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## FREE RADICAL OXIDATION CHARACTERISTICS IN BIOLOGICAL MEDIA IN OFTEN ILL CHILDREN AND CHILDREN WITH ASTHMA

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It was performed a comparative study of the free radical oxidation parameters in various biological media in children with diseases of the respiratory system – asthma and frequent acute respiratory diseases. The study involved 215 children, who were divided into 3 groups: 58 healthy children (group 1 – control), 74 children (group 2) – frequently ill children, 83 children (group 3) – children with asthma. The changes in the indicators of free radical oxidation intranasal lavage and exhaled breath condensate groups often ill children and children with asthma are manifestations of systemic disorders in the body of patients surveyed. Similar shifts are identified and in terms of the peripheral blood of these patients: in frequently ill children and children with asthma observed a significant increase in the concentrations of diene conjugates and malondialdehyde relative to the control level, while the value of the activity of antioxidant enzymes superoxide dismutase and catalase were significantly reduced relative the corresponding values in the control group of children. The identified biochemical changes confirm that a better balance of pro- and antioxidant systems of the body should be a prerequisite for complex treatment and preventive measures undertaken for children with common infectious diseases in the developing allergic background.

**Keywords:** free radical oxidation, bronchial asthma, often ill children, upper respiratory tract

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It is generally known that in the body of patient with the lung disease and disease of upper respiratory system, the changes develop on the cell and molecular levels as a result of pathological process which are virtually lack in normal [2–4]. These changes can be examined with the help of laboratory analysis of biological samples, for example, fluids are getting from bronchoalveolar lavage, nose irrigation, blood test and lung biopsy.

It is known at the present time that the changes of process of Free Radical Oxidation (FRO) and the functional disorder of Antioxidant System (AOS) make a valuable contribution to development of some diseases which are concomitant with the changes of cytochemical descriptions of upper respiratory tract. In particular, the active forms of oxygen play important role in the pathogenesis of bronchial asthma (BA) [1, 3, 12]. The courses of all pathological conditions that concomitant with concentration increase of active forms of oxygen are characterized by oxidation stress, including acute respiratory disease of ailing children (AC) [4, 9].

At the present time a lot of works devoted to study the role of active forms of oxygen in different pathological processes concerning survey and experimental descriptions, this is indicative of recognition basic meaning of active forms of oxygen in pathogenesis of different diseases [5, 14, 15]. The main mechanism of progress of oxidizing medium connected with free radical damage of plasmatic, mitochondrial and nuclear membrane, nuclear and mitochondrial genome, blood lipoprotein that lead to damage the vessels and histohematogenous barriers [8]. At the same time the report about pathological role of FRO processes and condition disorder of AOS in pathology of lungs and upper respiratory tract is not systematized. This is relevant in full to the assess-

ment of description of these processes for those children with different pathological respiratory system, in particular, those children who suffer from bronchial asthma and ailing children who have periodically acute respiratory disease. There is no such kind of information in accessible literature.

**The aim of work** is comparative inquiry of characteristics of Free Radical Oxidation in different biological environments of children with respiratory system disease.

### Materials and methods of research

There was checkup of 215 children on the basis of allergology department, Osh Regional Children Clinical Hospital and they were divided into three groups:

- 58 healthy children (1<sup>st</sup> group-control);
- 74 children (2<sup>nd</sup> group) ailing children;
- 83 children (3<sup>rd</sup> group) suffer from bronchial asthma.

There is distribution of patients according to age, gender and average lasting of disease in the following Table 1.

There was organized condensate collection of expired air by G.V. Belov's method (2005) [2] and also collection of rhinal lavage by general method. Concentration of some matters and indicators were tested in these biological environments: levels of total lipids, hydroperoxides, diene conjugates, oxidation index.

As well there was evaluation of estimate activity of Free Radical Oxidation processes and Antioxidant System patients that had been examined. At the same time there was tested concentration of diene conjugates, malonic dialdehyde, activity of catalase and superoxide dismutase (SD). Identification of malonic dialdehyde in blood was tested by fluorimetric method which is based on that thiobarbituric acid interact with low-molecular dialdehyde (mainly with malonic) in acid medium making pink color [7].

Identification of diene conjugates in blood plasma was implemented by UV absorption of heptanoic and isopropanolamic extracts which is based on measuring intensity absorption approximately 232–234 nm that specified with conjugative dialdehyde structures (beforehand extracted from plasma) which is appeared in forming hydroperoxides polyunsaturated fatty acids [7].

Table 1

Distribution of patients according to age, gender and average period of disease

Characteristics		1 <sup>st</sup> group (control group) <i>n</i> = 58	2 <sup>nd</sup> group (ailing children) <i>n</i> = 74	3 <sup>rd</sup> group (children suffer from bronchial asthma) <i>n</i> = 83
Age		13,9 ± 2,1	13,7 ± 1,8	12,8 ± 2,6
Gender	Female	30 (51,7%)	39 (52,8%)	45 (54,2%)
	Male	28 (48,3%)	35 (41,3%)	38 (45,8%)
Period of disease (year)		–	9,9 ± 2,1	5,7 ± 3,5

The activity of catalase was determined using spectrophotometric method which was based on identification of speed decomposition of hydrogen peroxide mm/m (wavelength 230 nm). There was added ethanol for stabilization hemolysate and decomposition of complex catalase H<sub>2</sub>O<sub>2</sub> [7].

Identification of superoxide dismutase activity was implemented by the method that suggested V.A. Kostjuk and others (1990) which was based on oxidation reaction of quercetin [6].

Statistical analysis of data was arranged with the help of program package Statistica 8.0. To determine the statistical important differences of characteristics, in those groups where the patients were examined, U-criterion Manna Whitnye (distribution of parameters value fundamentally differ from normal as shown Kolgomorov-Smirnov's test). The results were evaluated as statistical important in  $p < 0,05$  value.

#### Results of research and their discussion

The analysis of FRO of endonasal lavages showed that concentration of total lipids at the end was  $0,492 \pm 0,023$  mg/ml, and the levels of this parameter were significantly low  $0,426 \pm 0,021$  and  $0,412 \pm 0,031$  mg/ml in groups of Ailing children and Children suffer from bronchial asthma (Fig. 1).

Level of hydrogen peroxide content in endonasal lavages of examined children in control group was  $0,242 \pm 0,016$  mg/ml, the

results in group of Ailing Children was a bit higher  $0,267 \pm 0,016$  mg/ml, its meaning significantly did not exceed like that during the control. Children suffer from bronchial asthma had different result and it was higher in 1,5 size than in control, significantly exceeding this level and also exceeding adequate meaning level in second group (Ailing Children).

Concentration comparison of diene conjugates showed that the level of this result was  $0,045 \pm 0,011$  mg/ml in the group of ailing children rather like the level in control  $0,037 \pm 0,004$  mg/ml. The meaning of this result was maximum  $0,051 \pm 0,003$  mg/ml in group of children suffer from bronchial asthma significantly exceeding the control level (Fig. 2).

Evaluation results of oxidation index brought out significant differences in group of examined children. Like this, if the level was  $0,483 \pm 0,019$  in control group, the meaning of this result was significantly higher ( $p < 0,05$ ) –  $0,628 \pm 0,021$  in the group of Ailing Children. The level of oxidation stress was maximum  $0,849 \pm 0,034$  in the group of children suffer from bronchial asthma and significantly exceeded ( $p < 0,05$ ) the same levels of first and second groups (Fig. 3).

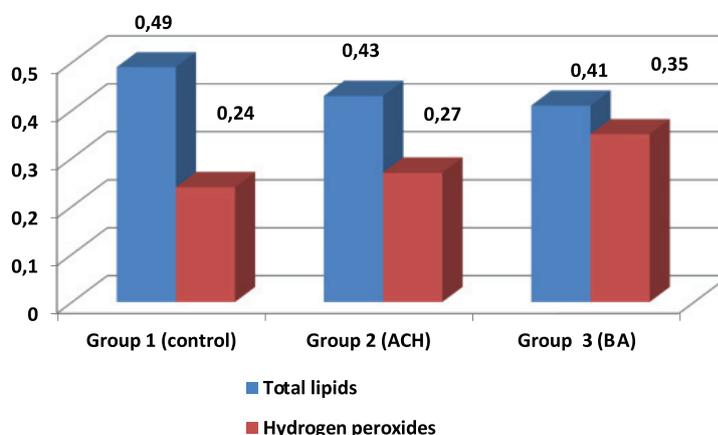


Fig. 1. Concentration of total lipids and hydrogen peroxides in rhinal lavages of examined children

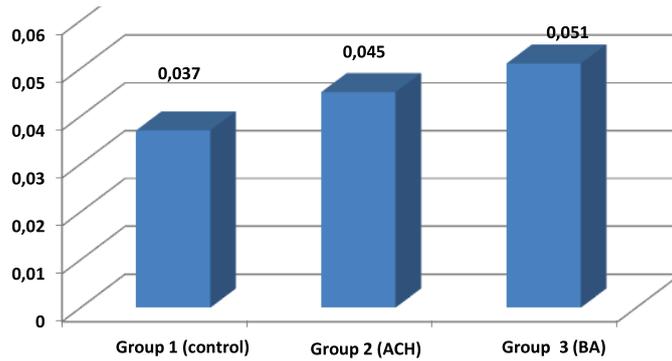


Fig. 2. The levels of diene conjugates in rhinal lavages of examined children

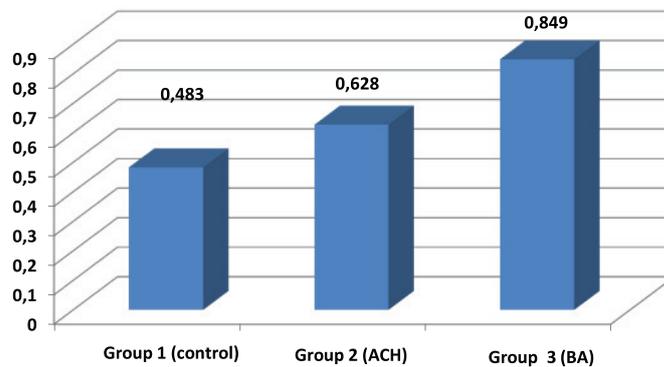


Fig. 3. Oxidation index of rhinal lavages in examined children

The process investigations of Free Radical Oxidation in condensate of expired air testified that the concentration of total lipids was  $0,106 \pm 0,007$  mg/ml in control group. The level of these parameters in the group of Ailing children and Children suffer from bronchial asthma were a bit lower  $0,093 \pm 0,0005$  and  $0,091 \pm 0,008$  mg/ml but significantly intergroup differences were no found (Fig. 4).

The level content of hydrogen peroxide in condensate of expired air (CEA) in control group was  $0,054 \pm 0,006$  mg/ml, the meaning of this parameter in the group of Ailing Children was significantly higher ( $p < 0,05$ ) –  $0,072 \pm 0,007$  mg/ml and this result in the group of children suffer from bronchial asthma was more higher  $0,079 \pm 0,005$  mg/ml significantly exceeded ( $p < 0,05$ ) the level of control group.

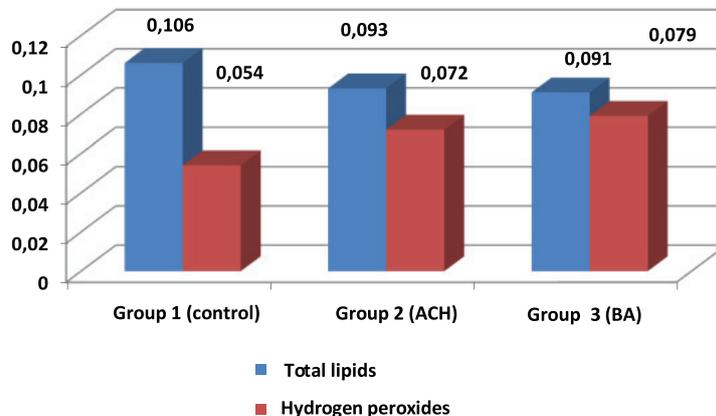


Fig. 4. Concentration of total lipids in condensate of expired air in examined children

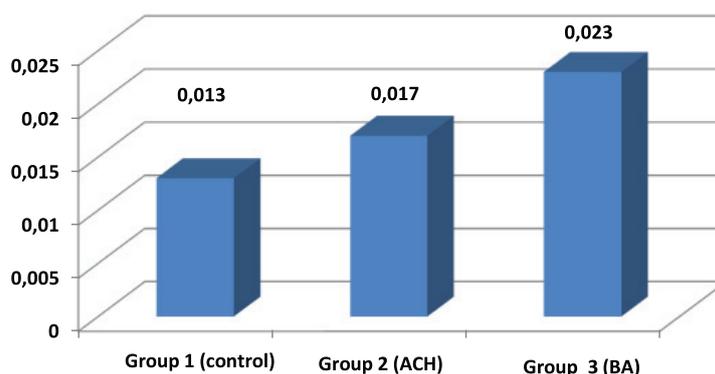


Fig. 5. The levels of diene conjugates in condensate of expired air in examined children

The level comparison of diene conjugates showed that the level of this result in the group of Ailing Children was  $0,017 \pm 0,004$  mg/ml considerably having no differed from the result in control –  $0,013 \pm 0,002$  mg/ml. The maximum meaning of this result was  $0,023 \pm 0,003$  mg/ml in the group of children suffer from bronchial asthma which significantly exceeded ( $p < 0,05$ ) the same levels in control group (Fig. 5).

The meaning comparison of the result of Oxidation index showed significant differences in the groups of examined children. The level in the control group was  $0,485 \pm 0,018$ , the meaning of this result in the group of Ailing Children was significantly higher ( $p < 0,05$ ) –  $0,781 \pm 0,021$ . The level of Oxidation stress in the group of children suffer from bronchial asthma was maximum  $0,856 \pm 0,033$ , that significantly exceeded ( $p < 0,05$ ) the same levels in the first and second groups (Fig. 6).

Probably, it says that brought out changes of results of Free Radical Oxidation in endonasal lavages and in condensate of expired air are become apparent of systemic disturbance in the body of examined patients from the group of Ailing Children and Children suffer from the bronchial asthma. Analogous changes certainly should be uncovered in peripheric blood of this contingent of patients which were showed in our further investigations.

The comparative evaluation characteristics of FRO and Antioxidant System of peripheric blood from examined children showed some changes as in the Fig. 2. Evidently the concentration of diene conjugates and malonic dialdehyde of ailing children and children suffer from bronchial asthma are significantly higher ( $p < 0,05$ ) relatively to control level at the same time the meaning of enzyme activity of antioxidant system of superoxide dismutase and catalase were significantly reduced relatively the same meanings in control group.

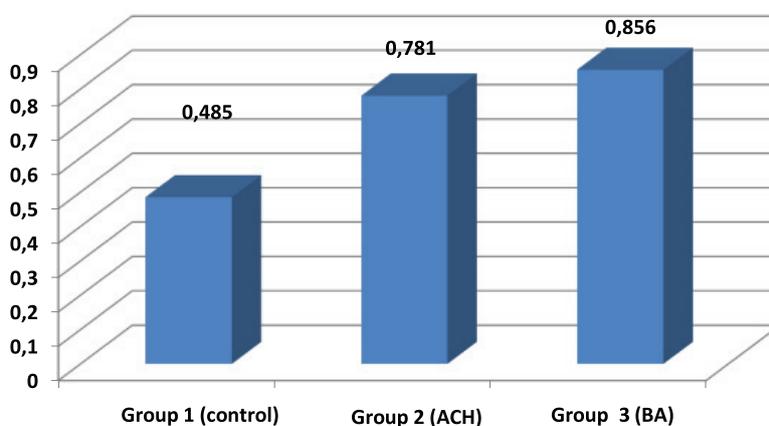


Fig. 6. Oxidation Index Condensate of expired air in examined patients

Table 2

Characteristics	Groups of children		
	Group 1 (control) (n = 58)	Group 2 (Ailing children) (n = 74)	Group 3 (Children suffer from bronchial asthma) (n = 83)
Diene conjugates (units of relative density/mg of gen. lipids)	0,212 ± 0,029	0,374 ± 0,52*	0,414 ± 0,77*
Malonic dialdehyde (units)	2,08 ± 0,35	3,67 ± 0,36*	3,85 ± 0,21*
Superoxide dismutase (units/mg Hb)	1,72 ± 0,41	0,62 ± 0,19*	0,55 ± 0,08*
Catalase (CAT) (ME/g Hb)	28,5 ± 3,2	13,8 ± 3,9*	17,3 ± 2,8*

Note: the difference of authentic (in  $p < 0,05$ ) relatively appropriate meaning of indicators of control group.

### Conclusion

Thus, at the present time described role of the processes of FRO in several homeostatic processes, including – the basis of synthesis of many biologically active compounds – leukotrienes, purine deoxyribonucleotides, uric acid, high energy compounds – the changes of concentrations in tissues may contribute to a number of pathological state [11, 13]. The active forms of oxygen (AFO) and free radicals are formed mainly in the sequential accession electrons to oxygen in the process of lipid peroxidation (LPO). LPO is one of oxygen utilization pathways in the cell membranes. LPO is a defensive reaction that facilitates the updating of phospholipid membranes [9, 10, 14]. It is obvious that these changes are manifestations of the processes occurring at the molecular and cellular levels in the mucosa of the upper respiratory tract and pathologies under consideration underlying the pathogenesis of nosology. One of these ways is the pathogenesis changes of free radical oxidation and violations of antioxidant protection.

The investigation has shown that ailing children and children suffer from bronchial asthma observed that increased activity of free radical oxidation, in particular increasing the concentration of malonic dialdehyde and diene conjugates in blood plasma and in the KBB. At the same time it showed a reduction in the activity of the antioxidant system in these patients, which manifested weakening enzyme systems – superoksiddissmutazy (SOD) and catalase. The identified biochemical changes confirm that the view expressed by many authors the optimize the balance of pro- and antioxidant systems of the body and should be an important mechanism and a necessary condition for complex treatment and preventive measures undertaken for children with frequent infections, developing on an allergic background.

### References

1. Abdrakhmanov M., Farkhutdinov U.R., Farkhutdinov R.R. Features of the expression of the active forms of oxygen in the blood cells of patients with chronic bronchitis // Ter. arhiv. – 2001. – № 3. – P. 45–48.
2. Belov G.V., Arbuzov A., Brimkulov N.N. Assessment of pulmonary surfactant system in normal and pathologic. – Bishkek KNIKIIVL, 2005. – 105 p.
3. Bolevich S. Asthma and free-radical processes. Pathogenetic, clinical and therapeutic aspects. – M.: Medicine, 2006. – 253 p.
4. Velichkovsky B.T. Environmental pulmonology (the role of free-radical processes). – Ekaterinburg, 2001. – P. 4–28.
5. Zenkov N.K., Lankin V.Z., Menytsikova E.B. Oxidative stress (biochemical and pathophysiological aspects). – M., 2000. – P. 56–58.
6. Kostyuk V.A., Potapovich A.I., Kovaleva J.V. A simple and sensitive method for determining the activity of superoxide dismutase, based on the reaction of quercetin // Problems of oxidation. honey. chemistry. – 1990. – № 2. – P. 88–91.
7. Menshikov V.V., Delektorskaya L.N., Zolotnitskaya R.P. et al. Laboratory Methods in clinic. – M., 1987. – 368 p.
8. Moroz V.V., Molchanov L.V., Muraveva M.YU. et al. Disorders of lipid metabolism after severe mechanical trauma // General reanimatol. – 2006. – № 5–6. – P. 40–43.
9. Soodaeva SK Oxidative stress and antioxidant therapy for respiratory diseases // Pulmonology. – 2006. – № 5. – P. 122–126.
10. Forman H.J., Torres M. Reactive oxygen species and cell signaling: respiratory burst in macrophage signaling // Am. J. Respir. Crit. Care Med. – 2002. – Vol. 166, № 12. – P. 4–9.
11. Mathias L.J., Khong S.M., Spyroglou L. et al. Alveolar macrophages are critical for the inhibition of allergic asthma by mesenchymal stromal cells // J. Immunol. – 2013. – Vol. 191 (12). – P. 5914–5924.
12. Pohl W.R. The pathobiology of COPD // Wien. Med. Wochenschr. – 2005. – Bd. 155. – P. 85–89.
13. Rahman I., Biswas S.K., Kode A. Oxidant and antioxidant balance in the airways and airway diseases // Eur. J. Pharmacol. – 2006. – Vol. 533. – P. 222–239.
14. Wagner P.D. The biology of oxygen // Eur. Respir. J. – 2008. – Vol. 31. – P. 887–890.
15. Wood L., Gibson P., Garg M. Biomarkers of lipid peroxidation, airway inflammation and asthma // Eur. Respir. J. – 2003. – Vol. 21. – P. 177–186.

## SOME PECULIARITIES OF YOUNG HARP SEALS BLOOD COMPOSITION

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Results of investigations of chemical and cellular blood composition of harp seals containing in captivity for long time are submitted. After year of stay in captivity the loss of sharp individual differences in the biochemical status of animals is marked. The most appreciable differences between seals, adapted to a captivity successfully, and not survived in new conditions, are found in cell content of blood, namely in the ratio of lymphocytes and neutrophils number. At the seals, which have lost, the so-called "physiological decussation", being characteristic age feature of the cell content of mammalian blood was not observed. This fact allows to assume, that the loss of the above mentioned characteristics can be considered as drop of vitality level, bringing in a result to death of animals.

**Keywords:** pinnipeds, harp seal, care in captivity, blood

Previously we examined blood cellular composition and metabolic features of harp seals (*Pagophilus groenlandicus*) during early postnatal ontogenesis [4, 7]. However, the formation of the hematopoietic system continues in the later stages of individual development. In this paper we present some results of blood parameters evaluation of harp seals at the age from 4 months to 3–4 years in connection with their adaptive capabilities.

#### Materials and methods of research

Blood of four harp seal pups brought from Kandalaksha Bay of White Sea at the age of 3 months was investigated. The first year seals spent in stationary oceanarium, and subsequently they were relocated to experimental station of MMBI in Kola bay of Barents Sea. Blood was taken from the extradural vein as described by Geraci [5] in the syringe with heparin. The first blood sampling was

done after 1 month of animals stay in captivity. Obtained samples were investigated by means of routine haematological and various biochemical techniques [6].

#### Results of research and their discussion

At the beginning of observation period, animals state differed from the normal. This was, among other things, indicated by data of blood cell count and indices of natural resistance of the animals: sorption capacity of erythrocytes, lysozyme and haptoglobin in the blood plasma (Table).

As a result of further tests of blood cellular composition it was found that the most significant changes during observation period involved the absolute (per 1  $\mu\text{l}$ ) number of eosinophils (Fig. 1). This index is sensitive indicator of adrenal cortex condition, whose hormones are involved in the development of stress.

Hematological parameters of harp seal pups for the first time of stay in captivity

Age	Seal N	ESR,	E,	Hb,	L,	SCE,	LYZ,	Hp,
		mm/hr	$10^6/\mu\text{l}$	g/l	$10^3/\mu\text{l}$	%	g/l	g/l
4 month	1	1	4,5	212	13,2	27,0	27,03	0,38
	2	32	3,7	192	12,2	56,8	56,76	0,25
	3	0,5	5,4	244	6,8	24,3	24,33	0,35
	4	0,5	3,8	218	12,8	37,8	37,84	0,35
4 month 2 week	1	2	4,4	234	15,8	23,1	23,08	1,00
	2	36	3,9	182	14,8	7,69	7,69	1,75
	3	1	4,9	224	9,0	7,7	7,69	1,5
	4	39,5	3,2	174	12,0	30,8	30,77	1,70
4 month 3 week	1	2	4,0	222	11,1	11,2	11,16	0,18
	2	32	3,6	230	13,2	14,5	14,47	1,72
	3	0,5	5,2	228	6,5	10,5	10,53	0,92
	4	37	3,4	202	14,2	19,7	19,74	1,57
5 month	1	2	5,3	238	9,0	23,1	23,1	0,20
	2	15,5	3,8	224	11,3	48,6	48,61	0,40
	3	1,5	4,3	232	10,1	30,6	30,56	0,80
	4	55	4,2	190	5,7	26,4	26,39	0,95

#### Notes:

ESR – erythrocyte sedimentation rate; E – erythrocytes; Hb – hemoglobin; L – leukocytes; SCE – sorption capacity of erythrocytes; LYZ – lysozyme; Hp – haptoglobin.

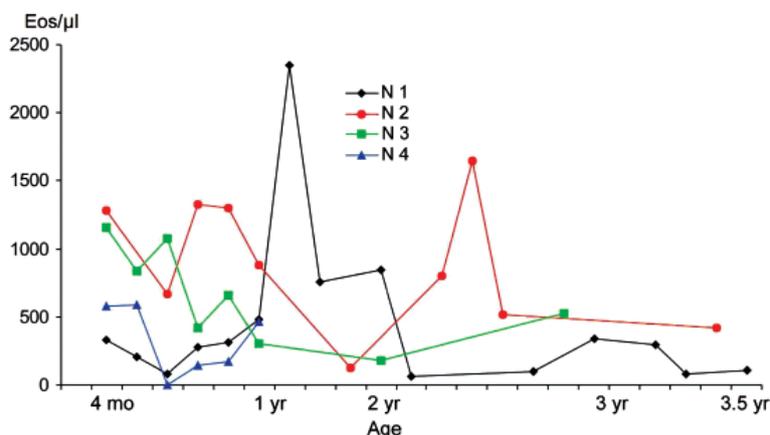


Fig. 1. Eosinophils content in harp seal pups in different age periods

Drop of eosinophils number by two times and more is regarded as reliable indication of development of stress response Phase II [1]. Eosinophil counts differed significantly in the animals under study. In fact, in seals № 1 and 4 the initial level was lower, and decline was greatest (down to 0%).

Capturing, transportation, placement in an enclosed space (in this case, baths) are known factors causing stress-reaction and associated shifts in the blood composition in wild animals, including marine mammals. The first blood research was performed after a month of seal delivery in oceanarium. Hence, the “acute” period of impact of above mentioned factors ap-

peared to have been over, although the glucose level was higher according to the first test. In the course of observations, intensive therapy of animals with anti-helminth drugs was conducted, those drugs being also capable of affecting the total count and composition of leucocytes.

In terms of the dynamics of the changes in the relative lymphocyte and neutrophil count between the pairs of animals, some significant differences were revealed. The same group included seals № 1 and 2 (that successfully passed the adaptation period and still living), the second, comprised № 3 and 4 (that died after 34 and 18 months of captivity, respectively) (Fig. 2).

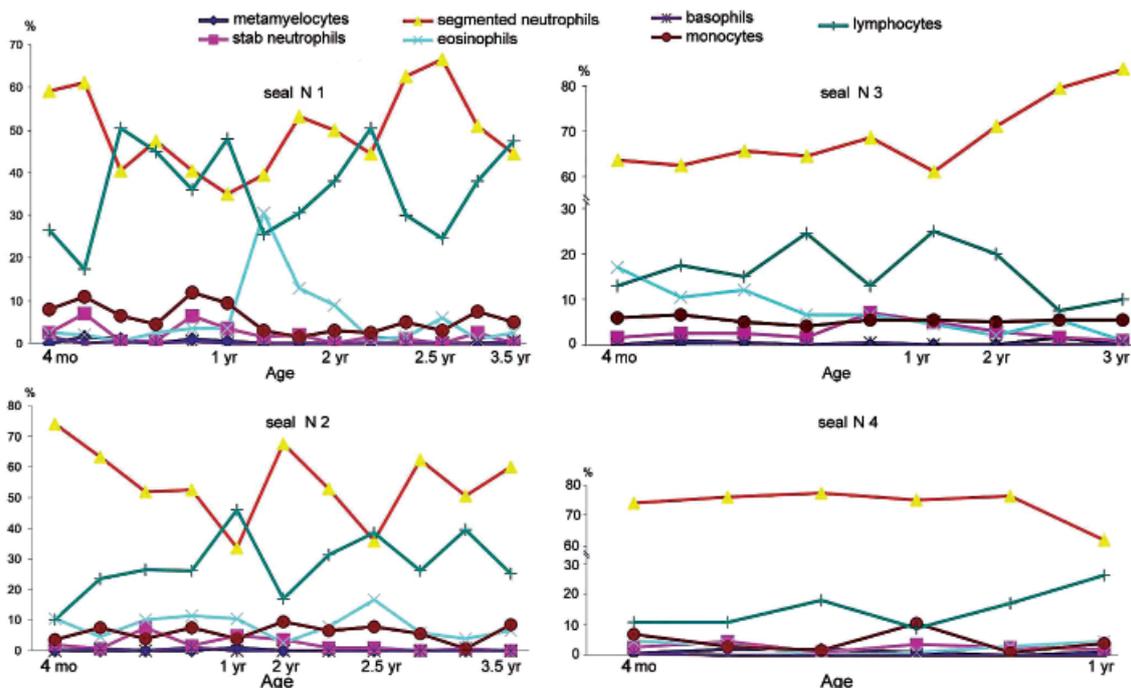


Fig. 2. Age dynamics of harp seal pups blood cell composition

It is known that the age features of the blood composition includes equaling in certain periods of the number of lymphocytes and neutrophils, which was referred to as so-called “physiological cross” or “physiological decussation”. In humans, this phenomenon is recorded on the 4th day of life and at 4 years of age [2]. Physiological increase of lymphocyte number is noted in other terrestrial animals, including dogs [3]. Subsequently, the neutrophil profile of the blood is established finally, and its normal composition remains stable. Naturally, for other mammalian species with different lifetime and ontogenetic features, the terms of “cross” may differ. In harp seal pups first “physiological crossing” is marked at the age of 2–3 weeks during period of milk feeding [7]. This phenomenon is observed in seals № 1 and 2, but is absent in seals № 3 and 4 (Fig. 2).

The set of parameters that we used in biochemical blood count of the harp seal pups includes some major metabolism indices:

1) protein – total protein (TP), albumen (Alb),  $\alpha$ -globulins (Alpha),  $\beta$ -globulins (Beta),  $\gamma$ -globulins (Gamma), urea (Urea);

2) lipid – total lipids (TL);

3) carbohydrate – glucose (Glu);

4) mineral – calcium (Ca) and phosphorus (P).

Because some individual indices are inter-linked via metabolic paths, change in some of them, normally is associated with changes in other parameters. In this respect the levels of various blood indices make a peculiar “metabolic profile” of the organism. Fig. 3 shows that profiles gently change with age, but sharp changes are recorded in seal № 3 one month before death. The most pronounced were changes in right-hand part of the profile, characterizing status of protein metabolism.

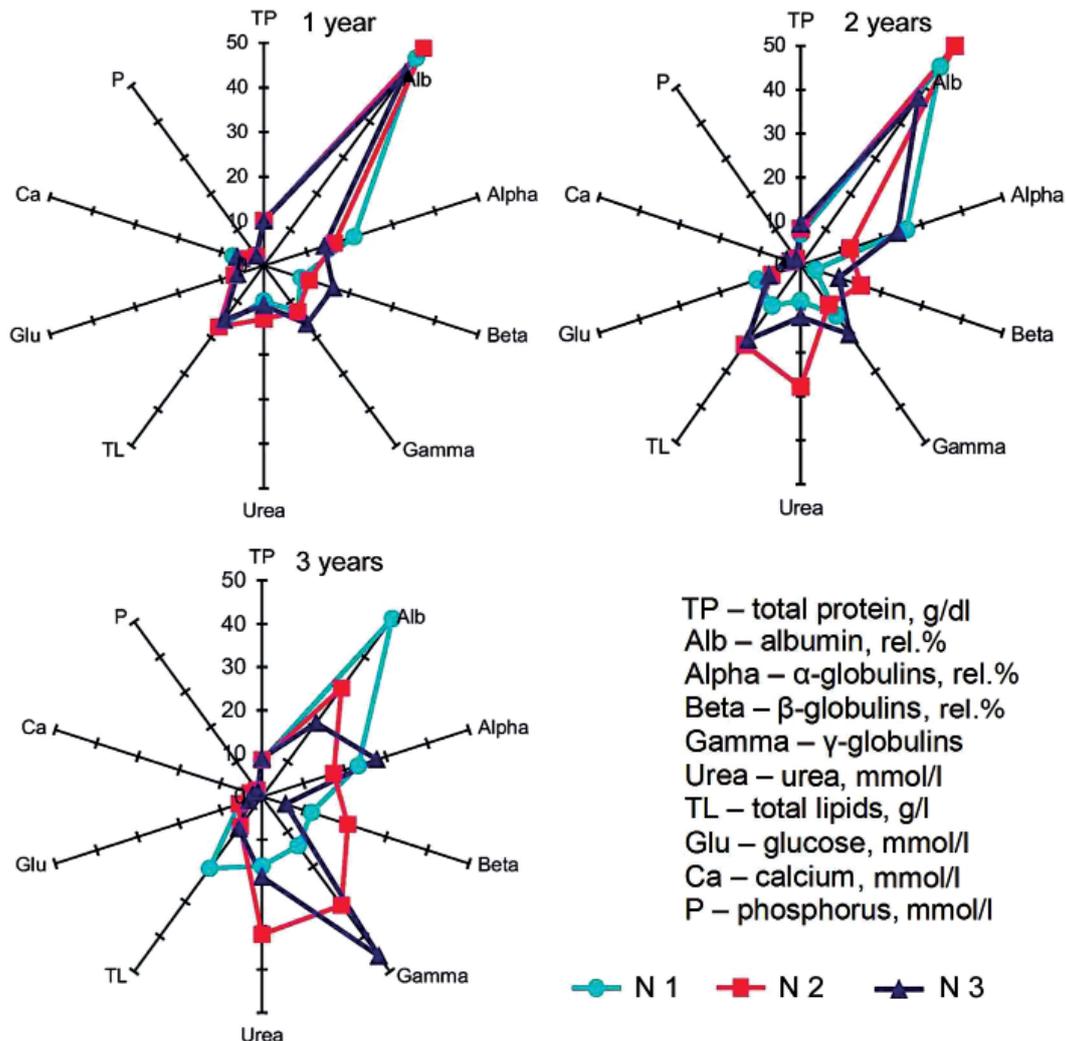


Fig. 3. Biochemical parameters of the metabolism basic types in seals of different age and health status

Thus, the maintenance of seals first in a stationary oceanarium, and subsequently in cages under conditions close to natural permitted tracing the rehabilitation of the animals, their condition being initially assessed as anomalous. The following regularities can be revealed in terms of dynamics of the blood indices in seals.

A year after putting in captivity, the blood indices approached the values characteristic of the normal physiological conditions. During the subsequent observation period, a leveling of some particular indices in different animals was recorded, whereas during the first three months of captivity, some well-defined individual features in the blood plasma were revealed.

Rehabilitation period in harp seal pups was no less than 3 months. After a year of captivity, lack of sharp individual distinctions in the biochemical status was revealed, which must have been determined by similar and more comforting conditions compared with free-ranging (absence of enemies, regular feeding, maintenance, and veterinary care).

### Conclusion

When comparing the variability of the cell composition of the blood in survivor seals vs. those that died, it was noted that some trouble indices were observed in the latter as early as the first months of their life. At the same time, the chemical composition of the blood plasma did not show differences of similar level; they appeared much later. The dynamics of the cell composition of the blood in the course of the observations was

sharply different in terms of the ratio of the level of lymphocytes and neutrophils. In the seals that died at different dates had shown no “physiological decussation”, which is characteristic age feature of the cell composition of mammal blood. This fact gives grounds to believe that the loss of the above characteristic features can be regarded as a decline of viability, which finally proves fatal. Hence, during the early period of postnatal development when assessing and predicting of the condition of seals, cell composition characteristics may prove more informative compared with that of its chemical components.

### References

1. Andreev O.M. Density dynamics of peripheral blood eosinophilia as a test standard for evaluating adaptive states // Morphophysiological adaptive states criteria: Sci. Proceedings Irkutsk Med. Inst. – 1979. – Vol. 146. – P. 5–10.
2. Bobova L.P., Kuznetsov S.L., Saprykin V.P. Blood histophysiology and immunogenesis. – M.: New Wave, 2003. – 157 p.
3. Broshkov M.M. Dynamics of cell immunity of the puppies during two month of their life // The Animal Biology. – 2015. – Vol. 17. – № 1. – P. 16–20.
4. Erokhina I.A., Kavtsevich N.N. New data characterizing the metabolic status of hooded (*Cystophora cristata* Erxleben, 1777) and harp (*Pagophilus groenlandica* Erxleben, 1777) seals in the early postnatal period of development // Doklady Biological Sciences. – 2011. – Vol. 440. – № 1. – P. 303–305.
5. Geraci J.R., Smith T.G. Functional hematology of ringed seals (*Phoca hispida*) in the Canadian arctic // J. Fish. Res. Board. Can. – 1975. – Vol. 32. – P. 2559–2564.
6. Handbook of laboratory techniques / Ed. L.A. Danilova. – SPb: Peter, 2003. – 736 p.
7. Kavtsevich N.N. Blood profile count in Greenland seals of different age // Doklady Biological Sciences. – 2001. – Vol. 380. – № 1–6. – P. 461–463.

*Materials of Conferences*

**PROSPECTIVE MONITORING  
OF THE PITUITARY ADENOMAS  
ASSOCIATED  
WITH HYPERPROLACTINEMIA**

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**Introduction.** Among all the most common pituitary tumors are prolactinomas, they accounted for 29% of all pituitary tumors, and this percentage increases to 47% if not pure prolactinoma and their mixed. If from the point of view of a specialist MRI we haven't problems in the diagnosis of pituitary adenomas, from the perspective of dynamic monitoring of patients at stages of therapy, there are certain difficulties due to the lack of monitoring standards, multiplicity of conducting MRI of the pituitary gland in the treatment, and this applies to both conservative and surgical phase.

**The aim** is to trace the changes in the stages of prolactinomas therapy and practice the multiplicity of conducting MRI on stages of surgical and therapeutic treatment in the prospective study.

**Materials and methods of research.** For almost 20 years there has been a group of patients ( $n = 1200$ ,  $m = 84$ ;  $w = 1116$ , ranging in age from 6 to 65 years). The study was conducted on low field magnetic resonance system (0,23 T) and superconducting MRI using standard sequences and used copyright protocols.

**Results of research and their discussion.** The author in great material was able to show the multiplicity of conducting MRI with adenomas of varying size, track the dynamics of changes of pituitary adenomas and prove the possibility of recourse to signs in the hyperprolactinemia stages of macro adenomas therapy of prolactin inhibitors. The duration of monitoring allowed the author to generate a new approach to classification of adenomas with the inclusion of initial changes in the pituitary gland, identified them as adenopatia. The work is supplied with high-quality graphics and histologically verified clinical materials, allowing her to consider this as a teaching aid, which can be successfully used in professions in radiology, radiation therapy, Gynecology, Endocrinology, eye diseases, Neurology, Oncology, neurosurgery. The cited author of clinical samples and duration observations confirm the fact that patients management prolactinomas conservative way are completely justified. Extremely important is described by the author of the discovery of the syndrome of sellar hypertension, mechanisms of its development and ways of intravital diagnosis with MRI. The above allows us to consider and recommend its use monograph as a handbook for

medical professions listed above, as well as in the pedagogical process of medical students, doctors, improve qualifications in postgraduate training. Deserves the description approaches such patients, the survey author's methods of calculating adenomas on the stages of therapy, development options and the pituitary Sella turcica, contrasting approaches.

**Findings and conclusions.** Prospective follow-up for patients with hyperprolactinemia, allowed to make a hypothesis about the existence of "co-factor" contributing to the pineal gland as the depress action on the pituitary gland, and in certain situations, the stimulating effect on the pituitary gland and the development of adenomas. Regress of clinical symptoms is especially pronounced when the pituitary micro adenoma associated thyroid dysfunction, taking contraceptives, as well as in micro prolactinoma, adenomas, the dimensions of which do not exceed 10 mm. It is, on the basis of these considerations, dynamic MRI, pathological changes in the pituitary gland, the author offers classified as adenopatia (small hypo intensive on T1 enable up to 1–2 mm in the front lobe of the pituitary gland 1 to 4-th, not inclined to merge), micro adenomas – sizes 4–6 mm, adenoma (sizes 6–10 mm), and where macro adenoma dimensions adenomas were more than 10 mm. The majority of prolactin requires conservative tactics of treatment for endocrinologist, but MRI approach-monitoring must be different.

So when pituitary changes caused by adenopatia enough observations 1–2 times per year; in adenomas, which size is 4–6 mm – 1 in 1,5 years; when prolactinomas size 6–10 mm – 1 once a year. It should be noted that in the process of dynamic monitoring of patients with pituitary adenomas with hyperprolactinemia, the translation should be sought from adenoma to adenopatia. While downsizing inclusions to 2–3 mm, must be implemented in the future, the hormonal control of times in 3–6 months. In this case, there is no need to understand some endocrinologists in carrying out magnetic resonance imaging at the stages of treatment bromocriptine or dostinex every six months. Best we can consider, when control of the situation is conducted in the Commonwealth physician-Endocrinologist and specialist of MRI.

The results of this work are published in the form of a monograph. The book contains 94 references, 78 figures and 294 pages.

The monograph will be accepted as collective and individual applications by e-mail: Lukans@yandex.ru.

The work is submitted to the XXIX International Exhibition-Presentation Of Educational Publications, Moscow, may 30 – June 1, 2016, came to the editorial office on 23.05.2016.

*Short Reports***PERSPECTIVE METHODS  
OF SURGERY TREATMENT  
OF INFECTED WOUNDS**

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**Intorduction.** Use of laser and nanotechnologies is considered to be quite relevant and perspective direction in contemporary experimental medicine [1]. Among variety of modern methods of modeling of infected wound the best method is use of high-intensive laser, that allows to simulate the wound of experimental animal: to get exact area and depth of lesion [2]. There is a little number of reports about use of laser radiation and nanoparticles of metals in experimental surgery [3]. In some researches of native and foreign authors the effectiveness of application of low-intensive laser radiation is high valued in combined treatment of infected wounds [4, 5]. It is showed that use of low-intensive laser for control of interstitial transport of metal nanoparticles allows to change hydropenetrability of tissue due to formation of canals and pores in 20 times [6], and laser influence boosts the penetration of metal nanoparticles in tissues [7]. It is discovered that use of low-intensive laser radiation in treatment of infected wounds provides with antimicrobial effect, stimulates the process of regeneration, improves microcirculation in area of wound [8, 9, 10]. It is proved by morphological examination, that use of low-intensive laser radiation stimulates macrophage reaction, activates biosynthetical function of fibroblasts, optimizes angiogenesis, promotes to faster maturation of granulation tissue and its fibrous transformation, which ends by 7–8<sup>th</sup> day [11]. In some foreign researchers' opinion, use of low-intensive laser radiation provides with faster wound purification, early formation of granulation, epithelization of wound defects and shortening period of treatment [12, 13]. Nanoparticles of copper shows expressive bacteriostatic and bactericidal effect and this effect is prolonged and less toxic in comparison with copper salts [1, 9]. In researches in vitro it is stated, that nanoparticles of copper have very expressive antibacterial effect on clinical culture of *Staphylococcus aureus* [8, 14]. Concentration of nanoparticles more than 100mg/ml is toxic and it is potential dangerous for organism [15]. Wound healing effect of copper nanoparticles is proved. In comparison with antibiotics copper

nanoparticles don't cause selection of resistant cultures. This conclusion allows to recommend anoparticles of copper for treatment of infected wounds caused by polyantibiotic resistant cultures [16]. Combined use of nanotechnologies and laser radiation has not found its wide use in experimental medicine. There is a little number of reports about this developments [15, 17]. In our researches it is proved that combined use of low-intensive laser radiation and nanoparticles of copper provides with fast and effective suppression of pathogenic microorganisms' growth and acceleration of regeneration [1, 3]. First results of potentiating effect of low-intensive laser radiation and nanoparticles of copper were reported by V.V. Alipov in Hannover in 2012 [18]. This way, experimental justification of metal nanoparticles' efficiency, searching the way of strengthening of its bactericidal effect including in combination with low-intensive laser effect on wound is the actual concept in modern surgery during treatment of infected skin wounds and soft tissues.

**Urgency.** Invent the method of infected wound simulating with help of laser and to prove the efficiency of joint application of low-intensive laser radiation (LILR) and nanoparticles of copper in experiment.

**Materials and methods of research.** 30 white rats (weight = 190–200 g) were used for experiment of infected wound simulating. 100 similar rats were used for exploration of joint application of LILR and copper nanoparticles during the treatment of simulated infected wound. The expression of antimicrobial influence of laser radiation and copper nanoparticles was rated relative to *Staphylococcus aureus* according to McFarland Turbidity Standart. In the first series of experiment wound was irradiated by laser machine "Matrix"; in the second – there was injection of copper nanoparticles; in the third – joint application of LILR and nanoparticles of copper.

**Results of research and their discussion.** The worked out way with use of high-intensity laser (Lasermid 1001) permits to simulate the wound: in depth and in the area of lesion. And after injection of *Staphylococcus aureus* it allows to get infection of wound. In experiment in vivo next aspects were registered: low antibacterial activity of: LILR using and expressed bactericidal activity of copper nanoparticles. Experiment also allowed to discover the potentiation of antimicrobial effect during the joint application of copper nanoparticles and the laser. Combined local use of laser radiation and copper nanoparticles to infected wounds of experimental animals provided stopping of pathogenic microflora seeding

by the 7<sup>th</sup> day, rise of granulation by the 4<sup>th</sup> day and wound epithelization by the 14<sup>th</sup> day.

**Summary.** As a result of conducted investigation with use of surgical laser «Lazermed 1001» it was discovered the experimental model of the wound controllable in depth and in the area of affection. Local application of copper nanoparticles transcends the efficiency of laser influence, and in combination with laser irradiation speeds stopping of infectious process in wound on 6 days and wound epithelization, which is noted by 10<sup>th</sup> day of treatment. It was experimentally validated the appropriateness of combined use of LILR and copper nanoparticles' suspension during surgical treatment of infected burning wounds, which was vindicated by shortening of term of treatment at 22,0 %

#### References

1. Nikolenko V.N., Alipov V.V. Perspective nanotechnologies in experimental medicine. *Nanotechnics*. – 2009. – № 19. – P. 66–68.
2. Kolsanov A.V., Alipov V.V., Lebedev M.S., Dobrejkin E.A., Limareva L.V. Method of simulating of thermal skin burn injury of laboratory animals. Samara State Medical University. – Russian Federation Published: 10.01.2013 Bulletin. – № 1.
3. Alipov V.V., Dobrejkin E.A., Urusova A.I., Belyaev P.A. Experimental laser nanosurgical technologies. First results and perspectives // *Bulletin of experimental and clinical surgery*. – 2011. – Vol. 4. – № 2. – P. 330–333.
4. Heinitz A.V. Laser therapy of infected wounds // *Medicine*. – 1988. – P. 150.
5. Tuchin V.V., Terentyuk, G.S., Maslyakova G.N., Suleymanova L.V., Khlebtsov N.G. and Khlebtsov B.N. Laser-induced tissue hyperthermia mediated by gold nanoparticles: toward cancer phototherapy. V.V. Tuchin // *J. Biomed. Optics*. – 2009. – № 14(2). – P. 21016(1–9).
6. Nikiforova T.E. Magnetic guidance of ferromagnetic nanoparticles dispersing in biotissues during laser modification of form // *Encyclopedia of Chemical Engineer*. – 2009. – № 5. – P. 19–22.
7. Omelchenko A.I. optomechanical tests of hydrotized biotissues during laser modification of theirs proportions and forms // *Quantum electronics*. – 2008. – № 38(3). – C. 269–272.
8. Alipov V.V., Dobrejkin E.A., Urusova A.I., Belyaev P.A. Experimental substantiation of combined use of copper nanoparticles and low-intensive laser radiation during surgical treatment of modeled infected burn wounds of skin // *Bulletin of experimental and clinical surgery*. – 2013. – № 4. – P. 411–417.
9. Babushkina I.V. Metal nanoparticles in treatment of experimental infected wounds // *Saratov scientific medical journal*. – 2011. – № 3. – C. 530–533.
10. Gadjeiev E.A. Morphological features of infected wound healing during traditional method of treatment and its potentiation // *Laser medicine*. – 2009. – № 13. – P. 35–39.
11. Gadjeiev E.A. Low-intensive laser and pulse-inductive magnet influence – method of potentiation of infected wounds traditional therapy // *Laser medicine*. – 2009. – № 4. – P. 21–28.
12. Nishimori H., Kondoh M., Isoda K., Tsunoda S.-I., Tsutsumi Y. and Yagi K. Silica nanoparticles as hepatotoxicants // *European Journal of Pharmaceutics and Biopharmaceutics*. – 2009. – № 7. – P. 496–501.
13. Tuner J., Hode. L. Laser therapy in dentistry and medicine // *J.Tuner. PrimaBooks*. – 2006. – 236 p.
14. Rahmetova A.A. Wound-cicatrizing effect of copper nanoparticles according to their physicochemical characteristics // *Russian nanotechnologies*. – 2010. – № 3–4. – P. 102–107.
15. Bystrzejewska-Piotrowska G., Golimowski J., and Urban P.L. Nanoparticles: Their potential toxicity, waste and environmental management // *Waste Management*. – 2009. – P. 2587–2595.
16. Doronin S.Y., Alipov V.V. Synthesis and bactericidal properties of superdispersed powder of copper. *Proceedings of Saratov University. New series // Series: Chemistry. Biology. Ecology*. – 2011. – V.11. – № 1. – P. 18–22.
17. Terentyuk G.S., Maksimova I.L., Tuchin V.V., Zharov V.P., Bogatyrev V.A., Dykman L.A. Application of gold nanoparticles to x-ray diagnostics and photothermal therapy of cancer. – *Saratov Fall Meeting: Conherent Optics of Ordered and Random Media VII Ed. D.A, 2007*. – P. 6536–6537.
18. Alipov V.V. Laser nanotechnology in experimental surgery // *International Kongress «uro Medica 2012»*. – Hannover, 2012. – P. 22–23.

## METHODICAL AND STAFFING FORENSIC CHEMICAL LABORATORIES IN FORENSIC INSTITUTIONS OF RUSSIA SYSTEM

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The analysis of the effectiveness of methods of analytical chemistry to meet the challenges of the judicial examination. The experience of the work of foreign forensic chemistry laboratories and identify problem questions regarding insufficient level of scientific and methodical, personnel and methodological support of forensic institutions of Russia. Formed proposals for modernization of the existing Russian system of forensic establishments and circuit training expert personnel in the field of forensic chemistry.

**Keywords analytical chemistry, forensic chemistry, expert report, experts, training of chemists, methodological support for forensic-analytical chemistry laboratories**

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Thus, we propose the following set of measures to address these issues:

- The establishment of the state system of compulsory licensing of forensic activities.
- Accreditation of laboratories of all forensic institutions to comply with Standard ISO / IEC 17025-2009.
- Reject the Agency on the basis of the principle of operation for the state forensic and forensic agencies and to establish their operation in the framework of the state system of higher education.
- The organization of mass execution of expert opinions in the interests of the various ministries, departments, organizations, individuals and other interested parties of legal proceedings on a contract basis in each region.

### *Conclusions*

These activities will provide high quality forensic, scientific and methodical, educational, developmental and other types of forensic chemistry. It will also help increase efficiency in the recruitment of science and engineering in practice as a forensic chemical laboratories, and other areas of forensics.

Forensics is of a great importance in establishing the evidence base during investigations and litigations; its history includes several hundreds of years [1]. Nowadays it is no doubt that successful crime prevention is possible only with the help of strict scientific basis which makes use of a wide range of scientific methods and technical facilities. In order to support this process effectively, the scientific and technical system must be improved and make constant progress, resting upon the fundamental developments in natural sciences including analytical chemistry. Employment of analytical chemistry methods for solving forensics issues requires prospective forensic estimation of research results so as to form an independent source of investigative and evidentiary information. At the same time new issues always emerge in forensic practices. In this connection the analytical chemistry methods are used in

a modified form meeting the peculiarities of issues and nature of research objects [2]. Thus, we have all reasons to imply the term «forensic chemistry» as a part of applied analytical chemistry aimed to solve forensics issues.

For the first time forensics became a research object for European doctors and chemists in the first half of the XIX century. Their surveys were devoted to toxicological research of the biological origin materials by reactive chemistry methods [3]. Very many analytical chemistry methods came into use to solve a wide variety of issues in modern forensic chemistry. With all that, along with physical-chemical analysis methods, chemical methods remain quite popular with forensic chemistry [4, 5]. Moreover the existing methodological support for forensic chemistry even for one type of an expertise object frequently implies the solving of common issues using chemical, chromatographic and spectral methods of analysis as a whole. In Russian forensics the term «forensic chemistry» did not settle in as an independent term. At the same time analytical chemistry became one of the basic elements of the multistage process to deal with corpus delicti of an investigative case. This is a forensic research of materials, substances and items (FRMSI) which has been developing since 1950–1960s in expert bodies of the soviet Ministry of Justice upon resolving two meaningful issues. These are a full-time training for a large circle of forensic experts including physicists, chemists and engineers and also a creation of a centralized tool-analytic base sufficient for researches of main incoming substances and materials. For now the FRMSI has evolved into an independent field of forensics. Despite the fact that FRMSI's goals are assigned in every specific case, its common issues are among the following:

- Discovery, i.e ascertainment of presence\absence of target objects.

- Diagnosis, i.e. determination of nature, name, purpose, application field or other classification qualities of objects and circumstances of investigation formation.

- Identification, i.e. identifying of several objects or its parts (elements) [12].

In the Russian Federation the uniformity of state regulation measurements covers the measurements that are fulfilled in compliance with a court order, procuracy authorities and government bodies of executive powers. In this case the unity of measurements in state forensic institutions is assigned to the federal bodies of executive power which they belong to [13]. The functioning of forensic chemistry laboratories in state forensic institutions can be performed beyond the national accreditation system [14] even while performance of expert reports of compliance assessment for industrial and other products and also other products that have to meet the obligatory requirements established by the legal system of the Russian Federation.

The functioning of forensic chemistry laboratories is not specifically prescribed by the Russian legal system, but this process is performed within a broader term called forensic functioning and is governed by the Federal law № 73 «On state forensic functioning in the Russian Federation» of May 31, 2001 [15]. The article 11 of this law equalizes state forensic institutions and expert branches created by federal bodies of executive power and constituent entities of the Russian Federation. Along with this, the forensic expert reports performance is independently prescribed by every governmental agency but federal bodies of executive power in their turn compose a list of types of forensic expert reports performed by subordinate state forensic institutions and their branches [16, 17, 18, 19].

Besides this, depending on a certain type of litigation the forensic expert report administration and performance fall under the corresponding code (civil, administrative, arbitration or criminal procedural). So far, state and non-state forensic functioning (except for expert reports on industrial safety) is not subject to obligatory licensing and certification [20, 21, 22]. But the national standard of the Russian Federation GOST 52960–2008 [23] developed by the Association of analytical centers «Analytica» and brought into effect in 2009 is used only with leading non-state forensic institutions in Russia [24].

Meanwhile, in the Russian Federation forensic chemistry laboratories are the main and essential part of the majority of state forensic institutions which function within different ministries and departments. Thus, in state forensic institutions of Ministry of Internal Af-

fairs of Russia such laboratories are included in structural subdivisions in charge of expert reports on materials, substances and items. Several methods of forensic chemistry are widely employed in laboratories in charge of performing criminalistic and various forensic engineering reports (tratology, ballistics, explosives studies and others) and it is also used with criminal experts while performing their duties on the scene [16, 25]. In such a way forensic chemistry laboratories are integrated in Russian state forensic institutions of the Ministry of Justice, the Federal Customs Service, the Federal Drug Control Service [26, 27, 28]. Moreover, state forensic institutions of the Federal Security Service and the Ministry of Defense of the Russian Federation contain their own forensic chemistry laboratories that conduct chemical and toxicological surveys on biogenic objects [17, 29]. The functioning of these state forensic chemistry laboratories being subordinate to the Ministry of Health and Social Development is aimed at researching a wide range of biological objects [30]. Non-state forensic organizations and private experts in forensic chemistry appeared in the post-perestroika period as an alternative to the state forensic institutions. The functioning of these organizations is solely aimed at subjects which turnover is not banned [31, 32].

As the result, a present-day level of the methodological support for forensic chemistry laboratories in state forensic institutions is regulated by governmental (inside) directions, instructions and recommendations [16, 17, 30] that are being formed because of unclear requirements of the Federal law № 73 mentioned above. Non-state forensic institutions regulate their functioning by their own regulations, while private forensic experts do this just with civil contracts. Thus, all requirements for tools, methods and techniques must comply with the contents of the article 8 of this law which states that «An expert must thoroughly and completely conduct an impartial research on a strict scientific and practical basis within their respective specialty. An expert conclusion must be based on the statements allowing to verify validity and authenticity of conclusions made on the basis of the conventional scientific and practical data». Apart from this, the article 11 of this law states that «State forensic institutions of the same type must administer and perform their forensic expert reports on the basis of unified research and methodological approach to expert practice, professional training and specialty of an expert». Requirements of this law for competence

of a forensic expert are in the article 13 which states that «An expert position in state forensic institutions can be assigned to a citizen of the Russian Federation who has an university degree and has completed a subsequent training in a certain expert specialty in accordance with statutory and regulatory enactments of the respective federal bodies of executive power» and «Professional qualification assessment of an expert and their eligibility accreditation to perform expert reports independently are fulfilled by qualifications commissions in accordance with statutory and regulatory enactments of the respective federal bodies of executive power». These requirements are also stated in the article 41: «an expert report can be performed beyond state forensic institutions by individuals who have particular knowledge in science, technology, art and craft without being a state forensic expert» [15]. It is important to note that major responsibility for expert reports results is of a personal matter in the Russian Federation [33], i.e. it is fully laid upon an expert but the management of the report performance is laid upon the head of a state forensic institution.

At the same time organizational directions of quality assurance in expert reports are among the next ones: a forensic institutions accreditation, a methodological support standardization (methods and techniques), an expert facilities certification (equipment and expendables), a training system improvement and a professional development of state forensic institutions' employees [34]. It is worth noticing that issues of forensics techniques standardization have become acute since mid-1980s. The standardization has been supposed to be a means of contributing to univocally interpreted results but the method has been a guide for a laboratory functioning. In 1990s the Forensic Science Center of the Russian Ministry of Internal Affairs was actively involved in process of certification of expert methods, with all that the method was understood as any mentioning about expert issue resolving in criminalistic literature [35]. The need for certification of the methodological support for forensics is suggested as one of the ways for non-state forensic functioning improvement, which differs from the state one not only by a quick-to-perform expert reports but also a minor awareness of non-state experts on procedural, organizational and methodic peculiarities of this practice [36, 37]. Some Russian forensic institutions and organizations began to create independent systems of voluntary certification of the methodological support for forensics expert reports. However the present-day voluntary certification of independent systems is performed only

on a contractual basis in regard to non-state experts and organizations [38, 39]. The accreditation is suggested as an effective method of the overall competence confirmation and forensic laboratories independence which simplify the valid choice of an expert research performer and an expert opinion assessment. Among state forensic institutions the Test Center (materials science subdivision) of the Criminology Institute for the Special equipment Center of the Russian Federal Security Service in the Analytical laboratory accreditation system [41] and forensic laboratories of the Forensic medicine center of the Russian Federation for the Ministry of Justice [42] have already been through the accreditation to meet the requirements of the GOST ISO/IEC standard 17025 [40].

Despite all of the aforesaid, there is no any unified methodological approach within the functioning of forensic chemistry laboratories of Russian forensic institutions among different agencies. This fact excludes the unified scientific and methodological approach to the experts' professional training and negatively affects the quality of expert reports and psychological factors as well as assessments' difference while performing repeated or comprehensive researches when they are commissioned to experts of different agencies [43]. To resolve this issue, the Federal Interagency Coordination and Methodological Council on Forensics and Expert Research (FICMC) has been functioning on a voluntary basis in Russia since 1996. It is aimed at the organizational, research and methodological assistance for the state forensics improvement and also at searching for suggestions to provide the unified research and methodological approach to experts' practices, professional training and specializing. To make the FICMC more representative it contains heads of state forensic institutions and expert services of all federal bodies of executive power as well as representatives of the Supreme Court of the Russian Federation, the Supreme Arbitration Court of the Russian Federation and the Office of the Prosecutor General of the Russian Federation [44]. However in order to unify the methodological support for forensic expert reports within priority guidelines over the 2000–2011 period the FICMC recommended expert and criminalistic branches of Russian state forensic institutions of federal executive power bodies only 8 guidebooks for practical use, only 5 of them are directly relevant to forensic chemistry [45]. The absence of unified legislative guidelines and formulations for forensic functioning administration in Russia causes one more trouble. The functioning of non-state forensic institutions along with state, non-state organizations and private experts that occasionally perform expert reports has

no special legal grounds. The number of annual expert reports performed by state forensic institutions is great and it is increasing steadily. With all that the present-day demand for judicial proceedings performed by state forensic experts cannot be completely met. Issues that require special professional qualifications appear in a very wide range of scientific and practical fields and can go beyond the competence of state forensic institutions. That is why it is impossible to do without non-state agencies and private experts. For today there is no any legal formalization for such significant points as conditions for establishment of non-state forensic agencies, their heads' status, training and retraining of private experts, professional requirements and other significant regulations for forensic practices. As the result, non-state forensic institutions having encroached on functions that in fact belong to state ones do not provide appropriate professional performance, their expert opinions often do not meet the requirements of a case evidence [46]. Among non-state forensic institutions only separate specialized branches being a part of several Russian universities have been managed to advance to the high-standard forensic performance [47].

The foregoing description of legal regulation and administration of forensic chemistry laboratories that enter forensic institutions and organizations have contributed to emergence and accumulation of a large number of troubles that evidently affect an overall level of their methodological support and forensic expert reports quality in general. Thus, in state forensic institutions of the Russian Ministry of Defense the number of expert reports to be performed is constantly increasing. There is an acute need for material and technical base upgrade and staff development. As the result, the current level of forensic expert reports does not meet the requirements of military justice bodies as it essentially limits a body of evidence during crime investigations [48, 49]. Forensic institutions of the Russian Naval Service have troubles both with technical equipment of its branches and professional training [50]. Except for the need to improve the material and technical support administration [51], the cases of staff misuse and false approach to registration discipline administration must be excluded in expert-criminalistic branches of the Russian Ministry of Internal Affairs [52]. Modern criminality has an obvious advantage in technical equipment over law enforcement authorities where state forensic administration plays one of the key roles. At all stages of crime prevention this administration has its goals to employ effective methods and technical facilities that comply with a higher level of science advance-

ment in order to expose, disclose, investigate and prevent crimes [53]. There is an inadequate knowledge of law disciplines among experts who have a degree neither in jurisprudence nor in expert assessment and represent expert-criminalistic branches of the Ministry of Internal Affairs of the Russian Federation. This shortage cannot be compensated by refresher courses in the agency system of state forensic institutions. One of the solutions for this issue is a staff retraining which is based on higher education institutions' knowledge in law and engineering along with the involvement of leading experts from forensic centers of the Ministry of Internal Affairs (Chief Administration of Internal Affairs, Directorate of Internal Affairs) [54]. Nevertheless this problem is typical for the most of forensic institutions. Development of the expert staff for forensic institutions of the Russian Federation is primarily achieved by the retraining of staff with higher education degrees and is based on these institutions. However certification of personnel who have completed this retraining reveals significant gaps in law theory. As a rule these employees are specialists in very particular fields. For example, specialists in natural, humanitarian sciences and engineering are not aware of essentials of substantial and procedural law, criminal law and forensic theory. Lawyers who retrain as forensic experts come across even bigger troubles since they do not have essential knowledge in different fields of science and engineering that are supposed to be accumulated within several years of practical work. Even in this case some objects of expert report are not available for research because of absence of regular basic professional education [38]. According to the administrative board of the Ministry of Internal Affairs of the Russian Federation, the decrease of the scientific staff qualification is caused by low-standard scientific researches performance [53]. In forensic chemistry's and chemical-toxicology's laboratories of the Russian Bureau of forensic medical examination apart from shortage in material and technical, informational and methodological types of support for the forensic functioning there is a drift of trained and skilled personnel. It also goes along with the absence of interest among young specialists with higher non-medicine education who have completed basic training and in «pharmacy» or «chemistry» [55].

Main issues of state forensic institutions of the Ministry of Justice of the Russian Federation are:

- Absence of the methodology-proven list of unified equipment for specific kinds of forensic expert reports.

- Different level of up-to-date equipment supply of forensic institutions of the Russian Ministry of Justice with (making use of out-of-date equipment).

- Different level of professional training for experts and of their ability to use the existing equipment.

- Long terms of expert reports performance.

- Inadequate scientific and methodological support.

- Absence of unified methods for all forensic institutions; compliance with legal requirements.

- Great opportunities to put pressure on experts, corrupt performance of expert reports.

- Inadequate administration and transparency of income generation in forensic institutions.

- Excessive number of expert reports commissioned by courts and law enforcement agencies [56, 57].

One of the the issues that significantly affect the quality of expert researches is extreme work overload with many types of expert reports in state forensic institutions which leads to delay of legal procedures. Capabilities of the state forensic functioning are roughly bound by budget financing. Nowadays they are practically depleted and cannot fully keep up with increased courts' demand for expert reports. The circumstance stated above led to the fact that terms of expert reports performance, provided that real report performance is overfulfilled by 1,5 times, may last from 3 months till 1,5 years. With all that, such long terms due to various reasons may occur both in state institutions and private experts. According to some specialists, time expenditure reduction for experts reports can be fulfilled in different directions:

- Increase of research amount is possible through expert staff augmentation and pay rise.

- Start-to-research terms reduction is possible through quality increase of materials for expert reports, coordination of text and list of issues with individuals that order expert reports.

- Terms of performance reduction is possible through implementing new techniques and making use of up-to-date technical facilities.

- Quality increase of researches being performed is possible through qualification improvement of experts of all types of ownership and agency's institutions, expansion of qualification requirements that are to be met by state forensic expert, expert activity of individuals who are not state forensic experts [38].

Majority of the state forensic experts (without service staff) are concentrated in forensic institutions and branches of the Ministry of Internal Affairs, the Ministry of Health and Social Development and the Ministry of Jus-

tice. With this being said, the system of state forensic institutions of the Ministry of Justice of Russia (and to some extent of the Ministry of Health and Social Development) is the only state experts' structure independent from inquiry and investigation bodies, courts and any agency's interest [38]. At the same time the affiliation of state forensic institutions and investigation branches to the same agency can be a reason for an expert challenge in courts [58], as the article 7 of the Federal law № 73 states that an expert must not be dependable on any agency or individual, parties or other individuals who have interest in outcome of a case [15, 58].

Current situation with low-standard scientific and methodological support for forensic chemistry laboratories and the whole Russian system of forensic activity need to be reformed. But the main body of suggestions for improving this kind of activity is idle. Unfounded calls for reformation of the financial motivation in experts, consolidation of the material and technical base, improvement and creation of techniques deepen the existing issues [38, 59].

Inadequate level of development of the methodological support for Russian forensics in general and forensic chemistry in particular required personal interference of the Russian President early in 2012, who charged the Russian government and concerned ministries and agencies draft a proposal for consolidation of the material and technical base of state forensic institutions, establishment of the state policy and improvement of the Russian legal system on forensics, administration of the unified methodological support for forensics, implementation of up-to-date ways and methods for expert research, control for quality performance of non-state forensic institutions, organizations and private experts, providing an adequate level of expert professional training [60]. The Supreme Court of the Russian Federation draws attention of national courts to necessity of «... the most extensive use of scientific and engineering achievements for the purpose of comprehensive and objective investigation of circumstances that must be proved in criminal cases through expert reports performance, when there is an investigation that needs to employ particular knowledge in science, engineering, art and craft for resolving issues emerged during a trial» [58].

In search for ways of improvement of methodological support for forensic chemistry laboratories one can appeal to foreign countries' experience which depends more on the level of their overall development and less on peculiarities of their current legal system. For the English-American List of national legal systems, which includes England, The USA, Northern Ireland, Canada, Australia, New

Zealand and also former colonies of the British Empire (49 states total), relativity of legal regulations for forensic issues is typical. The peculiarity of the forensic functioning within the English-American List of national legal systems lies in its maximum compliance with existing practices. The expert reports performance is regulated by the civil and criminal procedural codes and has a quite simplified nature in comparison with both developed classifications and a system of forensic science in Russia. The classification of forensics having divided into categories, kinds, species and subspecies is practically uncommon but reduces to a list of forensic disciplines instead. Distribution of permits for expert reports performance is fulfilled by authorized non-state professional forensic associations. As a rule regular forensic chemists have a university degree in chemistry. There is a widespread system of professional training for forensic experts via short-term courses on key issues of peculiar forensics fields. The forensic system of the English-American List of national legal systems also stands out for the high level of material and technical support and prominent amount of state and private grants for researches in forensics fields. At the same time there is a strong tendency towards the unification of techniques and forensics terminology. There is a specific hierarchy of forensic expert positions in forensic laboratories. They are specialists in forensic science of 1, 2, 3 ranks (specialists, technicians, scientists in forensics (2 rank), forensic scientist supervisor (3 rank), leading manager in forensic science of 1 and 2 ranks). Besides there is a quite active process of accreditation of forensic laboratories and quality control for laboratories functioning. Great attention is paid to an expert errors analysis. Some of the most difficult and knowledge-intensive kinds of forensic expert reports are performed by forensic laboratories which are national scientific units of universities [61, 62, 63].

Britain has the most transparent process of expert report performance. In this country expert researches are performed upon the request of both defense and prosecution. Any party is able to control the whole process of expert performance, read all papers including worksheets, check and witness research results. These results are to be presented in court by those who performed this research, they must explain the court what these results mean [64].

Except for what was said above, in the USA as opposed to Russia there is no multistage hierarchy of police forensic institutions and of the Ministry of Justice system. In the USA the forensic functioning is fulfilled by state and non-state forensic institutions of different organizational models which number is rather

considerable. There are forensic laboratories in states at police departments and at sheriff offices in big urban areas, at the Ministry of Justice of the USA, at ministries of justice of separate states and at the United States Department of Defense, at the Ministry of National Security, at the Secret Service and some other agencies. At this moment the Subcommittee of forensic science of the Scientific Committee of the National Research and Engineering Council plays a significant role in functioning of forensic institutions. It participates in financial issues of state forensic institutions, forensic laboratories accreditation, experts' certification, approval of new forensic methods. The Ministry of Justice of the USA plays a key role in forensics issues. The biggest state forensic institution is the Laboratory of FBI at the Ministry of Justice of the USA which was founded in 1932. The laboratory serves to provide the expert reports performance, expert staff training, assistance for experts on state and local level. Apart from other FBI's Laboratory structural branches that make use of the forensic method, there is a designated Chemistry Unit. Taking into account agency peculiarities, similar forensic chemistry laboratories function as parts of forensic institutions of the Drug Enforcement Administration, the US Secret Service, the Bureau of Alcohol, Tobacco, Firearms and Explosives – ATF, the Internal Revenue Service, the US Fish and Wildlife Service, the United States Postal Inspection Service and others. Besides this, each state of the USA has its own system of state forensic institutions. The Forensic Service Administration and the Forensic Science Committee perform organizational and methodological management of state forensic institutions in every particular state. These institutions accredit forensic laboratories of a state, control the quality of expert reports and coordinate the functioning of forensic laboratories of a state of those ones established by public authorities [65, 66, 67].

In 2005 the US Senate decided to make an overall examination of condition of forensic science and practice in the USA. In this connection the independent Forensic Science Committee was established by the National Academy of Sciences in the autumn of 2006. It included representatives of different forensic sciences, lawyers and researchers of allied sciences. The committee has always followed three main goals set by forensic science. They are assistance in solving crimes and ascertaining guilty persons, innocent people prosecution prevention and national security protection. Involvement of many representatives of science and practice from different fields to collaborate with the Committee let them make an overall and objective survey on emerged in forensic

science and practice issues of scientific, organizational, methodological, political and financial nature. The Committee stressed that American forensic practices and achievements in forensic science are rather dissimilar among different states, regions and country in general. There is a shortage for financing of laboratories with good personnel and technical facilities, the difference between states' legal systems is exposed, condition of research methods standardization and laboratories accreditation, forensic experts certification. Many states do not claim forensic laboratories for obligatory accreditation, no quality control for forensic sciences curriculums in colleges and universities. In opinion of authors of the paper, none of the existing state institutions of the USA can solve the accumulated set of issues in forensic science and practice [68]. Generally the work of western expert-criminalistic institutions may be assessed as an effective one. It is worth noticing that besides balanced organization structure and good technical equipment, successful and well-built system of expert staff training makes a significant figure among the contents of the success [69]. In leading countries of the world forensic chemists job positions are occupied by specialist in chemistry and physics who have admission to independent report performance upon completion the initial traineeship [70]. One of the effective methods of the improvement of scientific-methodological support for forensic institutions in many developed countries is an accreditation of forensic laboratories in order to comply with the standard of the International Standards Organization ISO 17025 [34, 71–74] which functions in Russia as GOST ISO/IEC 17025–2009 [40].

The main present-day tendency for forensic institutions in developed countries is their active cooperation within various professional associations. Nowadays in the world there are dozens of forensic expert associations in different fields. As a rule these associations are non-profit and are divided into international and regional ones depending on other countries' involvement. Associations and communities are the most popular form of international co-operations. Other forms of international co-operation are international teams of experts, forensic programs of international organizations, guilds, foundations, alliances, institutions, centers, international networks of forensic institutions, etc. Besides professional associations of forensic experts there are several international educational organizations educating forensic experts for international issue resolution, in particular for participating as experts in international courts and tribunals, international human rights organizations. Some multifunctional international organiza-

tions, for example the Interpol, contain forensic branches in the form of working groups and teams. The Interpol also organizes and holds international conferences and symposiums on the whole set of forensic expert reports. A variety of professional organizations function for the benefit of forensic chemistry development. So the International Association of Forensic Toxicologists has its headquarters in London and associates more than 1400 experts in analytical toxicology and other allied sciences all over the world. The purposes of this association are to join efforts and so simulate researches in forensic toxicology. The International Association of Forensic Science – IAFS was founded in 1957 and consolidated scientists and practical persons in various fields of forensics, among which are forensic medicine, toxicology, dactylography, forensic biology, drug research and others. The Association defined its main directions in forensic science development, scientific and engineering information exchange between forensic experts and scientists and also in holding training seminars [75, 76]. One of the biggest international forensic organizations is the European Network of Forensic Science Institutes (ENFSI) which was established in 1995 by analogy with the American Society of Crime Laboratory Directors (ASCLD) to become a member of which is free for any representative of European country. The ENFSI functioning does not interfere with national legal system on forensic issues but its purpose is to obtain a high-quality of forensic expert reports in European countries. An ENFSI member which is an educational or forensic institution must perform at least a half of all types of expert reports in its country, has a status of state importance, has at least 25 employees and has a necessary accreditations. At this moment 50 forensic institutions from 32 countries are members of the ENFSI. In the ENFSI Russia is represented by the Russian Federal forensic center for the Ministry of Justice, the North-West region forensic center for the Ministry of Justice and the Expert-criminalistic center for the ministry of Internal Affairs. The ENFSI includes three regular structures: the Expert Working Group Committee (EWGC), the Quality & Competence Committee (QCC), the European Academy of Forensic Science (EAFS). The Working Groups are organized in accordance with forensic fields of concern, they provide professional assistance for colleagues from national forensic institutions and publish their news-bulletins. For today 15 working groups are established in the ENFSI. Five of them forensic chemistry is of a great importance:

- Forensic documentation inquiry.
- Forensic drug inquiry.

- Forensic fiber inquiry.
- Forensic varnish and paint inquiry.
- Forensic fire and explosion inquiry.

The Quality & Competence Standing Committee is aimed at establishing an optimal regulation and successful operation of expert working groups and the ENFSI members. In addition, the responsibility of this committee is to create international standards and improve expert practices in general. The committee holds its seminars, cooperates with international organizations on accreditation and certification matters. One of the significant forms of activity of the committee is holding interlaboratory tests aimed at expert researches on presented educational objects. During the tests the laboratory takes the material to be researched which was prepared on basis of real law cases. Conditional circumstances of a case and other input data are stated as well. An expert opinion given after the research is sent to the committee and is being analyzed with relation to results reliability, methods, equipment, means, standards and units of measure, assessment criterions of intermediate results used. Generalization of such control tests lets to improve expert research methods and assess performance quality of forensic laboratories of the ENFSI members. The European Academy of Forensic Science exists as a permanent acting structure of the ENFSI. The Academy achieves its goals by holding a scientific conference and special projects in co-operation with expert working groups and the permanent committee of expert working groups. It also takes part in producing, supplementing and fulfilling the strategic plan of the ENFSI. Some companies being producers of equipment and facilities for forensics have already been working on meeting the ENFSI standards. Dynamics development of the Network and integration processes happening in forensics let us conclude that the ENFSI affection the functioning of national forensic institutions will increase within the next decade. With all that the main focus will be on unification, certification and standardization of forensic research methods and quality performance improvement of expert reports [75, 77, 78]. Studying the current situation in other countries it is worth mentioning the Chinese People's Republic where functioning of agencies' forensic institutions which have a sound material-technical and financial base is typical. Foreign publications are used as methods of forensic researches. To develop professional skill in their staff, leading experts of state forensic institutions from many developed countries (including Russia) are invited to give lectures [79, 80].

The post-soviet states have similar common issues on material-technical, scientific-

methodological, personnel and informational support. This situation can be explained by inadequate and inefficient system of material-technical support and payments in state forensic institutions and branches. Moreover the main part of the forensic activity is concentrated in state forensic institutions which report to agencies and function without special permits (licenses) [81, 82, 83]. Regular expert trainings in most of these countries are possible only within limited number of specialties. That is why leading practical specialists and lecturers from higher education institutions of Russia are engaged for expert trainings. The shortage of expert staff contributes to reduction of forensic laboratories number in regions and workload increase of current expert reports in laboratories of central state forensic institutions. The experts' work overload during excessive report performance leads to a time handicap for appropriate methodological work on experts practices generalization and new research methods development [84, 85, 86, 87].

Summing up the above we can assert that the FRMSI is estranging from forensic chemistry and is turning into one of the legal disciplines which for resolving its issues uses research results having got by forensic chemistry and some other natural sciences methods. At the same time with regard to analytical chemistry the main goals of forensic chemistry can be formulated like this:

- Chemical identification of a research object.
- Chemical analysis of research objects.
- Chemical compatibility of research object.

From the above it follows that the FRMSI's goals remain unachievable without resolving forensic chemistry issues which nowadays are ignored in the FRMSI. The objects of the FRMSI as well as of forensic chemistry are material objects which are subject for a circumstances (facts) survey that are important for a case investigation [12]. Typical objects of forensic chemistry are:

- Biogenic objects.
- Narcotic drugs, psychotropic substances and their precursors; superpotent and toxic substances.
- Oil product, combustibles and lubricants.
- Explosives.
- Chemical marking agents.
- Weapons and ammunition.
- Provisions.
- Polymers and rubbers.
- Documents data.
- Glassworks and ceramics.
- Metals and alloys.
- Paints, varnishes and coatings.
- Synthetical fiber materials.
- Construction materials.
- Soil-origin substances.
- Perfumery and cosmetic products.
- Trace objects.

Applying basic elements of analytical chemistry modern system [88] we can describe forensic chemistry's field of activity as a solution algorithm for the majority of the FRMSI's practical issues. These issues can be resolved by methods of analytical chemistry in regard to particular object:

1. Choice of a disclosable or a definable component.
2. Forensic issue assignment.
3. Choice of forensic chemistry method.
4. Selection of forensic chemistry facilities.
5. Resolving of methodological issues of forensic chemistry.
6. Chemical research performance.
7. Processing of chemical research results.
8. Forensic chemistry issue resolution.
9. Results discussion.
10. Resolution of an assigned issue.

To summarize we can assert that forensic chemistry is a high-demand field of analytical chemistry which methodological support exceedingly lags behind with modern issues that appear during legal procedures. Existing issues of methodological support for forensic chemistry laboratories are mostly connected with inadequate level of material-technical, scientific-methodological, personnel and informational support for Russian forensic chemistry laboratories functioning. It causes quality decrease and delay of the expert reports performance. In conditions of work overload of forensic laboratories and absence of commitment to conduct researches by experts chemists there is an irrevocable loss of results of a great quantity of isolated experimental researches which also diminishes the level of methodological support of this activity area.

All of the aforesaid proves the insistent need and strategic importance of critical analysis of today's situation within all components of the methodological support for forensic chemistry expert reports which are methodical guides, its methods and facilities and expert chemists as well. With the absence of reform initiatives that should particularly proceed from the Russian legal system, the majority of proposals for improving the forensic chemistry laboratories functioning is idle and is based upon requests for boosting financial backing, staff increase of branches, above mentioned staff training and establishing the system of non-state experts' certification. Taking into account the experience of foreign forensic laboratories we can assert that the existing Russian system of government financing for forensic institutions and expert training arrangement are no capable of providing the adequate level of methodological support for the functioning of forensic chemistry laboratories.

Thus, the following set of activities is proposed for resolving the mentioned issues:

- Establishing of the governmental system of obligatory forensic activity licensing.

- Accreditation of all forensic institutions' laboratories to comply with standard of the GOST ISO/IEC 17025–2009.

- Abandon the agency-based principle of functioning for state forensic institutions and establish their functioning within the state higher educational system.

- Organization of mass performance of expert reports for the benefit of different ministries, agencies, organizations, private individuals and other interested parties of legal procedures on a contractual basis within each region.

Carrying out of these activities will provide a high quality of forensic, science and methodical, educational, design and experimental and other kinds of forensic chemistry. It will also contribute to efficiency increase while employing scientific and engineering achievements in practical work both forensic chemistry laboratories and other fields of forensic.

### References

1. Laystner L. Buytash P. Chemistry in Criminalistics. [Khimiya v kriminalistike: translation from Hungarian]. – M.: Mir Publ., 1990. – P. 6.
2. Pavilova G.V. Bezhanishvili G.S. Analytical Chemistry in Forensics // Russian Chemical Journal (Mendeleev Russian Chemical Society). – 2002. – Vol. XLVI. № 4. – P. 76–80.
3. Torvald Yu. Vek kriminalistiki [Century of Criminalistics]. – Rostov-na-Donu: Feniks Publ., 1996. – P. 293–303.
4. Mayorova E.N. Using x-ray fluorescence spectrometers series "Spectroscan MAX" for solving problems of elemental analysis in forensics // Theory and practice of forensic examination. – 2007. – № 2. – P. 178–183.
5. Fesenko A.V., Milovzorov N.G. The definition of core and non-core components of the alloys of gold for forensic investigation // Russian Chemical Journal (Mendeleev Russian Chemical Society). – 2002. – Vol. XLVI. – № 4. P. 81–87.
6. Ezhevskaya T.B., Bublikov A.V. History and prospects of application of portable Fourier spectrometer «INFRALUM FT-801» in laboratories for forensic examination at the Ministry of Justice of the Russian Federation. // Theory and practice of forensic examination. – 2008. – № 1 (9). – P. 219–227.
7. Nekhoroshev S.V., Nekhoroshev V.P., Remizov M.N., Nekhorosheva A.V. Determination of the Chemical Composition of Spice Aromatic Smoking Blends by Chromatography–Mass Spectrometry // Journal of Analytical Chemistry. – 2011. – Vol. 66, № 12. – P. 1196–1200.
8. Nekhoroshev S.V., Turov Yu.P., Nekhoroshev V.P., Nekhorosheva A.V. Identification and Chemical Labeling of Substances, Composites, and Final Articles // Journal of Analytical Chemistry. – 2010. – Vol. 65, № 10. – P. 988–994.
9. Grigoryev A.M., Savchuk S.A., Melnik A.A. and others. Verification of the fact of reception of synthetic cannabinoid JWH-018 by chromato-mass-spectrometric methods // Journal of Analytical Chemistry. – 2012. – Vol. 67, № 11. – P. 995–1004.
10. Zolotov Yu.A., Ivanov V.M., Amelin V.G. Chemical test methods of analysis. – P. 8–12, 254–267.
11. Elber R., Frank A., Almog J. Chemical Development of Latent Fingerprints: Computational Design of Ninhydrin Analogues // J. Forensic Sci. – 2000. – № 45 (4). – P. 757–760.
12. Mitrichev V.S., Khrustalev V.N. Osnovy kriminalisticheskogo issledovaniya materialov, veshchestv i izdeliy iz nikh. [Fundamentals of forensic research materials, substances and products produced from them]. – SPb.: Piter Publ. 2003. – P. 10–36.
13. Federal law № 102-FZ of June 26, 2008 "On ensuring the uniformity of measurements" (revision on December 02, 2013).

14. Federal law № 412-FZ of December 28, 2013 "On the accreditation in the national system of accreditation" (revision on July 28, 2012).
15. Federal law № 73-FZ of May 31, 2001 "About the state judicial and expert activities in the Russian Federation".
16. The order of the Ministry of Internal Affairs of the Russian Federation of June 29, 2005 № 511 "Organization of production of legal expertise in the forensic departments of internal affairs of the Russian Federation". – Available at: <http://www.referent.ru/1/84449>.
17. Decree of The Federal Security Service of the Russian Federation № 277 "About organization of forensic expertise in the expert bodies of the Federal security service" dated June 23, 2011. – Available at: <http://base.garant.ru/12189652/#1000>.
18. Order of The Russian Federation Ministry of justice dated May 14, 2003 № 114 "On approval of the amount of examinations performed in the state forensic institutions of the Ministry of justice of the Russian Federation, and the list of expert specialties, which gives the right of independent forensic examinations in the state forensic institutions of the Ministry of justice of the Russian Federation".
19. Zakharaeva V.V. Features of departmental regulation of expert and specialist // Theory and practice of forensic examination. – 2007. – № 4 (8). – P. 10–13.
20. Federal law № 128-FZ "On licensing of some types of activity" of August 08, 2001.
21. Russian Federation Government Decree № 1013 "On Approval of the List of Products Subject to Mandatory Certification, and the List of Work and Services Subject to Mandatory Certification", dated 13.08.1997.
22. Federal law of 27.12.2002 № 184-FZ "On technical regulation".
23. National standard of the Russian Federation GOST 52960-2008 "Forensic Science Laboratories Accreditation"
24. Non-commercial partnership "Chamber of judicial experts". – Available at: <http://sudexp.ru/3/akkred>.
25. The structure of the Ministry of Internal Affairs of Russian Federation. – Available at: <http://www.mvd.ru/mvd/structure/unit/criminalistic/str/>.
26. The structure of the Russian Federal Center of Forensic Science. – Available at: <http://www.sudexpert.ru/structure/>.
27. The position of the Central forensic customs administration. – Available at: [http://www.customs.ru/index.php?view=article&catid=72%3A2011-01-25-08-16-33&id=14299%3A2011-05-31-12-13-22&format=pdf&option=com\\_content&Itemid=1865](http://www.customs.ru/index.php?view=article&catid=72%3A2011-01-25-08-16-33&id=14299%3A2011-05-31-12-13-22&format=pdf&option=com_content&Itemid=1865).
28. Structure of the Department of special and forensic support FDCS of Russia. – Available at: <http://www.fskn.gov.ru/pages/main/info/leadership/6000/index.shtml>.
29. 111th Main Federal Center of medical and forensic examination of the Ministry of Defense of the Russian Federation. – Available at: <http://www.111centr.ru>.
30. Order of the Ministry of Health and Social Development of the Russian Federation No. 346n dated May 12, 2010 "On the organizing and conducting forensic medical examinations at state forensic expert institutions of the Russian Federation". – Available at: <http://base.garant.ru/12177987/#1000>.
31. Autonomous non-commercial organization "Center of Forensic Science". – Available at: <http://sud-expertiza.ru>.
32. The Center for Independent Experts. – Available at: <http://www.expertcenter.biz>.
33. The Criminal Code of the Russian Federation № 63-FZ of June 13, 1996, art. 307. – Available at: <http://www.consultant.ru/popular/ukrf/>.
34. Giverts P.V., Khokherman G., Miklyaeva O.V., Sonis M.A., Usov A.I. Forensic laboratory accreditation testing against ISO 17025 (on the example of Ballistics laboratory of Forensic Bureau of the police of Israel) / Theory and practice of forensic examination. – 2010. – № 4 (20). – P. 346–350.
35. Moskvina T.P., Rossinskaya E.R. Certification of the methodical providing of legal expertise – the real way of improving non-state forensic activity / T.P. Moskvina, E.P. Rossinskaya // The scientific-practical journal Law. – 2006. – № 3. – P. 119–126. Russian Legal Academy of Ministry of Justice of Russian Federation. – M., 2005. ISSN 2072-991X.)
36. The system of voluntary certification of forensic experts, organizations and laboratories providing services in the field of forensic POCC RU.Я664.04BC/Д0 dated 12.07.2010. – Available at: <http://www.np-sudexpertiza.ru/certification>.
37. The system of voluntary certification of methodological support POCC RU.B175.04OЭ00 dated 02.03.2005. – Available at: <http://www.sudexpert.ru/standards>.
38. Lyubimov Yu.S. The role of forensic science at the present stage of development of the Ship's power plant system of the Ministry of justice of Russia / Yu.S. Lyubimov // Theory and practice of forensic examination. – 2012. – № 1(25). – P. 12–17.
39. Moskvina T.P., Usov A.I. (2004) Certification of experts is a critical component of quality assurance judicial expertise. Proceedings of the 2<sup>nd</sup> All-Russian scientific-practical conference on Criminalistics and Forensic held from the 1<sup>st</sup> to 3<sup>rd</sup> March, 2004: "Forensic tools and techniques in the detection and investigation of crimes": In 3 volumes. – M.: Forensic Science Center of Ministry of Internal Affairs of Russia, 2004. – Vol. 1. Session 1. – P. 20–25.
40. GOST ISO/IES 17025-2009 «General requirements for the competence of testing and calibration laboratories».
41. Bogdanov V.M. and others. The experience of the accreditation expert unit in order to confirm competence and procedural independence. / V.A. Bogdanov, Yu.A. Karpov, A.V. Kuchkin and others // Forensic examination. – 2009. – № 2. – P. 5–12.
42. Smirnova S.A. and others. Accreditation experience of forensic laboratory of Ministry of Justice of the Russian Federation testing against ISO/IES / S.A. Smirnova, A.I. Usov, G.G. Omel'yanyuk, G.I. Bebesheko, S.G. Korol' // Theory and practice of forensic examination. – M., 2011. – № 2(22). – P. 40. – 56.
43. Orlova V.F. Problems of unification of the legal basis of the forensic examination and their solutions // Theory and practice of forensic examination. – 2007. – № 4 (8). – P. 14–25.
44. The provision of the Federal interagency coordination and methodological council on forensic expertise (FICMCFE) and expert research, approved at the meeting of Federal interagency coordination and methodological council on forensic expertise from April 22. – 2005. – Available at: <http://www.sudexpert.ru/files/FMKMS.pdf>.
45. Miklyaeva O.V. 26<sup>th</sup> Meeting of the FICMCFE on forensic expertise and expert research // Theory and practice of forensic examination. – 2011. – № 4 (24). – P. 48–49.
46. Maylis N.P. On the preparation of expert personnel in educational institutions and in the system of state forensic institutions // Theory and practice of forensic examination. – 2007. – № 2 (6). – P. 34–37.
47. Engalychev V.F. Research center for Forensics and Criminalistics (RCF&C) // Theory and practice of forensic examination. – 2008. – № 4 (12). – P. 52–54.
48. Pinchuk Pavel V. Problematic issues of material and technical equipment of the state forensic institutions of the Ministry of defense of the Russian Federation: current status and scientific basis for their conceptual: (PhD Thesis of the Doctor of Medical Science): 14.00.24; [Place of the defense: SI "Russian center of forensic medical expertise"] – Moscow. – 2006. 875 p. 63 ill. – M, 2006. – 938 p.
49. Dzhvalyakov Sergey G. Organization of forensic chemical expertise in state forensic institutions of the Ministry of defense of the Russian Federation and the main directions of its improvement: (PhD Thesis of the Candidate of Medical Science): 14.00.24. [Place of defense: MGMSU «Moscow State Medical Stomatological University»]. Moscow, 2006. 128 p.
50. Fetisov Vadim A. Current state and ways of improving the activities of the forensic expert institutions of the Navy in peacetime and emergencies: (PhD Thesis of the Doctor of Medical Science): 14.00.33; Place of defense: Postgraduate Doctor's Training institute. – M, 2005. – 309 p. 57 ill. – M., 2005. – 366 p.

51. Gordienko V.V. Some forensic aspects of detection of crime // Proceedings of the 2<sup>nd</sup> All-Russia scientific-practical conference on Criminalistics and Forensic held from the 1<sup>st</sup> to 3<sup>rd</sup> March, 2004: "Forensic tools and techniques in the detection and investigation of crimes". In 3 volumes. – M.: Forensic Science Center of Ministry of Internal Affairs of Russia, 2004. – Vol. 1. – Session 1. – P. 14–20.
52. Berdnik P.V., Ryabov S.A. Organization of activities of the forensic departments of internal affairs body at the present stage // Expert practice. – 2004. – № 56. – P. 6–14.
53. Lobushev D.V., Polyanova Zh.A. Some aspects of staffing of the scientific activity in the internal affairs body of the Russian Federation. // Proceedings of the 5<sup>th</sup> international scientific-practical conference on Criminalistics and Forensic examination held from the 2<sup>nd</sup> to 3<sup>rd</sup> March, 2011: "Forensic tools and techniques in the detection and investigation of crimes". – M.: Forensic Science Center of Ministry of Internal Affairs of Russia, 2011. – P. 76–77.
54. Aminev F.G. Research and methodology and legal issues of the activity of the forensic departments of Internal affairs body // Forensic examination. – 2010. – № 3 (23). – P. 5–14.
55. Lisyanskiy B.M. The report on holding All-Russian scientific-practical conference dedicated to the memory of prof. Y.M. of Kubitskiy "Modern problems of medical, forensic, forensic chemical and chemical and toxicology expert research" and topic sections of the exhibition "Forensics and Criminalistics". The conference and the exhibition have been held in the framework of XI International exhibition of security facilities of the state "INTERPOLITEKH-2007" in Moscow on 31<sup>st</sup> October – 1<sup>st</sup> November, 2007 // Theory and practice of forensic examination. – 2008. – № 2 (10). – P. 241–249.
56. Cherekaev A.V. To the question of the development of the system of state forensic institutions // Theory and practice of forensic examination. – 2010. – № 2 (18). – P. 46–48.
57. Markelov A.G. The problem of assigning forensic examination in the criminal process remains unresolved issue // Proceedings of the 2<sup>nd</sup> International scientific-practical conference "Theory and practice of forensic examination in modern conditions". Moscow, 24–25 of June, 2009. – M.: Prospekt Publ., 2009. – P. 250–252.
58. The resolution of the Plenum of the Supreme Court of the Russian Federation dated 21.12.2010 № 28 "On forensic examination in criminal cases", entered into force from 21.12.2010.
59. Cherekaev A.V. To the question of development of system of state forensic expert institutions // Theory and practice of forensic examination. – 2010. – № 2 (18). – P. 46–48.
60. The order of the president of the Russian Federation dated 03.02.2012 № Pr-267.
61. Khaziev Sh.N. Peculiarities of organization of legal expertise in the countries of Anglo-American law // Theory and practice of forensic examination. – 2007. – № 4 (8). – P. 218–221.
62. Karaev M.V., Stetskevich A.D. Information about the participation of experts technicians of forensic science center of the Ministry of internal affairs of Russia in the international seminar on explosives subjects in the UK // Expert practice. – 2004. – № 56. – P. 116–121.
63. Usov A.I., Lamukhina O.A. Training of experts in Auckland // Theory and practice of forensic examination. – 2009. – № 1 (13). – P. 45–47.
64. Nesterina E.M. The carrying out of legal expertise in palynology unit, University of Worcester (UK) // Theory and practice of forensic examination. – 2010. – № 3 (19). – P. 220–225.
65. Khaziev Sh.N. On system of forensic institutions of the USA // Theory and practice of forensic examination. – 2010. – № 1 (17). – P. 240–246.
66. Druzhinin Yu.A. Features of the production and inspection of the scene in the United States by the FBI // Expert practice. – 2011. – № 70. – P. 82–87. For internal use only.
67. Martynov V.V., Filchakov A.A. Information about the presence of explosives expert of the USA in the delegation Ministry of internal affairs of Russia // Expert practice. – 1996. – № 44. – P. 89–91. For internal use only.
68. Khaziev Sh.N., Usov A.I. On the report of the national academy of sciences of the USA «On strengthening forensic science in the United States» and its importance for international forensic communities // Theory and practice of forensic examination. – 2010. – № 2 (18). – P. 196–202.
69. Kokin A.V. Problems of training of experts // Theory and practice of forensic examination. – 2010. – № 2 (18). – P. 50–58.
70. Martynov V.V., Naumov A.B. About the experience of the specialists work of the Central laboratory of the Prefecture of Police, Paris // Expert practice. – 2000. – № 48. – P. 123–127.
71. Latsiak O. Practical experience of quality management in the forensic laboratory of the Slovak Republic // Theory and practice of forensic examination. – 2007. – № 3 (7). – P. 196–200.
72. Lamukhina O.A. Institute of forensic research of the Ministry of Justice of Poland // Theory and practice of forensic examination. – 2008. – № 2 (10). – P. 214–219.
73. Lamukhina O.A. The forensic science Institute of the Federal criminal police of Germany // Theory and practice of forensic examination. – 2008. – № 3 (11). – P. 224–227.
74. Usov A.I. About the forensic science Institute of the Netherlands (NF) // Theory and practice of forensic examination. – 2012. – № 2 (26). – P. 160–161.
75. Khaziev Sh.N. The international forensic institutions (Handbook, part 1) // Theory and practice of forensic examination. – 2009. – № 1 (13). – P. 156–177. (rus).
76. Khaziev Sh.N. The international forensic institutions (Handbook, part 2) // Theory and practice of forensic examination. – 2009. – № 4 (16). – P. 210–235.
77. Ya de Kinder. European network of forensic science institutes (ENFSI) // Theory and practice of forensic examination. – 2011. – № 4 (24). – P. 200–204.
78. Lamukhina O.A. The report on participation in 21<sup>st</sup> annual conference of European network of forensic science institutes (ENFSI) // Theory and practice of forensic examination. – № 3 (15). – 2009. – P. 156–159.
79. Usov A.I. The international symposium "2007: progress in forensic symposium" in Shanghai (People's Republic of China) // Theory and practice of forensic examination. – 2008. – № 1 (9). – P. 242–244.
80. Semenov A.Yu., Stetskevich A.D. Information about the presence of explosives experts in People's Republic of China // Expert practice. – 2003. – № 54. – P. 114–117.
81. Rubis A.S., Moroz I.A., Ponomarenko Yu.V. Scientific-Research Institute for issues in Criminology, Criminalistics and Forensic examination of the Ministry of justice of the Republic of Belarus // Theory and practice of forensic examination. – 2007. – № 1 (5). – P. 174–179.
82. The decree of the President of the Republic of Belarus from 14.09.2003 № 407 "On certain measures for improving judicial-expert activity".
83. Lall'Annika E. Problems of development of forensic science institutions in the Republic of Estonia (genesis, status and prospects): (Candidate's dissertation) on the 18<sup>th</sup> of May, 2007: 12.00.09 – criminal procedure, criminalistics and forensics. [Place of the defense: Saint Petersburg University of Ministry of Internal Affairs of Russian Federation].
84. Atakhodzhaev S.A. Forensic service of the Ministry of justice of the Republic of Uzbekistan: history and prospects // Theory and practice of forensic examination. – 2007. – № 3 (7). – P. 188–192.
85. Musaev G.A. Forensic examination in Azerbaijan Republic // Theory and practice of forensic examination. – 2007. – № 3 (7). – P. 193–194.
86. Bishmanov B.M., Sagidan A.Zh. Legal aspects of forensic activity in the Republic of Kazakhstan // Theory and practice of forensic examination. – 2007. – № 2 (6). – P. 192–197.
87. Plakhov S.I. The international scientific-practical seminar "Current issues of methodological and technical support of the judicial fire investigation" // Theory and practice of forensic examination. – 2011. – № 3 (23). – P. 192–195.
88. Zolotov Yu.A. Chemical analysis and control of the main subjects // Russian Chemical Journal. – 2002. – Vol. 46, № 4. – P. 8–10.

## ALERTION IN NATURAL ENVIRONMENT OF NORTH UNDER THE IMPACT OF REPUBLIC SAKHA POWER SECTOR (YAKUTIYA)

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Intensification of industrial development in Republic Sakha (Yakutiya) has led to an escalation of ecological problems, including pollution of environment, and the most significant contribution to this process belongs to power complex. The article presents results of analyzing current condition and provides ecological evaluation of the predicted influence of RS(Y) power complex upon alteration of natural environment. The evaluation is based upon basic indicators: discharge of pollutants into atmosphere, dump of hazardous dirt into water objects, and also volume of production and consumption waste. As a result of the undertaken analysis of current condition we can outline that nowadays enterprises of heat power complex in Republic Sakha (Yakutiya) contribute greatly to formation of ecological situation, it consists of up to 80% of total discharge into atmosphere, up to 35% of total waste dumps into water objects, and up to 60% of production and consumption waste. Ecological evaluation of FPC upon perspectives of the republic has shown that the most hazardous objects remain coal power stations, enterprises of fuel extraction, and small boiler houses.

**Keywords:** natural environment, pollution, power complex, evaluation, prediction

Intensification of economic and social development in Republic Sakha (Yakutiya) has led to escalation of various ecological problems, including pollution of environment. The most significant contribution into this process belongs to fuel-power complex. It includes almost all sectors of power industry and uses all types of power resources, extraction, procession, and use of which has an active influence upon natural environment of North.

Russia holds third place in the world after USA and China in terms of discharging pollutants into environment and 74<sup>th</sup> place among ecologically-clean countries. The greatest atmosphere pollution takes place in result of power enterprises' activity and forms about 27% of total industrial discharge.

The bulk of pollutants' discharge into atmospheric air of RS(Y) comes from enterprises of electric power, coal, and gas industry. In 2013 of all Far-East federal district Yakutiya occupied second place in volume of pollutants' discharge into atmosphere (262,3 thousand tons) after Primorsk region (404,3 thousand tons) from all industrial sources.

In amount of polluted sewer waste dump into water objects RS(Y) occupies 4<sup>th</sup> place (75,63 million m<sup>3</sup>) after Primorsk (284,84 million m<sup>3</sup>), Khabarovsk (177,9 million m<sup>3</sup>), and Amur region (76,97 million m<sup>3</sup>).

Within Far-East federal district RS(Y) is the leading region in the greatest volume of placed wastes that equaled 288,322 million tons in 2013 (Khabarovsk region – 92,941 million tons).

The article presents some results of analyzing modern condition and provides ecological evaluation of the predicted influence of power complex of RS(Y) upon alteration of natural environment. Such evaluation has been received with facilitation of the existing methods

of predicting natural environment condition in terms of energetic development [5].

### Modern change in natural environment under the influence of energetics

The basic indexes that define antropogenic alteration of ecological nature condition are discharge of pollutants into atmosphere, dump of hazardous dirt into water objects, and also wastes of production and consumption.

**Discharge into atmosphere.** In 2013 amount of pollutants, discharged into atmosphere from stationed sources, equaled 165,14 thousand tons, of them 32,65 came from enterprises of oil-and-gas sector, and 39,48 thousand tons – from enterprises of power sector, and it equaled almost 50% of total industrial waste (Fig. 1) [3].

The degree of negative influence upon the environment is mostly dependent upon type of power source and the used types of fuel. In total volume of most wide-spread pollutants during 2000–2013 gas and liquid substances prevailed, and they are the main air pollutants. In structure of discharge in 2013 volume of carbon oxide equaled almost 43,8% of all discharges, nitrous oxide – 16,5%, sulphur dioxide – 6,4%. Solid substances formed 26,6% [3].

The greatest polluter of atmospheric air in Republic Sakha (Yakutiya) is JSC AK “Yakutskenergo” that consists of 7 branch offices and 4 subsidiaries. The basic types of activity for this company are production, distribution, transition, and sale of electric and heat power to consumers.

During the period 2009–2012 a growth in volume of pollutants' discharge into atmosphere happened at the enterprise: sulphur dioxide – by 2,1, nitrous oxide – by 2,1, carbonic oxide – by 1,4. On the contrary, volume of hazardous discharges into atmosphere decreased by 2% since 2012 till 2013 (Fig. 2) [1, 2, 3].

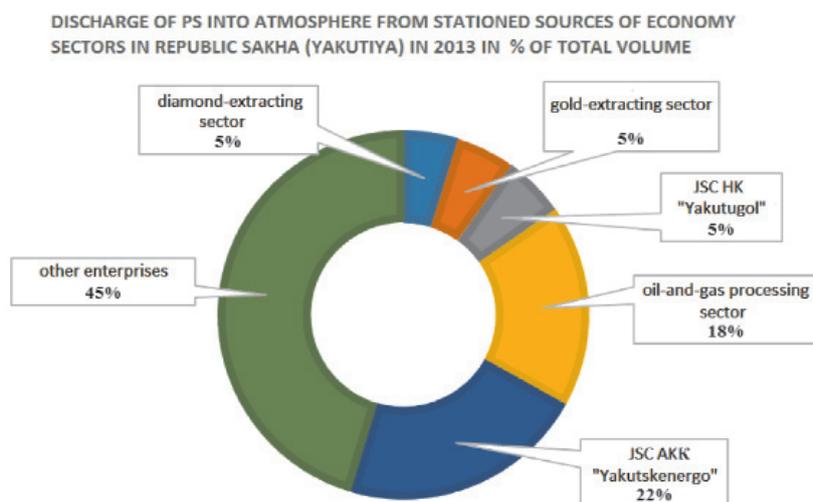


Fig. 1. Structure of economy sectors' contribution in atmospheric pollution [3]

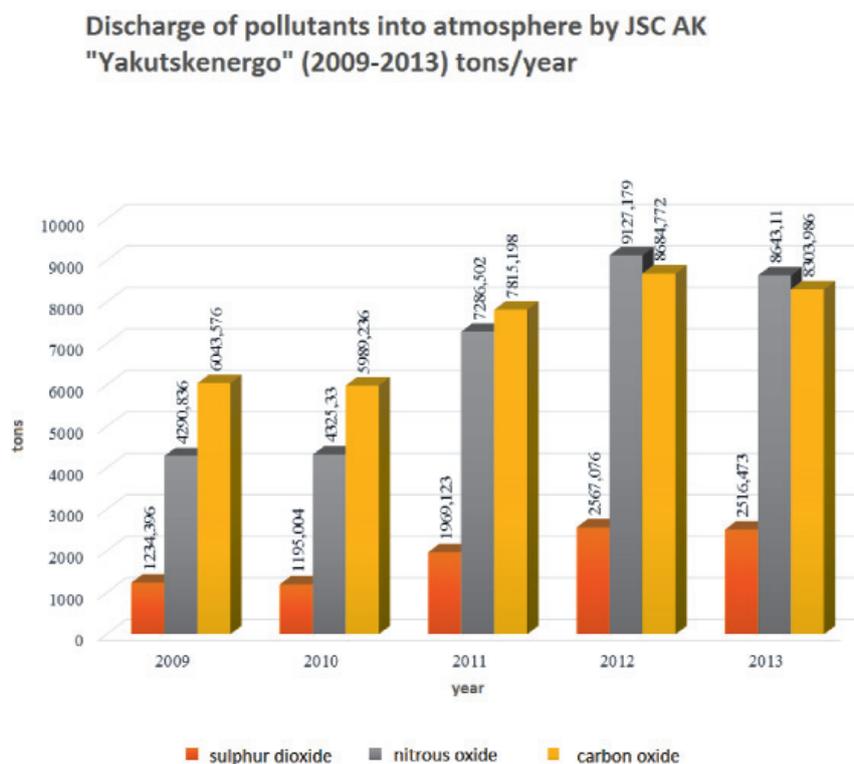


Fig. 2. Discharge of pollutants into atmosphere by JSC AK "Yakutskenergo" (2009–2013)

**Waste dumps into water objects.** Quality of surface waters is defined by indexes of sewer dumps into water objects. Nowadays in comparison to 2008 total dump of sewer waters from all economic sectors of Republic Sakha (Yakutiya) has increased by 8,3 %, but the volume of dirt decreased by 21,5 %. Within structure of sewer waters dirt forms almost 40 %. Among regions of Far East

federal district in 2013 contribution of Yakutiya in total mass of dirt equaled 12,4 % (133,1 thousand tons) of total dump of pollutants into surface water pools [3].

The leading position in total pollution of Yakutiya water objects belongs to large mining industry. Contribution of fuel-power complex into total dump of pollutants has equaled 30-35 % during recent years.

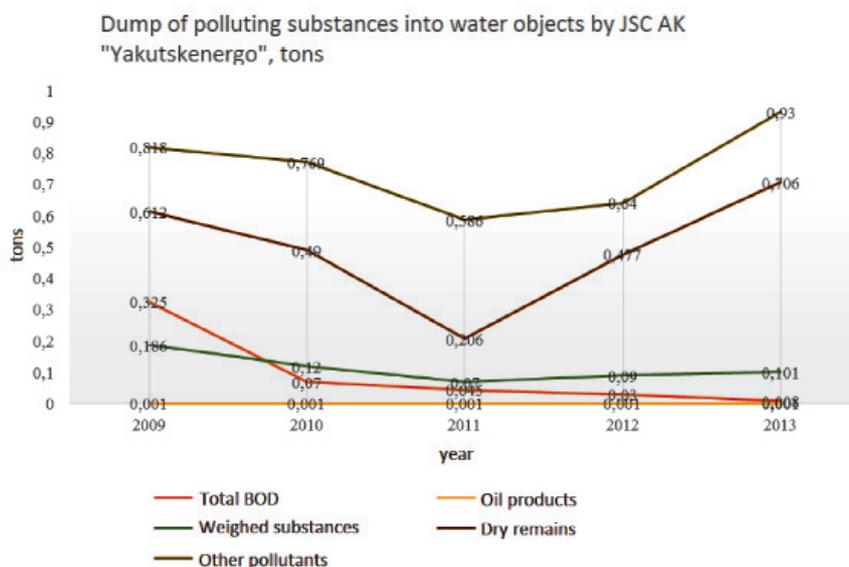


Fig. 3. Dump of polluting agents into water objects by JSC AK "Yakutskenergo" (2009–2013) [4]

Fig. 3 shows dynamic of dirt dumps according to their chemical composition during the period 2009–2013 decrease in total BOD from 0,325 tons to 0,008 took place, weighed substances – from 0,186 to 0,101 tons, but dump of dry remains grew from 0,612 tons to 0,706 tons, and of others – from 0,818 to 0,930 tons [4].

Analysis of surface water quality throughout pools of large Yakutiya rivers shows us that water object are still exposed to a severe antropogenic strain. Mostly water quality re-

mained unaltered during the recent years, as new powers of cleaning facilities have not been put into use, the existing facilities have not been reconstructed, though they are worn-off and use outdated technologies of filtration.

**Wastes.** One of the urgent problems of the republic is formation and accumulation of production and consumption waste. The share of power objects in total amount of wastes equals about 60%, and it has increased almost 1,8 times during the recent years, and it has a special reflection in wastes of class – 5 (Fig. 4) [4].

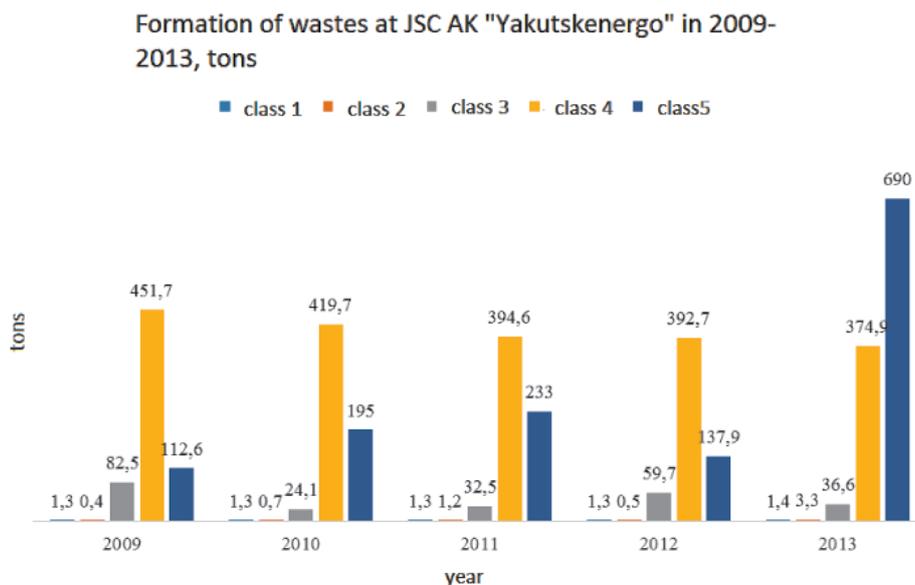


Fig. 4. Formation of wastes by JSC AK "Yakutskenergo" in 2009–2013 [4]

Due to lack of specialized enterprises of utilizing (burying) chemical wastes (wastes of HPS) in Republic Sakha, their transportation to polygon of burying industrial waste in the city of Krasnoyarsk is undertaken.

#### Evaluation of perspective change in natural environment

On the whole, ecological pollution of atmosphere carries local nature throughout the republic. A high level of pollution is observed in the largest inhabited areas, where enterprises of heat-power complex and diamond procession are located.

Ecological evaluation of heat-power complex development perspective has been done for two scenarios: strategic and moderate, and strategic variant has been accepted for favourable conditions of realizing power investment projects, and moderate – for less favourable, defined by objective economic reasons.

The undertaken calculations of total discharge into atmosphere during the period of 2013–2030 have shown its growth by 1,6 for both moderate and strategic scenarios, and it equals 202–203 thousand tons in 2030 (Fig. 5) [6].

among number of boiler houses that belong to main gas pipelines.

Discharges by diesel power stations will decrease in the studied period due to a decrease in volume of diesel fuel consumption.

Calculating dynamic of hazardous substances' discharge in the republic power regions for period 2008–2030 has shown that the greatest growth will happen in Southern-Yakutsk power region – by 2,4, in Northern – by 1,2. Discharge will remain practically at the same level in Central power region and will decrease by 1,3 in the West [6].

From the position of FPC impact upon water objects we should outline that sewer waters of large HPS and HRPS are formally clean in 95% of all cases. Enterprises of dwelling-communal complex will remain the main sources of water pollution in long-term perspective.

A special feature of the republic's power complex is the planned large-scale development of hydroenergetics. In this regard, regulation of sewer and water storage will have a great impact upon the environment. Change in hydromechanical water flow regime due to deconsumption of flooded

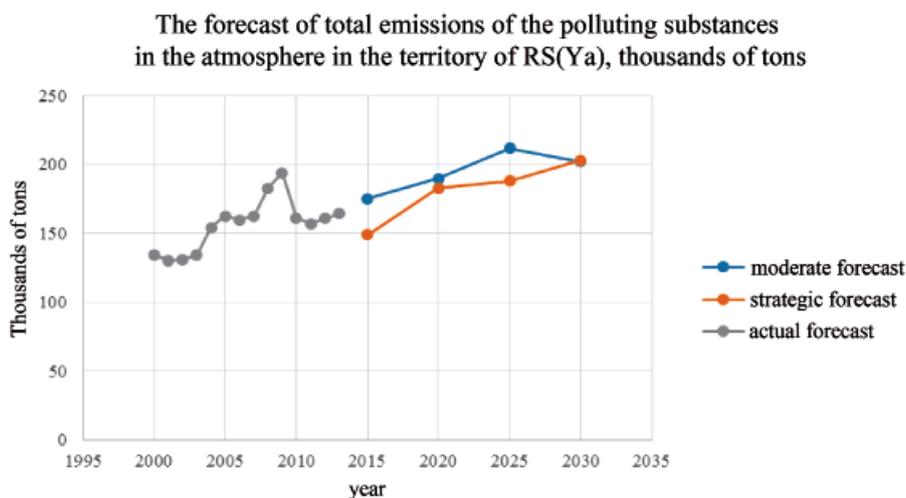


Fig. 5. Predicted total discharge of pollutants into atmosphere at the territory of RS(Y) [6]

In case of moderate scenario gradual growth in HEC discharge is observed, while strategic scenario implies is great growth from 2020 that is defined by more intense consumption of coal at new Elginskaya HPS and Elginskaya HRPS as well as expansion of Neryungrinskaya HPS.

Dynamic of discharge by boiler houses for both scenarios is decreasing due to modernization of boiling equipment and gasification

soil grounds and remaining plants as well as pollution with industrial and household sewer waters will serve as the major negative ecologic factor.

One of important ecologic indexes of fuel-power complex development in the republic is formation of ash-slag wastes. According to enlarged evaluations, by the end of 2030 amount of ash slag will equal 1,2 million tons per year for the moderate scenario and 1,5 million tons

per year for the strategic scenario. Considering the significant amount of wastes, accumulated at the republic territory nowadays – about 1,2 billion tons, solving problems of storing (construction of ash slag dumps) and utilization of this waste should be planned.

In result of the undertaken analysis of modern condition we can outline that nowadays enterprises of FPC have a great contribution into formation of ecologic situation in Republic Sakha (Yakutiya) that forms up to 80 % of total discharge into atmosphere, up to 35 % of total dump into water objects, and up to 60 % of production and consumption wastes.

Ecologic evaluation of FPC development in terms of republic perspective has shown that coal power stations, enterprises of fuel extraction, and small boiler houses remain the most ecologically-hazardous objects. Atmosphere, water, and land resources are exposed to significant influence in process of power sector development.

In order to decrease anthropogenic influence of electric and heat power objects upon natural environment it is necessary to intensify enterprises' activity in terms of providing the following nature-preserving measures:

- improvement in structure of the burnt fuel via decreasing part of using coal and black oil along with increase in burning of natural gas;
- gasification of small boiler houses of equipping them with modern dust-cleaning facilities;

- introduction of modern tools for dust and water cleansing into all large power enterprises;
- rational water consumption and decrease in amount of dirt wastes due to installation or modernization of sewer waters filtration systems;
- introducing system of processing and utilizing ash slag wastes at large power enterprises;
- recultivation of the damaged lands.

Thus, for the territory of Republic Sakha (Yakutiya) with its intense nature of business and production, it is necessary to develop an ecologic policy and principles of undertaking nature-preserving measures that will provide for preservation of natural resources and regulate parameters of keeping fragile Northern nature safe and in balance.

### References

1. National Report on the state and environmental protection of the Republic of Sakha (Yakutia) for 2009. Government of the Republic of Sakha (Yakutia), the Ministry of Nature Protection of the RS(Y). – Yakutsk, 2009. – 205 p.
2. National Report on the state and environmental protection of the Republic of Sakha (Yakutia) for 2010 year. – Yakutsk, 2011. – 225 p.
3. State report on the environmental situation in the Republic of Sakha (Yakutia) in 2013. – Yakutsk, 2014. – 44 p.
4. Materials of “OAO AK “Yakutskenergo” (Open Joint-stock Company).
5. Method of determining the emissions of air pollutants from fuel combustion in boilers with capacities of less than 30 tons of steam per hour, or less than 20 Gcal per hour. – Moscow, the State Committee for Environmental Protection, 1999. – 49 p.
6. Energy strategy of the Republic of Sakha (Yakutia) for the period up to 2030 / Edited by G. Alekseev and N. Petrov. – Yakutsk-Irkutsk, 2010. – 327 p.

## GEOLOGICAL AND GEOCHEMICAL PROPERTIES OF OIL SHALE IN AZERBAIJAN AND PETROLEUM POTENTIAL OF DEEP-SEATED EOCENE-MIOCENE DEPOSITS

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The paper is devoted to a detailed study of oil shale that is considered a new alternative energy and fuel resource for Azerbaijan. More than 60 surface manifestations of oil shale, related to sediments between Eocene and Miocene in the territories Shamakhi-Gobustan, Absheron, Pre-Caspian-Guba, Vandam-Lahij and etc. of the Republic are investigated on its distribution regularity and geochemical properties. Oil shale of these epochs, which can't be reached due to exploration wells, but brought from the different depths to the Earth's surface (where oil shale surface manifestations widely distributed) by eruptions of mud volcanoes have been studied as well. Along with geochemical study of oil saturated rocks, found in ejected production of mud volcanoes, a comparative analysis have been conducted on heavy fractions, obtained from these rocks and oil shale. The results of these studies show that bitumen (its heavy fractions) of Eocene-Miocene oil shale and oil-saturated rocks are similar, and may cause to formation and accumulation of hydrocarbons in ultra-deep sediments of mud volcanic areas. All conducted investigations are increasing the topicality of perspectives of shale gas in Azerbaijan, which is non-traditional for the country.

**Keywords:** Azerbaijan, distribution regularity, geochemistry, organic matter, oil shale, shale gas

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The rich hydrocarbon potential of Azerbaijan has a great influence in the status of country. Integrated studies are expanded for further enrichment of hydrocarbons reserves of Republic. To explore new oil and gas fields in deeper sediments of onshore and offshore territories becomes very relevant. However, the energy potential of the country should not depend only on oil and gas resources, and together with them the Republic is rich in non-traditional alternative sources of energy, such as natural bitumen, oil shale and gas hydrates [1, 11].

Currently, a number of countries are widely used of oil shale to produce shale gas (US, Canada, China and etc.), cement (Estonia, China, Germany), agricultural fertilizers (Estonia, Switzerland), burn at power plants (Estonia, China, Germany, etc.), obtain medical (France, Russia, China) and chemical products (China, Estonia, Russia) and etc.

Researches on oil shale of Azerbaijan have been carried out at the last century [4, 9, 10]. More detailed studies have been carrying out since 2000 by scientists of Institute of Geology and Geophysics of the Azerbaijan National Academy of Sciences. Employees of Department "Mud Volcanism" of the Institute have been studying geological, geochemical properties and probably reserves of oil shale [1, 2, 6, 7, 11, 12].

### **Distribution regularities of oil shale in Azerbaijan**

The most widespread areas of oil shale in the Republic are observed in Shamakhi-Gobustan, Absheron, Pre-Caspian-Guba and Vandam-Lahij and etc. regions (Fig. 1). There are more than 60 surface manifestations of oil shale in these regions, distributed in a wide stratigraphic range (from the Cretaceous to Miocene).

### **Shamakhi-Gobustan region**

The region is located in the south-eastern part of the Greater Caucasus and has a very complex geological and tectonic structure. There are about 120 mud volcanoes, more than 30 manifestations of oil shale, as well as some oil and gas fields in the region. The known oil shale manifestations are developed mainly in the Central Gobustan and Shamakhi tectonic zone.

The geological structure of the region consists of Mesozoic-Cenozoic sediments [12]. In generally, related to Goradil-Masazir Fault Zone and Gujur-Gyzyldash Thrust, three blocks: north allochthonous, central para-autochthonous and southern autochthonous are separated in Gobustan (Fig. 2).

Oil shale of the Northern Gobustan belonging to the Cretaceous deposits, have no commercial value [2].

Many of oil shale manifestations are observed in areas of the Central Gobustan associated with Paleogene-Miocene sediments. The Central Gobustan covers areas, relating to para-autochthonous tectonic block (Bayanata), which indicates favorable paleogeographic and paleotectonic conditions of the zone for the formation of oil shale. Paleogene-Miocene sediments are involved in the geological structure of Bayanata block, have thickness of 2,5–4,5 km. In contrast to these structural and facies complexes, deposits of the same age, observed in north of Geradil-Masazir fault zone (north allochthonous) are located under the Cretaceous sediments (consisting of flyshoids). It is assumed that the sediments of Paleogene-Miocene age in Bayanata block have been compressed between the carbonate complexes (Upper Cretaceous age) of allochthonous and the sediments (Cenozoic age) of autochthonous,

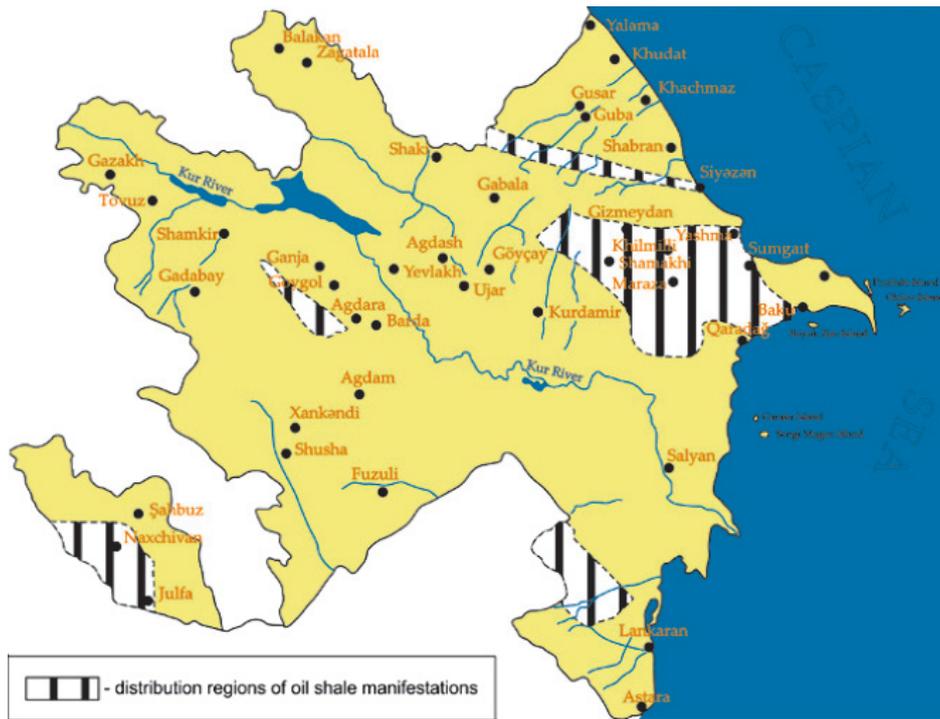


Fig. 1. Schematic map of oil shale distribution regions in Azerbaijan

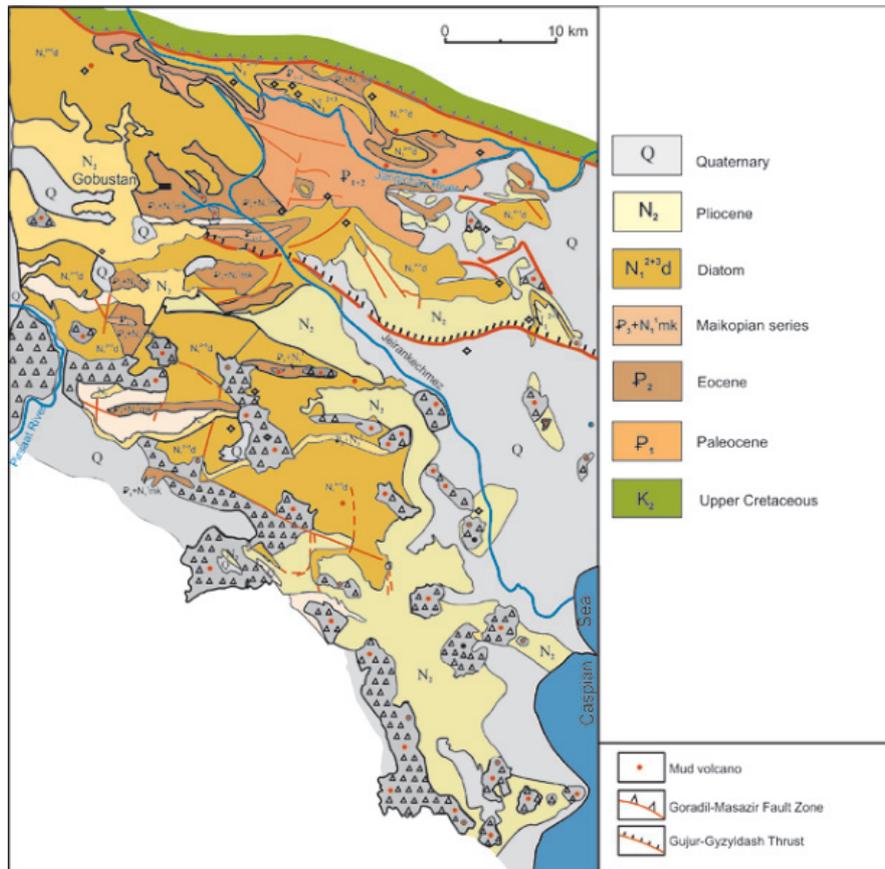


Fig. 2. Geological map of Gobustan [5]

increasing up to 11 km. In such a complex tectonic environment, there were favorable facies and paleogeographic (accumulation of organic matters in silt sediments, existence of shallow, broad bays and continental lagoons) conditions for the accumulation of organic compounds, which forming oil shale. The sediments accumulated with short geochronological breaks and at subsequent stages, a result of dynamic metamorphism these exposed to the process of oil shale formation.

According to the spatio-temporal distribution, the development of oil shale in the Central Gobustan are associated with complex tectonic structure of the region and accumulation of organic compounds with breaks, started from the Middle Eocene, continued in the Maikopian and Konk, ended in the Meotian during the process of lithogenesis.

In general, the number of oil shale manifestations in Gobustan and their probably resources are reduced in the direction from the center to the south-east [1] (Fig. 3).

per Maikopian, Konk and Meotian. The exceptions are related to two manifestations (Goytapa and Uchtepe), the age of Eocene, are located on the border with Shamakhi-Gobustan region.

Conditional border between clay and sandy-clay facies of the Upper Maikopian, traced in the direction of the north wing of Shorbulag folds over of mountains Garaeybat and Bozdag-Qobu, and further to the southeast to Puta Cape. Clay facies of the Upper Maikopian developed in the northern, north-western parts of the Absheron Peninsula and linked to the nature of folding – diapirism occurrence, composing the crest of folds. The most representative section is Riki horizon, situated in the northern slope of Mountain Uchtepe-Shorchala, with thickness of 112 m, composed layers of dark, chocolate-brown clay and black oil shale. The last traced in sections of Mountains Goytepe, Orjandag and Fatmai.

Thus, a broad band of oil shale in the section of Riki horizon coincides with the deepest part of the Upper Maikopian Basin and extends

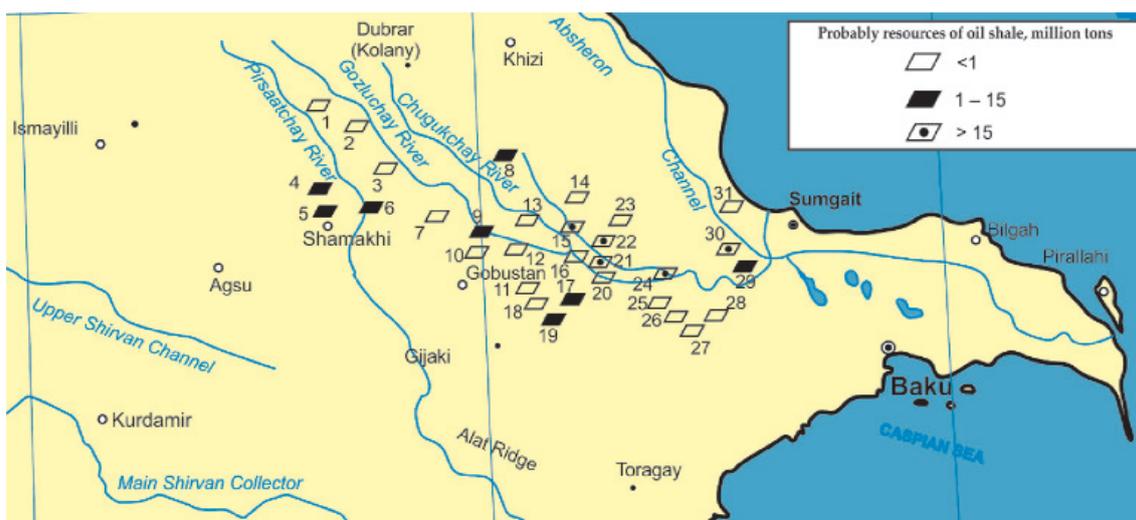


Fig. 3. Map of probable resources of oil shale in Shamakhi-Gobustan region (scale 1:1,000,000).

Oil shale manifestations:

- 1 – Gizmeydan; 2 – Talishnuru; 3 – Khilmilli; 4 – Angakharan; 5 – Shamakhi;
- 6 – Arabshalbashi; 7 – Jeirli; 8 – Agdara; 9 – Garaja; 10 – Ahudag; 11 – Baygushlu;
- 12 – Shaiblar; 13 – Tuva; 14 – Shahandag; 15 – Kichik Siyaki; 16 – Garayokhush;
- 17 – Garigishlag; 18 – Alagishlag; 19 – Baygushgaya; 20 – Jangichay; 21 – Jangidag;
- 22 – Boyuk Siyaki; 23 – Gibladag; 24 – Kechallar; 25 – Sungur; 26 – Bayanata; 27 – Girdag;
- 28 – Saridag; 29 – Pirekeshkyul; 30 – Islamdag; 31 – Agburun

### Absheron region

The geological structure of Absheron consists of clastic-carbonate rocks of the Upper Cretaceous and Cenozoic. There are more than 15 surface manifestations of oil shale in the region, relate mainly to the sediments of the Up-

per Maikopian, Konk and Meotian. The exceptions are related to two manifestations (Goytapa and Uchtepe), the age of Eocene, are located on the border with Shamakhi-Gobustan region.

Oil shale of Konk horizon developed within the Shorbulag and Garaeybat areas in the Western Absheron, has a thickness of 30 m. Whitish foliated oil shale is traced in

Uchtepe-Ilkhidag syncline and 2 km north-west of station Guzdek along the south-eastern end of Geytepe folds. Here, 120 m thickness of Konk-Karagan sediments are observed as a pack of gray, brown-gray foliated oil shale, with a thickness of 18,7 m. Within the southern pericline of Kechaldag-Zigilpiri fold, has been found Karagan-Konk sediments with frequent interlayers of oil shale, traces for several kilometers: in a section, near the Mountain Zigilpiri with a thickness of 26 m, allocated 7 layers of gray, dark gray oil shale. In addition, they are also recorded to south of the village Masazir and north of the mud volcano Kechaldag, in the western part of the Lake Shirinnour in a distance of 1,5 km. Further to east from station Binagadi, oil shale have been found in Karagan-Konk sediments, have a thickness of 125–130 m [6].

In the north-western and northern parts of Absheron Peninsula, oil shale is observed in sections of the north-eastern wing of Fatmai, Orjandag and Saray folds. Total thickness of Konk sediments in the area is 20–25 m. In Absheron Peninsula, oil shale is traced in section of Meotian, spreads throughout the area and characterizes by different thicknesses.

In the southern part of West Absheron, oil shale is observed in Shorbuluga area, Kosmalidag synclines and Uchtepe, as well as and in a considerable part of the hill Damlamaja down to the town Garaeybat. The others distributions of oil shale are traced in the areas of Ateshgah, Khirdalan, Shabandag, Binagadi and to the north of the mud volcano Keyreki, near Kerpyukshor syncline [10] with 1,5 km length and 4,5 m thickness to the west of station Masazir and district Guzdek. In the northern part of Absheron, oil shale found along the right bank of Sumgaitchay River, in the northern Geytepe Mountain, western and eastern periclinal of Jorat folds, north-east wing of Orjandag (thickness of 22 m, length of 650 m), Saray (thickness of 6 m, length more than 1 km) and Fatmai folds. The thickness of Meotian in these areas ranges from 72 to 130 m.

#### **Pre-Caspian-Guba region**

Related to Upper Cretaceous sediments, oil shale are mostly located in the north-east wing of Zarat syncline. The most studied section is in Atachay River, near the village of Bakhishli in Khizi region. The section consists of dark gray bituminous marl, black oil shale and the total thickness is 27 m. The bituminous oil shale also has been found in the section of the Lower Cretaceous (Albian), in the south-eastern pericline of Kemchi fold with the thickness of 3,5 m in Altigaj area.

The Eocene sediments are presented in two facies in the area: bituminous marl in the north-

west (from Samur River to the city of Shabran) and clay, clay shale in the south-east. The thickness of Middle Eocene in this layer is not more than 40–50 m. Here, there are basically no significant oil shale manifestations with much practical value. Also, minor interlayers of oil shale encountered in some sections of the wells (Siyazan, Saadan and Shuraabad) [4].

The layers of Maikopian series (Oligocene-Upper Miocene) oil shale found in the north-west of Pre-Caspian-Guba region do not attract the attention of the economic prospect.

Oil shale of Konk sediments observes in the Chandagar coast with thickness of 8 to 15 m, but Meotian sediments only in the south-east of Shuraabad district. In the Yashma area, two layers of oil shale are separated in the section of Meotian.

#### **Guba oil shale deposit**

Guba oil shale deposit is located 25 km south of Guba city. Oil shale of deposit relates to Upper Sarmatian, ranges from 27 to 255 m and alternates with layers of clay shale, which hardly differ from oil shale. The greatest practical interest is associated with the segment of the Upper Sarmatian layer, length of 29 km, elongated in the NW-SE direction from Gudiyalchay River to Velvelichay River (Fig. 4), although the individual manifestations of oil shale are found to Gilgilchay River. To the north-west of Gudiyalchay River, oil shale appears like an individual spots in the watershed Gusarchay-Tahirjalchay and village Anig [7]. In this direction, the overall thickness of the upper Sarmatian increases up to 1350 m and transgressive bedding of oil shale also traces in the Middle and Lower Sarmatian. Sheet black oil shale in the section has a monoclinical bedding.

Larger manifestations of oil shale have been studied in the area between rivers Velvelichay and Garachay. There are three areas that contain oil shale with the most favorable properties for practical use. The first area, a length of 4,7 km, includes 11 layers of oil shale. The second area, situated between rivers Kamalchay and Chagachukchay, a length of 3 km, includes 14 layers. The third area, 1,5 km, located on the right bank of Garachay River contains 16 layers of oil shale (Fig. 5).

#### **Diyally oil shale deposit**

The deposit is located 7 km east of Ismailly city, 1,5 km the northeast of Diyally village, in strong cross wooded area, at an altitude of 800 m. Tectonically point view, the area relates to the complicated zone of Vandam Lahij where at the Upper Sarmatian time there were favorable geological and geochemical conditions for the formation of oil shale. The main structural

element is tilted to the south anticlinal fold of the northwest with a torn stretch to fault the southern wing, with dips 50–55°. The core of the folds in the west is composed of Upper Cretaceous rocks, in the south-east of the Maikopian and Upper Sarmatian sediments. North of these folds at a distance of 1,5 km there are two troughs (moulds), relates to Sarmatian sediments, and which belonging to Diyally oil shale deposit. The thickness of oil shale layer varries 300–370 m, in the north is hidden under limestone thrust of Kemchi suite. At the base of the section of the Upper Sarmatian, lies pack of basal conglomerates, with a thickness of up to 70 m, under which a pack of layered clays with interbedded sandstone and oil shale. The last one confined to the upper half of the sec-

tion, black and light brown (weathered) colors, 1,5 km long and contains 12 layers (Fig. 6).

**Geochemical characteristics of oil shale and petroleum potential of deep-seated deposits**

Eruption of mud volcanoes ends with emission of products at a depth of up to 6–8 km and more. These products are sole data, which contain information on geology of deep-seated sediments of mud volcanic areas, where have not been studied with drilling or detailed geophysical surveys. To study of hydrocarbon potential of these areas on the basis of geological and geochemical research of oil shale and oil-bearing rock association, which found in ejected products of mud volcanoes provides interesting results [3, 13–16].

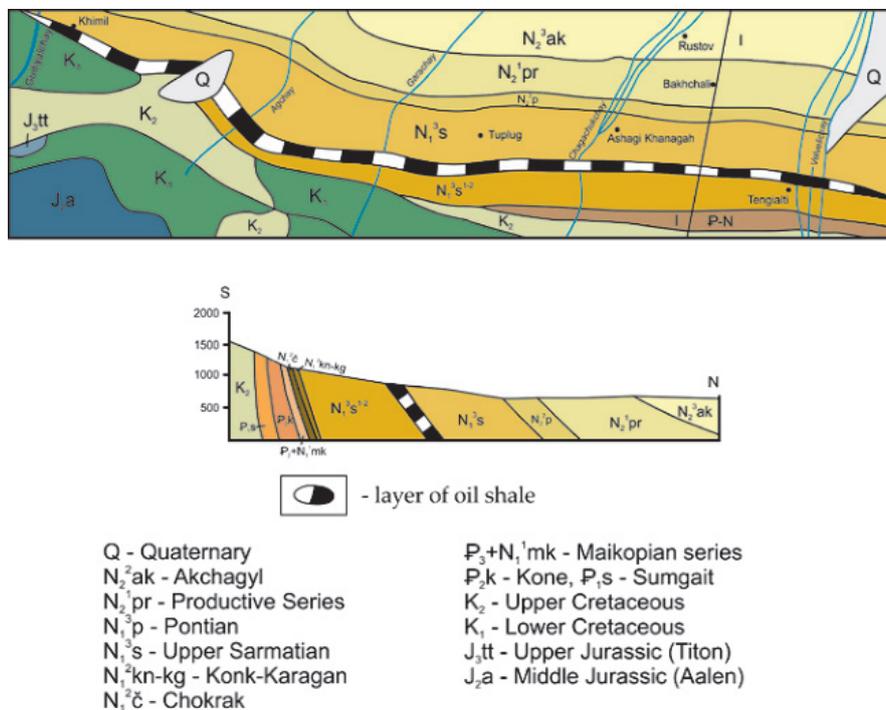


Fig. 4. Schematic geological map and profile of Guba oil shale deposit

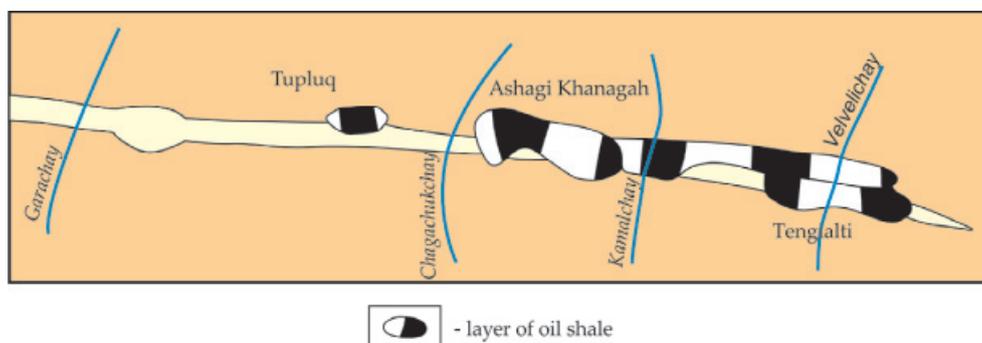


Fig. 5. Schematic map of oil shale containing areas, located between the rivers Velvelichay and Garachay

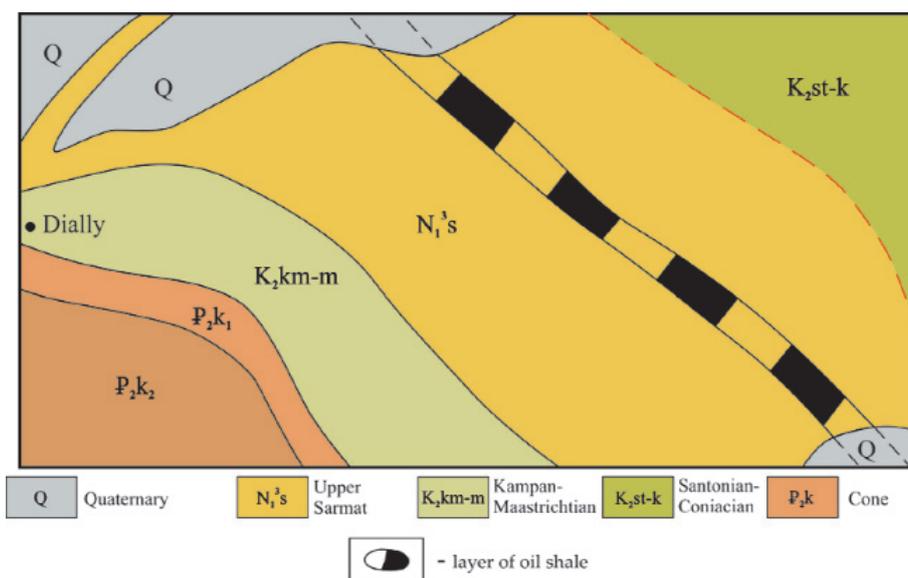


Fig. 6. Schematic geological map of Diyally oil shale deposit

Almost all mud volcanoes, located in Gobustan ejects oil shale and oil-bearing rock during their eruptions (Fig. 7).



Fig. 7. Oil shale (ejected by mud volcano in Gobustan)

There are more than 120 mud volcanoes in Shamakhi-Gobustan region (Fig. 8). Approximately all the mud volcanic structures in the region are potentially oil-bearing. Duvanny oil and gas field is developing in Southern Gobustan (Productive series, Miocene). Commercial oil and gas content of the productive series V and VII horizons has been established (over the Garadag break-down suite) at the Dashgil mudvolcanic area; Kyanizadag gas condensate field has been discovered in the Productive series; commercial oil influx from the Miocene sediments (Chockrak horizon) has been obtained on the Dashgil structure.

A geochemical study aimed at obtaining new information on stratigraphic intervals and depths of hydrocarbon in the study area to clarify the hydrocarbon generation and accumulation potential of the Eocene and the Miocene sediments, associated with mud volcanoes. The studies of oil shale, which sampled from mud volcanic products show that its organic composition ranges between 7,56–42,55 %.

According to data, obtained from a result of the extraction of oil shale, the largest number of soluble organic matter is observed in the composition of the mud volcano Gushchu – 8,34% (composition of kerogen – 34,02%). Relatively fewer soluble organic matter is observed in the composition of oil shale, sampled from mud volcanoes Chapilmysh and Cheildag (0,56%). Most of the organic matter in the composition of oil shale samples accumulates in their kerogen portion (Table 1).

Formation and distribution of organic substances, mainly depend on the processes taking place at the final stages of diagenesis and the specific properties of the initial substances. In order to explain the process of natural catagenesis, held thermal laboratory analysis of oil shale. Thermolysis of samples, taken from various zones of mud volcanic areas, shows their T<sub>max</sub>. Samples of mud volcano Gushchu, rich with organic matter burn with several stages at temperatures of 300, 400 and 500 °C. Samples of mud volcanoes Chapilmish and Veys, containing relatively greater amounts of organic substances lose their masses at a temperature of 400 and 200–400 °C (Fig. 9, 10).

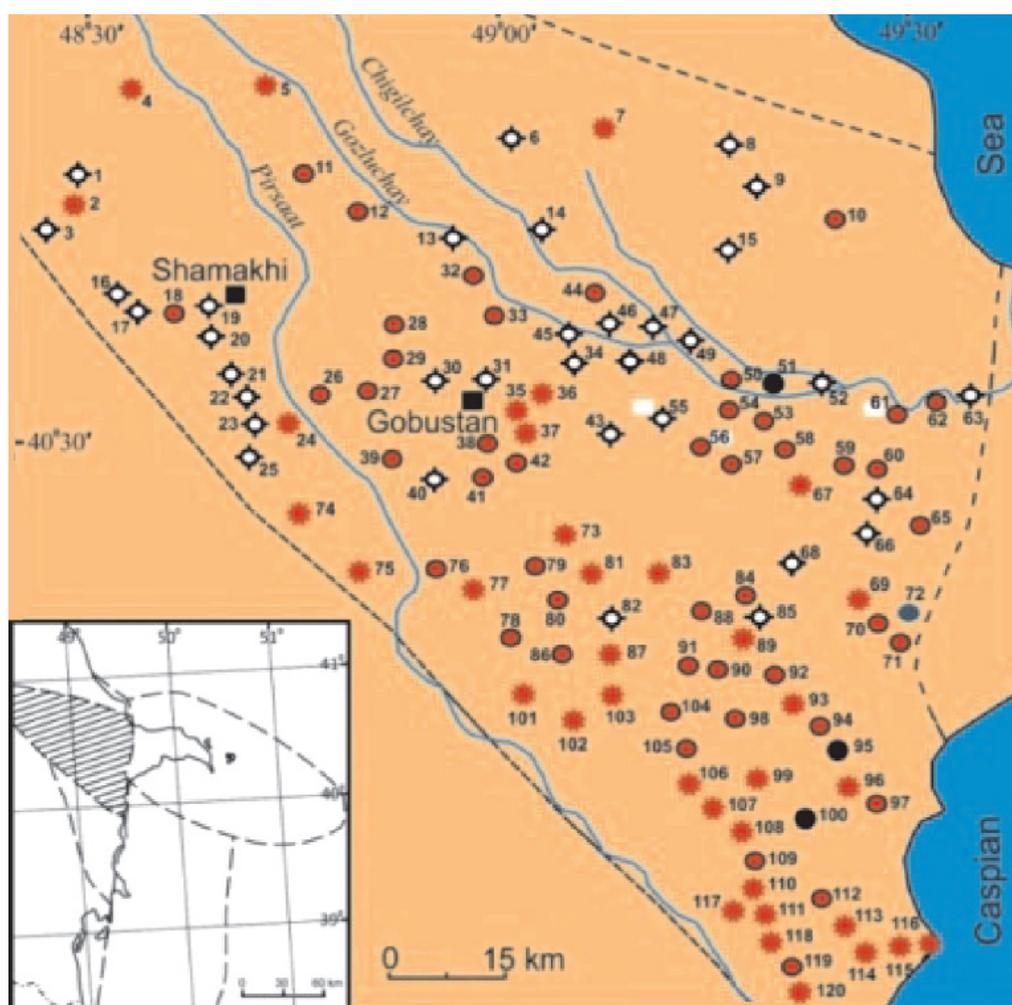


Fig. 8. Location map of mud volcanoes in Shamakhy-Gobustan region:

- 1 – Sarsura; 2 – Zeiva; 3 – Bizlan; 4 – Demirchi; 5 – Gyzmeidan; 6 – Yailag – Tudar;
- 7 – Gasymkend; 8 – Kekhnagyady; 9 – Kemchi; 10 – Kurkachidag; 11 – Hajly;
- 12 – Khilmilli; 13 – Garayaz; 14 – Agdere; 15 – Shikhandag; 16 – Nohur;
- 17 – Garanohur; 18 – Madrasa; 19 – Sarabil; 20 – Kyalakhana; 21 – Osmanbeili;
- 22 – Charhan; 23 – Nyuidi; 24 – Melikchobanly; 25 – Gyrllyg – Geoglyar;
- 26 – Chyrarly; 27 – Akhar – Bakhar; 28 – Jeirli; 29 – Chalov; 30 – Maraza;
- 31 – Gurbanchi; 32 – Nabur; 33 – Chaigur – banchy; 34 – Shimshadi;
- 35 – Kichik Maraza; 36 – Bozaakhtarma; 37 – Shikhzarli; 38 – Shorsulu; 39 – Ekakhana;
- 40 – Makhhlajik; 41 – Arabgadim; 42 – Juan; 43 – Gaiblar; 44 – Yeldarasi; 45 – Garajyuzlyu;
- 46 – West Tuva; 47 – East Tuva; 48 – South Tuva; 49 – Siyaki; 50 – west Veis;
- 51 – East Veys; 52 – Neftik; 53 – Jengi; 54 – Syungur; 55 – Iyimish; 56 – Birgut;
- 57 – Donguzdug; 58 – Baygushlu; 59 – Sarydash – Bayanata; 60 – Gyrdag;
- 61 – Pirekeshkul MV group; 62 – Agdag; 63 – Arbat; 64 – Gyrgyshlag;
- 65 – Boransyz – Jylga; 66 – Agzygyr; 67 – Garyja; 68 – Charani; 69 – Chapilmish;
- 70 – Shakhgaya; 71 – Chukhuroglybozu; 72 – Gazanagyl; 73 – Sheitanud MV group;
- 74 – Gushchu; 75 – Kolany; 76 – Baidar; 77 – Ayazakhtarma; 78 – Ilkhychy;
- 79 – Sheikh Novruz; 80 – Sundi; 81 – Nardaranakhtarma MV group; 82 – Kyurdamich;
- 83 – Suleymanakhtarma; 84 – Cheilakhtarma; 85 – Gadridere; 86 – Hajjiveli; 87 – Agnohur;
- 88 – West Cheildag; 89 – East Cheildag; 90 – Galandarakhtarma; 91 – Umbaki;
- 92 – West Davalidag; 93 – East Davalidag; 94 – Utagi; 95 – Agtapa; 96 – Beyuk Kyanizadag;
- 97 – Goturlug; 98 – Gylynch; 99 – Toragay; 100 – Kichik Kyanizadag; 101 – Hajjiveli;
- 102 – Dashmardan; 103 – Shekikhan; 104 – Agdam MV group; 105 – Arzani; 106 – Durandag;
- 107 – Gotur; 108 – Agtirme; 109 – Emjek – emjek; 110 – Solakhay; 111 – Oyoug;
- 112 – Gyogyarchin; 113 – Dilyangyaz; 114 – Dashgil; 115 – Bala Bahar; 116 – Bahar;
- 117 – Garakyura; 118 – Airanteken; 119 – Saryboga; 120 – Goturdag

Table 1

Extraction of oil shale, sampled of mud volcanoes in Gobustan

Mud volcano	Amount of dissolved organic matter, %		Amount kerogen, %
	Chloroform	Alcohol-benzol (1:1)	
Shikhzarli	0,44	0,97	6,15
Pirekeshkul	1,00	0,61	19,97
Veys	0,51	0,42	16,85
Gushchu	2,54	5,80	34,02
Chapilmish	0,34	0,22	27,31
Suleymanakhtarma	1,12	0,62	8,75
Cheildag	0,18	0,38	9,35
Galandarakhatarma	1,04	0,74	6,12
Shekikhan	0,59	0,50	10,36
Agtirme	1,16	0,48	8,47
Solakhay	0,82	1,05	9,88
Dashgil	0,72	0,56	10,02
Ayrantoken	0,93	1,02	8,96
Durandag	1,01	0,52	12,35
Gotur	1,22	0,55	10,06

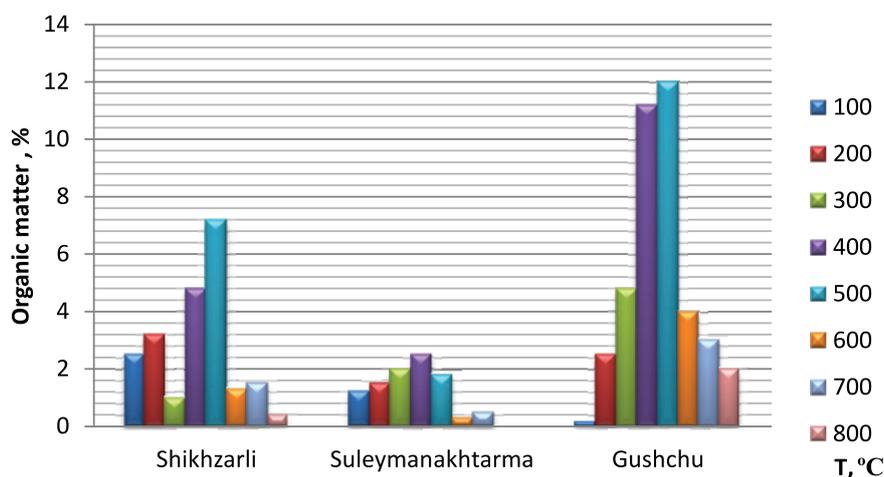


Fig. 9. Thermolysis of oil shale, sampled from mud volcanoes Shikhzarli, Suleymanakhtarma and Gushchu

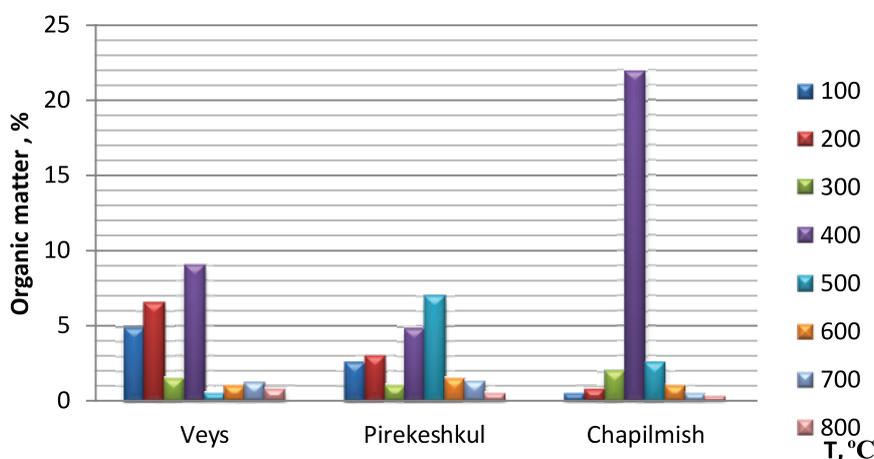


Fig. 10. Thermolysis of oil shale, sampled from mud volcanoes Veys, Pirekeshkul and Chapilmish

Table 2

The two-stage pyrolysis of oil shale, sampled from mud volcanoes in Gobustan

Mud volcano	500–550°C			800–850°C		
	Water, %	Bitumen, %	Gas, %	Water, %	Bitumen, %	Gas, %
Shikhzarli	0,24	3,21	3,13	0,84	–	2,64
Pirekeshkul	0,42	4,12	4,53	0,32	0,42	2,81
Veys	4,25	5,60	6,31	–	–	1,19
Gushchu	1,35	6,18	17,69	0,32	–	11,77
Chapilmish	0,12	1,20	24,0	1,27	–	2,81
Suleymanakhtarma	0,81	3,87	2,34	0,43	–	2,27
Galandarakhatarma	0,25	4,15	2,12	0,33	–	2,11
Dashgil	1,80	3,12	7,01	–	–	0,80
Durandag	2,78	3,38	4,17	–	–	1,30
Gotur	0,56	0,45	10,67	–	–	5,53

Pyrolysis of oil shale samples of different mud volcanoes (Veys, Gushchu, Pirekeshkul, Galandarakhatarma and et al.) showed that up to 500°C temperature obtains fractions, similar to oil, but at higher temperatures, only gases. A sharp changing is observed at a temperature of 400°C (Table 2).

According to the amount of products obtained from oil shale, is making possible to define the structure of organic matter. Greater amount of bitumen indicates the structure of an aliphatic but others – like gas and light hydrocarbons an aromatic.

In addition to oil shale, oil-saturated rocks are also appear on the mudvolcanic crater zones after the eruptions of mud volcanoes [8]. In contrast to oil shale, they are mainly related to younger sediments (Miocene). The fraction, obtained by extraction (chloroform) mainly consists of asphaltenes (42,52–47,15%), and oil (26,86–37,96%).

Data obtained from chromatographic analysis (silica gel ASM) of oil fractions show that the majority of bitumen consist of monocyclic hydrocarbons (56,0–75,50%). The compounds similar to oil, but methane-naphthene relatively less than aromatic hydrocarbons (11,21–18,06%). The paraffins are almost absent in studied fractions.

### Conclusions

The analysis of oil shale objects in Azerbaijan shows that greater manifestations are developed in Gobustan and Absheron, during the Middle Eocene (Kone) and the Upper Miocene (Meotian). But Diyally oil shale deposit belongs to Sarmatian age. Regarding the conditions of formation of oil shale (within the shale facies) in these areas, it should be noted that a relatively significant manifestation (sustained by length and thickness) observed in

large synclines or trough: in the northern areas of Gobustan they trace in the cores of synclines (Charkishlak, Ambizlar, Shahandag, Agburun and etc.), in the southern areas, in the wings of synclinals (Boyuk Siyaki, Kichik Siyaki, Mayash, Jangidag, Islamdag and etc.) and in the front wings of anticlines (Buransiz-Bayanata, Jangichay and etc.).

The main practical features of Azerbaijan oil shale relate to its distribution regularities along the areas. Connected with different geological age, oil shale manifestations (Kichik Siyaki, Boyuk Siyaki, Islamdag, Baygushkaya, Uchtepe etc.) have found development within the same area (mainly in Gobustan) and closely spaced from each other. Such a regularities creates favourable conditions on joint development of these manifestation for their future exploitation. To locate away from the tracts of forest and the housing unit, is extra superiority of Azerbaijan oil shale from an economic and environmental point of view.

Analysis of thermolysis process shows that the maximum interval of mass loss for oil shale depends on the structure of organic matter, initial substances, geological conditions and thermocatalytic impacts and etc. Thus, if organic substances lose mass at high temperatures correspond an aliphatic, at low temperatures an aromatic type of structures.

The results of the pyrolysis show that the development of some kerogens of oil shale (found in ejected products of Chapilmish, Gotur and others mud volcanoes) has been weak in the oil generation processes, but others (Veys, Pirekeshkul, Galandarakhatarma and others) more intensive. Thus, if at low temperature the amount of obtained bitumen is much in former, but for the second group of mud volcanoes it almost absent. If compare the amount of gases, they are much greater (24,0%) in the samples of

Chapilmish mud volcano. The analytical study of such rocks show that related to re-changing of organic matter: long aliphatic C–C bonds are destroyed at the stage of ketogenesis, minerals and organic substances are separated from each other in kerogen composition and the whole process ends with formation of hydrocarbon.

IQ-spectrum of kerogen indicates its similarity to oil asphaltenes and coal. In this regard, during the pyrolysis of kerogen (matured) obtains hydrocarbons. Thus, the results of laboratory tests show that some kerogens of oil shale (including of Chapylmysh mud volcano) are not yet fully matured.

Geological and geochemical analysis of oil shale, related to Paleogene-Miocene sediments and traces with a thickness of 3,5–4,5 km in the Central Gobustan (the location zone of Veys, Pirekeshkul mud volcanoes) provides the economic prospects in terms of the exploitation of shale gas.

The territory of South Gobustan is considered to be more promising in hydrocarbon generation, related to maturity of kerogen in oil shale (Eocene and Maikopian age). In addition, the comparative analysis of bitumen, which obtained from kerogen of oil shale (Eocene and Maikopian age) and oil-bearing rocks (Miocene age) confirms their close genetic relationship. The results confirm the possibility formation of hydrocarbons in the sediments of Eocene age (probably also accumulation in its granular and fractured reservoirs) and Maikopian series in the study area and their migration to the relatively younger Miocene reservoirs.

#### References

1. Abbasov O.R. Geological and geochemical features of combustible slates of Gobustan (Azerbaijan) and their forecast inventories // Bulletin of the Atyrau Institute of oil and gas. – 2008. – № 2 (14). – P. 22–29.
2. Abbasov O.R., Mamedova A.N., Guseynov A.R., etc. Some new data of geochemical researches of combustible slates of Azerbaijan // Geology, geophysics and development of oil and gas fields. – 2013. – № 2. – P. 32–35.
3. Abbasov O.R., Ibadzade A.D., Hasayeva A.B., etc. Hydrocarbonic potential of the deep-shipped deposits of Gobustan (Azerbaijan) (on the basis of combustible slates and oil-bearing breeds, emissions of mud volcanoes) // Resursovosproizvodyashchy, low-waste and nature protection technologies of development of a subsoil. – Kyrgyzstan, Bishkek, 2015. – P. 342–443.
4. Ali bakh A.A., Akhmedov G.A., Zeynalov M.M. Combustible slates of the Miocene of Azerbaijan // ANH. – 1962. – № 1. – P. 5–8.
5. Aliyev Hell. And., A.A's Bayrams. Some aspects of tectonics of mud-volcanic zones of Gobustan // Izv. AN of Azerbaijan, Science about Earth. – 2000. – № 1. – P. 129–131.
6. Aliyev Hell.And., Belov I.S., Bayrams T.A's. Combustible Paleogen-Miocene slates of Azerbaijan // Geologist of Azerbaijan. The scientific bulletin. – 2003. – № 8. – P. 68–80.
7. Aliyev Hell. And., Belov I.S., Aliyev G.A. Combustible slates of the Miocene of Azerbaijan // ANH. – 2000. – № 5. – P. 7–11.
8. Babayev F.R., Abbasov O.R., Mamedova A.N. etc. Studying of bitumens of Azerbaijan // Actual problems of humanitarian and natural sciences. – 2013 7 (54), I Is frequent. – P. 40–42.
9. Sultanov A.D., Sultanov R.G. Combustible slates of a southeast tip of Greater Caucasus Range in Azerbaijan // Az is THIS. Soviet Socialist Republic. – 1945. – T. 1. – № 1. – P. 11–13.
10. Sultanov A.D., Sultanov R.G. Materials on combustible slates of Azerbaijan // Izv. AN of Azerb. Soviet Socialist Republic. – 1947. – № 2. – P. 18–20.
11. Abbasov O.R. Oil Shale of Azerbaijan: Geology, Geochemistry and Probable Reserves // IJRSET – International Journal of Research Studies in Science, Engineering and Technology. – 2015. – Vo. 2, Issue 10. – P. 31–37.
12. Abbasov O.R. Distribution regularities of oil shale in Azerbaijan // ISJ Theoretical & Applied Science. – 2016. – Vol. 35, Issue 3. – P. 165–171.
13. Abbasov O.R., Akhundov R.V. Petroleum potential of Paleogene and Miocene deposits in Gobustan based on oil shale products of mud volcanoes // Baku World Forum of Young Scientists. – Baku, 2014. – P. 27–28.
14. Abbasov O.R., Baloglanov E.E., Akhundov R.V. Geochemical analysis of oil shale and oil-bearing rocks of Gobustan mud volcanoes // 6th International Conference of Young Scientists and Students "Multidisciplinary approach to solving problems of geology and geophysics" (Baku, October 12–15). – Baku, 2015. – P. 118–119.
15. Abbasov O.R., Baloglanov E.E., Akhundov R.V. Organic compounds in ejected rocks of mud volcanoes as geological and geochemical indicators: a study from Shamakhi-Gobustan region (Azerbaijan) // International Multidisciplinary Forum "Academic Science Week-2015". – Baku, 2015. – 02–04 November, P. 3–4.
16. Abbasov O.R., Ibadzadeh A.C., Mammadova A.N. Hydrocarbon generation potential of the deeper sediments of Azerbaijan // Integrated approach for unlocking hydrocarbon resources. – Baku, 2012. – P. 48.

Short Reports

**GEOMETRICAL CORRELATION OF STRATIGRAPHIC SURFACES AS THE WAY FOR LEVEL OF INVESTIGATION OF THE OIL FIELD STRUCTURE**

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The article was observed the way of geometric correlation sign for decision of the problems oil-and-gas in geology. It was developed the method of the study of deposits without oil well drilling. It was revealed the differences of the structural maps of stratigraphic boundary of the oil deposit.

Geometrization of depths is a method of graphic modeling and it is integral element of the rational exploring and development deposits. Geometrization of depths is identifying phenomena, which it is pass in earth crust [4]. For using the geometric method was select one deposit situated in Permskiy Krai. For example of the interpretation data were choose famennian reef structures of this deposit.

Two structural maps of boundary upper famennian oil accumulation on 2005 and 2009 years are built with use the computer program.

On structural maps it is necessary to place the square network a point. From each point it is necessary to draw gradients (or normal). The size cell depends of that, how in detail it is necessary to study the territory.

The following stage it is an imposition of the maps gradient 2005 and 2009 years. It is the measured angles between gradient by protractor. The angle recorded in junction of the net (Fig. 1). The gradients are revealing the area of the mismatch.

Map of coefficients of correlation are make on cosines of angle between gradients. We get map of the mismatch of the structural plans of upper boundary on 2005 and 2009 years (Fig. 2).

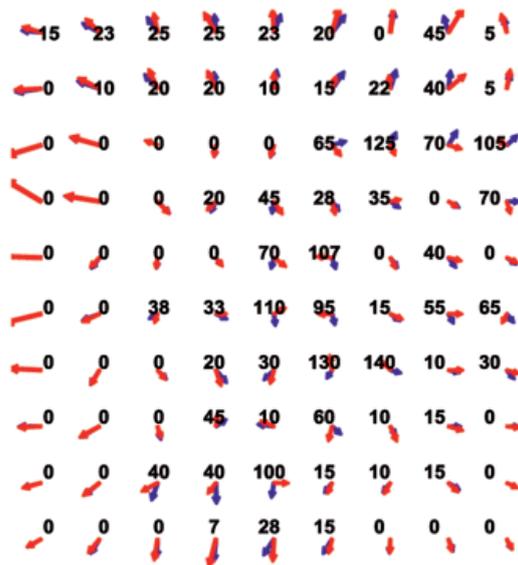


Fig. 1. Scheme of angles between gradients of the structural plans surfaces

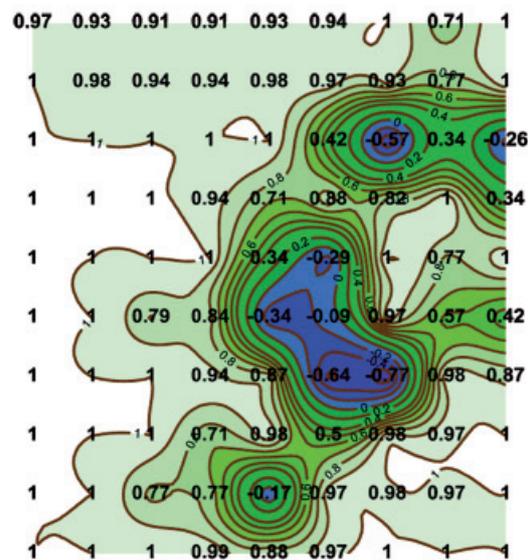


Fig. 2. Coefficients correlation between structural maps surfaces

The coefficients of correlation changes from -1 to +1. The nearer to +1, the more coincidence this corresponds to the concordant correlation of field, -1 is anticordant and zero is discordant.

The analysis of the map coefficient correlation make it possible to reveal the area, on which conception about configuration of the construction did not change, and make it possible to reveal the area conception about construction which greatly changed.

For revealing the general regularity of the change the under investigation value it is conduct the smoothing. Most easy way smoothing it is «slippery window». The regularities of the different order can be revealed from size window. The value window it is choose depending on required to accuracy. The smoothing by window of the small size does not remove the influences of the casual deflections. But big window brings to the loss of data.

Using of «slippery window» the different size it makes possible to shorten time and facility on revelation of area with the most change the under study sign.

This method of geometric correlation makes it possible:

1) to get information about level of investigation of the oil field structure and about construction of deposit without well-drilling;

2) to identify little-studied area for building of the qualitative model of deposit;

3) to identify area for well-drilling which required for building of the models deposit and for refinement reserves oil;

4) to ascertain the moment in chronologies of well-drilling, which make it possible to cut material costs;

5) to create the algorithm an information handling on computer

#### References

1. Bukrinskiy V.A. Geometrization of depths. – M.: MSU, 2004. – 333 p.
2. Gubina A.I. The Geophysical methods of stratigraphical correlation. – Perm, 2010. – 201 p.
3. Myagkov V.F. Geochemical method of paragenic analysis of ore. – M.: Nedra, 1984. – 126 p.
4. Trofimov A.A. Fundamentals of mining geometry. – M.: MSU, 1980. – 224 p.

#### A COMMON SCALE OF THE STAGES OF A GEOASTRONOMICAL CHRONOLOGY

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For the first time on the basis of a “Geocontinuum” and a “Geoastromical” continuum “A Common Scale of Stages of Geoastromical Chronology” is constructed. Is offered new Common Scale of Geoastromical Chronology from the Big Bang

to the Present Time. The author uses this scale in lectures on historical geology for students and in a geological museum.

For the description PreArchean chronology of events of formation of the Earth, the Solar System, method representation about “continuum” [6, 4] is used.

The time scale continued in area of PreGeological events of the past, possible to interpret as “a GeoAstronomical scale” for events PreArchean time down to the moment of formation of the Our Universe [8, 1].

Attempts of construction of a calendar PreArchean time were undertaken earlier [2, 3].

The Principle of Stenon (for the stratigraphical and the geochronological scales) illustrates stratigraphical continuum (“geocontinuum”). For construction of “a General Scale of Stages of GeoAstronomical Chronology” it is offered to use of the Principle Stenon as events-and-time, not only straton-and-time.

In this case the common geochronological scale becomes is a part of “Common Scale of Stages of GeoAstronomical Chronology” of events at the Universe and at the Earth.

Representation of events-time (chronological), and not just only stratigraphical geocontinuum allows to consider Archean-Cenozoical a stage as a component of an interval of time from formation of the Our Universe ( $13,72 \pm 0,12$ ) milliard years [1, 7] up to «Present Time». In this case the general geochronological scale becomes a part of “the General Scale of Stages of geoastromical chronology”. The geoastromical scale allows to order and describe chronology of events from the Big Bang to the Present Time (Table).

A Common Scale of the Stages of a GeoAstronomical Chronology

Stages	GalaYear	Gelion	Acron	Eon	Era	Period	From beginning (in milliard years)						
1	2	3	4	5	6	7	8						
23	Retrospective Galactic Year № 1	Geozoic (GEOZ)	Neozoic (NZ)	PH Phanerozoic	KZ	Qrcnt	0						
						Q	0,018						
						N	0,023						
						E	0,065						
22	RGY № 2 Mesozoic				Geozoic (GEOZ)	Neozoic (NZ)	PH Phanerozoic	MZ	K	0,15			
									J	0,20			
									T	0,25			
21	RGY № 3 Hertsynian							Geozoic (GEOZ)	Neozoic (NZ)	PH Phanerozoic	PZ	P	0,30
												C	0,35
												D	0,40
												S	0,45
20	RGY № 4 Caledonian										Geozoic (GEOZ)	Neozoic (NZ)	PH Phanerozoic
		€	0,54										

End Table

1	2	3	4	5	6	7	8
19	RGY № 5 Vendian	Geozoic (GEOZ)	Proterozoic (NZ)	PR <sub>5</sub> (BKL) Baikalian	V	ED	0,63
18	6–7: Baikalian RGY					CRG	0,85
17	8–9: Baikalian RGY					TON	1,0
16	10–11: Baikalian RGY				KRT (RF <sub>3</sub> )	–	1,2
15	12–13: Late Karelian RGY				YUR (RF <sub>2</sub> )	–	1,4
14	14–17: Late Karelian RGY		BRZ (RF <sub>1</sub> )	–	1,6		
13	18–21: Belomorian RGY		PR <sub>1</sub> (KRL)	KRL <sub>2</sub>	–	1,9	
				KRL <sub>1</sub>	–	2,5	
12	22–27: Saamian RGY		Archean (AR)	AR <sub>2</sub> (BLM)	Early Geosyncline Stage		3,15
11	28–29: Regolitian RGY			AR <sub>1</sub> (SMS)	Nuclearian Stage		4,2
10	30–31: Accreccian RGY	Prisconia (PRS)	Regolitian (RGL)	<b>Regolitian Stage.</b> Lunar images		4,3	
9	32–36: ProtoSolarian		Accreccia n (ACC)	<b>Accretion Stage</b> of meteoric bodies, <b>forming of the Earth</b>		4,5	
8	37–43: ProtoGalaxian	Geliozoic (GELZ)	Protoplanet-Gal- axian (PGL)	Proto- Solarin (PRS)	<b>Forming of ProtoEarth</b>	5,6	
7	37–43: ProtoGalaxian			Proto- Galaxian (PGL)	Forming of Pro- toSolar System, Galaxes. <b>Beginning de Sitter's Epoch</b>		7,2
6	<b>Epoch of formation of the first Stars, Galaxies; forma- tion C, O, N, Fe</b>			from 150 millions to 1 milliard of years		12,7	
5	<b>Epoch of formation of the first atoms.</b> Universe is filled H, He, relic radiation of H on wave 21 sm. Stars are absent			380000 years to 150 millions of years		13,55	
4	<b>Epoch of beginning of forming He, deuterium, Li-7 (20 min)</b>			3 min – 380000 years		13,70	
3	Fridman's Epoch of expansion of Our Universe; forma- tions of protons and neutrons			10 <sup>-34</sup> s – 3 min		13,70	
2	<b>Epoch of beginning of fast expansion of Our Universe</b>			10 <sup>-43</sup> s – 10 <sup>-34</sup> s		13,70	
1	<b>Planck's Epoch.</b> The first instants of formation of Our Universe, birth of particles			from 0 to 10 <sup>-43</sup> s		13,70	
1	<b>Epoch of Singularity.</b> The Big Bang (13,72 ± 0,12) milliard years in the past			<b>0 (the Beginning of Histoiy of Our Universe)</b>		<b>(13,72 ± 0,12)</b> milliard of years	

Duration of the «events» located on a scale of chronology is not criterion of ranks for the “stages” of geoastronomical chronology. Attributes of division of a scale of stages, are defined by qualitative specificity of events at the Earth and at the Universe [1, 5]. Duration of a stage is not criterion of the size of division's rank. Criterion of allocation of a separate stage is its qualitative attributes and specificity of corresponding events. For example: three minutes of Fridman's Epoch and 50 millions of years for the Period of Paleozoic.

References

1. Kaku Michio. The parallel worlds. M.: Publishing House “Sofia”, 2008. – 416 p.  
 2. Kulikova V.V., Kulikov V.S. A Galactic Calendar of History of the Earth. – Petrozavodsk: the Karelian Center of the Russian Academy of Science, 2000. – 14 p.  
 3. Kulikova V.V., Kulikov V.S. Universal a Galactic Chronometric Scale (Experience of comparison of world and regional

scales PreCambrian, the analysis of cyclicity and periodicity of events). – Petrozavodsk. 1997. – 93 p.

4. Ozhgibesov V.P. General Scale of Geological time and a events-time GeoContinuum // Geology and minerals of the Western Urals Mountains: Materials of regional conf. (Perm Univ., May, 17–18th 2005). – Perm: Publishing House Perm. 2005. – P. 25–28.

5. Sobotovich E.V. Isotope cosmochemistry. – M., 1974. – 208 p.

6. The philosophical encyclopedic dictionary. – M., 1983. – 839 p.

7. Hinshaw G., Weiland J.L., Hill R.S., Odegard N., Larson D., Bennett C.L., Dunkley J., Gold B., Greason M.R., Jarosik N., Komatsu E., Nolte M. R., Page L., Spergel D.N., Wollack E., Halpern M., Kogut A., Limon M., Meyer S.S., Tucker G.S. and Wright E.L. Five-Year Wilkinson Microwave Anisotropy Probe Observations: Data Processing, Sky Maps, and Basic Results // The Astrophysical Journal Supplement Series. – 2009. – Vol. 180, № 2. – P. 225–245.

8. A Geologic Time Scale 2004 / by F.M. Gradstein, J.G. Ogg, A.G. Smith et. al. // Cambridge University Press. – 2004.

## CURRENT TRENDS ESTABLISHMENT OF INNOVATION INFRASTRUCTURE IN THE INDUSTRIAL SECTOR OF UZBEK ECONOMY

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In order to create favorable conditions for attracting foreign and domestic investment to create a modern high-tech industries, providing the output of competitive products with high added value, as well as integrated and efficient use of production and resource potential of the individual regions of Uzbekistan, creation on this basis of new jobs and increase revenue population in the country has created three special free economic zones. The work is devoted to comparative analysis of systemic institutional framework of the innovation infrastructure in the industrial complex of the national economy of the Republic of Uzbekistan. Formulation of the problem. To consider the principles of selection, priority activities of subjects of business, and also fiscal privileges and preferences provided by the government in the free industrial economic zone "Navoiy" and the special industrial zones "Angren" and "Jizzakh". Conclusions. The work opens the factors reducing efficiency of innovative activity, the author's interpretation of innovative system is presented, offers on their overcoming are given.

**Keywords:** industry, innovation, infrastructure, innovation, investments, investment climate, national innovation system, the special industrial zone, free industrial economic zone, science and technology park, business incubator, a favorable business environment

The modern industrial complex of national economy of Uzbekistan by means of innovative infrastructure forms the relations between economic entities providing his competitiveness by commercialization of new knowledge at the minimum transactional expenses. According to experts, it is possible to carry to basic elements of innovative infrastructure of an industrial complex of national economy of Uzbekistan:

- the free industrial economic zone (FIEZ) – the limited territory in which favorable conditions for implementation of priority kinds of activity are created;
- the special industrial zone (SIZ) – the territory provided with communications, provided by the state to subjects of private business for placement and operation of objects of the industry;
- the technological park is the organization which main goal is increase in welfare of local community by means of advance of innovative culture, and also competitiveness of innovative business and the scientific organizations. For achievement of these purposes the science and technology park stimulates and operates streams of knowledge and technologies between universities, research institutes, the companies and the markets. He simplifies creation and growth to the innovative companies by means of incubatory processes and processes of removal of the new companies of existing (spin-off processes). The science and technology park besides the high-quality areas can provide other services;
- the business incubator is the organization which is engaged in support a startup projects of young businessmen at all stages of development: from development of idea to her commercialization.

In the Republic of Uzbekistan the institutional foundation of formation of innovative infrastructure has been laid in 1996 by the Law "About Free Economic Zones" [1]. In 2008 in Navoiy the Uzbekistan's first free industrial and economic zone has been organized. The main activity of economic entities in the territory of SIEZ "Navoiy" has determined production of production, hi-tech, competitive in the world markets, due to introduction of the modern foreign high-performance equipment and equipment [2].

According to the current legislation, the full complex of fiscal privileges and preferences is provided to the enterprise structures registered in SIEZ by the state.

According to the SIEZ "Navoiy" information center, in for January 1, 2016 21 productions work. The carried-out analysis shows that every fifth enterprise is connected with production of automobile accessories.

JV Uzegayecable has been created between JSC "Uzavtosanoat" and Erae cs Ltd (South Korea) company in 2011 for production of automobile wires. The total cost of the project exceeds \$13 million. The main consumer of production is JV "Uzkodzhi".

On the basis of JV UzEraeCable the localized production is made: accumulator plait for the Chevrolet Cobalt car and the global GSVEM model.

JV UzMinda is created by JSC Uzavtosanoat with the Indian company "Minda Capital". The enterprise with an annual production capacity of 251 thousand auto sets makes speedometers and security systems for cars.

Since 2014 the Uzbek-Italian JV LLC Avtosanoat – Landi Renzo functions. His profile – production of 25 000 units of the podkapotny equipment for the transfer to the compressed natural gas.

The Markazsanoateksport foreign trade company together with the Kefayat General Trading Co company (United Arab Emirates) has created JV AgroFres on storage and packing of fruit and vegetable products. The enterprise equipped with modern Italian refrigerating appliances with the adjustable gas environment allows to store up to 3 000 tons fruit and vegetable products.

Besides two plants on production of polyethylene and polypropylene pipes of unitary subsidiary “Shurtan gas-chemical complex” – “Kuvurlara polyethylene” 8,6 thousand tons work. polyethylene pipes with a diameter from 75 to 630 mm and “Kuvurlara polypropylene” 2 300 items of km in a year of polypropylene pipes with a diameter from 16 to 63 mm.

In 2015 three new enterprises with participation of the British investors are created. The British company “Dartlex Impex LLP”, LLC “J-United Group” and business owners have created JV “Green Line Profil” and JV “National Plast” for production of 35 tons of aluminum shapes and other products from aluminum (cost of the project of \$35,2 million) and 42 thousand tons of profiles and products from polyvinylchloride (\$20,3 million). SP LLC “Infinity Electronics” and the British company “Wynex Innovation LLP” have created JV OOO “Samrt Communications” on production of 200 thousand pieces of mobile phones. The cost of investment makes \$2 million.

For formation of favorable conditions on attraction of foreign and domestic investments for creation of the modern hi-tech productions providing release of competitive production with a high value added and also complex and effective use of production and resource capacity of the Tashkent region, creation on this basis of new workplaces and increases of the income of the population in April, 2012 SIZ “Angren” has been created [3].

Rather for short term large-scale work on the organization of all necessary legal and institutional conditions to start work of new object has been carried out. For involvement of domestic and foreign investors in the territory of a zone the particular fiscal treatment has been set.

In the territory of SIZ “Angren” for short term production of hi-tech production on 23 projects for the total amount about \$487,84 million, including \$193,5 million direct foreign investments – energy saving LED lamps, copper pipes of various diameter, briquette coal, production of an architectural facing brick, production on processing of skin, plant on production of sugar and other enterprises is already arranged [4].

For formation of favorable conditions on attraction of foreign and domestic investments for creation of the modern hi-tech industrial productions providing release of competitive production with a high value added, complex and effective use of production and resource capacity of the Jizzakh and Syr Darya regions in 2013 the special industrial zone “Jizzakh” has been organized. The main directions of its activity were [5]:

- attraction of direct investments for creation and effective activity of modern hi-tech and innovative productions on release competitive on internal and foreign markets of production with a high value added;
- ensuring complex and effective use of production and resource capacity of the regions entering a special industrial zone, creation of new productions on deeper processing of mineral raw material resources and agricultural raw materials;
- deepening of processes of localization of production of hi-tech production on the basis of local raw materials and materials on the basis of establishment of close cooperation ties and development of industrial cooperation between the organizations of a special industrial zone and in general the republics;
- ensuring the advancing development and effective use of transport, engineering communication and social infrastructure in the territory of SIZ “Jizzakh”.

Selection criteria of economic entities for providing the status of the participant of SIZ “Jizzakh” by him are:

- creation modern or carrying out deep modernization of the operating productions, with equipment by their hi-tech equipment and technologies, first of all, for deep processing of local mineral raw material resources and agricultural raw materials;
- compliance of a profile of activity to the main objectives of SIZ “Jizzakh”, without inclusion of the organizations for production and primary processing of strategic natural raw material resources;
- implementation of investments at the expense of own means of founders and the loans attracted by them without provision of a guarantee for the Republic of Uzbekistan;
- stage-by-stage formation in SIZ “Jizzakh” of technological chains on production of import-substituting and export-oriented competitive production;
- adoption by investors of obligations for reinvestment in the organization not less than 50% of income gained from application of privileges during the term of their action.

So, according to the government Program of the advancing development of transport, production and engineering and communication

infrastructure of SIZ “Jizzakh” in 2013–2018 in Jizzakh it is planned to realize 17 projects for the total amount of \$48,3 million. Including, 5 projects on construction and reconstruction of sites of highways for the sum of \$20,3 million, 3 projects on development of railway infrastructure for the sum of \$2,3 million and 5 projects on development of water supply, irrigations and sewerages for the sum of \$24,8 million. During the period till 2018, it is planned to realize 2 projects on construction and reconstruction of networks of power supply for the sum of \$406,7 thousand and 2 projects on development of gas supply for \$507,1 thousand. Projects will be financed by funds of the state budget for the sum of \$21,4 million, own funds of the enterprises for the sum of \$3 million and funds of the international financial institutions for the sum of \$4,6 million.

Now here large-scale work on development of transport, production and engineering and communication infrastructure is conducted. With attraction of direct investments the hi-tech productions which are turning out products, competitive as in the internal, and external markets are created.

Only in past, 2015 in the territory of SIZ “Jizzakh” 9 industrial enterprises have become operational, in present it is planned to continue work in this direction and to open new which will make over 10 types of demanded goods.

As show our researches, a main objective of the organization of science and technology parks is further activization of innovative activity in Uzbekistan in general and certain regions in particular, and also ensuring need of economy for innovative products. In our opinion, creation and further development of science and technology parks is urged to solve the main task in formation of the competitive overworking sector on the basis of strengthening of connection of science with production, introduction of modern technologies, increase of labor productivity in the industries and, as a result, productions of hi-tech and competitive production.

So, according to the memorandum in the territory of SIZ “Jizzakh” the Uzbek-Chinese industrial park is created. Now 54 agreements with the Chinese investors on joint implementation of projects in the sphere of the electrotechnical, mechanical, pharmaceutical, light and food industry, production of modern construction materials and products from polymers for the sum of 300 mln. dollars of the USA are signed.

In Namangan the project of the science and technology park specializing in production of silk is carried out.

In October, 2015 in Tashkent creation of educational and research textile “Science and technology park” has begun. The project is

realized by JSC Uzbekyengilsanoat together with the Ministry of Trade, the industry and power industry of the Republic of Korea. Purpose of science and Technology Park: developments and implementation of the international training and research Programs for introduction at the Tashkent institute of textile and light industry. Besides, the science and technology park will develop technological know-how and to carry out research works in the field of materials science, tinctorial and finishing productions, new designs of fabrics and clothes.

In the Tashkent region (Parkent) the science and technology park on renewable and ecology is created.

More than thirty business incubators operating now in Uzbekistan are the main objective the practical help to subjects of business at the first stage of activity – the organization of business process, rendering information and consulting services, assistance in implementation of investment and innovative projects. The important program documents causing development of this institute of infrastructure [6], A number of Resolutions of the President of Uzbekistan became the important program documents causing development of this institute of infrastructure [7]. In the republic the Association of business incubators and science and technology parks of Uzbekistan which serves further development in the country of small business and private business, to expansion of the sphere of service is created.

In addition, the main activities of business incubators are also rendering marketing and consulting services to businessmen, increase of their economic and legal culture, formation of skills of record keeping. As a result of effective measures and the created conditions practical help annually is given in financing more than hundred investment projects of subjects of business.

The phased transition of national economy of Uzbekistan on innovative rails isn’t possible without formation of competitive national innovative system which is represented to us as the difficult, open, dynamic, organized system universal founded on economic relation and a state system of the country, regulating rules of law innovative activity, internal and external institutional environment for economic subjects for the purpose of preservation and increase in national wealth of the country [8].

Any system, including national innovative system, has certain functions. The analysis of works of scientists of the former Soviet Union has allowed counting about 30 functions of national innovative system.

Foreign scientists are more unanimous in allocation of functions both innovative systems, and national innovative systems. The scientist

of technological university of Chalmers (Sweden) A. Johnson considers: "The purpose of innovative system – to develop, extend and use innovations. The main functions are two, directly connected with innovative process:

1) identification of problems, bottlenecks of innovative system;

2) creation of new knowledge.

The third function is connected with maintenance of innovative process and includes:

3.1) ensuring incentives for innovative activity;

3.2) granting necessary resources;

3.3) direction of search, i.e. definition of strategic priorities;

3.4) determination of potential for growth of innovations;

3.5) assistance to exchange of information and knowledge;

3.6) stimulation and creation of the markets of innovations;

3.7) decrease in social uncertainty of the markets, i.e. prevention or the solution of the conflicts between firms and individuals;

3.8) counteraction to resistance to changes which arise in an society at introduction of changes, i.e. introduction of the mechanism of legitimacy for innovations" [9].

M.P. Hekkert and S.O. Negro in work of 2005 allocate the following functions:

"1) business activity;

2) development of knowledge (training);

3) diffusion of knowledge through networks, i.e. an exchange of information;

4) guide to search of priority activities;

5) formation of the market;

6) mobilization of resources;

7) creation of legitimacy / counteraction to resistance to changes" [10].

In later their work of 2007 once again are evidential limited to listed seven functions [11].

Based on that:

- "function – (Latin function-execution, implementation) – 1) mission; 2) activity, duty, work";

- "functions represent the directions of activity of system which interacts with Wednesday";

- "functions are inherent in system and its components, and functions of system are the integrated result of functioning of the components forming it".

It is possible to formulate the following conclusions.

First, national innovative system equips with a number of "others" functions. So, for example, formation of national innovative policy; development and providing standard legislative base; the choice of priorities in the field of innovations, scientific researches and developments, etc. treat the state functions and

functions of authorities of the state (which have more concrete character). Further, generation of knowledge, dissemination of knowledge, storage of knowledge, etc. belong to an education system.

Secondly, any author doesn't allocate internal and external factors of national innovative system, despite active development of supra-national and global processes in world economy recently.

Thirdly, as the national innovative system on category of variety of effects possesses adaptability (property of system to keep the identity in the conditions of variability of external environment), policy and actions of the state shouldn't bring system to a crisis state. The national innovative system has to possess functions as the "properties in dynamics" leading to achievement of the purpose even in conditions of the changing state.

In the conditions of the Republic of Uzbekistan, in our opinion, it is necessary for creation of effective national innovative system:

- step by step to increase demand for innovations from subjects of branches of national economy (it is caused by the fact that today innovative activity is generally concentrated in narrow number of sectors, and technological updating of production mainly relies on import of technologies, but not on domestic developments);

- to considerably increase efficiency of sector of generation of economy of knowledge (fundamental and applied science): now in separate scientific research institutes there was a decline in quality of scientific researches, there is no orientation to requirements of economy;

- to overcome a fragmentariness of the created innovative infrastructure: many elements of innovative infrastructure are created, but they don't support innovative process throughout all chain of generation, commercialization and introduction of innovations yet.

To one of explanations of low efficiency of the operating innovative policy can serve weakness of its institutional base. In public consciousness there is no understanding of importance of science, use of scientific knowledge for technological modernization as main thing in the modern world of a factor of national competitiveness and safety today. This understanding wasn't up to the end created also at many levels of branch and territorial administration.

Low level of a demand of the knowledge-intensive production from her potential consumers is explained, on the one hand, by their low solvency, interest import of equipment and technologies from the outside, and with another incompleteness to the level of

introduction or production of developments, and also insufficiently active work on joint advance of innovative production on the markets from her producers.

Activization of innovative activity in the country, undoubtedly, will be promoted by adoption of law of the Republic of Uzbekistan "About innovations and innovative activity". It is expedient to provide development of mechanisms of legal regulation of the relations between subjects of innovative activity, attraction of investments, creation of innovative and venture funds, infrastructure innovative organizations and further improvement of system of the taxation and crediting, and also development of measures for development of interest and encouragement of the participants of innovative activity who are carrying out priority hi-tech innovative projects and introducing these developments in branches of economy in general and an industrial complex in particular in this law.

#### References

1. Ukaz Prezidenta Respubliki Uzbekistan "About creation of a free industrial and economic zone in the Navoiy region" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2008. – № 49. – P. 478; 2011. – № 9. – P. 84; 2012. – № 3–4. – P. 26; 2014. – № 29. – P. 356.
2. Ukaz Prezidenta Respubliki Uzbekistan ot 13.04.2012 g. № UP-4436 About creation of the special industrial zone "Angren" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2012. – № 16. – P. 177.
3. The realized investment projects – [electronic resource]. – URL: <http://sizangren.uz/page/realizuemye-investitsionnye-proekty>.
4. Postanovlenie Kabineta Ministrov Respubliki Uzbekistan ot 15.05.2013. № 130 "O About measures for the organization of activity of the special industrial zone Jizzakh" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2013. – № 20. – P. 256.
5. Postanovlenie Prezidenta Respubliki Uzbekistan ot 17.04.2006. № PP-325 "About measures for acceleration of development of a services sector and service in the Republic of Uzbekistan in 2006–2010" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2006. – № 16.
6. Postanovlenie Prezidenta Respubliki Uzbekistan ot 21.05.2007. № PP-640 "About additional measures for acceleration of development of a services sector and service in the Republic of Uzbekistan during the period till 2010" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2007. – № 21. – P. 213; 2008. – № 14–15. – P. 99. – № 52. – P. 515; 2011. – № 52. – P. 561.
7. Postanovlenie Prezidenta Respubliki Uzbekistan "About additional measures for stimulation of introduction of innovative projects and technologies in production" // *Sobranie zakonodatelstva Respubliki Uzbekistan*. – 2008. – № 29–30. – P. 280; 2010. – № 1–2. – P. 2; 2011. – № 36. – P. 366; 2012. – № 8–9. – P. 78.
8. Kurpayanidi K.I. Modern approaches to definition of concept and functions of national innovative system of economy of Uzbekistan // *Sovremennyye nauchnyie issledovaniya i innovatsii*. – 2016. – № 1 [electronic resource]. – URL: <http://web.snauka.ru/issues/2016/01/62282> (date of the adress: 15.04.2016).
9. Johnson A. Functions in innovation system approaches // Paper for DRUID's Nelson-Winter Conference. – 2001.
10. Hekkert M.P., Negro S.O. Functions of innovation systems as a framework to understand sustainable technological change: Empirical evidence for earlier claims // *Technological forecasting and social change*. – 2009. – T. 76. – № 4. – P. 584–594.
11. Hekkert M.P. et al. Functions of innovation systems: A new approach for analysing technological change // *Technological forecasting and social change*. – 2007. – T. 74. – № 4. – P. 413–432.

## USING VIDEO IN DISTANCE LEARNING

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This paper describes the creation of training video materials in the Siberian State University of Telecommunications and Information Sciences (SibSUTIS), the experience of video consultations via videoconferencing facilities, and the experience of remote defence of a graduation project using videoconferencing. The authors discuss technical aspects of preparation of educational video lectures in special video studio, features of equipment selection, recording and editing of video lectures. This paper reports on hard- and software required for Internet videoconferencing and methods of videoconferencing in training process. It considers cognitive and incentive roles of the lectures on the electronic medium. This paper also describes methods of creation of video and audio sets for electronic lectures.

**Keywords:** e-learning, studio video lectures, electronic medium lectures, videoconferences, distance learning

Such method of training like lecture appeared more than 1,000 years ago, and became the leading form of the traditional educational process. Having lost in the beginning its significance when the new educational technologies, such as computer training, appeared lecture came back as video lecture on the individual electronic medium or on the web server [6]. Video lecture gained the most important advantage of the textbook: student can stop the playback at any moment and look for the required explanations in previous sections of the video lecture, or other sources. It became possible to increase both cognitive and incentive roles of the lectures on electronic medium [1, 3].

Currently, there are several types of electronic video lectures. A number of American universities [7–9] placed on their web sites video recordings of traditional classroom lectures, which were carried out by skillful and trained operators.

Other universities offer videos of lectures recorded in a special studio and representing

alternation on the screen of the lecturer and shots with schemes or formulas (they can be prepared in advance or played by the lecturer during the lecture). In process of improvement of recording methods it became possible to combine the lecturer and the course materials on the same screen (Fig. 1). Sometimes, electronic avatar is placed on the screen instead of the lecturer himself who reads the text of the lecturer. In this paper the authors deal with the issues of creating and using electronic studio video lectures (Fig. 1) and videoconferencing used in distance learning at SibSUTIS. The rest of this paper is organized as follows. The next two sections discuss the methods of formation of the motives for learning among distance students and introduce the technical aspects of creating a video studio at the university. Finally, last section shows the use of videoconferencing in distance learning. Presentation of the effectiveness of video lectures' implementation into the learning process concludes the paper.



Fig. 1. Screenshot of the studio video lecture on the PC monitor

### Methods of motivation of students

It is very important for instructor to know how to attract attention and to awake students' interest in the lecture when creating learning video material. The instructors who prepare video lectures for students of distance learning are trained in the following methodical modes.

The contents of the video lecture should be understandable, and its volume has to be feasible for the student. The material has to be implemented by the principle from the simple to the complex. Systematization of the material and its correct rubricating play important role in the video lecture. Each video lecture should represent holistic and complete fragment.

One of the most powerful methods of motivation is the use of well-known didactic principle of theory-practice connection [7, 4]. Practice-oriented video lecture is not only interesting and gives professional knowledge, but also is a good school of life.

An introduction of problem elements into the video lecture gives the essential motivation for learning [5]. The whole point is that the lecturer creates a problem situation or gives a challenging task, which has to be settled by the lecture with the assistance of students. The lecturer reveals the logic of solving the problem, shows the difficulties and ways to get over them. Students become participators of the research. Such activity promotes a developing of creative and mental capacity of students.

The lecturer's speech is one of the most important "tools" of teaching in the video lecture. The strength of the speech is in ability to share lecturer's emotional mood with listeners. Speech of the lecturer must not contain inaccurate turns and professional dialect. It is unacceptable to use vulgar expressions. It should be brief and consist mainly of short sentences. The lecturer should be expressive.

In pedagogy great importance is attached to the behavior of the lecturer, his style and manner. The expressiveness of the speech can be enhanced by using gestures, facial expressions, and poses. The gesticulation has to be as temperate as possible. Facial expressions are also very important. However, it is inadmissibly to use entertainment mimicry: grimaces, winks etc. The face of the lecturer should have kind expression and should always express positive attitude towards the student.

Since the effectiveness of studying discipline depends to a large extent on the quality of the video lecture, instructors have to take the creation of video lectures responsibly. Something that goes unnoticed

in a traditional classroom lectures, will be forever imprinted in the video lectures on the electronic medium.

### Technical aspects of video lectures creation

The main functions of the video studio are the following: video recording, audio recording, video editing and arrangement, video storage, and video recording on different carriers.

The main element of the video studio is a video camera. The more professional video camera the better the video quality. It is important that it should have a high definition recording format. It would be good if the camera in the studio pavilion was equipped with a special teleprompter with TFT monitor, such as TLW-LCD150. Such a teleprompter is able to play the text of the lecture that is visible to the lecturer, but "invisible" for the camera.

The lecturer can use any video material during his lecture, such as a slide presentation that is pre-recorded on a dedicated computer (usually a laptop) and put by lecture "to the air" at the right moments. Thus two video streams are consolidated in the video studio: one from the camcorder and the other from the lecture's laptop. These two streams are combined by a device that is called "video mixer" (e.g. video mixer SE-500, "Data Video").

In order to record the sound clip-on microphone ("SENNHEISER EW 122-G2") is used. In order to make a sound of a high quality it is also necessary to use a condenser microphone, for example, "AKG C 3000 B". In order to mix the sound mixing console "Yamaha MGC – 124 CX" is used. Sound control is put into effect by the instrumentality of audio monitors "Yamaha MSP-3" and "Beyerdynamics DT990 PRO" earphones.

Generic data flow that is formed in the video studio transmits to the apparatus room. Since modern facility in the video studio generates video and audio signals in digital form, special equipment has to be used for transmitting a digital data flow from the video studio to the apparatus room.

The main device in the apparatus room is a nonlinear editing station based on Apple MacBook Pro and Final Cat Studio 2.0. software package. It provides high-quality video and sound files editing. As a rule video and audio mixers are put in apparatus room and not in studio pavilion.

In SibSUTIS a simplified version of video studio was chosen, which nevertheless allows one to create a learning product of high quality [2].

Fig. 2 shows the appearance of SibSUTIS studio pavilion and central control room.

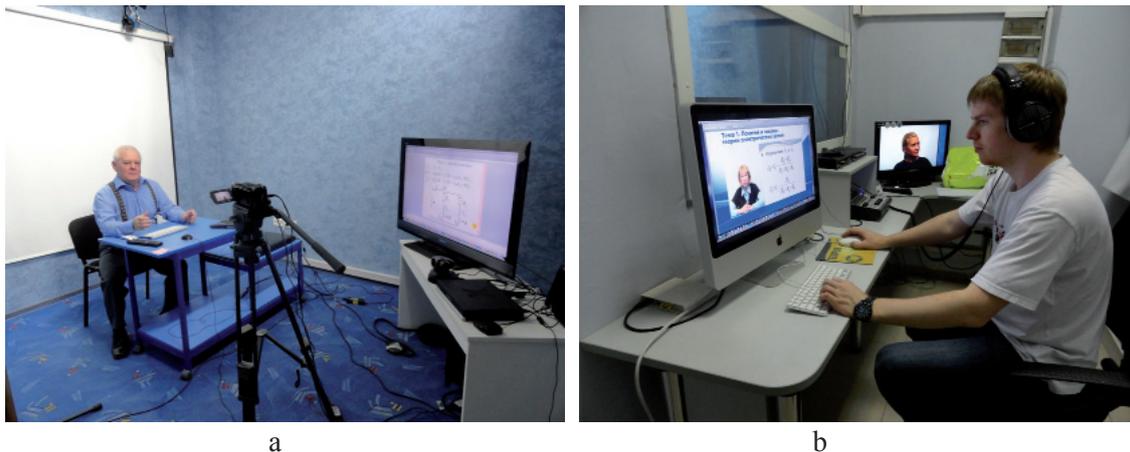


Fig. 2. Appearance of the studio pavilion (a) and apparatus room (b) in SibSUTIS

When recording of the video lecture in pavilion is over an engineer puts it on a temporary nonlinear editing program track and makes a draft of the lecture. In this instance the lecture work is not over. It must be reviewed by the instructor, whose lecture was recorded, and he must specify those video parts on a temporary track that need to be corrected. Video engineer makes correcting and editing of clips (scenes) via nonlinear editing tools, or if such a correction is not possible, retakes these clips. In order to store these digital files special device RAID-array (e.g., Promise SmartStor NS4300N), which provides easy access to the stored files, has to be used. Four 1 – terabyte hard disks are placed inside of the RAID-array. Such memory space will provide a file backup and storage of 130 hours of unreduced video lectures and 600 hours in a packed form. Finally, the video lectures are placed on the training web-site or recorded for students to DVDs.

#### The use of videoconferencing

Modern videoconferencing system includes the following hardware and software:

- terminals with a camera and microphone providing a visual communication;
- video and audio output facilities (PDP or LCD panels, monitors, TVs, projectors, sound amplifiers, speakers, etc.);
- special videoconferencing servers;
- specialized software (for data collaboration, text and graphic documents, etc.).

It is very conveniently to exercise the videoconferencing via equipment that is called Emblaze VCON's xPoint. It is good for group videoconferencing so long as it allows one to display the presentation on big screen, to connect the external laptop for collaborate work of the users with the data and a variety of documents.

Currently the following kinds of video communication are used in SibSUTIS distance learning: network online video lectures broadcasted via the Internet to one or more classrooms; online workshops, video consultations, colloquiums, testing, remote tests and examinations, and distance defense of students' degree thesis [10].

Fig 3 shows the organization of distance defense of graduate works in SibSUTIS. On the one monitor the speaker is shown and on the other one presentation materials of the speaker are displayed. It is also possible to see colleagues on Fig 3, b, who are involved into remote defence and stay in another classroom, on the monitor.

The described in this paper saving engineering solution for creating video studio enables one to put into practice high-quality video and audio recording on various carriers.

#### Conclusion

Functional capabilities of the used in SibSUTIS educational process videoconferencing systems allow one to organize any on-line training sessions: lectures, laboratory practical, consultations, testing, and defence of students' degree thesis.

In order to find out the effectiveness of introducing educational video materials in distance learning, two polls for graduates were conducted. The first questionnaire was aimed at students' satisfaction with e-learning technology, in which training videos were used. The second poll was aimed at students' assessment of the quality of electronic educational video materials. 150 students participated in the survey and they graduated from the following specialties: "Economics and Management", "Communication Networks and Switching

Systems”, “Computer Aids and Automated Systems’ Software”, “Multi-channel communication systems”, and “Radio Communication and Television”. Approximately 46% of the graduates gained their first higher education, and 54% gained their second degree. The survey showed that 88% of respondents worked in the sphere of telecommunications.

The assessment of distance learning in SibSUTIS showed that all specialties’ graduates have highly estimated (9,8 points) the usability of training video materials. The degree of interest in video materials was evaluated by graduates at 8,8 points, and the availability and convenience of distance learning web-site – at 8,5 points. Results of the survey are presented in Table 1.

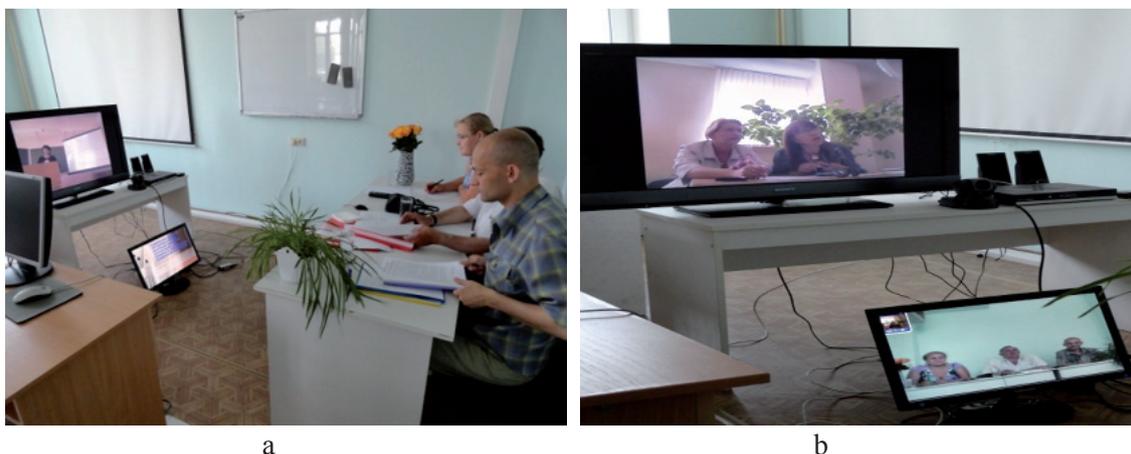


Fig. 3. Organization of the distance defence of graduation project in SibSUTIS

Table 1

Students’ satisfaction with e-learning technology

Estimable Parameter	Specialty					Average grades
	“Economics and Management”	“Communication Networks and Switching Systems”	“Computer Aids and Automated Systems’ Software”	“Multi-channel communication systems”	“Radio Communication and Television”	
Availability of training materials	8,9	9,1	8,8	9,1	6,5	8,5
Degree of interest in video materials	8,0	8,5	9,7	8,8	9,0	8,8
Utility of training materials	9,9	9,7	10,0	9,5	9,8	9,8

Table 2

E-learning materials grade estimation

Estimable Parameter	Specialty					Average grades
	“Economics and Management”	“Communication Networks and Switching Systems”	“Computer Aids and Automated Systems’ Software”	“Multi-channel communication systems”	“Radio Communication and Television”	
Theoretical material	6,1	7,6	7,1	6,3	8,1	6,8
Tests and yearly projects implementation study guides	6,5	8,1	7,5	6,5	8,4	7,1
Virtual laboratory works	7,2	8,5	7,1	8,0	8,4	7,7
Educational video materials	7,6	9,3	9,1	9,8	9,5	8,9

Respondents were asked to rate the following types of e-learning materials: a theoretical material, guidelines for the implementation of tests and yearly projects, laboratory works, educational video materials.

Analysis of grades showed the following results:

- the quality of the theoretical material – 6,8 points;
- the quality of tests and yearly projects implementation study guides – 7,1 points;
- the quality of virtual laboratory works – 7,7;
- the quality of educational video materials – 8,9.

Results of the e-learning materials grade estimation are presented in Table 2.

In conclusion, it should be noted that the implementation of the above-described video lectures for distance learning in SibSUTIS enabled students to significantly improve their motivation to studying.

#### References

1. Kruk B.I., Sitnikov S.G., Zhuravleva O.B., N. Chupakhina N.A. Change of Educational Paradigm to Respond the Challenge of Information Society // Proceedings of International Conference “PHOENIX-PHE”. – Brazov, Romania. September 2010. – P. 175–182.
2. Kruk B.I., Svarovsky I.N., Zhuravleva O.B. Support System in E-learning at the Workplace // International Journal of Experimental Education. – 2011. – № 12. – P. 12–16.
3. Kruk B.I., Zhuravleva O.B. Analysis of Transformations in Innovative Pedagogical Education // International Journal of Experimental Education. – 2010. – № 5. – P. 119–126.
4. Kruk B.I. Zhuravleva O.B. Corporate E-learning Strategy // International Journal of Advanced Corporate Learning (IJAC). – 2010. – Vol. 3. – P. 41–44.
5. Kruk B.I. Zhuravleva O.B. Modern Approaches to Engineering Education // International Journal of Experimental Education. – 2013. – № 6. – P. 10–13.
6. Kruk B.I., Zhuravleva O.B. The Experience of University – Industry Interaction in Telecommunication Sector // International Journal of Experimental Education. – 2013. – № 2. – P. 6–9.
7. Lectures of Carnegie Mellon University. – URL: <http://www.cmu.edu/oli> (date of reference: 30.11.2015).
8. Lectures of Massachusetts Institute of Technology. – URL: <http://www.ocw.mit.edu/OcwWeb/web/home/home/index.htm> (date of reference: 30.11.2015).
9. Lectures of the Yale University. – URL: <http://www.open.yale.edu/courses/index.html> (date of reference: 30.11.2015).
10. Lukin V. From Massachusetts to Berkeley // Action. Career. – May 2008.

## SOCIAL AND CULTURAL CONDITIONS FOR THE REFORMATION OF THE SCHOOL SYSTEM IN CENTRAL KAZAKHSTAN IN 1930-1940-S

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The article examines the processes of reform of school education in Central Kazakhstan, highlighted the steps fundamental changes in education in the 1930–1940. The main feature of the reform of the specified period was the organization of primary universal education, elimination of illiteracy among the Kazakh population. The main effort in the formation of a new system of education focused on the development of the elementary school, which is the basis of the educational system. The authors note that Soviet school had a positive experience of the polytechnic education, teaching of natural sciences. The most important components of system of polytechnic education are implementation of the principle of polytechnic in teaching of the principles of science, industrial excursion, extra-curricular lessons on technique and agrobiolgy. Socially useful productive work of pupils become unchangeable in the practice of the Soviet school. School was able to meet not only the requirements of institutions, but also the need for replenishment of the working class and the collective farm peasantry. However, the Great Patriotic War, which began in 1941, broke People's Commissariat for Education's plans, but suspended the decision of this problem.

**Keywords: school education, illiteracy, semi-illiteracy, reform**

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One of the major problems is illiteracy significant part of the population of Kazakhstan in the early 30-s of XX century, which had a negative impact on the prospects for socio-economic development of Kazakhstan. In this connection, February 11, 1930 was made the CEC Decision KazASSR "On mandatory literacy of the population", which identified concrete methods of teaching school-age children and the achievement of literacy among the adult population [1, 139-141]. It should be noted that accounted for 37% in 1930, literacy among native peoples of the Republic of Kazakhstan is already 37% [2, 5].

To implement this goal August 27, 1930 the Government of the KazASSR was signed a decree on the introduction to the 1930–1931 school year, compulsory primary education in the country, and, in particular, in the Karaganda region. According to the decree provided for the introduction of universal compulsory primary education of children aged 8–11 years. The beginning of primary education for nomadic areas planned at a later date. It should be noted that the conditions of such areas may be increased one school per radius of three kilometers with the necessary transportation of children to school or to the opening of boarding schools with catering for poor children. For teenagers from 11 to 15 years have not passed primary school, provided for the creation of one- and two-year schools courses. According to the document in total needed to educate on January 1, 1931 – 440,575 children of school age and 60,000 teenager, and on September 1, 1932 – 651 402 school-age children and 180,339 teenager [3, 11].

January 30, 1930 Regional Committee CPSU (B) enacted by-law on the report of the Republic of Narkompros about school, which recognized the need for publication of textbooks in the native language and qualification courses for teachers [4, 168].

To solve this problem 12 December 1930 on "Karaganda coal" was sent to the document of the Central Soviet of National Economy (CSNE), in which the paramount importance attached to the elimination of illiteracy. It said that the issue of the elimination of illiteracy among the workers, and especially among their Kazakh people, must find a ready response from the business organizations.

This task was not easy, as was hampered by lack of funds, personnel and facilities. Due to the shortage of teachers in 1930, almost everyone who had seven grade education, could work as a teacher. At the end of 1930 in Karaganda was opened 33 points literacy teaching in the Kazakh language. As teachers from Almaty arrived 50 Kazakh students, who carried out this work [5, 110–111].

Total according to a report of the Karaganda District Board of Education from April 1 to August 1, 1931, it was noted the presence of four schools in the area of Bolshoi Mikhailovka, Tikhonovka, New Uzenke, Zelenya Balka. This document pointed to the expansion of the school network in 1931–1932: 17 of the first stage school in Karaganda, one school in addition to the above-mentioned towns and one school of factory training. It is also anticipated opening of the school and the mines of the Karaganda area: "...For mine number 4/11 constructed

2 buildings for 320 children”, and to mine number 5 and number 18 – one school for 8 groups [6, 22].

The next step in the eradication of illiteracy in the region was the adoption of the Karaganda Oblast Executive Committee 9 February 1933. Resolution on holding cultural excursion for solid literacy field signed by the chairman of the regional executive committee Koshkunova and manager of the executive committee Dudkin. The campaign was planned for the period from January 1 to September 15, 1933 the staff of Karaganda Department of Education was instructed to organize a mass work to mobilize workers at the elimination of illiteracy among the adult population. To this end, February 5, 1933 it was necessary to establish a contingent of illiterates by region and cover all studies [7, 53]. This Regulation obliged to October 5, 1933 fully cover the training of illiterate and semi-literate recruits and youth of premilitary age (years 1910–1911–1912.), To entrust Regional Land Office and the Regional Board of Education to provide all school premises equipment, fuel, lighting, textbooks and educational aids and no later than February 10, 1933. In this areas of the school to create basic literacy and illiteracy, and to assign to these schools, in addition to the training sessions, conducting methodical work with kultarmeytsami [8, 69–70].

As a result of the work done at 1 January 1934 130 200 children aged 8–15 years, are covered in the training schools of stages 1 and 2 119 838 people have been taken into account in Karaganda region, or 92% [9, 111].

However, in 1935 implementation indicators literacy in Karaganda region have fallen sharply: instead of 35 000 people have been educated only 19 242 t. e. 32% of the planned amount. In terms of 107,000 people on January 1, 1936 the training was covered by only 56,748, or 53% [10, 57]. This was due primarily to a lack of teaching staff, shortage of textbooks and teaching aids students who lack special facilities for training.

From the reference: “Progress in literacy CUY” of the Regional Committee of the Young Communist League should “by the decision of the Regional Committee of the Republic of Kazakhstan on the need to eliminate illiteracy in 1935, 300 thousand people. From the reference: “Progress in literacy CUY” of the Regional Committee of the Young Communist League should” by the decision of the Regional Committee of the Republic of Kazakhstan on the need to eliminate illiteracy in 1935, 300 thousand people.

In its turn, we set a goal to eliminate illiteracy among elementary Komsomol in 1935. In total, there are illiterate CUY – 17 389 people. For this purpose, it decided 3000 kultarmeytsev mobilize [11, 3]. Including the Karaganda regional committee “in nine areas considered illiterate 230 people, uneducated 316 people, and trained in all 231 people, mobilized by the liquidators to 100 people”, and the city of Karaganda “illiterate KSM 143, enrolled 120 mobilized kultarmeytsami 54” [12, 5].

In order to meet the literacy plan May 19th 1935 Kazakh Central Executive Committee announced a competition for the city, town, rural units on the best training schools for 1935–1936 academic year. One of the winners of this contest was Karkaraly area, despite the fact that geographically it is located quite far from the railway, and some of its parts at that time still remained in a state of semi-nomadic. Through the efforts of local party organizations and national education departments managed to cover 97% of universal education of school children against 91% in the 1934–1935 school year, as well as using traditional construction complete and put into operation 163 school buildings, overhauled 142 schools that influenced the results competition [13, 201–202].

It should be noted that the educational functions in schools in Central Kazakhstan carried out teachers who have made a great contribution to literacy and the development of school education in the region: K. Komkenov, G.F. Hoffmann, G.N. Belyakova, L.F. Potapenko, A. Tatikios, M.P. Malikov, A. Ya Plotnikov, A.A. Kobzev, Igor Bubnov, T. Nuralieva, N. Spassky, V.A. Seypulnik, R. Khasenov, A.P. Orleans, Z. Dakirova, T. Tleubekova etc.

Teachers of Karaganda region passed systematic training and improvement of the network evening courses in the city of Karaganda. For example, the city elementary school teachers improved their skills on the six-month courses in the evening Teachers College, opened in 1935 in the village of Prishahtinsky at junior high school number 11. And from November 1, 1936 became operational evening Pedagogical College, which raised the qualification of the teacher who had incomplete secondary education in Karaganda [14, 59].

Arrangements due to the rapid increase in the number of schools and students in them was not enough, so the already 3 March 1937 came into force Decree Orgburo Kazkraykoma CPSU (b) in the Karaganda region “on

the preparation by short courses of teachers for primary, lower secondary and secondary schools Karaganda region". This Regulation instructing the regional department of public education at the expense of the local budget in 1937 to organize a four-month training courses for primary school teachers to Kazakh and Russian schools in Akmolinsk, Karaganda to German schools, as well as a two-month training courses for teachers of the Russian language for the Kazakh parent middle schools and high schools in the city of Karaganda [15, 98–99].

Arrangements of the leader of the region have shown positive results: if in 1935, taught by 26 teachers with higher education, then in 1937 the number of teachers who have received higher education, was already 79 people in the city's schools [14, 59]. In the 1937–1938 school year in primary schools of the region were employed 1657 teachers in junior high and high schools – 441. At the same time 1626 of them had primary education, 370 – secondary 102 – higher [16, 80–82].

The situation began to improve with the opening in 1938 of the Karaganda teacher's institute. So, at the beginning of the second half of 1940 it employed 2226 teachers in schools, including specialists with higher education 173, incomplete higher – 262, with the average – 641. However, the proportion of teachers with incomplete secondary education, the presence of which was partly due to an artificial increase in the needs of teachers as a result of the discovery of small schools and classes with little quantitative people, was still unacceptably high – 1 150 people [17, 2].

The next event in the reform of the school system was the adoption of the Decree SNK of Kazakh SSR from March 15, 1938 "On the state of literacy in the country". Council of People's Commissars in the document marked a completely unsatisfactory implementation of the plan in 1937 to eliminate illiteracy in the whole country. For example, adopted a plan for the eradication of illiteracy in 1937 was carried out only by 45,6%, that is, have been trained in all 202,0 thousand. People, instead of 444,4 thousand. People identified in the plan. At the same time, especially lagging three areas of the country, among them the Karaganda region (18,9%) were noted in the implementation of the plan. The main reason for this state of work on literacy and illiteracy was the absence on the part of the People's Commissariat leaders, trade unions and executive

committees of the Bolshevik struggle for the implementation of the decisions of the Central Committee of the CPSU (b) and SNK, Kazkrykoma CPSU (b) and CPC of Kazakh SSR [18, 2].

However, according to the All-Union census in 1939y. literacy rate in Kazakhstan at the age of 9 years and older reached 76,3%, including the ages of 9 to 49 years – 83,5% and 50 years and older – 31,4%. These figures were significantly higher in Karaganda region. This was related not only to the conducted activities on the eradication of illiteracy, but with the voluntary and forced migration in the region of large numbers of people. There were not only competent, but also qualified workers and specialists of different professions and intellectuals. So, the All-Union census in 1939 recorded literacy rate in the Karaganda region at the age of 9 years and older – 83,5%, including the age group of 9 to 49 years – 88,9% and 50 years and older – 47%. In this way, including the all age the Karaganda region ranked 1st place in Kazakhstan, exceed the level of not only Kazakhstan, but also the all-Union level (Literacy rate in the Union at the age of 9 years and older was 81,2%).

The positive experience of polytechnic education, teaching subjects of natural-mathematical cycle was accumulate in the Soviet school of 1930–1940. After the abolition of the labor education in the school as an independent academic subject, there was gap between school and life's demands. In spite of this, many of the advanced schools and teachers included important elements of labor education and polytechnic education in the teaching of subjects of natural-mathematical cycle. The most important components of polytechnism were realization polytechnic principles in the teaching of fundamentals of science, production's excursions, class outing work on technique and Agrobiology, socially useful productive work of pupils remained immutable in the practice of the Soviet school of the late 30-s of XX century. Another thing that, they were subordinated to academic and educational goals of the school, it were preparing the graduates for studies at the universities and colleges. Only after The Decision of XVIII Party Congress (1939) the schools had at the same time preparing graduates for further education in secondary and higher special education and also prepared them for practical work in the national economy. In this way, development of the cultural and technical level of the working class to the level of

engineering and technical workers ensured by the development of universal secondary education in the country. Secondary school was able to meet not only the needs of higher educational institutions, but also needs of replenishment of the working class and the collective farm peasantry. Life has demanded changes in the content of secondary education in accordance with the best training of school's graduates to practice in the national economy and the service sector. The Decisions of XXVII Party Congress demanded from system of the school education not just improve the cultural level of the working class, but also increase cultural and technical level, caused by the rapid technological progress in socialist society. According with the decisions of the Party Congress it was necessary to strengthen the polytechnic education at the Soviet school. The problem of preparing school graduates for practice can be addressed through integrated development of labor education and polytechnic education. However, the People's Commissariat of the Union republics and local departments were unprepared to meet with new goals in the field of public education. It should also be noted that no one developed the answers of forecasting future development of the Soviet school on more or less prolonged period. Therefore, management bodies of public education and educational science at first could not give clear and precise directions to schools and teachers about the nature, content and the main ways of achieving the objectives of "prepare graduates to practice". S.M. Shabalov wrote about this task, that "we encounter rarely with such vague concept". Order of the People's Commissariat of the Russian Soviet Federative Socialist Republic on August 26, 1940 "About measures on improvement of rural secondary school work", according to contemporaries, "had a great fundamental and practical value". He paid the attention of all teachers, especially teachers of rural schools, on the need for the teaching of science together with the theory and practice and on the importance of transmission the knowledge of vital importance to students. This decision represented a significant achievement in the development of Soviet Polytechnic School. In accordance with the order of the state inputted the significant changes in the curricula of rural schools in the subjects of natural-mathematical cycle (Compulsory practical classes, excursions and so on). Order of the People's Commissariat was a kind of complement to existing curriculums, concretizing their on individual

classes and subjects. Practical classes and excursions were held in conjunction with the study of biology, chemistry, physics, mathematics, drawing, without disturbing systematic programs. As a result of checking the status of educational work of schools in Karaganda region for 1940 was noted that the total number of pupils of general schools at the beginning of 1940–1941 academic year was 1 138,2 thousand people, of them in urban areas - 351,9, in - 786,3. In the 1–3 (4) classes - only 469,5, in urban areas - 123,6, in rural areas - 345,9. In the 4–8 (5–9) classes - only 637,0, in urban areas - 208,6, in the countryside - 428,4. In the 9–10 (11) (10–11) classes - only 28,3 in urban areas 16,4 of them, in rural areas 11,9.

The Great Patriotic War broke the peace plans of the People's Commissariat for preparing students for practice, but not suspended the decision of this problem. In military circumstances, these plans were more relevant, the decision acquired new forms, but still remained significant labor and polytechnic training of pupils. The main feature of reforms in 1930–1940-s was the organization of primary universal education, elimination of illiteracy among the Kazakh population. The main efforts in the formation of a new system of education focused on the development of the elementary school. During these years, there were ideologization, politicization of the school system, destroyed the Kazakh intelligence. V. Baitursynov, Sh. Kudaiberdiev, T. Zhurgenov, S. Mendes, C. Asfendiyarov and many others were repressed. They were the best representatives of the Kazakh people, people of high spiritual and intellectual culture.

Since the 30-s of XX century began a slow but steady offensive on national school, national component in the content of education, the national language of education, national identity. In the 30-s of XX century finally established a new educational model of the Soviet school, working on unified programs, with constant statutes and regulations.

Before the war, especially after the XVI-II Party Congress, the labor education and polytechnic education at the Soviet school were greatly enhanced because of task of "training school graduates to practice". People's Commissariat of the Union republics held intensive development of new curricula and programs, which were to provide the best training students to practice. Socially useful productive work of students took on an unprecedented scale in the new

environment. Department of People's Commissariat of the Russian Soviet Federative Socialist Republic of primary and secondary schools and the State Research Institute of the People's Commissariat of Education schools of the Russian Soviet Federative Socialist Republic to the teachers' meetings in January 1941 developed methodological recommendations "About assignment of practical skills to students in connection with the study program material".

Historic-retrospective look at the formation and development of the school system of 1930–1940 allowed us to identify two main areas of educational policy of the Soviet state. There were the elimination of illiteracy and low literacy, and the upbringing of the younger generation in the spirit of Marxist-Leninist theory.

The peculiarity of the first direction was determined by the sharply increased national economic needs of the Soviet state in the conditions of rapid development of the economic power of the country and of the second upbringing of Soviet human, in the conditions of the dictatorship of proletariat, who could execute the instructions of the Party and government.

These measures have been impossible without reforming the school system in the USSR and Kazakhstan in 1930–1940-s. Therefore, all secondary schools of the republic, including the Central Kazakhstan, in the second half of the 1930s was taken under strict control by the Party and government bodies, and all following transformation in them happened only in the context of the principles of the Unified Labor School.

#### References

1. Cultural Construction in Kazakhstan (1918-1932 gg.): Proc. documents and materials. V.1. / Head of H.H. Khabiev. – Alma-Ata, Kazakhstan, 1965. – 566 p.
2. Balahmetov K.B. The development of education in Kazakhstan. – Alma-Ata: Knowledge, 1980. – 40 p.
3. Administration of the President of the Republic of Kazakhstan. F. 141. Op. 1. D. 4950.
4. Cultural life in the USSR. 1928-1941. Chronicle / Ed. M.P. Kim. – Science, 1976 – 816 p.
5. Kozina V.V. The population of Central Kazakhstan (the end of XIX century. 30 years of the twentieth century). Bk. first. – Alma-Ata Өркениет, 2000. – 144 p.
6. Administration of the President of the Republic of Kazakhstan. F. 15. Op. 1. D. 3.
7. Nurligenova Z.N. Development of the system of secondary schools in Central Kazakhstan in the 30-s of XX century // Materials of the V International Scientific and Practical Conference: Science and technology: Step into the Future – 2009 – Prague: Publishing House Education and Science sro, 2009. – P. 52–54.
8. Cultural construction in Kazakhstan (1933 – June, 1941.): Proc. documents and materials. V. 2. / Otv. red. H.H. Khabiev. – Alma-Ata, Kazakhstan, 1985. – 283 p.
9. Nurligenova Z.N. Problems of development of school education in the 30–40-s of XX century (an example of Central Kazakhstan) // Herald of the Al-Farabi Kazakh National University. – 2006. – № 3 (42). – P. 110–112.
10. Archive of the President of the Republic of Kazakhstan. F. 141. inventory 1. D. 11711.
11. Archive of the President of the Republic of Kazakhstan. F. 143. inventory 1. D. 2439.
12. Archive of the President of the Republic of Kazakhstan. F. 143. inventory 1. D. 2439.
13. Sembayev A.I. The history of the Soviet school in Kazakhstan. – Alma-Ata: Kazakh state educational and pedagogical Publishing, 1962. – 367 p.
14. Karaganda. Series: History of the cities of Kazakhstan / Ed. Ed. A. Elagin. – Alma-Ata. Science, 1989. – 192 p.
15. State Archives of the Karaganda region F. 469. Op. 1. D. 2.
16. State Archives of the Karaganda region F. 469. Op. 1. D. 2.
17. State Archives of the Karaganda region F. 1H. Op. 2. D. 253.
18. State Archives of the Karaganda region F. 1H. Op. 2. D. 130.
19. Shabalov S.M. Polytechnic education. – M.: Publishing House of the Academy of Pedagogical Sciences of the Russian Soviet Federative Socialist Republic, 1956. – 728 p.
20. The national economy of Kazakhstan for 70 years: statistical coll. / Ed. M.K. Abdrakhmanov. – Alma-Ata, Kazakhstan, 1990. – 392 p.

*Materials of Conferences***MODULE APPROACH EXPERIENC  
TO DEVELOP MEDICAL STUDENT  
LEARNING STYLE**

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Academic health programs in the age of globalization aim at lifelong career trajectories of the future health care professionals. Innovative technological mechanisms are of great demand to provide an effective support and to facilitate their academic achievements. The logic of lifelong learning suggests that students will become more motivated to learn by knowing more about their own strengths and weaknesses as learners. In turn, if teachers can respond properly to students' barriers, then achievement rates in training programs are likely to rise.

Learning styles have been extensively discussed in the educational psychology literature and specifically in the context of language learning [1]. Studies show that matching teaching styles to learning styles can significantly enhance student professional and cultural competence, specifically in foreign language. What must be done to achieve effective foreign language learning is to balance instructional methods, structuring the class so that all learning styles are simultaneously accommodated.

Module approach is known to be one of the powerful means to provide the students' own pace within the schedule [7]. Russian and foreign pedagogical practice showed the effectiveness of this technological approach [4].

The particular purpose of the work is to present a new approach of students learning styles development. The tasks are: to diagnose students learning styles; to modify learning environment to different range of students according to their learning preferences.

Students: pharmaceutical students (15 persons aged 18–19), post-high school learners, with low advanced language proficiency.

To make learning more effective the integrated communicative-informative approach has been applied.

Settings: state university with tech-friendly environment, where learners are studying English for Specific Purposes 4 hours once a week for 4 semesters, they have to do homework outside of class as well. All students have Internet access in and outside of class.

Study instruments: Learning Styles Questionnaire – AVK [5], Nibelung – Dialogue computer program. The content material of four modules was delivered in four different modes, modules 1–3

were devoted to the diseases of definite body systems, whereas module 4 was integrated.

It has been established that the strongest preference of the group was Auditory Visual Kinesthetic style (AVK) – 64%, the second preference was Visual Kinesthetic Auditory style (VKA) – 27%, and the least favorite preference was Auditory Kinesthetic Visual style (AKV) – 9% of learners. Mean group auditory style preference value was 4,3, mean group visual style preference value was 3,4 and mean group kinesthetic style preference value was 3,0, estimated from 10 scores.

As AVK students are known to learn best by experience, by being totally involved, firstly, in Module 1 a domain style was used. Lessons of the first Module were delivered with more time to read aloud the texts on their professional domain, being corrected by means of Nibelung – Dialogue computer program. This program provides the opportunity for feedback and help in the case of any problems. The written assignments have been accompanied by the thematic video films, preliminary audio tracks. Students have been organized in small groups of 2–4 for pair work and following oral discussion. The pair work included tasks to make a list of essential information, give the examples of the notions, and make a song out of information to be remembered, record and play it back.

Further, in Module 2 exercises for the second visual style have been added: word webs for the units, diagrams, flashcards, concept maps with key points to draw lines between concepts and their definitions for the modules, colour-coding of the tasks so the headings of the written assignments, concerning the definite theme had the same colour.

After that, the instructions at the lessons of the Module 3 were varied and students were provided a lot of kinesthetic activities: to test the understanding of the text structure texts were organized to have gaps, following a list of possible sentences with one or two extra to fill in by “dragging”, students were allowed to role-play to deal with the main concepts of the unit, learners made a task ‘pass a paper to another student’ with the help of Nibelung – Dialogue, to reinforce key concepts field trips, workshops, making models were planned.

Finally, Module 4 presented tasks based on the integrated skills. Students were working on their speaking and writing skills, problem-solving skills and cooperative group work. The module “Medical Education” was the final independent module of 4 ones. Students were expected to take part in discussion on the modern methods of treatment and prophylaxis. At the prior lesson students were collaborating on collecting data on the topic. The part

of the lesson was a group presentation of the pilot draft of the project "Peculiarities of Medical Education in English-speaking countries". Next three hours students were forming a final draft, clarifying the language, adding comments. Students have been divided into groups, have chosen the topic (an English – speaking country), creating a brief initial report for further presentation, applying relevant vocabulary, collocations and linking phrases they have learned through previous writing assignments. Then they worked to assess each other's writing before giving presentations. In this part of lesson they were to write a report, devoted to the chosen country. Towards the end of the class they evaluated their group writing and got peer's feedback. The initial draft was a base for a video presentation, or oral reports, or interviews, or posters, so students could themselves see their progress for the whole year of education. At the beginning of the lesson, students were organized in groups of four, each member of the group having his/her own role for the fourth time and coped with it properly. Then students proceeded to collaborating to make summary on their problem. At the middle of the class the groups were called on and make their initial report by chain. Their peers made comments. At the end of the class students brainstormed the form of activity to present their work next lesson. This writing assignment based on a real-world experience used integrated skills and was beneficial for students, allowing them being presented fully during making their task.

Cooperative classroom management on the base of multimodal module approach is perfect to

enhance student individual peculiarities. Under such circumstances they became more aware of the vocabulary, key phrases, structure and grammar and logical organization of the utterance. Students gained skills of data interpreting, making assumptions, adding comments on second language. Using different group roles for students helped to take into account their both language proficiency levels and personality traits. It could be concluded that module approach modularity basing on the learning styles develops professional and cultural competence of the future health care professionals.

#### References

1. Hawk T.F., Amit J., Shah A.J. Using Learning Style Instruments to Enhance Student Learning Decision // *Sciences Journal of Innovative Education*. – 2007. – № 5. – № 1. – P. 1–19.
2. Felder R.M. Learning and Teaching Styles In Foreign and Second Language // *Foreign Language Annals*. – 1995. – № 1. – P. 21–31.
3. Uchjavichene P.A. Theoretical basis of the modular education. Dissertation of doctor of sciences. – Vilnius, 1990.
4. Popova T.M., Poddubnykh E. N. Modular-rate technology in the educational process on the example of the discipline "Information Technology". – [http://ejournal.khstu.ru/media/2013/TGU\\_4\\_233.pdf](http://ejournal.khstu.ru/media/2013/TGU_4_233.pdf).
5. Fleming & Mills' VARK. – <http://www.varklearn.com/english/page.asp?p=questionnaire>.

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## GEOGRAPHICAL NAMES OF WATER OBJECTS IN «THE SONG OF IGOR'S CAMPAIGN»

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The article is devoted to the topical problem in modern linguistic science – restoration Old Russian's system of geographical names. «The Song of Igor's Campaign» can be considered as important source for description system of hydronyms.

**Keywords:** Old Russian written monuments, geographical names, hydronyms, etymological comments

Place names of an era of the Old Russian state, being a cultural heritage of ethnic community of east Slavs, store in itself memory of the past of the Slavic people and their representations of a world order. As geographical names differ known stability and conservatism, the perspective of their studying is on a joint of history of language, etymology, lexicology and dialectology. Indirectly reflecting historical and geographical reality, geographical names the XI–XIII centuries keep forever sociocultural, historical, lexicological and ethno geographical information, reflect valuable data on language contacts and ancient ethnic communications, migrations of the people, culture, a life and their language consciousness. Certificates of written monuments are defined by that value, «which helps to add our idea of toponymic system on any synchronous cut, about structure of loans, their shifts and rates of adaptation, about the contacting native toponymy going back to unwritten languages and being one of the major sources of data on language of the before Russian population» [4, t. 2, p. 31].

Value of data of a hydronimiya within studying of history, language and culture of ethnos is difficult for overestimating, as water objects at an early stage of development of any civilization had paramount value. In particular, exactly along the rivers there was a moving of certain ethnic groups.

Hydronyms (proper names of a body of water), the writings fixed in Old Russian monuments, including in «The Song of Igor's Campaign», owing to known stability allow to reconstruct the ethno linguistic map of the past of the East Slavic people. The multilayered objects of hydrography within a certain territory testifying to their various languages possessive, and also about processes of migrations.

«The Song of Igor's Campaign» reached us in the list of the end of XV – the beginnings of the XVI centuries which was in library of a Spaso-Yaroslavsky monastery, and then was acquired by count A.I. Musin-Pushkin. This list is remote from the original about three centuries (1185–1190). In the Ipatyevsky an-

nalistic list the story about Igor's campaign «is placed in the text of the Kiev chronicle which, in turn, got data from chronicles of Chernigov» [7, p. 92–93]. Igor Svyatoslavich's entering into the Lavrentyevsky chronicle the history, appeared in it taken of chronicles of Suzdal, and was transferred to the local chronicle of Pereyasavl Southern.

As G.F. Kovalev notes, «from the point of view of proper name theory this work gives in hands of the researcher excellent, often a unique material. These are personal names of heroes of the poem, the name of the ancient cities, settlements, the rivers, the names relating to ancient Slavic mythology» [5, p. 48].

The toponymic space of the text develops of place names (117 units), relating on the origin to different languages and fixed in different territories. It in the majority geographical names, going back to lexicon of Slavic, Turkic, Norman and Finno-Ugric languages. «For the most ancient geographical names, especially with the indefinite inner form, only belonging to a family of languages usually is defined. For structural and semantic clear geographical names reference to group of related languages is possible...» [2, p. 192].

The most ancient layer of toponymic lexicon make hydronyms – own names of any object of hydrography: the seas, the rivers, lakes, a well, a reservoir, suited, etc. [8] – which can be divided on names of the seas (and also sea water areas: lip, gulf, bay), names of the rivers, names of lakes (and also ponds), names of bogs (boggy places), microhydronyms (names of sources, streams, springs, wells, etc.).

In «The Song of Igor's Campaign» the following objects of hydrography are fixed:

### Names of the seas

*Pomorie* (the coast of the Sea of Azov, the earth on Sula's right river bank, bordering on the polovetsky steppe): «Div is aroused, he shrieks a command to the unknown land, to the Volga, *Pomorie*, Posulie, Surozh...» [10, fr. 29]. Geographical name with konfiks: a prefix *on-* + a nominal basis + a suffix *-je*: *Po-mor'-je*.

### Names of the rivers

*Bolonie* (in English translation *thickets*) (the low bank of Dniepr where the Kiev Podol settled down): «In the *thickets* at Plesensk there were four brother princes, and they were carrying me toward the dark blue sea» [10, fr. 99]. N.V. Charlemagne believes that it is a space between shaft – protective constructions on both parties of the bottom watercourse of Glubochitsa, i.e. in close proximity to Kiev; this place was called subsequently as Obolon' [9, t. 1, p. 134]. *Bolonie* is «a water meadow, the lowland». According to F.F. Fortunatov, it is connected about a *bog*, lit. *báltas* «white», also lit. *bálnas* «white» [3, t. 1, p. 189].

*Volga* (the largest river of the Russian Plain) is repeatedly mentioned in the text hydronym. «In the second floor XII century within Old Russia (generally – the Vladimiro-Suzdalsky principality) there were headwaters of Volga, approximately to a place of a confluence in it of Sura and Vetluga. Below on the Volga Current settled down the earth of the Volga Bulgarians» [9, t. 1, p. 223]. «For you can empty the *Volga* with oars; You pour out the Don with your helmet» [10, fr. 124] (Here the mention of Volga is connected with Vsevolod Big Nest's war with Bulgarians.); «Div is aroused, he shrieks a command to the unknown land, to the *Volga*, Pomorie, Posulie, Surozh and Korsun» [10, fr. 29] (In the specified context means the average and the bottom Volga Current where there lived the steppe people.). The origin of the name is disputable. «Existence of the rivers of *Volgayoka*, *Vol'ga* (*Volga*), *Volgoma*, *Volgozero's* lake in space from Oka to Karelia allows to assume name emergence Volga in language of the tribes which living in its headwaters at the time of a neolith and have extended later on more northern areas. But sources and the headwaters of the river are in a zone where prior to the beginning of II thousand lived the Baltic tribes. In balt. valka languages «small stream; a stream flowing on a bog; small river, spring»; this term is often compared with the name *Volga*, i.e. the Neolithic population of a wood zone could be Indo-European. Some authors allow origin *Volga* from an ancient word, related slav. *moisture*, *volgly*; this etymology causes objections, and, besides, it is improbable that this large river before arrival of Slavs remained anonymous» [8, p. 102].

The name *Dvina* (runs into the Dvina Bay of the White sea) mentions in a context: «The *Dvina* flows like a swamp for those awesome men of Polotsk» [10, fr. 143] (Here the mention of *Dvina* indicates narration transition from southeast border of Russia to northwest, to Polotsk princes). «In Russian chronicles it is mentioned as *Dvina*; the Velikoustyuzhsky

chronicle contains an explanation: «*Dvina* therefore called that moved two (the rivers, – the Yug and Sukhona) and made from itself the third»: this explanation then repeated up to the Encyclopedic dictionary of 1901, but is recognized naive later [6]. Possibly, emergence of the name *Dvina* (from the middle of the XIX century *Northern Dvina*) it is necessary to consider in connection with all hydronyms from a basis *dvín-* which have quite extensive area» [8, p. 374]. Considering that names of *Dvina Western* and *Dvina Northern* are conformable in Slavic, Finnish, the Scandinavian languages and at the same time are separated from the Latvian-Lithuanian name, V.A. Bulkin established the phenomenon to «a mirror hydronimiya» when both rivers, in this case both *Dvina* appears are geographically compatible. «The rivers with the same name with the pulled together sources and dispersing courses served, according to the researcher, certain reference points on portage sites upon transition from the basin of one river to the pool another. Fixing of the name of the river at men of Polotsk was promoted clear to Slavs by semantic contents of the term reflecting local geographical feature – merge at Polotsk two rivers realized as means of communication» [9, t. 2, p. 86–87]. «It is possible, it is more ancient i.-e. the name which by Y. Rozvadoysky carries to other – Old Indian *dhāvātē*, *dhāvati* «flows», *dhāutís* «a spring, a stream» [3, t. 1, p. 488].

*Dniepr Sloputich* (modern Dniepr, the river running into the Black Sea): «O *Dniepr*, *Son of Fame!*» [10, fr. 178]. *Dniepr* – «the river moistening, impregnating the earth». From \*Dunipros > \*Duneapar > ; slav. \*Дънепръ > Old Russian Дънепръ, 1016; Дънепръ, 1214 [8, p. 142]. Concerning an epithet «*Sloputich*» V.P. Adrianova-Peretts noted that «existence in the Ipatyevsky chronicle under 1241 of a word «*sloputny*» with the same significance «nice, well-known» – «*sloputny* the singer *Mitusa*» – enters also definition «*Sloputich*» into lexicon modern to language «The Song...». In its basis widespread verb from the most ancient monuments «*слуги, слову*», one of which meaning «to be known, glorified» [9, t. 2, p. 124].

*Donets* (Severski Donets, right inflow of Don): «but Prince Igor had dashed like an erinine to the weeds... and he sped toward the bend of the *Donets*» [10, fr. 188, 190]. Judging by numerous researches, in Old Russia the Severski Donets was called as Don (for the first time the specified opinion was stated by V.N. Tatischev, B.A. Rybakov subsequently is proved), and *Donets* or *Little Donets*, probably, called Udy river. Despite a community of the main geographical reference points, Old Russian authors could have various systems

of geographical representations. In this name *Donets* – diminutive from *Don* (Great Don), formed by means of a suffix – *ets*.

*Donets Little*: «Igor... measures the steppe in his thought from the great Don to the *little Donets*» [10, fr. 185] (Small Donets is Udy river, the right inflow of the Severski Donets here is probably called).

*Don* (the river running into the Sea of Azov): «Igor is leading his warriors to the *Don*» [10, fr. 30]. The name is given by the Iranian people that are once living in the territory of Northern Black Sea Coast. In their language *don* is «river» [8, 144].

*Don Great*: «The Polovtsians, by uncharted routes, raced toward the *great Don*» [10, fr. 30] (In this context it means the average watercourse Donets, because Igor's fight occurred to Polovtsians to the west of the Severski Donets). Big geographical objects are, as a rule, richer with resources necessary for life and consequently are allocated as reference points. In toponymic forms adjective «great» matters «big». Opposition of toponyms with adjective components «great» – «small» very frequent phenomenon, including in a hydronymy. The dichotomy «great-small» could have in the ancient time geographical meaning «northern-southern». So, the northern cities called «great», and southern – «small».

*Danube*: «Maidens sing on the *Danube*; their voices are heard across the sea in Kiev» [10, fr. 212] (the poetic name of the river in general here is meant). Celtic by origin the *Danuv* form «indicates communication of it hydronym about Iran. *danu* «river» [8, 147]. In chronicles the geographical name is mentioned from X-th century.

*Kaiala* (the symbolical or place name of the river on which there was Igor's fight to Polovtsians in 1185): «There the brothers were parted on the banks of the swift *Kaiala*» [10, fr. 71]. The origin of hydronym is disputable. Especially in detail the origin of geographical name *Kaiala* from a Old Russian verb «*каяти*» was proved by L.A. Dmitriev who came to a conclusion that *Kaiala* – a common noun, instead of proper which was given by the author of «The Song...» to «the river carrying any other place name» [9, t. 3, p. 33]. M. Fasmer two options of etymology were offered: from the Turkic *kaja* – «the rock»; from the Turkic *kajan* – «a fast, mountain stream, falls» [3, t. 2, p. 216]. According to N.A. Baskakov, the etymology of the name of the river «can be opened under condition of the accounting of other name either the same river, or another, mentioned in Russian chronicles in connection with Igor Severskyi's campaign, namely the rivers *Syuurlyi*» [1, p. 243]. The researcher frames a number of hypotheses about an ori-

gin of hydronym, making the name from the following Turkic words: *qoyaly*, *qyjaqly* – «abounding with sedge»; *qyjyly* – «with a narrow strip of the coast between rocks and the river»; *qyjyqly* – «twisting, with bends». Anyway, supporters of a Turkic origin correlate *Kaiala*'s name to real geographical objects, and supporters of Russian etymology consider *Kaiala* by the symbolical river.

*Nemiga* (the small river near modern Minsk, inflow of Svisloch): «opened the gates of Novgorod, smashed the glory of Iaroslav and as a wolf leapt to the *Nemiga*» [10, fr. 156, p. 157]. The first publishers of «The Song...» (including N.M. Karamzin), identified *Nemiga* with Neman, being guided by V.N. Tatischev's opinion. «But in 1821 of Z.D. Hodakovsky in hand-written «The historical and geographical dictionary» identified *Nemiga* with a channel in Minsk, and N.P. Barsov wrote that «a stream *Nemiga* and exists hitherto in Minsk, its bloody coasts are mentioned by the «The Song of Igor's Campaign» which author certainly knew about bloody defeat of Minsk by *Monomakh*» [9, t. 3, p. 310].

*Posulie* (left coast of Dniepr): «Div is aroused, he shrieks a command to the unknown land, to the Volga, Pomorie, *Posulie*» [10, fr. 29]. The geographical name from *Sula* with konfiks: a prefix *on-* + a nominal basis + a suffix – *je*: *Po-sul'-je*.

*Ros* (the right inflow of Dniepr running into it to the south of Kiev; the river, boundary with the polovetsky steppe): «Along the *Ros* and the *Sula* pagans are portioning the cities» [10, fr. 137]. Possibly, the proper name is related to the word «course» [3, t. 3, p. 506].

*Stugna* (the right inflow of Dniepr running into it of 30 km below Kiev): «Not such was the River *Stugna*, having a poor current... At its dark banks as the Dnieper it closed over young prince Rostislav» [10, fr. 197] (River *Stugna* at that time unexpectedly spread; prince Rostislav Vsevolodovich sunk in it). The name is connected with Old Russian verb *стугнуть* «to run cold» [3, t. 3, p. 786]. On *Stugna*'s left (northern) coast the cities of the main defensive line of Russia on border with the Steppe settled down [9, t. 5, p. 76].

*Sula* (the left inflow of Dniepr running into it to the south of Kiev behind which the polovetsky steppe began): «Now the silvery current of the *Sula* no longer flows to the city of Pereiaslavl...» [10, fr. 143]. Name, possibly, primordial-Slavic. Compare got.bi-sauljan «to soil, pollute», Norw. *søyla* «silt, bog», Swed. *saula* «dirt» [3, t. 3, p. 800]. According to N.A. Baskakov, the proper name *Sula* «*suwlaq* – *suwlay* would be characteristic for the settlement, than for the river name rather,

the last could occur from other derivative form *suw* «water», namely from *suw-ly* «having water, with water, full-flowing», i.e. from *suw* «water» basis + a possession affix *-ly* > *suw-ly* > Russian *Sula*» [1, p. 110].

### Microhydronyms

*Kanin* (a stream near to Chernigov, mentioned also in the Lavrentyevsky chronicle): «Pride brought Boris Viacheslavich to judgment on the River *Kanina* Pride spread a green shroud for the brave and young prince, to the disgrace of Oleg» [10, fr. 47]. Group of researchers (F. Timkovsky, I. Snegiryov, M.A. Maksimovich, etc.), considered *Kanin* as a proper name, connecting this word with the name of the district being near to Chernigov and mentioned under 1152 in the chronicle. «The Bulgarian scientists N.M. Dylevsky and B.S. Angelov represented in the articles data about existence on the Balkans the river «*Kanina*» and the city with the same name» [9, t. 4, p. 10]. In this geographical name *kanin* – a possessive adjective from Russian nickname *Каня* (a bird *каня*, *канюк* «buzzard») [8, p. 186].

Names of water objects are a valuable historical and linguistic source as rather seldom change for the extra linguistic reasons, remaining throughout many centuries. Besides, in some cases hydronyms promote restoration of personal own names and the nicknames which have not been fixed by historical sources. Such personal names and nicknames can be discovered and in structure of names of the cities. Names of water objects find close interrelation both with names of the cities and with others hydronyms. For example: *Don River* and its inflow *Severski Donets*; river *Sula* and *Posulie* [10] and under.

Within historical toponymics very important there is a question of motives of motiva-

tion of geographical names. In «The Song of Igor's Campaign» the group of the landscape place names, indicates the sizes and a configuration of natural objects, features of a hydrology and a relief, flora and fauna. In the Old Russian monument are fixed the names having as a motivation basis a proper name of the person, connected with called object on the birth, an occupation and the possessive relations. A group of geographical objects connect with the color characteristic in the toponymic nomination, an ethnic origin, communication with Christian faith and divine service.

### References

1. Baskakov N.A. *Kaiala* river in «the Word ...» and the river *Syuurlyi* in Russian chronicles // «The Song of Igor's Campaign» and its time. – M, 1985. – P. 241–248.
2. Bondaletov V.D. Russian proper names. – M: Education, 1983. – 224 p.
3. Fasmer M. The etymological dictionary of Russian: in 4 vol. / translation from German and additional O.N. Trubachev. – SPb.: Alfabeta, Publishing center «Terra», 1996. – Vol.1. – 576 p.; Vol. 2. – 672 p.; Vol. 3. – 832 p.; Vol.4. – 864 p.
4. Frolov N.K. The chosen works on linguistics: in 2 vol. – Tyumen: TSU, 2005. – Vol.2. – 520 p.
5. Kovalev G.F. Ethnos and name. – Voronezh: VGU, 2003. – 236 p.
6. Nikonov V.A. Short toponymic dictionary. – M.: Thought, 1966. – 509 p.
7. Pikkio R. Old Russian literature. – M.: Languages of Slavic culture, 2002. – 352 p.
8. Pospelov E.M. Place names of the world: Toponymic dictionary. – M.: Russian dictionaries: Astrel: AST, 2002. – 512 p.
9. The encyclopedia of «The Song of Igor's Campaign»: in 5 vol. / Russian Academy of Sciences, Institute of Russian literature. – SPb.: Dmitry Bulanin, 1995. – V. 1 – 276 p.; Vol. 2. – 334 p.; Vol. 3. – 387 p.; Vol. 4. – 330 p.; Vol. 5. – 339 p.
10. The Song of Igor's Campaign. Translation into English language. V. Hani and E. Dahl [Electronic resource]: Parallel case of translations of «The Song of Igor's Campaign». – URL: <http://nevmenandr.net/slovo/trans.php?it=k2> (28.10.2012).

*Materials of Conferences***CONDITIONS FOR MOTIVATION WHILE  
LEARNING ENGLISH IN THE TECHNICAL  
HIGHER EDUCATION INSTITUTION**

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The problem of learning languages is very important today. Foreign languages are socially demanded especially at the present time when the progress in science and technology has led to an explosion of knowledge. The total knowledge of mankind doubles every seven years. English is needed as the main and the most efficient means of information exchange. It is the language of literature, education, modern music, international tourism. English has become the key to international scientific, technological and commercial innovations of today.

With the acceptance of English as the international language of technology and commerce appears a new generation of people who know why they are learning the language. Scientists and scholars need it to keep up with developments in their fields. Many students need English because their course of studies includes textbooks available only in English. Young people around the world need English in order to be able to use the Internet, communicate with their partners in other countries, understand films and songs. Specialists should know foreign languages to communicate with their colleagues at the conferences.

Russia is integrating into the world community and the problem of learning English for the purpose of communication is especially urgent today [2, p. 50]. In Russia people learn English to be able to exchange the latest information concerning science, technology and commerce with their colleagues; to be able to read foreign newspapers and books. Learning foreign languages is especially popular among young people. For them English is a way of exploring a completely new world. A person who travels a lot also needs English. Even in the countries where English is not an official language people will generally be able to understand it.

Specialists have to know that kind of English which will help them solve their professional problems. They need English for specific purposes. It has been established that there are important differences between, say, the English of commerce and that of engineering.

Testing the students entering the technical university shows that the majority of them have

the low level of knowledge in English. That is why the lecturer at the higher education establishment has to organize his or her activity in such way in order to equalize the students' level of knowledge in a short time.

Motivation is one of the most famous factors which stimulates the interest of the students in learning foreign languages. Motivation is the result of his wishes, purposes, tasks. The real final success supports the motivation. If there is no success, the motivation disappears [3, p. 92].

As for the higher education establishments, their task is to create conditions for appearing of the impulse, the students' realization of the necessity of knowing the English language and further development of the sphere of motivation.

The teacher of the English language is aimed to develop the skills of communication. These skills are the base in the organization of the production, in the sphere of management and in the sphere of service. Therefore, acquisition of the basis of foreign communication is the specific base for the professional becoming of the students.

At the lessons of foreign languages we solve a number of concrete tasks directed on the professional forming of the person: the development of the individual features of the students, their abilities, professional interests. Due to the Internet they learn new achievements in the different spheres of science and technology while reading, translating, annotating, abstracting scientific technical texts. Moreover this kind of work develops the students' intellect, widens their outlook. The teaching the student to work with books (dictionaries, reference-books), to annotate, abstract foreign scientific technical texts master their educational abilities [3, p. 93].

The novelty of the information obtained plays a great role in the forming of the motivation. The need in getting new knowledge in their specialty promotes the personal activity of the students, that is stimulates the students being their motivational factor. Today specialists of different branches of sciences and professionals can learn English for their specific purposes. They should be able to write business letters [1, p. 74]. These skills are necessary in any professional activity.

To equalize the students' level of knowledge in a short time we had to organize extra English courses for the students with different level of knowledge, such as elementary, pre-intermediate, intermediate, upper- intermediate.

## References

1. Rakhmanova V.M. English for students of a correspondence department of technical colleges: education guidance. – Ufa: UGNTU publishing house, 2015. – 214 p.
2. Rakhmanova V.M. English for technologists: the education guidance for first-year students of the specialty // Chemical Technology of Organic Substances. – Sterlitamak: UGNTU publishing house, 2012. – 140 p.
3. Rakhmanova V.M., Fayzrakhmanov L.A. A motivation problem in the professional oriented teaching a foreign language // Actual problems of chemical technology and training: materials All-Russian scientific and practical conference. – Ufa, on September 28–29, 2006 – P. 92–94.

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**STAGES OF TRANSPOSITION  
CONVERTING RUSSIAN VERBS  
OF INDICATIVE MOOD  
IN THE FORM OF THE 2<sup>ND</sup> PERSON  
INTO PARENTHETICALLY MODAL  
WORDS AND PHRASES**

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The paper explores the gradual nature of transposition converting verbs in the form of the 2nd person of the indicative mood into an inter-part-of-speech semantico-syntactic category of parenthetically modal words and phrases. The authors define the characteristics of the word forms, representing different stages of modalation: A (the core set of verbs with modally complicated semantics manifesting a range of typical differential properties of a given part of speech); Ab (a periphery of verbs, expressed by word forms in the function of the main predicate of the complex sentence with subordinate complement clause); ab (zone of hybrid verb-modal structures in the function of the predicate and parenthetically-modal component of the utterance); aB (periphery of verbal modal words in the function of the introductory component of semi-compound sentences) – B (the core set of parenthetical modal words that are no longer in semantic connection with initial verbal lexemes). The results of the study can be used to create transpositional grammar of the Russian language, and to teach morphology and syntax of modern Russian language in higher school.

The investigation of mechanisms transposing linguistic units of different parts of speech into an inter-part-of-speech semantico-syntactic category of parenthetically modal units is one of the crucial tasks of the Russian transpositional grammar (see for instance [4–8]). Recent research demonstrates that this process involves nouns, adjectives, adverbs, verbs, etc. A significant group of parenthetically modal words and phrases is represented by verbs in the predicative (*видишь, говорят, посудите –*

*you know, they say, judge for yourself, etc.*) (1), substantive (*видать, знать – looks like (perhaps), probably, most likely etc.*) (2), attribute [short past participle as part of an analytic passive *не в обиду будет сказано – no offence meant*; adjectivised form: *видимо, знамо (дело) – apparently, undoubtedly etc.*] (3) and semi-predicative representations (*откровенно говоря, грубо выражаясь – frankly speaking, putting it bluntly, etc.*) (about the concept of representation of the Russian verb see [1, p. 94–115]) (4). Cf. contexts of modulation:

1) (a) *С особенной яростью, говорят, он выбрасывал из лодки ошибочно попавших к нему русских с недопротитым металлическим рублём в кулаке* (Ф. Искандер. Курортная идиллия);

(б) *With special fury, they say, he was throwing out of the boat the Russians with metal under-drunk-away rouble in their fists, mistakenly taken by him* (F. Iskander. Holiday resort idyll);

2) (a) *Война продолжается и долго, видать, ещё не кончится* (В. Астафьев. Обертон);

(б) *The war goes on and is not going to end soon, you know.* (V. Astafyev. Overtone);

3) (a) *Собственных детей у него, видимо, не было* (А. Волос. Недвижимость);

(б) *He has not apparently had children of his own* (A. Volos. Real estate);

4) (a) *Я же, мягко выражаясь, был чересчур общителен* (С. Довлатов. Заповедник).

(б) *I, on the contrary, putting it mildly, was too sociable* (S. Dovlatov. Wildlife reserve).

#### Results and discussion

A special subgroup among modalates are formations correlative with verbs in the forms of the 2nd person of indicative and imperative moods. They are characterised by parenthetical modal use in an independent position and in stock phrases (cf: *видишь / видишь ли; знаешь / знаешь что*) – *see / you see; you know / you know that*). The verbal modalates of this type allow the subject of mode (modus) to focus the listeners' attention on certain aspects of information (*you understand, you imagine, you know, etc*) (5), to assess the degree of its authenticity (*perhaps, probably, looks like, most likely etc.*) (6), and being included in a parallel process of interjection – to express emotional attitude to the stated facts, for instance, feelings of dissatisfaction, indignation; cf: (*don't you see, don't you understand etc*) (7). Cf.:

5) (a) *Мне воздуха нужны, а не советы! Грины, понимаешь? Повторяю: день-ги!* (А. Волос. Недвижимость);

(б) *Pieces of air I need, not pieces of advice! The greens, you know? I repeat: the mo-ney!* (A. Volos. Real estate);

6) (a) *Но с этим командиром, пожалуй, никакого отдыха не получится* (В. Быков. Болото);

(б) *But with this commander, I suppose, we will have no respite at all* (V. Bykov. Swamp);

7) (a) *Я прошлый раз с верхотуры сорвался, позвоночник повредил и то себе не позволил.*

А у неё, **видишь ли**, голова! Тебе что, ей думать? (Г.Я. Бакланов. В месте светлом, в месте злчном, в месте покойном).

(б) *Last time I fell from the upper bed boards, damaged my spine but even didn't let it to myself. And she, **you see**, has a headache! You don't need it here to think with?* (G.Y. Baklanov. In the light place, in the bad place, in the quiet place).

Transposition of finite forms of verbs such as *you see/ don't you see* into the inter-part-of-speech semantic-syntactic category of parenthetically modal words and expressions has a gradual character. The main stages of their modalation can be represented graphically as the links of a chain on the transitivity scale: [A / V(erb) (core of verbs) – Ab / V(erb) m(od) (periphery of verbs) – Ab / v(erb) m(od) (zone of hybrid verbal-modal structures) – aB / v(erb) M(od) (periphery of modal words) – B / M(od) (core of modal words)]. The links of scale manifest, on the one hand, the initial and final points in the movement of word forms from verbs to modal words, and on the other hand, the zone of syncretism with peripheral and hybrid structures that synthesise in different proportions attributes of interacting words classes. We shall illustrate the stages of modalation of the verb *you see* with a few comments.

**Stage A / V(erb)** introduces contexts with prototypical (nuclear) word form manifesting a number of basic differential attributes of the verb as part of speech in the position of a principal member in a mononuclear sentence; cf. a typical context:

8) (а) *На фронте какие-то секунды **видишь** освещённый край немецкой обороны, но, когда ракета сникает и полоса погружается во враждебную темноту, память в мельчайших подробностях восстанавливает только что увиденное, расширяет высвеченный на секунды круг – и человек ночью видит то, чего не узрел ясным днём* (А. Азольский. Облдрамтеатр).

(б) *In the lines you can **see** the illuminated edge of the German defense for a few seconds, but when the pistol-light goes out and the strip gets immersed in a hostile darkness, the memory in minutest details restores what has just seen, extends a circle flashed out for a second – and the man at night sees what he didn't see clearly in the daylight* (A. Azolsky. The regional dramatic theatre).

The stage **Ab / V(erb) m(od)** presents the contexts with the peripheral verbal word form making, relatively speaking, a step towards parenthetically modal words and expressions. Such a word form often functions as a principal member in a structurally incomplete main body of a complex sentences, in which there is a complement clause with a conjunction *that*. Cf. typical context:

9) (а) ***Видишь**, что старшего товарища заносит, и сидишь, как воды в рот набрал* (А. Маринина. Последний рассвет).

(б) **You see (are aware)** that your elder companion is going over the top with it, and keep sitting as if clamp up (A. Marinina. The last dawn).

**The stage ab / v(erb) m(od)**, introducing contexts with intermediate (hybrid) word form falls into two substages: **ab / v(erb) m(od) 1** and **ab / v(erb) m(od) 2**:

Substages **ab / v(erb) m(od) 1** correspond to the contexts with prepositional usage of hybrid *see* in asyndetic complex sentences with explanatory relations between predicative parts, punctuated by “colon”.

10) (а) ***Видишь**: я её люблю до безумия... и я думаю, я надеюсь, она также меня любит...* (М.Ю. Лермонтов. Герой нашего времени).

(б) ***See**, I love her madly... and I think, I hope she also loves me...* (M. Yu. Lermontov. A hero of our time).

The word form *see* is the principal member of the mononuclear predicative structure of a complex sentence.

The substage **ab / v(erb) m(od) 2** depicts the contexts with prepositional use of a hybrid *see* in transitional constructions, synthesising attributes of an asyndetic complex sentence and a simple sentence with complicating introductory component. Parts of such sentence are separated from each other by a comma:

11) (а) ***Видишь**, ни то ни сё, тридцать семь и две* (А. Солженицын. Один день Ивана Денисовича).

(б) ***See**, neither this nor that, thirty seven and two degrees centigrade* (A. Solzhenitsyn. One day in the life of Ivan Denisovich).

In such contexts the hybrid used prepositively combines in almost equal proportions the properties of a verb [the meaning of action, expressed in categories of aspect, voice, mood, time, and person; the category of number; the syntactic role of a principal member in a sentence, etc.] and a modal word [a sentence with subjective modal meaning of the logical evaluation of the stated in the function of an introductory component; specific prosodic pattern: faster speech rate, a lower tone of voice, etc.]. Syncretism is manifested in such cases not only through the hybrid, verbal-modal word forms *see*, but also through the syntactic structure in which it was used. Its transitional nature is due to the synthesis of properties of an asyndetic complex sentence and mononuclear complicated sentence, with a separate introductory construction.

It should be added that in a parenthetical situation grammatical forms of hybrid *see* have two types of use:

a) an opposed one (person, number; cf: *видишь / видите; видишь / вижу – you see / I see*; without the form of the 3rd person in the parenthetical modal use: *\*видит, \*видят – \*he sees \*they see*;

b) a settled one, determined by the context of parenthesis (aspect, voice, mood, time) (about the types of grammatical forms, see, for instance [2, p. 97–102; 3, p. 34–36]). The latter is accompanied with the isolation of the forms of active voice, indicative, present time of the relevant categories, their syntactic isolation.

The stage **aB / v(erb) M(od)** is represented by the contexts with a peripheral modalate that does not break the semantic identity of initial verbal lexeme. It is always in an inter – and rarely in a postposition, acting as an introductory component of a simple sentence with a complicating component:

*Эту задачу, видишь, нам сейчас не решить, давай отложим ее на завтра.*

*This task, as you see, we are unable to solve now, let's put it off till tomorrow.*

The modalate *see* retains the syncretism of a verb and a modal word properties to the stage **aB / v(erb) M(od)**.

The stage **B** introduces the contexts of use of a core (nuclear) modalate *see*, that has lost a semantic link with the verb *to see* which occurs most often when used with a particle *if/whether*:

12) (а) *Это, видишь ли, не так просто, как может показаться на первый взгляд...; Видишь ли, малыш, если бы я жил три жизни, я бы одну просидел в тюрьме, другую – отдал тебе, а третью прожил бы сам – как хочю (В. Шукшин. Калина красная); Видишь ли, у Льва есть большой недостаток – он упрям (Ю. Трифонов. Дом на набережной); Есть, видишь ли, люди, которым очень не нравится город... (В. Шукшин. Печки-лавочки); Видишь ли, папа... – промямлил я, и вдруг меня осенило: Понимаешь, есть у меня дружок, он служит на научной шхуне (В. Аксенов. Пора, мой друг, пора); Демидов, видишь, и то знал через своих доглядчиков, что Юрко Шмель испытывает какой-то новый камень (П.П. Бажов. Шелковая горка).*

(б) *This, as you see, is not as easy as it might seem at first glance...; You know, buddy, if I had three lives, I would have lived one serving time in prison, the other one I'd have given to you, and the third one would have lived myself – the way I want to (V. Shukshin. Cranberry bush); You see, the Lion has a big drawback – he is stubborn (Yu. Trifonov. The house on the embankment); There, you see, are people who really don't like the city... (V. Shukshin. Pechki-Lavochki); You see, dad... – I mumbled and suddenly it dawned on me: you know, I have a friend, he serves on the scientific schooner (V. Aksenov. It is high time, my friend, high time); Even Demidov, as you see, knew very well through his informers that Yurko Smel is testing some new stone (P.P. Bazhov. Silk hill).*

All stages of modalation (except the zone of a core set of modal words and phrases) the verb *to see (you see)* remains the lexical semantics of perception, and the object of perception is in the range of vision of the participants of the dialogue. Cf. the depiction of a river with a sharp turn, in utterances with a finite verb, representing different stages of the transitivity scale:

The stage **A / V(erb)**: Can you **see** a sharp turn of the river ahead? (a core (nuclear) verb-predicate with complicated modal semantics) → Stage

**Ab / V(erb) m(od)**: Don't you see that the river turns sharply to the right? (peripheral verb-predicate, representing the modus frame in the main part of the complex sentence) → Stage **ab / v(erb) m(od)** 1: **See: the river turns** sharply to the right. (hybrid verbal-modal formation in the predicate function that represents the modus frame in the first predicative part of an asyndetic complex sentence) → The stage **aB / v(erb) m(od)** 2: **See, the river turns** sharply to the right? (a hybrid verbal-modal formation in the syncretic function of a predicate and an introductory word representing a modus frame in the transient structure, where properties of an asyndetic complex sentence and a simple sentence with complicating introductory component are combined) → Stage **aB / v(erb) M(od)**: **the river turns** sharply to the right, **can you see?** (peripheral verbal modalate in the function of an introductory word representing the modus frame in a simple sentence with a complicating introductory component) → Stage **B / M(od)**: Well, **you know** the river once made a sharp turn there. *When we get there, you'll be able to see this...* (nuclear (core) modalate in the function of an introductory component of an utterance).

At the stage of the core set of parenthetically-modal words a verb completely loses the meaning of perception of a subject and the object of perception per se is absent at the moment of speaking: the comment clause *don't you know/ you know* acts here as a blank insert, which is used by a speaker to attract the attention of a listener to the given fact. Please, note that the extreme degree of semantic departure from the verbs under modalation are demonstrated by single formations with the meaning of assumption *looks like (I know him); perhaps (he's right); most likely (he will come, if promised)*.

At the stage **B / M(od)** the desemantised modalates such as *see/you know* can fall under the influence of other classes of words – interjections, conjunctions and particles.

Thus, in case of parallel interjectionalisation the verbal modalates become functionally closer to etiquette (6) and emotive interjections (7), positioning themselves in the area of interaction between two parts of speech (verb, interjection) and inter-part-of-speech category (class) of parenthetically modal units. Cf.:

13) (а) *К сожалению, я не приду. Сегодня, видишь ли, я обещал быть на дне рождения моего друга (просьба извинить, простить за вынужденный отказ);*

(б) *Unfortunately, I won't come. Today, you know, I promised to be at the birthday party of my friend (a request to excuse, to apologise for the enforced refusal);*

14) (а) *Устал он, видите ли, а остальные не устали? (выражение возмущения, негодования по поводу чего-либо).*

(б) *Tired he is, you see, and the rest are not? (an expression of indignation, outrage about something).*

Interjectivisation of word forms such as *excuse me...*, *I apologise* can be seen in cases when the speaker expresses a feeling of regret, trying to soften the listener's reaction to negative information about him:

15) (a) *Да что вы, Захар Миронович, вы еще, простите, па-ца-ан!* (Д. Рубина. Белая голубка Кордовы).

(б) *Indeed, Zakhar Mironovich, you are, excuse my words, young-ster!* (D. Rubina. White female dove of Cordoba).

Functional convergence with emotive interjections occurs in cases when the speaker tries to establish contact with the interlocutor and simultaneously express the emotional attitude of protest, disagreement with something:

16) (a) *Извините, но на подобную ерунду у меня нет времени!* (В. Попов. Очаровательное захолустье).

(б) *I do apologise, but for such nonsense I have no time!* (V. Popov. A charming lonely spot).

In case of parallel conjunctivisation the verbal modalates express the meaning of assumption, and functionally are getting closer to concessive conjunctions such as *although; though*:

17) (a) *А пожалуй, все еще может измениться – рано делать выводы (≈ 'хотя')*.

(б) *And perhaps, everything may change – too early to draw conclusions (≈ though)*.

In case of parallel particulation the verbal modalates are used with pronouns that developed the qualitative semantics, and are getting functionally closer to emphatic particles:

18) (a) *Знаешь, какое там было напряжение...*

(б) *Just imagine what tension there was...*

#### Conclusion

From what has been stated so far it follows that the modalation degree of finite forms of verbs such as *you see* vary in different contexts, which is proven graphically by the scale of transitivity. The semantic shift from the verb is far more evident with involvement of word forms into several transposition processes at the level of parts of speech and inter-

parts-of-speech category of parenthetically modal units, i.e. when combining modalation with interjectivisation, conjunctivisation and particulation.

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#### References

1. Bulanin L.L. Structure of the Russian verb as part of speech and its grammatical categories. Disputable issues of Russian linguistics. Theory and practice. – Leningrad, Leningrad State Univ. Publ., 1983. – P. 94–115.
2. Bulanin L.L., Knyazev Yu P. Neutralisation and privative morphological oppositions. – Bulletin of Leningrad State Univ. Series: history, language and literature, 197. – P. 97–102.
3. Shelyakin M.A. Morphology of modern Russian language (Noun. Numerals). – Tartu, 1989. – 259 p. (pp. 34–36 – on types of usage of morphologic forms).
4. Shigurov V.V., Shugurova T.A. On some of the principles of describing phenomena of transposition and syncretism in the theory of parts of speech. Fundamental research. – M., 2014. – № 9 (vol. 2). – P. 463–468.
5. Shigurov V.V., Shugurova T.A. Modalation of participial verbs forms in the Russian language: form, reason, pre-requisites. Fundamental research. – M., 2015b. – № 2 (vol. 26). – P. 5972–5976.
6. Shigurov V.V., Shigurova T.A. Parenthetical-modal type of using finite verbs in the Russian language. 8S-ASS04 // Asian Social Science, 91-CCSE. Canadian Center of Science and Education. – 2015. – Vol. 11, № 8. – P. 292–298. [Retrieved from www.scopus.com].
7. Shigurov V.V., Shigurova T.A. Modalation of verbal adverbs in the Russian language // European journal of natural history. – 2015. – № 4. – P. 57–59.
8. Shigurov V.V., Shigurova T.A. Types of use of Russian infinitives in syncretical contexts of modalation, predicativation and conjunctivisation // Wschodnioeuropejskie Czasopismo Naukowe (East European Scientific Journal). – 2016. – № 6. – P. 181–185.

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*Materials of Conferences***MODELING OF OPTICAL TELESCOPE DEVELOPMENT BY ENVELOPE CURVE**

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Among the others methods of technical predictive modeling and scientific forecasting envelope curve method deserves special attention [1, 2]. The main advantage of this method is taking into consideration both evolutionary development and revolutionary development of optical telescope characteristics on account of combining local evolutionary development trends into one overall trend.

Applying of envelope curve is grapho-analytical method and its main idea is to get overall trend curve (macrovariable) by smoothing of the particular curves (microvariable) of evolutionary development and extend this trend to the future. Plotting of envelope curve is based on the following non-strict assumption: Macrovariable changes are rather slowly, smoothly, continuously and without any spikes compared to microvariables. The main aim of the method is the detection of the most probable date of switch in technologies evaluation. It also means that new products with advanced characteristics (by using results of fundamental and applied researches) will be developed as well.

Envelope curve can be plotted by smoothing of polyline that is composed of tangent lines to the particular curves [3]. In a particular case envelope curve can be defined as curve that has tangent line to the one of assembly of particular curves at each point of its space. However specific definition of envelope curve is impossible as well as this curve can't be plotted unambiguously.

Accuracy of such scientific forecasting depends on main parameter choice. This parameter should

comprehensively characterize development of whole technical system at once. Hence first of all quantitative parameter  $P$  should be chosen.

Technical systems' development is either evolutionary or revolutionary. It means that development goes by increasing some quantitative parameter as far as face limit. After system's parameters get close to this limit, revolution switch in technologies, which gives birth to new quantitative parameter race within the new technology, occurs. It should be noted that limits could be difficult to evaluate and sometimes requires deep fundamental researches. There are many possible reasons to get into limitation: physical, technical, economical, law.

When new technology occurs, switching to it always isn't instant. Previous technology goes on its development dramatically fading away in light of inertia of interest. Genrikh S. Altshuller noted that inertia of interests consists of financial, science (pseudoscience), career and simple human (anxiety of losing accustomed system) interests. Thus economical factor adapts to such inertia of interests and system stays efficient through exploitation of nature resources [4]. Thereby two development curves can exist in one time: the one that is increasing and second one that is fading away. Also it should be noted that usually characteristics of new technology is lower than characteristics of previous technology at the beginning. However this compensates later due to higher level of parameter limitation.

In this paper the authors try to predict the development of optical systems on the example of optical telescopes to 2050. It should be noted that in this work we use only linear sections of optical telescope development curves. It is made because of lack of precise information about optical telescope characteristics especially for the initial stages of development. Information about highlighted stages is shown in Table.

Optical telescope development stages

Stage	Dates, years	Type of telescope	Variable quantitative parameter
I	1609–1686	Refracting telescope	Diameter, focus distance
II	1668–1800	Reflecting telescope	Diameter
III	1747–1897	Refracting telescope with different kinds of optical glass	Diameter
IV	1880–1948/1975	Reflecting telescope with glass mirrors	Diameter
V	1979–2018	Reflecting telescope with adaptive optics	Diameter of each element (adjustable optics), quantity of elements, speed and precision of calculations

Thereby it could be considered that there are five revolution switches in optical telescopes development history. Each of this stages accompanied by technology switch (from refracting telescope to reflecting telescope and back again when new technologies were developed). Diameter increasing was the main tool within every stage before it got into limitation. During the first stage people didn't know about the possibility of different optical glass combination. This fact resulted in optical telescopes with length about tens of meters, complexity of installation and alignment led to the limitation of diameter increasing. During second stage length was reduced by using mirrors in optical system. The largest mirror of this stage had a diameter of 126 cm; further increasing of the parameter was technically difficult. Besides this fact at this time already began to emerge optical telescopes with combination of optical glasses with different refracting index. The more detailed history of optical telescopes development is described in [5].

As mentioned above the main difficulty of this method is in choosing of parameter that will be used in forecast. In case of optical telescope on the one hand parameter "optical resolving power" could be used. This parameter ranges from 6<sup>m</sup> (human eye) to 30<sup>m</sup> (modern optical telescopes).

However object should be observed clearly and without distortion. Thus parameter "angular resolving power" could be used. This parameter ranges from 1' (human eye) to 0,1 (modern optical telescopes).

Hence we can conclude that it is not enough just to observe object (optical resolving power) it is also necessary to resolve fine details of object (angular resolving power). Thus and so we propose using the integral parameter  $P$  that takes into consideration both optical resolving power and angular resolving power. This parameter can be calculated on the basis of expert estimations and its starting point matches with the first stage beginning. At this point the parameter  $P$  is assumed equal to 5,5. At stage I parameter  $P$  varies within 5,5–8, at stage II in the range 6,5–11, at stage III within 8–14, at stage IV within 12–22 and at stage V within 17–29.

In this case as envelope curve we assume most smooth curve of possible that related to all or most of the individual optical telescopes development curves, some located at short range and some overlap. Analytically this dependence can be expressed in the following equation:

$$P(t) = 10^{-6} \cdot 2^{0,016(t-485)} + 7,5.$$

Initial equation was obtained by build-in MathCAD approximation function; its accuracy was in-

creased by iterations of its coefficients. Resulting dependence has exponential shape. Other shapes may be possible for other technical systems: quadratic, logistic, linear, logarithmic. It depends on specificity of technical system and can be chosen directly in the course of forecasting.

Based on presented analysis, the following conclusions:

- It is advisable to use integral parameter for technical predictive modeling and scientific forecasting. Such integral parameter represents functional characteristics of whole system rather than specific technical parameters.

- Integral parameter has stable growth compared to individual technical parameters.

- Based on obtained forecast we are able to predict that by 2050 integral parameter reaches the value 42. That means that we can expect different combinations of optical resolving power and angular resolving power values. For example, one of possible combination sets optical resolving power parameter value equal to 34<sup>m</sup> and angular resolving power parameter value equal to 0,005 seconds of angle.

- There is high probability that by 2050 revolution technology switch will have place.

Performed research shows that using envelope curve as method of technical predictive modeling and scientific forecasting is an excellent way of forecasting. It most completely takes into consideration both evolutionary development and revolutionary development of technical systems.

Such scientific forecasts can be the reason of early recognition of next-generation technologies as the result of reverse influence of technological forecast on technical system development.

## References

1. Martino G. Tekhnologicheskoe prognozirovanie. – M.: Progress, 1977. – 592 p.
2. Ayers R.U. On Technological Forecasting. Report HJ-484-DF. Hudson Institute. – N. J. 1966.
3. Babich T.N., Kozeva I.A., Vertakova Y.V. Prognozirovanie i planirovanie v usloviyah rynka. M.: INFRA-M, 2012. – 336 p.
4. Altshuller G.S. O prognozirovanii razvitiya tekhnicheskikh sistem // Oficial'nyj fond G.S. Al'tushullera. – URL: <http://www.altshuller.ru/triz/zrts3.asp>.
5. Sergeev A.N. Teleskopy: ot stekol k lazeram // Vokrug sveta. – 2009. – № 10. – URL: <http://www.vokrugsveta.ru/vs/article/6782/5>.

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