedimentation conditions and the influence of structural and tectonic factors on the formation of oil and gas content in the eastern side of the Caspian basin.*

*According to the features of the geological structure and lithological-facies characteristics of the sedimentary complex of the eastern part of the Caspian depression, facies zones are distinguished, corresponding to the distinguished structural-formational zones, in which several types of Paleozoic sections are developed.*

*Comparative comparison of the Paleozoic sections in the eastern part of the*

*Caspian Basin showed that it developed in the regime of collisional processes of various nature. The formation of vertical facies rows was influenced by tectonic factors and sea level fluctuations.*

*An important role in the distribution of sedimentary material was played by carbonate platforms that controlled the depth of the sea, which could not but affect the lithological composition of rocks and their textural and structural features. The presence of carbonate platforms was also reflected in the completeness of the sections and the thickness of the Lower Permian deposits, which within the carbonate platforms is much less than in the adjacent relatively deep-water areas located to the west outside the carbonate platforms. In the formation of the structure of carbonate platforms, thrust tectonics was of great importance, which controlled the location of oil and gas fields and prospective structures.*

**Keywords:** *Caspian depression, eastern flank, lithological-facies zones, structural-facies zones, Aktyubinsk, Ostansuk-Dzhurinskaya, Temirskaya, Zhanazhol-Tortkolskaya, Tuskum-Kozhasayskaya, Borzher-Akzharskaya, Teresken zones, terrigenous complex, carbonate deposits, paleozoic deposits lithological.*

In the Paleozoic sedimentary complex of the eastern flank of the Caspian Basin, several carbonate platforms of different ages are distinguished, as well as zones with predominantly terrigenous deposits. The complex geological structure of the region is due to the influence of collisional processes that took place in the junction zone of the East European platform and the Ural paleocean /1/.

On the territory under consideration, the Zhanazhol-Tortkol structural-formation zone is distinguished, which, along the sub-latitudinal (Kenkiyak-Alibek) tectonic fault, joins the Temir and Ostansuk-Dzhurinsk structural-formation zones. Temirskaya corresponds to the carbonate platform, and Ostansuk-Dzhurinskaya - to the southern end of the Cis-Ural foredeep, where overthrusts occur intensively in the sediments of the Upper Carboniferous-Early Permian, forming an en-echelon system of alongside strike. A series of thrust faults is traced both in the Zhanazhol-Tortkol zone and in the inner part of the depression and reaches the Temir carbonate massif.

A detailed analysis of biostratigraphic data on subsalt sediments shows that the reference seismic horizons traced in the east of the Caspian Basin are confined mainly to the unconformity surfaces. So horizon P1 is confined to the erosional surface of subsalt deposits, P2 is the surface of KT-II, P2d is the erosional surface of Devonian deposits. All horizons in each specific section are recorded at a different stratigraphic level.

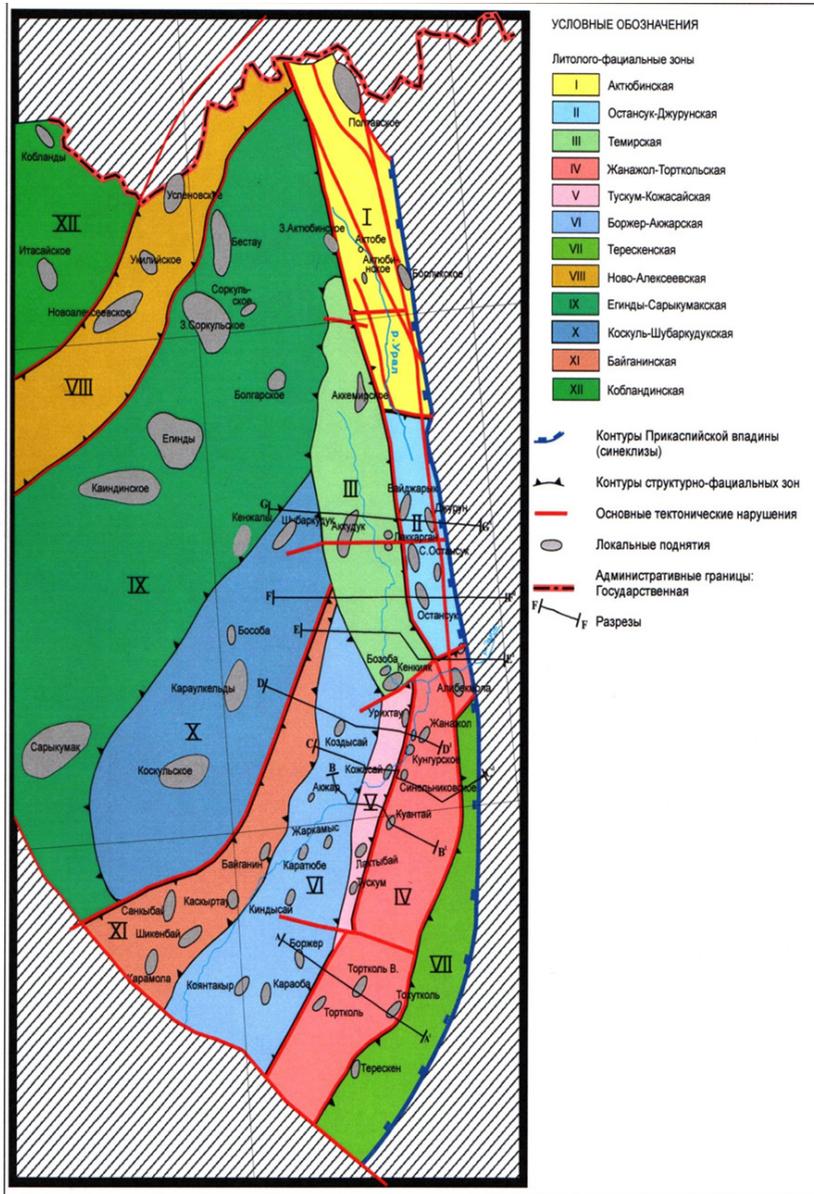
According to the features of the geological structure and lithological-facies characteristics of the sedimentary complex of the eastern part of the Caspian depression, facies zones are distinguished, corresponding to the distinguished struc-

tural-formational zones, in which several types of Paleozoic sections are developed. Of these, seven are well studied by drilling: ***Aktobe, Ostansuk-Dzhurinskaya, Temirskaya, Zhanazhol-Tortkolskaya, Tuskum-Kozhasayskaya, Borzher-Akzhar, Teresken zones.***

*The Paleozoic complex in the Novo-Alekseevskaya, Egindy-Sarykumakskaya, Shubarkuduk-Koskulsakaya, and Baiganinskaya zones has been poorly studied by drilling.*

The Zhanazhol-Tortkol and Temir types of sections are characterized by the presence of thick strata of carbonates. In the formation of the structure of carbonate platforms, thrust tectonics was of great importance, which controlled the location of oil and gas fields and prospective structures. The Ostansuk-Dzhurinsky and Zharkamisky are characterized by the predominance of terrigenous deposits, and the Laktybay-Tuskum-Kozhasai type of section is transitional, which is characterized by the presence of reduced thicknesses of carbonates.

In describing the sections, data on the Paleozoic stratigraphy were used, carried out in different years by N.B. Gibshman, A. Pronin, L.Z.Akhmetshina, L.N. Ivanova, and Yu.A. Pisarenko.



*Fig. 1. Scheme of lithological-facies zoning of the Eastern dislocation zone of the Pre-Caspian depression. Compiled by: Abilkhassimov Kh.B.*

**The Ostansuk-Dzhurun type of section** is characteristic of the territory of the Ostansuk trough and the linear-folded zone of the Aktobe Urals, located northeast of the Temir arch uplift and bounded from the east by the Sakmar-Kokpekta fault. In the structure of the section, two structural stages are distinguished: preorogenic - Devonian-Carboniferous, lying in the form of a rigid carbonate-terrigenous basement, and orogenic, represented by strongly dislocated terrigenous deposits of the Upper Carboniferous-Artinskian molasses of clinoform structure (fig. 2).

Geological exploration works in 2008-2012 in the zone of closure of the southern flank of the Cis-Ural trough identified the Shirak subsalt structure, where within the northern arch of the structure (along the P1 subsalt horizon) a deep prospecting well Sh-1 was drilled with a design depth of 7000 m and a target horizon - Devonian, actual bottomhole - 6597 m.

*Table 1. Recovered actual section of the Shirak-1 well*

№	Revealed stratigraphic section	Depth interval, m	
		project	actual
1	Quaternary	0-20	0-20
2	Jurassic	20-300	20-420
3	Triassic	300-1200	420-652
4	Lower Permian, Kungurian stage	1200-5590	652-5368
5	Lower Permian, Artinsk-Asselian + Upper Carboniferous	5590-6270	5368 - 6597 (well)
6	Middle Carboniferous, Bashkirian	6270-6840	
7	Lower Carboniferous	6840-7000 (well)	

According to well logging and geological survey data in the lower part of the section, 4 structural-formational strata are distinguished, represented by alternating terrigenous rocks: marls, mudstones, sandstones, siltstones with rare thin layers of limestone, gravelstones (in the upper part) and siliceous rocks (in the lower part of the section). Of these strata, strata III and IV are distinguished, corresponding to the intervals of 5887-6195 m with a thickness of 308 m and 6195-6597.1 m with a thickness of 302 m, respectively, which are of interest in oil and gas bearing ratio. Details on the results of drilling this well are reflected in article /7/.

The section of the Upper Carboniferous has been studied from the outcrops of rocks on the day surface in the eastern part of the Aktobe Urals. It is represented by a thick stratum of sandy-argillaceous deposits with subordinate limestone interlayers. The upper part of the section is characterized by the presence of lenses of gravelites and conglomerates, the presence of landslide breccias.

In the western part of the Aktobe Cis-Urals, where the Upper Carboniferous is penetrated by some wells in the Severo-Petropavlovskaya, Aleksandrovskaya and Zhilyanskaya areas, the upper part of the section is absent, and the rest contains more clay interlayers than in the eastern part of the area. The thickness of the Upper Carboniferous deposits is 800-1800 m.

СИСТЕМА	ОТДЕЛ	ЯРУС	ГОРИЗОНТ	ИНДЕКС	ЛИТОЛОГИЯ	МОЩНОСТЬ (м)	КОЛЛЕКТОРЫ, ПОКРЫШКИ	НЕФТЕГАЗОНОСНОСТЬ	СЕЙСМИЧЕСКИЙ ГОРИЗОНТ
Пермская	Нижний	Кунгурский		P <sub>1</sub> kg					П <sub>1</sub> П <sub>1</sub> <sup>1</sup> П <sub>1</sub> <sup>2</sup> П <sub>1</sub> <sup>c</sup>
		Артинский		P <sub>1</sub> ar		700-1500			
		Сакмарский		P <sub>1</sub> s		450-500			
		Ассельский		P <sub>1</sub> a		400-1200			
Каменн.	Верхний			C <sub>3</sub>		900-1000			

Fig. 2. Consolidated lithological and stratigraphic section of the subsalt deposits of the Aktobe and Ostansuk-Dzhurun zones

The Lower Permian section in the volume of the Asselian, Sakmarian, and Artinskian stages is composed of gray-colored terrigenous rocks: mudstones, siltstones, clays, sandstones, gravelstones, and conglomerates. The thickness of the Asselian deposits is 345-1200 m, the Sakmarian deposits are 300-1870 m, and the Artinsky ones are 700-1500 m.

Gravel-pebble deposits compose the frontal parts of the fan fans in the Ostansuk-Dzhurunskaya structural-formational zone. Up to five fans have been traced

and identified by different researchers in different years within the linear-folded zone of the Aktobe Urals. During the Lower Permian time, the position of the fan fans changed several times: they appeared, disappeared, changed their direction somewhat.

In addition to the frontal coarse-detrital parts of the fan, the Ostansuk-Dzhurun zone contains finely reclaimed clayey and silty deposits of the peripheral parts of the fans, coastal-marine facies of sandy deposits of tidal strips, ridges, beaches, patchy sands, as well as clayey, between sandy channels, "settling" zones of bays. The coastal sediments are characterized by mineralogical and structural immaturity, oblique bedding, roiling textures as a result of a steep bottom slope, the presence of deep-water areas, signs of sliding.

West of the Ostansuk-Dzhurun structural-formational zone, on the territory confined to the Temir uplift along the basement, the **Temir type of section** is characteristic, characterized by the presence of a carbonate platform (fig. 3).

The Temir carbonate massif is 150x30 km in size. The thickness of carbonate deposits ranges from 1.6 to 2.4 km. The upper layer (KT-I) in the eastern part of the carbonate platform has a thickness of 800-1000 m, and in the western - up to 400 meters. The most ancient rocks are the Eifelian deposits of the Middle Devonian, penetrated by the wells Kumsay G-4, Bozoba G-9, Bakhtygaryn G-1. The Zhivet stage of the Middle Devonian is exposed by the wells Kumsai G-4 (5155-5370 m), Bozoba G-9 (5310-5545 m), which are represented by organogenic-detrital and coral limestones, massive, dense.

The Frasnian stage of the Late Devonian was exposed by the wells Bozob G-9 (5020-5310 m), Kumsay G-4 (4830-5155 m), Bakhtygaryn G-1 (5610-5907 m), where it is represented by brown and light gray organic-detrital limestones, recrystallized, massive, dense. Famennian deposits of the Late Devonian on the Temir platform, uncovered only in well G-1 of the Bakhtygaryn area (5480-5610 m), are represented by detrital, biomorphic, algal-foraminiferal, brecciated and lumpy-clotted limestones.

The upper structural stage of the Temir carbonate platform with significant stratigraphic unconformity overlies the eroded Frasnian-Famennian surface of the lower part of the platform.

In the area of the Kenkiyak deposit, the KT-II carbonate section begins with the Aleksinsko-Mikhailovka, and in other areas, with the Venev sediments of the late Vise, represented by gray, light gray biomorphic detrital, organogenic-detrital limestones with interlayers of dolomites and weakly calcareous clays up to 347 m thick (Bakhtygaryn G-1).

The Serpukhovian stage is composed of shallow-water shelf carbonates (200-250m). Above, there are deposits of the Bashkir (200 m) and Moscow stages (8-25 m). They are exposed by drilling in the Kenkiyak and Aransay areas, and are

represented by white, gray, dark gray organogenic-lumpy, biomorphic-algal, fine-grained and clayey limestones.

The deposits of the carbonate platform are overlain by Late Gzhel-Lower Permian terrigenous deposits, the thickness of which ranges from 400 to 1000 m.

The Lower Permian is represented by the Asselian, Sakmarian and Artinskian stages. In the Kenkiyak section of the pre-Kungurian Lower Permian, at least five productive horizons are distinguished. At the base of the Asselian stage, there is a gamma-active member, with HA values up to 13-30  $\mu\text{R}/\text{hour}$ , having a bituminous-carbonate-siliceous-clay composition and composed of dark-colored micro-grained, often clayey limestones, clay dolomites, silicites, tuffites. The thickness of the lobe is 20-90 m.

On the shallow-water paleoshelf at that time, there were environments with high and low hydrodynamic regimes. The first include meandering and branching underwater channels, which are a continuation of the delta. These channels were washed up by sandy-argillaceous embankments and bars. These lenticular bodies with increased thickness, in comparison with the synchronous surrounding deposits, are characteristic mainly of the southern part of the Temir zone (Kenkiyak, Kumsay, Aransay, Bozoba, Blaksay, etc.).

For the greater part of this zone in the Early Permian time, the accumulation of shelf clays is more characteristic. It took place in quiet areas of shelf lagoons, away from the main routes of transportation of clastic material, as well as on several towering silty shoals.

**The Zhanazhol-Tortkol type of section** is developed in the structural-facies zone between the Zharkamysk uplift along the basement and the Sakmar-Kokpekty fault. In this zone, sections KT-I and KT-II are best studied (fig. 4).

At the base of the section of the carbonate platform, the boreholes have exposed a terrigenous stratum, represented by black mudstones with charred plant detritus and imprints of the Tournaisian flora. The Visean section is represented by medium- and fine-grained graywacke sandstones of the Tula-Aleksin age. Less common are coarse-grained sandstones, gravelstones, and conglomerates. Above, there are two productive carbonate strata - Late Visean-Kashira (KT-II - thickness from 268 to 1094 m) and Late Moscow-Gzhel (KT-I - thickness from 160 to 830 m). They are separated by terrigenous strata of the Upper Kashira and Podolsk horizons of the Moscow Stage of the Middle Carboniferous, up to 550 m thick.

Late Carboniferous sediments consist of light with brown tint organogenic algal, algal-foraminiferal and organogenic-detrital limestones, dolomitized with alternating greenish-gray mudstones, with a total thickness of 180 to 650 m. In the eastern part of the Zhanazhol deposit, the Upper Carboniferous deposits are replaced by gray and bluish-gray anhydrites and dolomites. Their thickness is 100-180m.

СИСТЕМА	ОТДЕЛ	ЯРУС	ГОРИЗОНТ	ИНДЕКС	ЛИТОЛОГИЯ	МОЩНОСТЬ (м)	КОЛЛЕКТОРЫ, ПОКРЫШКИ	НЕФТЕГАЗОНОСНОСТЬ	СЕЙСМИЧЕСКИЙ ГОРИЗОНТ
Пермская	Нижний	Кунгурский		P <sub>1</sub> kg		100-4500			P <sub>1</sub>
		Артинский		P <sub>1</sub> ar		140-330			
		Сакмарский		P <sub>1</sub> s		70-397			
		Ассельский		P <sub>1</sub> a		45-238			
Каменноугольная	Средний	Московский		C <sub>2</sub> m		8-25			P <sub>2</sub>
		Башкирский	прикамский	C <sub>2</sub> b <sub>1</sub> <sup>pk</sup>		0-66			
			северокельтменский	C <sub>2</sub> b <sub>1</sub> <sup>sk</sup>		36-85			
	краснополянский		C <sub>2</sub> b <sub>1</sub> <sup>krs</sup>		50-80				
	Нижний	Серпуховский	протвинский	C <sub>1</sub> s <sup>pr</sup>		45-95			
			стешевский	C <sub>1</sub> s <sup>st</sup>		45-105			
			тарусский	C <sub>1</sub> s <sup>tr</sup>		45-65			
Визейский		алекс.-мих.-веневский	C <sub>1</sub> v <sub>2</sub> <sup>al-vn</sup>		35-104				
Девонская	Верхний	Фаменский		D <sub>3</sub> fm		430-550			P <sub>3</sub>
		Франский		D <sub>3</sub> fr		430-550			
	Нижний, средний	Живетский Эйфельский ?		D <sub>1+2</sub>		>600			

Fig. 3. Consolidated lithological and stratigraphic section of subsalt sediments of the Temir zone

The early Permian is represented by the Asselian, Sakmarian, and Artinski-an stages. The Asselian stage in the submeridional zone in the eastern part of the territory, from East Zhanazhol to Tortkol and Tokhutkol, is represented by shallow-water carbonates - algal, foraminiferal. The thickness of the Asselian carbonates reaches 850m. At the base of the Assel section, there is a thin (15-30 m) gamma-active siliceous-carbonate-clayey member, similar to that uncovered in the Temir zone. The deposits of the Sakmarian age are similar in composition to the Asselian ones, but differ in the presence of lenses of gravelites and conglomerates. On Zhanazhol, Sakmara deposits have a thickness of up to 150 m. The Artinsky Stage is not developed everywhere, and is represented by terrigenous rocks of coarse-detrital composition up to 90 m thick.

About a dozen oil and gas-oil fields have been discovered in the Zhanazhol-Tortkol zone (Zhanazhol, Alibekmola, Urikhtau, Sinelnikovskoye, Bashenkol, etc.).

**The Laktybai-Tuskum-Kozhasai type of section** is developed within a narrow strip 15-20 km west of the Zhanazhol-Tortkol structural-formational zone. It is characterized by the presence of only the lower (CP-II) part of the carbonate platform, the slope of which is extended to the west compared to the distribution line of the CP-I carbonate unit (fig. 5).

The described structural-formational zone contains the areas of Kozhasai, Bashenkol, Zhanatan and Kuantai. The most complete sections of this zone were penetrated by the wells Bashenkol P-6 and Kozhasai P-2. The exposed terrigenous strata (thickness up to 1500 m) of the late vise is represented by sandy-mudstone rocks with interlayers of gravelites, conglomerates and, less often, limestones. In the well Kozhasai P-2 in the interval 3825-3709 m there are organogenic-clastic, algal-foraminiferal limestones with inclusions of oolitic and lumpy.

The Serpukhovian stage in the wells of the Kozhasai P-2 (thickness - 200 m) and Bashenkol P-6 (thickness - 588 m) areas is represented by biohermal algal and foraminiferal-algal limestones, recrystallized and dolomitized.

СИСТЕМА	ОТДЕЛ	ЯРУС	ГОРИЗОНТ	ИНДЕКС	ЛИТОЛОГИЯ	МОЩНОСТЬ (М)	КОЛЛЕКТОРЫ, ПОКРЫШКИ	НЕФТЕГАЗОНОСНОСТЬ	СЕЙСМИЧЕСКИЙ ГОРИЗОНТ	
Пермская	Нижний	Кунгурский		P <sub>1</sub> kg		0-2500			П <sub>1</sub>	
		Артинский		P <sub>1</sub> ar		0-334				
		Сакмарский		P <sub>1</sub> s						
		Ассельский		P <sub>1</sub> a		10-524				
Каменноугольная	Верхний	Гжельский		C <sub>3</sub> g		192-339			П <sub>1</sub> <sup>c</sup>	
		Касимовский		C <sub>3</sub> k						
	Средний	Московский	мячковский		C <sub>2</sub> m <sub>2</sub> <sup>md</sup>		30-711			П <sub>2</sub> <sup>T</sup>
			подольский		C <sub>2</sub> m <sub>2</sub> <sup>pd</sup>					
			каширский		C <sub>2</sub> m <sub>1</sub> <sup>ka</sup>					
			верейский		C <sub>2</sub> m <sub>1</sub> <sup>vr</sup>					
		Башкирский	прикамский		C <sub>2</sub> b <sub>1</sub> <sup>pk</sup>		0-300			П <sub>2</sub>
			северокельтменский		C <sub>2</sub> b <sub>1</sub> <sup>sk</sup>					
	краснополянский			C <sub>2</sub> b <sub>1</sub> <sup>krs</sup>						
	Нижний	Серпуховский	протвинский		C <sub>1</sub> s <sup>pr</sup>	110-483			П <sub>2</sub> <sup>1</sup>	
			стешевский		C <sub>1</sub> s <sup>st</sup>					
			тарусский		C <sub>1</sub> s <sup>tr</sup>					
		Визейский	алек.-мих. веневский		C <sub>1</sub> v <sub>2</sub> <sup>al-vn</sup>	300-450				
			тульский		C <sub>1</sub> v <sub>2</sub> <sup>tl</sup>	240-530				
			бобриковский		C <sub>1</sub> v <sub>1</sub> <sup>bb</sup>	260-500				
			радаевский		C <sub>1</sub> v <sub>1</sub> <sup>rd</sup>	370-530				
		Турнейский	козьвинский		C <sub>1</sub> t <sub>2</sub> <sup>kav</sup>	260				
			кизеловский		C <sub>1</sub> t <sub>2</sub> <sup>ks</sup>	150				
			черепетский		C <sub>1</sub> t <sub>2</sub> <sup>cr</sup>	320				
упинский			C <sub>1</sub> t <sub>1</sub> <sup>up</sup>	430						
		малевский		C <sub>1</sub> t <sub>1</sub> <sup>ml</sup>	256					

Fig. 4. Consolidated lithological and stratigraphic section of subsalt sediments of the Zhanazhol-Tortkol zone

СИСТЕМА	ОТДЕЛ	ЯРУС	ГОРИЗОНТ	ИНДЕКС	ЛИТОЛОГИЯ	МОЩНОСТЬ (м)	КОЛЛЕКТОРЫ, ПОКРЫШКИ	НЕФТЕГАЗОНОСНОСТЬ	СЕЙСМИЧЕСКИЙ ГОРИЗОНТ
Пермская	Нижний	Кунгурский		P <sub>1</sub> kg	△ △ △				П <sub>1</sub> П <sub>1</sub> <sup>1</sup> П <sub>1</sub> <sup>2</sup> П <sub>2</sub> <sup>1</sup>
		Артинский		P <sub>1</sub> ar	▨ ▨ ▨	0-250			
		Сакмарский		P <sub>1</sub> s	▨ ▨ ▨	0-300			
		Ассельский		P <sub>1</sub> a	▨ ▨ ▨	50-200	■		
Каменноугольная	Нижний	Визейский		C <sub>1</sub> v <sub>2</sub>	▨ ▨ ▨	900-1300	▨ ▨ ▨	■	П <sub>2</sub> <sup>1</sup>
			Бобриковский + Косьвинский ?	C <sub>1</sub> v <sub>1</sub>	▨ ▨ ▨		▨ ▨ ▨	■	

*Fig. 5. Consolidated lithological and stratigraphic section of the subsalt sediments of the Laktybai-Tuskum-Kozhasay zone*

Above, light gray, creamy algal, oolitic and layered limestones of the Bashkirian stage, up to 236 m thick, are distinguished. Deposits of the Moscow stage overlap with unconformity and interruption. In the well P-2 of the Kozhasai area, in the interval of 3351-3260 m, black calcareous mudstones were encountered.

In the lower part of the Permian section, the sediments are represented by dark gray mudstones of the Asselian stage (12 m) with interlayers of fine-grained polymictic sandstones, sometimes calcareous with foraminiferal and radiolarian shells, as well as pelitomorphous limestones, radiolarites, and spongolites.

The Sakmara Stage includes a member of thin alternation of layers of mudstones, siltstones, marls, limestones. In the P-6 well of the Bashenkola area, the thickness of the Sakmarian deposits is 132 m.

Higher in the section, there are terrigenous deposits of the Artinskian stage, represented by sandstones in the lower part and mudstones in the upper, with a total thickness of up to 91 m.

The Laktybai-Tuskum-Kozhasai zone is characterized by a reduced thickness of Moscow deposits and the absence of Upper Carboniferous deposits, which is associated with the facies sedimentation environment in the Middle - Late Carboniferous in this zone. And one more feature of the section of this zone is the presence of 3 terrigenous strata.

**The lower terrigenous sequence** of the Visean stage (1300 m) corresponds in stratigraphic position and is close in lithological composition to the sections of the Zhanazhol-East Tortkol zone.

However, it is possible to trace some differences in the sedimentation conditions of the Lower Visean deposits, for example, graywacke sandstones prevail in the sections of the Laktybay area, composed of fragments of effusive, siliceous, carbonate and clay rocks of poor sorting and weak roundness. The accumulation of these sediments took place on the continental slope in the underwater fans. These sediments lack textures indicative of wave activity. The plastic material was supplied by grain and turbidity flows that appeared from time to time in the submerged part of the river valley, located near the shelf edge.

Significant variability of the Lower Visean deposits is noted near the Tortkol area. There are gravel-pebble and sandy-argillaceous deposits, represented by mudstones, silty-sandstones, less often gravelstones and conglomerates.

**The average thickness** of the section of the Laktybai-Tuskum-Kozhasai zone up to 200 m thick is composed of interbedded carbonate-terrigenous bituminous-clayey rocks containing landslide-mudslide breccias, conglomerates, bedding angles of 45°-90°. A set of paleontological remains without an orderly stratigraphic sequence from the Lower Carboniferous to the Asselian of the Lower Permian was determined from these deposits. According to paleontologists, the age of this interval of deposits should be considered as the middle part of the Asselian. The signs of slumping of the primary weakly lithified sediment, the presence of facies of grain and silt flows indicate that the sedimentation of the above-described sediments was of a slope nature; there was a gravitational movement of clastic material from the shelf ledge, periods of tectonic activity were accompanied by volcanism.

The described deposits can be considered as a thickness of filling the unevenness of the relief with deposits of different scales in terms of volume and formation time.

**The upper stratum** (Asselian-Artinskaya) overlies the above-described deposits, composed mainly of sandy-clayey rocks with rare interlayers of limestones, which are sediments of paleodelts.

**Borzher-Akzhar** zone includes the structures of Kozdysai, Akzhar, Tasshiy, Karatyube, etc. The zone is characterized by the presence of pre-Devonian, Devonian, and Lower Permian deposits in the section (fig. 6).

On a reliable paleontological basis, stratigraphic unconformities between the Devonian and Carboniferous, Carboniferous and Permian were revealed, deposits of the upper part of the Lower Devonian may fall out of the section, deposits of the Middle-Upper Devonian, Tournaisian stage and the lower part of the Lower Visean substage, as well as the Upper Serpukhovian substage, middle and the Upper Carboniferous and the lower part of the Asselian. The deposition of several stratigraphic subdivisions from the section indicates the tectonic activity of this territory and, possibly, the indicated zone was the most elevated area of the Zharkamys arch. In this zone, in the well G-5 Vostochny Akzhar, a 38 m stratum of metamorphic rocks (basement?) Was exposed, which is overlain by carbonate-terrigenous rocks of conventionally Cambrian age. They are overlain by Lower Devonian limestones.

The overlying terrigenous rocks belong to the Carboniferous and Lower Permian deposits. In this zone, the Lower Permian deposits are characterized by increased thickness (825-1066 m), and the Lower Carboniferous ones are reduced (up to 500 m) in comparison with adjacent areas.

The Visean stage contains clay-sandy sediments of the lower substage. The deposits of the upper substage are characterized by the distribution of lamellar siltstones and fine-grained sandstones.

СИСТЕМА	ОТДЕЛ	ЯРУС	ПОДЪЯРУС	ГОРИЗОНТ	ИНДЕКС	ЛИТОЛОГИЯ	МОЩНОСТЬ (м)	КОЛЛЕКТОРЫ, ПОКРЫШКИ	НЕФТЕГАЗОНОСНОСТЬ	СЕЙСМИЧЕСКИЙ ГОРИЗОНТ
Пермская	Нижний	Кунгурский			P <sub>1</sub> kg	Λ Λ Λ Λ Λ Λ	130-3500			П <sub>1</sub>
		Артинский			P <sub>1</sub> ar		188-387		○	
		Сакмарский			P <sub>1</sub> s		220-310		■	П <sub>1</sub> <sup>2</sup>
		Ассельский			P <sub>1</sub> a		88-250		■	П <sub>2</sub> <sup>1</sup>
Каменноугольная	Нижний	Серпуховский	Нижний		C <sub>1</sub> s <sub>1</sub>		31-85		○	П <sub>2</sub> <sup>2</sup>
		Визейский	Верхний		C <sub>1</sub> v <sub>2</sub>		400			П <sub>3</sub> <sup>2</sup>
			Нижний		C <sub>1</sub> v <sub>1</sub>					
Девонская	Нижний				D <sub>1</sub>		90			П <sub>4</sub>
Ордовик-силур					O-S		42			Φ
Фундамент (Pr)						+++	38			

Fig. 6. Consolidated lithological and stratigraphic section of the subsalt deposits of the Borzher-Akzhar zone

Clay rocks are predominantly developed; in the upper part, rare interlayers of organogenic-sludge-detrital limestones appear. The section of the Visean stage is characterized by the presence of interbeds of gravelstones, as well as the presence of interlayers enriched in organic matter, creating a gamma-active background.

The deposits of the Serpukhovian stage are represented by clayey-siltstones with rare interlayers of organogenic-detrital limestones transferred from the coastal zone. Lower Carboniferous deposits may have accumulated in the lower part of the coastal slope below the base of wave erosion, as well as in the delta.

Above, deposits of the Lower Permian lie in full stratigraphic volume. At the base of the section, a gamma-active member is traced, composed of interbedded clay-siliceous-bituminous rocks with the inclusion of brecciated limestones, dolomites, mudstones with the inclusion of a mixed complex of the Carboniferous-Permian fauna. In terms of lithological composition, these deposits are similar to the deposits of the Asselian stage of the Tuskum-Kozhasai zone. Above, there is a dolomite-limestone-mudstone-siltstone complex with interlayers of sandy, tuffite, siliceous, marly rocks. Oblique and horizontal bedding of rocks is characteristic. The age of the deposits is Asselian.

Sakmara-Artinskian deposits are represented by interlayering of clayey rocks, various-grained siltstones, sandstones from fine-grained to gravel, rare clayey dolomites, tuffites and conglomerates. An increase in the thickness of the Lower Permian deposits is observed at the Akzhar deposit, at pl. Kozdysay, Krykkuduk, Tereshkovskaya, i.e. to the west of the development boundary of carbonate deposits of the Carboniferous.

The formation of the Lower Permian deposits took place in shallow-sea conditions, with a complex of rocks of underwater paleodelts, with the introduction of carbonate material from the shelf area, as well as tuffaceous material from the area of volcanic activity.

***Teresken zone.*** The Teresken zone corresponds to the trough of the same name located southeast of the Minsylmas-Teresken uplift of the Devonian-Early Carboniferous deposits of the South Emba uplift. The deflection with a depth of 9-10 km is made by a layer of sediments, which (due to the lack of drilling data) are interpreted by different researchers in different ways. Some attribute them to the Permian-Triassic strata, which is located on the Ustyurt basement, others suggest the presence of Paleozoic formations in the Middle and even Early Devonian, while others believe that the strata occurring in the lower troughs and on the ledges correspond to effusive-sedimentary and ophiolite formations of the Southern Urals. The currently available seismic materials obtained in the course of studies of the Teresken block by the Japanese National Oil Company make it possible to substantiate the model of the geological structure of the Teresken zone much more clearly.

In the pre-Jurassic structural-tectonic complex, two structural stages are distinguished, differing in different types of folding and separated by the boundary of angular unconformity: the lower one, represented, in our opinion, by Paleozoic deposits and the upper one, which is confidently identified by a number of char-

acteristic features with the Upper Permian and Triassic terrigenous complexes. The Paleozoic stage of the Teresken trough is possibly represented by a part of the carbonate platform that has survived from destruction (erosion), which has been lowered in the southeast direction as a result of the formation of the Permian-Triassic troughs in the area of Northern Ustyurt.

***The following structural features of the Paleozoic deposits of the Teresken trough are noted:***

- In the area of the Minsualmas-Teresken uplift, composed of Devonian and Tourne-Visean terrigenous deposits, there is a scaly uplift of the base of the sedimentary cover along a series of thrust faults and a general reduction of more than two times in the thickness of the Paleozoic complex in comparison with the central parts of the South Emba trough of the basement, the thickness of which in the area of the Tohtkol-2 well it reaches 10-11 km. The Teresken trough is separated from the bulge by a regional fault (or a system of faults) of possibly ancient origin, but most actively manifested in the Late Permian-Triassic time, since the Permian-Triassic deposits southeast of the fault become the dominant complex of the entire pre-Jurassic section.

- At the top of the Paleozoic section of the considered trough, there is a layered member that creates a train of intense reflected waves in 3-4 phases on the seismic sections. The member under consideration is an angular unconformity surface for the underlying Paleozoic sediments and is overlain by Permian-Triassic sediments that are also uncomfortably dislocated. Such structural features of the member under consideration make it possible to identify it with clayey (carbonate-clayey) deposits that accumulated in a relatively deep-water environment during a period of relative tectonic calm before the Upper Permian deposits. We believe that these deposits are of Kungurian age. In contrast to the closed Caspian basin, where saline deposits accumulated in the kungur, the North Ustyurt Kungur basin was open and deepened from the South Emba uplift to the south, as evidenced by a noticeable reduction in the thickness of the complex under consideration in this direction.

- The Paleozoic level of the Teresken trough is subdivided into three seismic complexes. The lower parts of the Paleozoic sediments between the basement surface and the reflecting horizon  $P_2^1$  are represented by terrigenous sediments of the Upper Devonian-Early Carboniferous - an analogue of the Zilair Group of the South Emba uplift. However, the thickness of these deposits in the trough is the first hundreds of meters (up to 1 km), in contrast to the core of the uplift, where these are multi-kilometer strata. Above there is a carbonate complex, according to V.M. Pilifosov and E.S. Votsalevsky, which is the southeastern termination of the carbonate complexes KT-II and KT-I. Above, carbonate deposits are limited by a sharp reflecting horizon. In some areas, the seismic complex under consideration

is divided by the reflecting horizon P2 into Late Visean-Early Moscow and Late Moscow-Kasimov parts. The total thickness of carbonate deposits of presumably Late Visean-Kasimov age is 700-900 m, which is quite comparable with the thickness of deposits in the area of the Tokhutkol-East Tortkol part of the carbonate platform, facing the Caspian basin. It should be emphasized that to the southeast there is a sharp reduction in the thickness of carbonate deposits to almost complete pinching out, which we associate with the end of the carbonate platform and the replacement of carbonates by deep-water facies. On the example of the Teresken zone, the sedimentation scarp of the carbonate platform, facing southeast, is confirmed, which was clearly recorded in the Saztobe-Bekbolat zone. The described Carboniferous deposits are overlain by a largely eroded sedimentary complex, from 50-100 to 1000 m thick. The stratigraphic position between the Kungurian and Late Carboniferous deposits allows us to attribute it to the Early Permian complex, represented by a terrigenous-carbonate stratum, which is probably an analogue of the Asselian-Sakmarian deposits (KT -0), penetrated by the Yakut-1 well on the carbonate platform.

### **Conclusions**

A comparison of the Paleozoic sections of the eastern part of the Caspian basin showed that it developed in the regime of collisional processes of various nature /1, 3/. The formation of vertical facies rows was influenced by tectonic factors and sea level fluctuations. In addition, thrust tectonics, which controlled the placement of oil and gas fields and prospective structures, was of great importance in the formation of the structure of carbonate platforms.

In the Late Devonian - Early Carboniferous, the Temir carbonate platform was formed on the uplifted edge of the passive continental margin adjacent to suture zones composed of graywacke complexes. It developed in the mode of stable long deflection.

The uplift of the South Emba uplift in the Late Visean time led to a gradual shallowing and accumulation of shallow terrigenous deposits in the Zhanazhol-Tortkol zone.

In the Gzhel-Early Permian time, orogenic processes began in the Urals, as a result of which the Cis-Ural Trough (Ostansuk-Dzhurun structural-formation zone) was formed in the eastern part of the depression. The molasse complex of the trough underwent consolidation compression from the Urals, with the appearance of anticlinal thrust folds.

The Asselian age was marked not only by an increase in the depth of the sea, but also by the emergence of a shortage of sedimentary material for a certain period of time. Under these conditions, the accumulation of condensed sediments of the so-called - Lower Permian gamma of the active member took place, in the

formation of which the processes of Early Permian volcanism played a significant role. It has a microlayer structure and consists of silicified rocks, ash tuffites, silicites, radiolarites, multicomponent bituminous-clay-carbonate rocks, limestones and dolomites with a high concentration of organic matter in the sediments. Lower Permian deposits are infill strata in the form of a huge cliniform.

Against the general background of the regression of the Lower Permian basin, a number of minor transgressions and regressions were revealed. Transgressions are timed to the beginning of the Asselian, Sakmarian and Artinskian centuries, regressions - to the end of each tier.

As you can see, the Temirskaya and Zhanazhol-Tortkolskaya carbonate platforms, which controlled the sea depth, played an important role in the distribution of sedimentary material, which could not but affect the lithological composition of the rocks and their textural and structural features. The presence of carbonate platforms was also reflected in the completeness of the sections and the thickness of the Lower Permian deposits, which within the carbonate platforms is much less than in the adjacent relatively deep-water areas located to the west outside the carbonate platforms.

There are differences in the structure of these carbonate platforms:

1. Temirskaya has a two-tiered structure: lower - Devonian-Early Visean (KT-II) and upper - Oka-Early Moscow (KT-I), separated by terrigenous strata.
2. The Zhanazhol-Tortkol carbonate platform has a three-tiered structure: the lower one is the Late Visean-Kashira (KT-II), the middle one is the Late Moscow-Gzhel (KT-I) and the upper one is the Asselian-Sakmarian.

In the Laktybai-Tuskum-Kozhasai zone, the absence of KT-I is associated with the subsidence of this zone in the Moscow Age, which was manifested in the appearance of algal biostromes, bioherms, and shallow sea shallows in the section above the calcareous sediments of the bathyal complex of slope facies with a characteristic condensed type of sediments. Between the inner and outer shelf, in the Laktybay-Tuskum-Kozhasay zone, there were sedimentary incisions, along which flows transported sedimentary material, unloading in the Borzher-Akzhar zone. One of such incisions is clearly traced between the Laktybai and Zhanatan-1 structures according to drilling data. All the material brought in, scattered by the currents, was distributed over the territory of the far shelf, creating various sedimentation forms: accumulative sandy-argillaceous swells and bars, as well as silty areas beyond the reach of underwater currents and deltaic flows. In the latter case, in the described relatively deep-water area of the sea basin, there was an accumulation of thin-horizontally-layered clay-silty sediments, which in transgressive series alternated with interlayers of carbonate silts and silicites. This is especially true for the most remote territory (East Akzhar-Kursay).

In the Teresken zone, Paleozoic deposits are quite intensively deployed. There are several stages of tectonic activity. At the first stage, apparently, in the pre-Artinskian time, an inversion of the South Emba trough occurred with the withdrawal of the Devonian-Early Carboniferous terrigenous deposits above the baseline in the Minsualmas-Teresken zone and the complete destruction of the carbonate Carboniferous-Early Permian platform in this zone. In the pre-Kungur time, the Teresken trough was formed on the southeastern slope of the platform, in which clay deposits accumulated in the Kungur time in a calm environment.

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