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CONTENTS

DEVELOPMENT AND METHODOLOGY OF NATIONAL SCIENTIFIC SCHOOLS AND EDUCATION IN AZERBAIJAN

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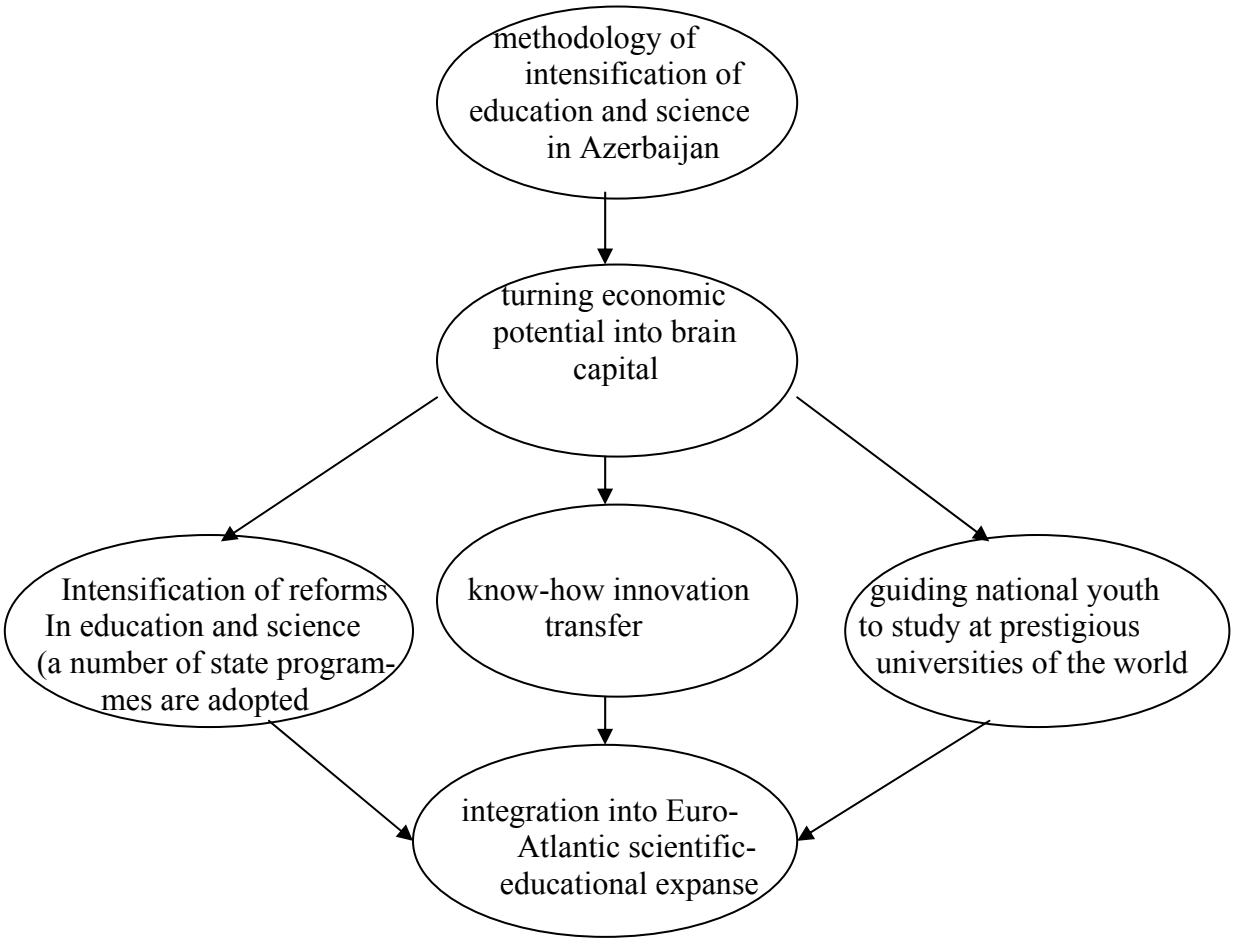
In present-day world science and education are the key spheres of development of assuring success in market competition and basic means to improve the efficiency of production and upgrade goods and services. The share of new knowledge embodied in technology, facilities, personnel organization, management in developed countries is 70-85% of gross domestic product [1]. Transition to continuous innovative process in management practice at all levels has become a key feature of present-day economic growth as well. All these will surely increase the significance of state scientific and technical, innovative and educational policy specifying general conditions for scientific and technical progress in different countries. It's almost a regularity in macroeconomic competition that the countries making favourable opportunities for scientific investigations and scientific and technical progress overtake. However, organization and development of such a medium accomplish a number of interrelated tasks. Among them organization and development of scientific schools capable of uniting the process of education and fundamental science hereby maintaining the unity of educational and scientific work are of great significance. The existence of scientific schools fosters progress of science and formation of creative, scientific personnel. They provide the continuity of not only conceptual and methodological knowledge but also research experience, values, the tradition of scientific activity. Specificity of scientific schools is the output of new information applied not only in economic behaviour but also directly in academic activity, particularly in postgraduate and doctoral studies. Scientific schools form their area of scientific research adjusted to past experience and coordinated to modern demands. In other words, a scientific school can be characterized as an institute - "reproduction" of generation of scholars that includes inflow and selection of talanted youth. Another characteristic feature of scientific schools is that they are continuously innovative centers of activity. Most commonly, the pivotal figure of a scientific school is its leader combining scientific-pedagogical abilities with organizer responsibilities, bringing together creatively gifted people, the like-minded. All the while, it is not a secluded but an open organization for competition of ideas and criticism [2]. As a result, a single scientific course can advance several scientific schools. Discordance of attitudes and opinions among them, including on an international scale, maximizes scholars' creative output and inspires scientific discoveries. Scientific achievements and the significance of the gained results of scientific schools are determined, first of all, by the recognition of their activity. National and international recognitions are notewothy here. Nevertheless, before receiving international recognition, absolute majority of scientific schools function on national scale and within national system of interests with the support of their states. [3] Development of scientific schools, particularly in the countries of transition economy, substantially depends what policy the state pursuits. Herewith, scientific policy of the country must consider the following factors: national aims and their realization by means of present-day scientific achievements. These factors favor state support for the establishment and development of scientific schools. Throughout the history of science, appearance of vivid personalities in clerisy and scientific school has always been associated with rapid development of some or other science discipline that is predetermined by public interest. Determination of these interests allows us to find out the directions that national scientific schools are established upon. This will be one of the most efficient forms of managment through science, that in essence results in the management by research team that also includes scientific schools as a particular case conductive to high intensification of intellectual work. As a whole, a scientific school is evaluated as irreplaceable national wealth

that, on the one hand, preserves intellectual potential of the country, on the other hand, presents itself as the producer of new ideas and discoveries, favouring social-economic progress of the country. From this point of view, quite relevant is the President of the Azerbaijan Republic Ilham Aliyev's quote "turning economic potential into brain capital". Its realization requires availability of professional, competent skilled group satisfying international criteria whose background has two principal directions; within the country and beyond its borders at the most prestigious universities. The very synthesis of these two directions i.e. cooperation of trainers of national and foreign scientific, educative schools will advance the development of economy, science, education and social sphere.

A developed country has to be both the exporter and importer of scientific achievements. we should take into account, that the development level of science to a large extent determines the efficiency of economic activity, defense capability, intelelctual and political culture of the population, protection of a person and society against adverse factors generated from economic globalization. Herein domestic and international scientific potentials need distinguished support. Only suchlike exchange can condition favourable environment for healthy competition and enterpreneurship in the spheres of science and technology, stimulation and support of innovative activity. Today, we can speak about the establishment of world science in its most various manifestations: body of knowledge, information technologies, communicative features. The more science and education intensify, the more they deviate from classical structures and methodologies. It's noteworthy to state, that methods of global cooperation at all levels are devised namely in science: amongst governmental bodies, educational institutions, scientific schools, individual scholars. Presently, the latest presentations of the achievements of science and technology are widely implemented and spread – scientific-technological parks (technoparks), technology transfer centers, support of innovations, exchange of scientific information. Alongside with the technical sciences, humanitarian ones such as history, culture, traditions, people's behaviour in different states are also included into the sphere of international transfer, that founds new approach to international relations as the interaction of the civilization carried out by cross-cultural management.

All the mentioned processes are characteristic for Azerbaijan as well, where critical measures have been taken and remarkable results are received in the reconstruction of economy, social sphere, education and science in accordance with the market demands. The country intensively integrates into the international economic system, stabil political and economic environment is established. Further development in the stated sectors requires corresponding development of education and science and the implementation of the latest technology. On this basis, considerable steps are taken both in the development of national scientific schools, education system, introduction of advanced technology and all-round application of foremost international practice in the specified spheres and integration into global educational space. Such topical questions as highgrade management in the field of higher education, joint academic programmes, cooperation of universities with industry sector and local communities, IT&C for network establishment among universities, advanced teaching and study of technology are on the agenda. Greater attention is focused on the recruitment of young staff educated at higher educational establishments abroad that corresponds to the public educational political course of the Azerbaijan Republic. In this respect it bears to mention, that in 2007 Ilham Aliyev, the president of the Azerbaijan Republic issued a decree on the state sponsorship of 5000 students' education at leading universities of the world (4) i.e. all the best is done to conform the utterly poor inherited from the former regime technological infrastructure of education with the state of the art international standards. All this hard process, demanding considerable financial and intellectual investments is carried out pursuant to the following chart which presents intensification methodology of education and science in Azerbaijan.



This process embraces intensification of reforms in the spheres of education and science, innovation transfer such as know-how and guiding national youth to study at prestigious universities of the world, that will serve the country to advance and integrate into Euro-Atlantic scientific-educational expanse.

Despite the difficult problems – Azerbaijan-Armenian conflict in Nagorno Garabagh lasting over 2 decades, over one million refugees and internally displaced people, the country considers the development of science and education to be one of its most important directions of activity. About 25% of the state budget is allocated on the advance and material-technical supply of these fields. The most spectacular example of the priority of science and education in the domestic policy of Azerbaijan can be cited the fact that, within the last few years millions of euro were appropriated for workout and development of scientific researches of applied relevance and purchase of unique in South Caucasus facilities such as Cary Eclipse spectrofluorometer, atomic-force microscope, NMR, chromaspectrometer, spectrometer Furye, SF spectrocopy Perkin Elmer, derivantograph Q-1500, atomic-adsorptive analyzer, APEX II X-ray diffraction meter. The government of the country does its best to computerize all the schools, improve social welfare of teachers, appointment of motivation in education, realization of different programs and projects in the sphere of education.

The decision on the orientation of setting European education system as “international quality benchmark” adopted by European Union in 2002 has become the initial stage of the perfection of education system. All the participant states brought national legislation pursuant to the principles and goals of Bologne process.

After issuing the declaration of joining Bologne process by in 2005, Azerbaijan universities extensively join Bologne declaration, that enables to construct a more promising expance of solidarity in the sphere of European hisgher education. Even the conception of European expance of higher education itself places an emphasis on the actual from the point of view of social changes components of education and upbringing a new crop of graduates. Allround conversion of higher education establishments into two-tier system of education, implementation of credit system, workout of the Enclosures to diploma on European model, quality improvement of higher education, and evaluation system are being carried out and developed in the country. The problem of accreditation of higher educational establishments, recognition of diplomas, students' and teachers' mobility are worked out, "Exemplary conduct of organizing education process at higher educational establishments on the basis of credit system" is worked out by the Ministry of Education of the Azerbaijan Republic.

Students of Azerbaijan present themselves as active members of a number of international and regional associations of universities of different countries. Our scientists take part at such prestigious international scientific seminars and forums as "Forecast of disaster prevention and management in oil industry", "Nanomaterials and nanotechnology for sustainable development", "Safety through science", "The problems of integration into education and science and technology transfer in Black Sea region in the context of globalization", some of which were organized and held in Baku. In brief, large-scale work is carried out for comprehensive development of education and science, workout and imlementation of modern technologies, intensification of integration among higher educational establishments, supply of students with highgrade advanced education.

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ECOLOGICAL AND ECONOMIC PRECONDITIONS FOR CREATION IN A COASTAL ZONE OF CASPIAN SEA SHELF ARTIFICIAL REEF ZONES

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Shallow coastal part in ecosystem of Caspian Sea is more productive place for the formation of trade marketable bioresources. Anthropogenic activity on Caspian Sea water area, connected with the development of coalfield deposits, bears in itself potential threat for coastal ecosystem. The most dangerous situation can emerge in case of emergency oil spill. Small depths, wave dynamic, plenty of suspensions in coastal waters will promote fast emulsification, oil products sedimentation and their accumulation in ground deposit of shallow water.

The areas and their material and technical basis, where prospecting works or mastering and operation of deposits are directly carried out, on sea shelf, take up the limited areas. Their anthropogenic influence on an environment is local, and under the condition of ecologically pure technologies is not dangerous for ecosystem as a whole. Besides, highly productive local biocoenosis can become by force of anthropogenic loading on biota in places of liquidated holes. Next data of observation are the evidence of it.

Prospecting technology of hydrocarbon raw material stocks on a shelf of Caspian Sea covers construction and liquidation of searching- estimated holes. Their number is going up yearly. For example, there are 12 such holes in north part of Caspian Sea on a license area "Northern" and "Central-Caspian" of Public Corporation LUKOIL for the period of 2009. One of the features of holes liquidation is the installation on its head protection means which represents a concrete of platform 50-70 m^2 square.

Ground landscapes of Northern Caspian Sea and coastal shallow water of Average and Southern Caspian Sea are offered by monotonous "desert" on a greater part of (fig. 1). That is caused by presence of loose, mobile soils, which are deprived of a steady firm surface property. In those places where there are firm stable substrata of a natural or anthropogenic origin at the bottom, communities with a high biodiversity and a biomass of organisms develop (fig.2).

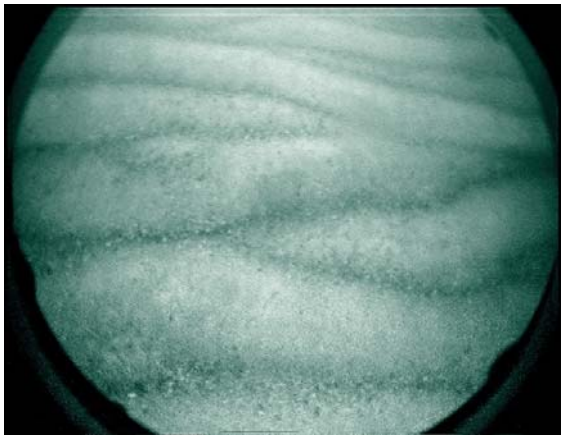

Fig.1
Typical landscape of Northern Caspian bottom, offered by loose, mobile soils

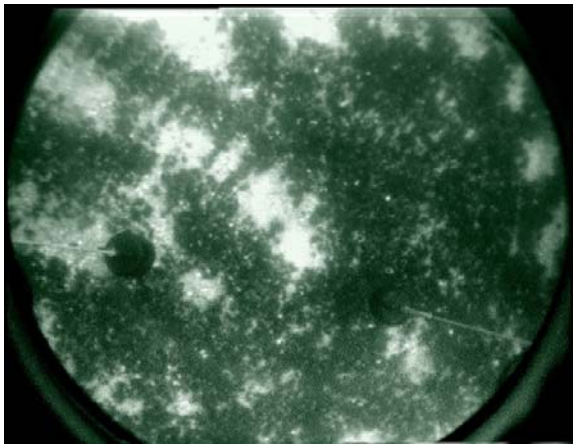

Fig.2
Bottom landscape by the stable soil.

The porous concrete plate, that being the close head of the liquidated hole, is ideal substratum for development of benthon organisms at all trophic levels from bacteria up to fishes. Many of inhabitants are capable to precipitate and decompose oil products. Underwater supervision on 12 liquidated holes, which were carried out in July 2008, has allowed receiving the materials testifying to the formation of such biocoenosis on security facilities - concrete plates. Unlike the communities living on background sites (fig. 3) the flora and the fauna which has generated on artificial substrata, had wider spectrum of kinds and number (fig. 4).

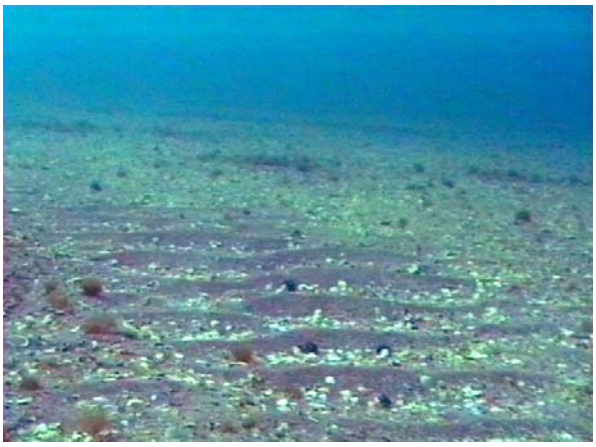

Fig.3
Phytobenthos assemblages over the hole «Shirotnaya 2»

Fig. 4
Phytobenthos assemblages on the plate's head of the hole «Shirotnaya 2»

Significant differences in tests were observed also on a hydrobionts' biomass (Tab. 1). As opposed to natural, on artificial substrata it was marked bright domination of separate classes, that corresponds to literary data [4]. For example, among the ground fishes populated concrete plates of head's holes dominated gobies whose density reached 20- 25 specimens/m^2 (Fig. 5, 6) in some cases.

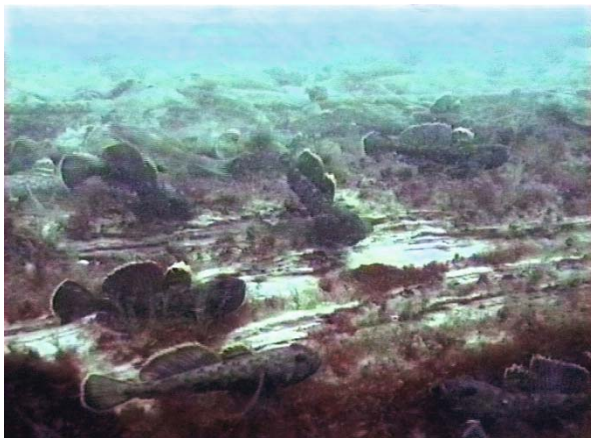

Fig. 5
Gobies gathering above hole's head "Rakushechnaya 1"

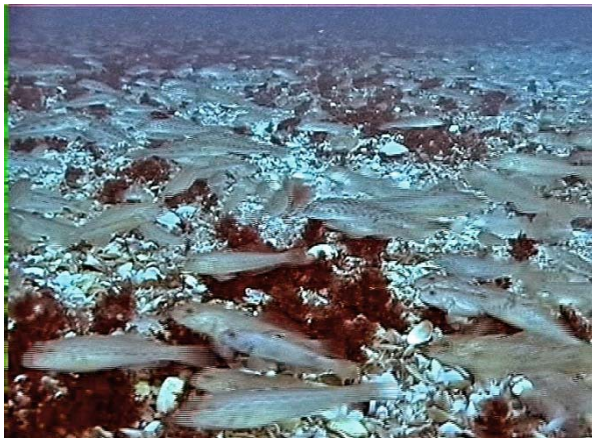

Fig. 6
Gobies gathering above hole's head "Sarmatskaya"

Mollusks dominated in benthon tests around of concrete plates at shallow stations, where depths made 7-15 m, in the temperature range of 22 24^{0}C. Crustaceans dominated at a depths of 25 - 30 m at the temperature 10,5 - 12^{0}C, among which the mass Caspian classes have received their greatest development reaching in these places as the much as possible known sizes [1].

Table 1

A comparative estimation of ground communities of the liquidated holes heads and background areas.

Monitoring station	Substratum presence	Water temperatupe, ^{0}C	General number of types	Species composition in association	Total biomass жив/раст. в г/м^2
Rakushechnaya 1	Concrete slab	24,5	14	Fishes - 3 Mollusk - 2 Crayfishes - 5 Worms - 1 Macrovegetation - 3	11,397/325
Rakushechnaya 2	Concrete slab	24, 7	18	Fishes - 3 Mollusk - 2 Crayfishes - 8 Worms - 2 Macrovegetation - 3	28,838/350
Rakushechnaya background	None	24,5	8	Fishes - 0 Mollusk - 3 Crayfishes - 3 Worms - 2 Macrovegetation - 0	22,53/ 0
Shirotnaya 1	Stab is washed off by mobile soil	23,8	10	Fishes - 3 Mollusk - 1 Crayfishes - 2 Worms - 2 Macrovegetation - 2	67,336/25
Shirotnaya 2	Concrete slab	24,2	13	Fishes - 4 Mollusk - 2 Crayfishes - 2 Worms - 2 Macrovegetation - 3	50,56/655
Shirotnaya 3	Concrete slab	24,5	14	Fishes - 5 Mollusk - 1 Crayfishes - 2 Worms - 2 Macrovegetation - 4	43,9/760
Shirotnaya background	Shell rock fragments	24,5	8	Fishes - 1 Mollusk - 2 Crayfishes - 1 Worms - 2 Macrovegetation - 2	23,4/315
Hvalynskaya 1	Concrete slab	10,5	12	Fishes - 3 Mollusk - 1 Crayfishes - 1 Worms - 4 Macrovegetation- - 3	12,31/790
Hvalynskaya 4	Stab is washed off by mobile soil	10,5	10	Fishes - 2 Mollusk - 1 Crayfishes - 3 Worms - 1 Macrovegetation - 3	14,22/245
Hvalynskaya 3	Stab is washed off by mobile soil	10,5	27	Fishes - 2 Mollusk - 1 Crayfishes - 10 Worms - 1 Macrovegetation - 3	79,534/190
Hvalynskaya background	None	10,5	7	Fishes - 1 Mollusk - 1 Crayfishes - 2	10,85/75

				Worms - 1 Macrovegetation- 2	

The results of the chemical analysis of a ground and near-bottom water above hole's heads on the presence of oil hydrocarbons are shown in table 2. It follows, that concentration of oil carbohydrates in all water tests did not exceed maximum concentration limit for fish industry reservoirs (0,05 mg/l). Here in the water tests selected on impact areas, concentration of oil carbohydrates was below, than in the tests selected on background areas (structures "Hvalynskaya", "Shirotnaya" and "Sarmatskaya"). Water tests on impact and background areas did not differ on the presence of oil carbohydrates only on structure "Rakushechnaya". It is necessary to note, that concentration of oil carbohydrates in all water tests was close to the background values registered earlier at carrying out of engineering-ecological researches (on materials of Open Company LUKOIL-Nizhnevolzhskneft). Obtained data unequivocally specify absence of pollution in a near-bottom water by oil hydrocarbons from the liquidated hole's mouth.

Table 2

Concentration of oil hydrocarbons in water tests (mg/l) and bed silt (mg/kg)

	Water		**Bed silt**			
Hole	**Impact area**	**Backgrounds area**	**Impact area**			**Backgrounds area**
Hvalynskaya 1	0,03	0,05	2,29	2,15	1,72	1,3
Hvalynskaya 3	0,01		0,41	1,45	1,18	
Hvalynskaya 4	0,00		1,73	2,16	1,87	
Shirotnaya 1	0,01	0,04	1,22	1,34	0,96	1,33
Shirotnaya 2	0,03		1,28	1,25	1,43	
Shirotnaya 3	0,03		5,02	6,12	5,33	
Rakushechnaya 1	0,04	0,04	1,15	0,93	0,78	5,14
Rakushechnaya 2	0,04		0,89	1,26	1,15	
Sarmatskaya	0,03	0,04	1,07	1,56	1,25	1,25

The structure analysis of pedon shows the differences both in species composition of hydrocole and in their productivity. Parameters of a biomass and of benthon-fauna biodiversity were always above on experimental stations on a substratum playing for many hydrocole the role of a refuge (crustacea), habitats (mollusk and crustacea) [2], duplication (goby fishes) [3]. An attractive effect was strongly pronounced because of food resources aggregation (detritus organic, macrovegetation, crustacea and so forth). In addition to that, it was observed depletion of pedon of background areas in comparison with the areas of hole liquidation. Here, the greatest development receive detritophagous animals (Nereis and Olygochaeta, Corophium) and some crustaceous, unlike rich epibioses fauna. Low parameters of filterer development in these areas (Mytilaster, Balanus) are caused by the absence of firm substrata. Fastening on soils, consisting of sand with shell rock, is complicated for the most accreter.

In addition, reef function of a plate promotes organic accumulation and gives facilities to rather plentiful development of macrovegetation, that increase accumulation of organic substance in turn. This fact was confirmed by the plentiful development pelophyte fauna (Oligochaeta, Polychaeta, some Cumacea, Gammaridae, and Corophium), whose variety and quantitative development is in the rough or surpass parameters on background areas.

Thus, complex biocenose of an artificial reef is formed in the area of holes liquidation, which formation occurs on a initial ground fauna which are filled up by typical accreter (Mytilaster, Balanus, Corophium) and some crustaceous (oder Cumacea, oder Amphipoda).

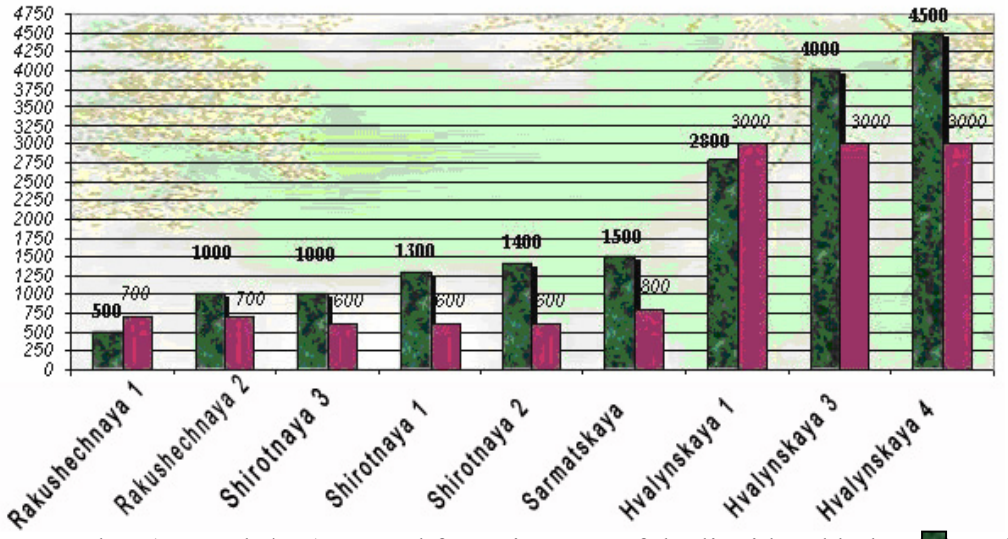

Fig. 7. Number (example/m2) ground fauna in areas of the liquidated holes (■) and on corresponding background areas (■)

The general biomass epibioses including macrovegetation can reach 1- 3 kg/m2 at mass development of a mollusca-accreter complex on an artificial substratum. The most part of community is capable to active clearing of water mass.

Two-year researches of ground fauna in areas of the liquidated holes show significant variability of ground communities owing to changes of habitation conditions (soils' moving, fluctuations of salinity, etc.). At the same time, epibioses' communities on the basis of Mytilaster, Balanus show relative stability of their characteristics under a steady condition of a firm substratum. For example, simultaneously with it variability of bottom-living crustaceous fauna, supplementing communities epibioses, is below than on deprived accreter complex areas . These facts create preconditions for successful realization of works on formation of the highly productive areas equipped with artificial reef substrata. Research of ecologically effective artificial reef constructions are carried out periodically since 80th years of the last century on Caspian sea [2,5]. Materials of our observations on formation on artificial substrata of the richest biocenosis have allowed creating special reef station which can become a basis for the formation of bioproductive zones (fig. 8).

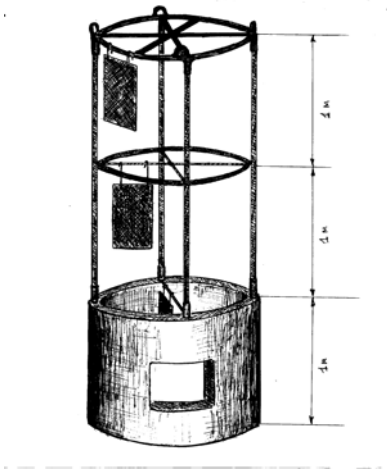

Fig. 8. Reef station for production gain water ecosystem.

The station consists of the concrete ring - the basis, above which the metal framework. Height of the station is 2 m, weight 300 - 500 kg.

The concrete ring is a substratum for the formation of the bottom level of communities. Its construction elements provide the formation of conditions for development of more bottom dweller.

Two top levels settle down on metal framework in water column. Their constructive elements are intended for the formation of the organisms of periphyton and phytobenthos.

Demountable registration platforms are located on all levels (0,5m2) for an estimation of diversity, of efficiency formed biocenosis on it and communities introduction in other areas of the sea, with the subsequent movement on such station. Depending on the purpose on each station level can be located up to 10 demountable platforms.

Internal space of the metal framework must be covered by polypropylene material or caproic seine with 5-6 mm mesh. The best results on a variety and a hydrocole biomass turn out as have shown researches at use in water column of these materials as a substratum [5].

The influence zone of reef stations on surrounding water area with the change of a landscape has radius up to 10m. The area of a zone with the raised efficiency makes more than 300 m2. The cost price of station is 3500 rouble. Service life is 45-50 years at use of reinforcement steel as a material for a metal framework. Service time is not limited at use of not corrosive materials. The station washing in a ground is excluded due to height of the concrete ring basis (more 1m) and special windows in it, provided for creation of the turbulent streams in conditions of the strong currents interfering accumulation of deposits around a ring.

Formation of the productive area, that has importance in fishing industry, must be carried out around of the liquidated holes on the basis of biopotential their communities by installation on a surface of a reef stations bottom on the certain removal from each other in the form of modules (fig. 9). For example, it is required 100 modules for the formation of a productive zone by the area of 1 km2 for the sum 1,4 million roubles.

The total biomass of epibioses on one module will make 400 kg at the rate of useful areas its constructive elements equal 200 m2 and average efficiency of 2 kg/m2. In the whole, ecosystem efficiency will increase only due to epibioses at an arrangement of 100 reef modules on 1 km2 in 2 months in the average on 160 tons. The cost price of 1 kg additional biomass will make 8,75 roubles.

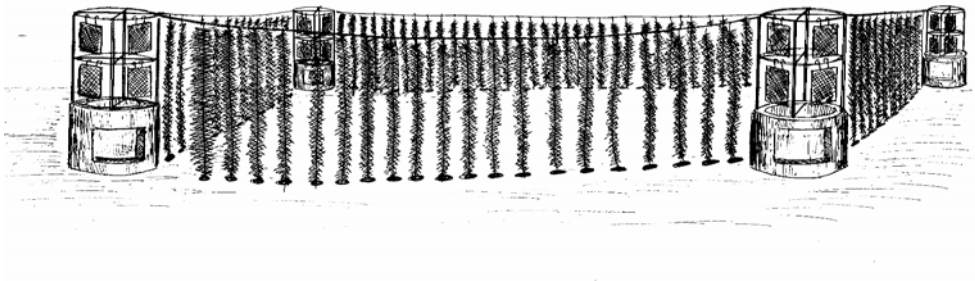

Fig. 9. Universal reef module for increase of ecosystem bioefficiency and self-cleaning of the aqueous medium.

Ecological safety of sea water areas is an important problem for the oil companies working on a shelf. Researches materials of self-cleaning biopotential ecosystem testify about the use of artificial reef constructions strengthens oil decomposition in 9,6-23,6 times. During vegetative period the reef 100 m long can decompose up to 500 kg of mineral oil (A.F.Sokolsky, N.V.Popova, etc., 2005).

The Caspian bioterrorism is not the resolved problem for many conservancy and fish industry during many years. Not authorized take of valuable fish kinds in the sea it is conducted by fixed gill nets. It will be planned to place reef modules at a distance 50 m from each other at reef zone formation by area 1 km2. That result in removal this area from fund of poachers because of statement any net and line trawls here will lead to their loss. Besides, this high-productive zone will influence on food migration of sturgeon fishes and to keep them in the protected place, considerably reducing probability of hit in nets in other places.

Thus, the formation the artificial reef zones opens the ways to increase fish capacity in seas, to creation feeding areas for fine kinds of fishes, to strengthening of biota resistance to oil pollution and bioterrorism suppression. The investment of the oil companies in this direction will give the greatest efficiency at moderate costs.

Fig. 10. Festival «Artificial reefs 2008» was in Astrakhan. On photo: fixing of symbolically state flags on reef module, carried out in form of Caspian sea.

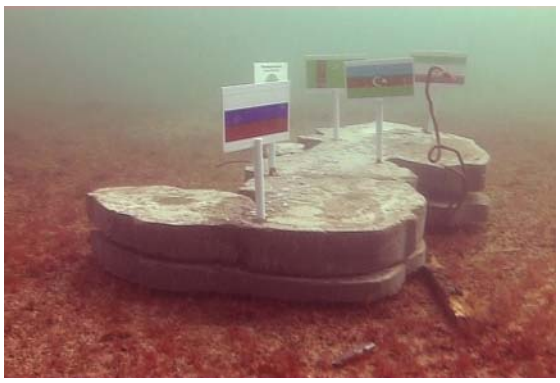

Fig. 11. Symbolically reef was placed at the border of Northern and Average Caspian sea.

The Caspian branch of Oceanology Institute and engineering company "Octopus" hold international youth ecological festivals for popularization of the idea of artificial reefs creation since 2006 on the Black, Azov and Caspian seas. Participation in such the action, having mass character, allows youth, scientists, the public to expand the international contacts in practice, to show knowledge, initiative, to receive practical experience, an opportunity to communicate with professional experts, scientific, deal with the ecology problems, to contribute to a common matter of preservation of sea ecology. The festival has been hold in Astrakhan in 2008. Commands from all pre-Caspian states (fig. 10) have taken part in it. Festival participants have made a symbolical reef in the form of Caspian sea, which heads of delegations have decorated with the state tags and have dipped on a sea-bottom on border of Northern and Average Caspian sea (fig. 11). Kazakhstan will pick up the baton of festival in 2009. And it should become kind tradition for all pre-Caspian states.

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FREE LIVING INFUSORIANS OF THE CASPIAN SEA

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The paper contains the results of researches conducted during more than 40 years on free-living infusorians (mikrobenthos, plankton, periphyton) of the Caspian Sea and the analysis of their species composition (545 species) is given. Distribution of infusorians on the main biotopes of the sea is analysed, influence of environmental factors on these organisms is considered and zoogeographical analysis of fauna is given.

Great amount of infusorian species are known at present. They play an important role in biology of seas and oceans. The zoogeographical analyses of the found out species shows that the fauna of infusorians in the various geographical areas possesses considerable degree of similarity of specific composition. Fauré-Fremiet (17) has suggested that the fauna is a cosmopolite. However, for the definitive decision of the given question the much interest represents studying of the fauna of infusorians of the seas with high degree of endemism of the fauna. One of such seas is the Caspian Sea. As the Caspian Sea has an original and peculiar geographic situation it is necessary to study its infusorians fauna. This question is of great zoogeographical and ecological interest. It is because of not only hydrological condition, but also hydrochemical peculiarities and the origin of this water reservoir.

Within the last 90 years nobody studied infusorians of Caspian Sea. The first data about Caspian Sea infusorians were met in the works of Grimm (11). But they were fragmentary and have become outdated. For recent years (1966-2007) we have published many scientific papers (1-10) devoted to the description of new and most typical species, and also containing data on specific composition and ecology of infusorians.

The material and methods

Investigations on free-living infusorians of the Caspian Sea involved depths down to 100 meters. In all sections 5 stations with standard depths (0,5; 10; 25; 50; 100 m) were done. Samples of mikrobenthos and fouling were taken from the surface layers of the ground and immovable objects (rocks, stones, submerged structure) by scoop or jar (in shoals), by special drag and Petersen dredge (in deep water). Samples of plankton were taken in an ordinary net of gas No 75 and in bathometer of Nansen. For studying of vertical migration of infusorians samples were taken in the ground with the piston tube (2 sm in diameter) and separated from the sand at a depth of 20 cm by the method of Uhlig (22,23). For studying of vertical diurnation samples of infusorians were taken 6 times in 24 hours (at 16, 20, 24, 4, 8, 12 o'clock) at the same place. Daily and seasonal variation in the periphytic infusorians fauna was studied quantitatively on experimental glass plates at standard depths of 0-5; 5-10; 10-15; 20-25 meters. There were collected and treated altogether 4800 samples. From them 1560 were quantitative samples.

Determination of infusorians of all ecological groups (mikrobenthos , plankton and periphyton) was carried out according to living material as a rule. For that purpose infusorians were placed on clean microscope slide in drop of water and examine under microscope. At the same time alive objects were sketched and measured.

Studying of the nuclear apparatus on temporary preparations with the help of acetocarmine or the acetic methyl green gives inexact results at the forms having small quantity of DNA in the macronucleus. Therefore the considerable quantity of total preparations has been made. For making of total preparations the infusorians were fixed in Nissenbaum's mixture (21) with doubled quantity of tertiary butyl alcohols against original formulation. Some infusorians fixed in Buen's mixture. Then the final mixture is transferred into the subject glass where some drops

of spirit and ether mixture have been added to (1:1); after all the smear is covered by 0.25 % solution of celloidin with the mixture of absolute spirit and ether and is stored in 70 % spirit for further treatment. With the purpose of studying of the nuclear structure three methods of coloring of fixed preparations are used: reaction of Folgen, sour hemalaun and methyl green – pironin by method of Unn.

For final determination and description of infusorians the method of Shatton and Lvov (16) was used.

This method helped us to obtain valuable information on external structure of infusoria. They were fixed in Shampi's mixture (5 mines) and then are processed within 2 hours up to 1 day (or more) by Da – Fano's liquid. Then infusorians transferred to distilled water for washing out and dropped on a thin layer of heated 10 % gelatin containing 0.05% NaCl. Then the preparation is dropped into cold 3% solution of $AgNO_3$ for 25-30 minutes, it is carefully washed by cold distilled water and is put on a white background in cold distilled water under a quartz lamp for 25minutes or under the sun for 1 hour. After that the final preparation is dehydrated and put in balsam. At the same time sand samples were taken for granulometric analysis and determination of content of organic substances and the temperature was measured as well.

Species composition and distribution of infusoria

The results of faunistic researches carried out within 1963-1983 were generalized in the monography "Infusorians of the Caspian Sea". It contains full species composition (439 species), description of all new species and forms, distribution peculiarities of infusorians in geographic areas, biotops and sea depths, and quantitative assessment of their number in the different biocenoses and zoogeographic analyses. Continuing studying of infusorians (mikrobenthos , periphyton, plankton) at the Western coast of Middle and South Caspian Sea (in the freshened gulfs – Lesser Kyzylagach, Agrahan and Davachi estuary, in supralittoral zone and adjoining islands) in addition has been found out 106 earlier not specified species of infusorians for Caspian Sea, 3 of which have appeared tobe new ones to a science. Thus the general list of ciliofauna of the Caspian Sea is brought up to 545.

All species found out in the Caspian Sea belong to 3 classes (*Kinetofragminophora, Oligohymenophora, Polyhymenophora*), 6 subclasses (*Gymnostomata, Vestibulifera, Hypostomata, Hymenostomata, Peritricha, Spirotricha*) and 15 orders (table 1).

Table 1

Structure and distribution of free-living infusorians of the Caspian Sea

Orders	Total amount of species	Caspian Sea			Gulfs	Supralittoral zones
		Northern	Middle	Southern		
Karyorelictida Corliss	44	24	28	37	18	16
Prostomatida Schew.	32	19	29	28	19	9
Haptorida Corliss.	64	27	42	48	29	19
Pleurostomatida Schiew.	19	12	17	19	12	12
Trichostomatida But.	9	4	9	8	4	3
Colpodida De Puit et al.	4	0	1	3	0	4
Synhimenida De Puit et al.	5	2	3	4	2	0
Nassulida Lank.	8	3	4	7	2	2
Cyrtophorida Fauré-Fremiet	33	16	18	28	9	4
Hymenostomatida Del.et Her.	13	10	11	10	6	3
Scuticociliatida Small	28	10	18	22	13	11
Peritrichida Stein	76	29	48	61	36	17
Heterotrichida Stein	26	14	16	25	11	12
Oligotrichida But.	46	20	35	45	23	3
Hypotrichida Stein	138	52	85	129	48	20
Total	545	242	364	474	232	135

As per table 1 the richest infusorian fauna was registered in the Southern Caspian (474

species), Middle Caspian occupied the second place (364 species) and the Northern Caspian the third place (242 species). Totally 227 species were recorded in the gulfs and 135 species in the supralittoral reservoirs. According to species composition the richest order was *Hypotrichida* with 138 species.

Thus, from the founded infusorians 396 species were registered in the mikrobenthos , 189 species in the periphyton and 168 species in the plankton. 25 species were new to science. Infusorians of the mikrobenthos were quantitatively and qualitatively different in the various geographical areas, coasts, gulfs and supralittoral reservoirs. There were registered 166 species (in the western coast-120, in the eastern coast – 86 species) in the Northern Caspian Sea, 267 species (in the western coast-210, in the eastern coast – 176 species) in the Middle Caspian Sea, 340 species (in the western coast-285, in the eastern coast – 198 species) in the Southern Caspian Sea. 139 species were common for all geographical areas.

More than 160 species of infusorians were registered in the mikrobenthos of the Caspian Sea gulfs and 103 species in the supralittoral reservoirs. Marine forms (75 species), brackish water forms (6 species), ultrahaline forms (5 species), fresh water forms (32 species) and ground forms (6 species) were registered in the supralittoral reservoirs.

In the mikrobenthos of the highly freshened gulfs (Lesser Kyzylagach, Agrahan and Davachi estuary) there were found out 97 species of infusorians (72,56 and 66 species respectively). Main background (about 70%) in the infusorians fauna of the gulfs was created by fresh water species. Most of marine forms were met in the Davachi estuary (32 species) (5).

ECOLOGY OF INFUSORIA

1. Benthic infusorians

In the mikrobenthos of the Caspian basin psammophilous fauna dominated in the whole. They make 73% of total number of species.

The recourses and structure of psammophilous infusorians were defined basically with the sizes of particles of sand (very fine, fine, medium and coarse). Fine heterogeneous sand is the richest in infusorians (Mo = 0,1-0,4мм). The fauna of psammophilous infusorians contains a lot of microporal, mesoporal and euryporal ecological groups. Number of infusorians is maximal in the top layers of the sandy ground (0-4 sm, 10-12 mln. ind./m^2).

The main representatives of studied fauna are typical microporal species. The following species can be related to this group: *Holophry caspica, Placus striatus, Lacrymaria coronata, Trachelocerca binucleata, Trachelonema oligostriata, Litonotus lamella, Hemiophrys rotunda, Dileptus aculeatus, Peritromus faurei, Uroleptopsis viridis, Tachysoma saltans, Euplotea raikovi, E.balteatus, Aspidisca caspica,* etc. From the listed species *L.coronata, T.oligostriata, L.lamella, E.raikovi* etc. were met in mass.

Mesoporal species are mainly occurred in the medium and coarse sands; however they can also be met in fine and very fine sands. The typical representatives of this group are *Mesodinium pulex, Paraspathidium fuscum, Frontonia marina, Condylostoma arenarium, Strombidium sauerbreyae, Euplotes harpa, Diophrys scutum,* ets. *Prorodon marinus, Tracheloraphis prenanti, Pleuronema coronatum, Anigsteinia clarissima, Uronychia transuga,* etc. should be related to euryporal fauna.

Comparing the fauna of different types of sand (very fine, fine, medium, coarse) it should be noted that the fine sand is rich in species composition of fauna and number of species (Mo = 0,1-0,4мм). Totally 278 species were found out here. The average number of infusorians in the $1m^2$ is 8-10 mln. ind. The majority of infusorian species of the given sand are specific forms.

The fauna of the very fine (Mo=0,05-0,08 mm), medium and coarse grained sands (Mo=0,05-0,7 mm and Mo=1,3-2,5 mm) is a little bit more poor, and it quantitatively differ from the fauna of fine grained sand (96,149, 86 species respectively, 6-8 mln.ind/m^2). It should be noted that about 80% of the mentioned groups of sand were of eurytopic ones.

As it is specified above, the fine gravel and algal silt have appeared to be the most

impoverished biotopes of the research area concerning the number of species, and occurrence of separate forms (54 and 78 species, 4,5-6,7 mln.ind./m^2). In specified biotopes mass forms were *Tracheloraphis prenanti, Tr.teissieri, Mesodinium pulex, Euplotes balteatus, E.harpa,* etc.

It is necessary to notice that infusorian fauna in the mentioned biotopes to a considerable degree coincides with the fauna of the sandy ground (mesopsammon) and basically consists of not specific components of fauna.

Distribution of infusorians in the different species of soils depends on content organic substances in them. Quantity of them in the studied area is varied within 0,24-1,86%.

The optimum saprobity for the studied area is 0,53-0,63% of the organic substances. There was observed very different infusorians fauna in the sand having the above mentioned saprobity. Species from such genera as *Tracheloraphis, Remanella, Paraspathidium, Frontonia, Holosticha, Oxytricha, Euplotes* and *Aspidisca* formed mass populations here.

Analyzing the material collected in the North, Middle and West coasts of the Southern Caspian and comparing it with that collected amount during previous years we can be sure that there is some differences between them depending on hydrological regimen, degree of contamination and ground regimen. Comparison of species composition of infusorians in these sections (Mahachkala, Derbent, Khudat, Khachmaz) gives us a chance to assert, that infusorian fauna in the Khudat and Khachmaz sections is very poor. It was clearly expressed in 1965-1966. The Mahachkala and Derbend sections occupied the first place by a number of infusorians and Holotricha had much number here.

The lowest number of infusorians is registered in the Khachmaz section. İt is related with hard siltation of the ground and occurrence of landwash here. The landwash causes more visible effect on interstitial infusorians fauna and the fauna of biofoulings.

Thus landwash sites of the studied area have appeared to be highly enough impoverished in case of infusorians. The eurytopic forms (*Pleuronema, Cyclidium, Euplotes, Uronychia, Diophrys, Aspidisca*) which are covered by firm armour or have pellicular skeletal formations prevail in the fauna.

Studying of vertical distribution of infusorians in separate types of sand of the Caspian Sea has shown that the greatest number (70-80% of specimens) of infusorians is found out in the upper layer of sand. In all types of sand in underlying layers there is the pauperization of fauna especially expressed in fine sand. So, for very fine sand the maximum depth of penetration of separate copies in a ground is 6 sm. For fine sand these indicators are respectively are equal to 0-4 sm (9-12 mln.ind./m^2) and 10 m, for medium and coarse sands - 0-8 sm and 17 sm (2-3 mln.ind./m^2).

In order to determine the horizontal distribution of microbenthic infusorians a number of samples were taken in different depths (0,5; 10; 25; 50; 100 meters) in all sections of studied area. The results have shown that in shallow water infusorians have greatest diversity (276 species) and number (15-16 mln.ind./m^2). As the depth increased, a considerable impoverishment of fauna occurred that, possibly, is connected with original distribution of various biotic and abiotic factors. In the samples taken at the depth of 50-100 meters in Makhachkala and Derbent regions, in mikrobenthos have been registered *L.coronata, Tr.prenanti, C.remanei, T.caudata*, etc. But these species were representea as the individual ones

Diurnal vertical migration of microbenthic infusorians were studied. It begins at twilight and comes to an end at dawn. Probably, it is connected with complex influence of temperature, light exposure, salinity, a gas regime, sea, etc. Quantitative development and seasonal dynamics of diurnal vertical distribution of infusoria in fine heterogenic sand was studied. It was specified that all year round infusoria prevail at upper layers of ground at twilight. In spring and summer at darkness (by 24 and 4 o'clock) the base quantity of infusoria was concentrating on depth of 0-2, 0-4 sm. In autumn, particularly in winter infusoria rises to the surface at darkness by 20 o'clock; they make the greatest quantity on 0-2 and 1-4 sm ground layers in autumn and on 0-4 and 0-5 sm layers in winter. It should be noted that not only concentration of infusorians in the ground surface takes place at darkness, but there also occur partial migration of some species

(*Frontonia marina, Pleuronema coronatum*, etc) from the ground into thickness of bottom water mass.

2. Periphytonic infusorians

Periphytonic infusorians are also widely presented in Caspian Sea and in gulfs. They settle on various substrata - stones, rocks, algae thallome, stalks of the higher water plants, and bodies of the boats, baulks and hydrotechnical constructions. In structure of fauna of foulings of the Caspian Sea (including gulfs) 238 species of the infusorians belonging to 3 subclasses and 7 orders are found. Among them 4 species turned to be new to a science. The richest areas were found to be Southern Caspian Sea (165 species) and Northern Caspian Sea (112 species). The number of similar species between Middle and Southern Caspian Sea made 153 species.

In the freshened gulfs of the Caspian Sea (Lesser Kyzylagach, Agrahan gulfs and estuary Devechy) 65 species of periphytic infusorians (accordingly 42,36 and 30 species) were revealed. The number of common species between gulfs and Caspian Sea made 48.

Periphytonic infusorians are most richly presented in fouling of the stones and hydraulic engineering constructions. In fouling cenoses of the gulfs the basic background is created by eurytopic species. However various substrata significantly differ by specific composition and number of infusorians.

Comparison of fauna of periphytonic infusorians in the various geographical areas of the Caspian Sea allowed to establish high similarity between their specific structure (Southern and Middle Caspian- 63,1 % (150 species).

Southern and Northern Caspian - 37,3 % (98 species), Middle and Northern - 46,2 % (110 species).

Studying of fouling in the protected and open sites of the sea has shown that the maximum number of infusorians and greatest specific diversity are characteristic for the sites protected from a landwash. For example, the sections of Kazakh, Krasnovodsk, Greater Kyzylagach gulfs and Derbent turned to be richer in comparison, for example, with sections Sagyndyg, Kuuly-lighthouse, Khachmaz, Khudat, Sumgait. As the last ones were more opened (inshore). Even on hanged plates were found the single samples of peryphytic infusorians.

As a result of experimental works it is revealed, that in day time after dipping the plate in to water, active infusorians are found out on its surface. The fastest settling of infusorians on a plate occurred in summer, in most protected areas, at a depth of 0,5-1 m. Within 6 hours of the first days have already appeared individual samples of *Holosticha manca, Aspidisca*, etc. Sedentary forms were not registered on plates at this time. In another 6 hours on plates have appeared new forms of mobile infusorians and single samples of species from genus *Vorticella* also began to be found out. Starting from the third day they increase distinctly. At this time the number (and also a specific diversity) of mobile infusorians is also sharply increased. Starting from the 7^{th} day, increase in number of mobile infusorians stoped, and the number sedentary ones continued to be grown and they outrun the number of mobile ones for 9-10 days.

Presence or absence of certain species of infusorians on plates is closely connected with the seasons of a year, i.e. with the temperature factor. In the spring about 60 % of the found species (on experimental glasses) were representatives *of Holotricha*. Mass forms here were *Lacrymaria coronata, Uronema marinum, Frontonia marina*, etc.

Close towards the end of the experience (on the 9^{th} and 10^{th} days) representatives of *Spirotricha*, some of which, for example, *Holosticha manca, Keronopsis rubra* and *Euplotes balteatus,* formed mass populations on certain plates, were also recorded. As to sedentary forms *(Peritricha)* in spring they were found out on the third day of the experiment only. *Zoothamnium duplicatum, Z.marinum, Z.alternans* prevailed.

In 2-3 days (6^{th} and 7^{th}) *Vorticella claparedei, V.nebulifera* and *Epistylis caliciformis* also appeared on plates in mass.

In summer and in autumn as well as in spring, main forms were the representatives of *Holosticha* and *Peritricha.* In winter both on plates and on natural subjects, infusorians were not numerous.

3. Planktonic infusorians

There is a large number of species of infusorians met in the plankton of the Caspian Sea. In the given reservoir 139 species of planktonic infusorians were recorded. From which 48 species turned to be common for all the geographical areas (Northern, Middle and Southern) of the Caspian Sea. Other species are distributed as it is presented below: In the Northern Caspian Sea - 73 species, In the Middle - 112, in the Southern - 108 species. The Western coast is rich in planktonic infusorians. The specific composition of planktonic infusorians is most similar in the Middle and Southern Caspian Sea (90 common species).

Typical planktonic, exclusively marine groups are the representatives of the suborder Tintinoidea. They occur almost in all studied areas of the Caspian Sea. Planktonic infusorians reach their maximal diversity and number in a coastal zone of the sea.

Studying of vertical distribution of planktonic infusorians of the Caspian Sea allowed to establish, that some typical forms (species of the genera *Tintinnopsis, Parafavella, Cadonella*) are concentrated mainly in superficial layers of water (0-10, 0-5m).

Comparison of the data obtained by us with the data of Beers and Stewart (14, along Pacific Ocean), Margalef (19,20 along Mediterranean Sea), Morozovskaya (13, along Black sea) showed, that vertical distribution of planktonic infusorians of the Caspian Sea has similar character with the data obtained from the mentioned geographical areas. Depending on seasons of year the zone of the maximal aggregation of infusorians is varied within 0,5 - 25 and 10-50 m.

The majority of (70-80 %) benthic, periphytic and planktonic infusorians of the Caspian Sea are euryoxibiont ones. In conditions of the Caspian Sea there are available three peaks in seasonal development benthic and periphytic infusorians (spring, summer, autumn) and two peaks in development of planktonic infusorians (spring and autumn).

The sites polluted by oil are impoverished both in specific structure of infusorians, and in number. Nevertheless separate species (*Trachelloraphis prenanti, Paraspathidium fuscum, Spirostomum teres, Condylostoma arenarium, Keronopsis rubra*, etc.) reach significant number (4-5 mln.ind./m^2), in moderately polluted soils. Other species (*Frontonia marina, Euplotes eurystomus var.marinus, Diophrys scutum, Uronychia transfuga*, etc.) even form mass populations in places of accumulation of household and industrial sewage. It is necessary to note, that infusorians are main bioindicators of pollution of various characters. According to this feature they take the first place among other hydrobionts. In this aspect they have huge practical value. Developing in great mass in water-purifying constructions, they play an important role in the process of biological cleaning of sewage .

In connection with the fact that Caspian Sea is heavily freshened and it is characterized by a high degree of endemicity of fauna of some groups of Metazoa, it would be possible to expect some specificity in the fauna of infusorians. However comparison of the list of species of the Caspian infusorians and infusorians of other geographical areas shows, that specific structure of fauna of this basin is basically similar to that in the seas of Atlantic Ocean and in the Sea of Japan. In order to compare the specific structure of infusorians of all geographical areas of the World ocean the works of last ten years were considered and results are given in table 2.

Table 2

Similarity among the fauna of microbenthic infusorians in the sandy soils of Caspian Sea and fauna of other geographical areas
(On number of species-410 species)

Areas	Number of	From them the general	Index of similarity

	species	with Caspian sea	(in %)
Northern Atlantic	280	120	34
Equatorial Atlantic	148	73	23
Mediterranean Sea	173	95	32
Black Sea	152	108	38
Baltic Sea	346	260	68
Barents Sea	48	32	14
White Sea	290	179	51
North Sea	78	46	19
Sea of Japan	84	62	25

As per table, indices of similarity of benthic infusorians fauna of the Caspian Sea and other geographical areas vary in number of species from 14 % up to 68 %, in number of genera from 35 % up to 74 %. The Caspian Sea has the highest similarity (both on number of species, and on number of genera) with Baltic Sea where the number of known species is high and the lowest one with the little-studied Barents Sea.

Suchconformity makes it improbable existence of appreciable endemism of fauna of infusorians of the Caspian Sea or any other area. The given picture speaks that, many widely distributed species simply were not still found in little studied areas or were not still identified. As to new species of infusorians of the Caspian Sea 3 of them were already found by different authors in other seas: *Tracheloraphis sarmaticus* in the Black sea (12), *Euplotes raikovi* at the Atlantic coast of the USA (15), *Euplotes doqieli* on Bermudas (18). The same may happen with other new species. It is necessary to note, that without comprehensive investigation on free-living metozoa, in particular infusorians (in the seas, fresh –water reservoirs, in soils) it is impossible to solve the problems of clean water, some zoogeographical and phylogenetic questions, and also the definition of bioproduction in individual biocenoses.

Our future task is studying of fauna and ecology of infusorians of epibionts, neuston and deep-water (200-500 meters and above) zones of the Caspian Sea.

Researches on sarcodics (testates, rhizopods, foraminiferan, radiolarians), flagellate which will have positive influence on development of protozoological researches in the Caspian Sea are of greater importance. It is necessary to study free-living metazoa not only in the Caspian Sea, but also at gulfs, estuarial spaces of the rivers (Volga, Ural, Kura, Terek, Samur), islands of the Apsheron and Baku archipelagoes. For preservation of Caspian Sea biodiversity it is necessary to increase works in places of concentration of oil products, drilling wastes, household and industrial wastes.

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XƏZƏR DƏNİZİNİN SƏRBƏST YAŞAYAN İNFUZORLARI

F.Q. AĞAMALIYEV, I.Ə. SÜLEYMANOVA

Məqalədə Xəzər dənizində sərbəst yaşayan infuzorların (mikrobentos, plankton, perifiton) 40 ildən artıq bir dövr ərzində tədqiqinin yekunları verilir. Son illərin tədqiqatlarının nəticələri də daxil olmaqla infuzorların növ tərkibi ümumiləşdirilmiş (545 növ), onların biotoplardan, abiotik faktorlardan asılı olaraq yayılması və zoocoğrafi analizi verilmişdir.

PETROGRAPHIC AND GEOLOGICAL CHARACTERS OF THE CENTRAL ELBURZ REGION'S COAL DEPOSITS (ISLAMIC REPUBLIC OF IRAN)

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Abstract:

This study focuses on Bituminous coals (0.80-0.83 Ro %) of Galanderud region of central Elburz in northern Iran. Coals of this region within carbonaceous sediments of Shemshak formation with the age of upper Triassic – lower Jurassic have been deposited in the form of 32 coal beds. These coals are characterized by relatively high percentage of ash content (12.2-18.6%), high volatile matters (28.3-39.3%) and calorific value (7430-8880 kcal/kg). Total sulphur amount of Galanderud coals is low (0.45-1.05 %wt which indicate this region's coals have been deposited in fresh water liminic sedimentary environment. Mineral sulphur is seen only in the form of fine and dispersal pyrite within coals of coal layers. Detected minerals in Galanderud coals are of dolomite (more than 80%), siderite, quartz and kaolinite. Macercals, forming organic part of these coals are mostly of vitrinite (collotelinite) and inertinite (fusinite) group in which the pores and fissures have been filled with carbonate and silica. As the percentage of coals' volatile matters decrease from surface layers toward the bottom, the rank of the coals increases. Friction metamorphism is involved in the process of change in coalification rank of coals in Galanderud region. This is due to the presence of tectonic pressures and activity of sub-faults, in addition to regional metamorphism.

1. Introduction

Geologically, Iran is a folded plate situated geographically between Arabian plate (in south) and Eurasian plate (in north). The Current complex structural-sedimentary status of Iran demonstrates that various parts have gained different geological characteristics over time, and as a result, have become distinguishable from each other (Pedrami, 1993). Eshtaklun (1968) divided Iran into several structural zones basing on different tectonic status and geological and sedimentary history. He designated an area of northern Iran which included Elburz Mountains and descendent block of Caspian Sea as Elburz zone [1]. He proposed that Basement of this zone which is consideredas a part of Iran-Afghan side of Alp-Himalaya trust fold belt in Western Asia, is of continental type [4].

Due to the effect of previous Cimmerien orogenic movements which had been coincided with close-up of Paleo-tethys Ocean, situated between the plates of Iran and Touran, most part of Iran emerged out of water and became marshy environments. This resulted in development of mass forests in Upper Triassic to Lower Jurassic and eventually formation of coal sediments with heteropic compounds (continental - intermediate and marine) in parts of north (Elburz), central (Kerman) and eastern (Khorasan) Iran. Carbonaceous sediments in Iran were designated by Asreto (1966) as Shemshak formation, and all coal mines such as Galanderud in central Elburz are ~~is~~ located in that formation [7]. These sediments are also found in north-west of Iran but they have never been worked out.

There is a very little information available about the geology and petrology of coals in Central Elburz area of Iran especially Galanderud region. The initial studies of stratigraphic status and tectonic structure of central Elburz region with emphasis on its carbonaceous sediments were carried out by Buxtrof & Erni (1931) and White et al (1939-40). This research was continued during the following years by other researchers such as Bayat (1969), Vatan & Yassini (1969), Bayat & Agel (1970), Yassini (1981), Paluska & Degens (1992) and Musavi & Ruhbakhsh et al (1997). The study of organic petrography and mineralogy of Galanderud coals

also primarily was conducted by Zamani (1991) and Goodarzi et al (2006). This paper reports the results of the conducted studies on geology and petrology of coal seams of Shemshak formation in coalfield Galanderud of central Elburz located in northern Iran.

2. Study area

The coal-bearing strata of Galanderud is located on northern slopes of Elburz mountains and is as far as 20 km south of Rooyan town (between 36˚34'/36˚40' N and 51˚19'/51˚56' E Fig. 1) in Mazandaran Province of Iran [7]. These sediments with longitudinal extension of about 100km have been deposited at a height of more than 1240 m from the sea level. Coalfields of central Elburz such as Galanderud region occur in Upper Triassic-Lower Jurassic and part of the Shemshak formation which is similar to other coal-bearing strata of Iran (Fig. 2) [12]. Due to the humid climate (average annual rainfall of more than 850mm) and as a result, expansion of forest covering the Galanderud region, the coal beds are totally masked by the dense forest.

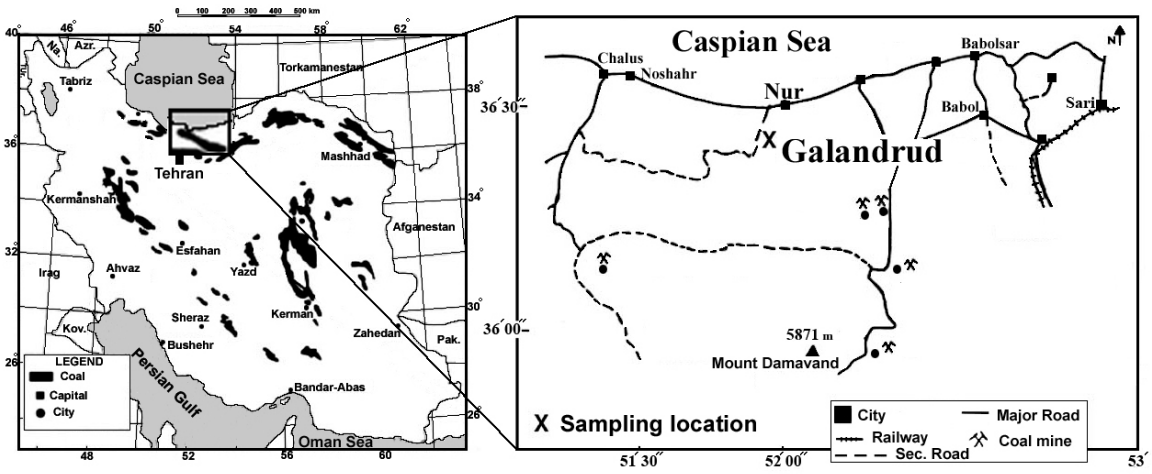

Fig. 1. Location of the Galandrud mine of the central Elburz region of northen Iran. Redrawn after Razavi-Armagani & Moenoalsadat (1994).

3. Method of study

There are more than 30 coal seams at carbonaceous sediments of Galanderud in central Elburz. In this study, coal samples were collected from working face of 17 coal seams which are workable in Galandrud mine. Samples were air dried, crushed and blended before analyses. Thickness of observable coal beds and the intermediate layers of sediments between them were measured to draw stratigraphic column.

Approximate analyses to determine moisture, volatile matters, ash and total sulphur (using ASTM D 3175 standard) of coals were performed in Geological Survey Laboratory in Iran. For microscopic and the petrographic analyses of macerals and minerals, polished and thin sections were used in order to determine the composition of the Galanderud's coals. Also, we used results from investigation of the same region's coal macerals [9] to determine the type and percentage of macerals more accurately. By estimating vitrinite reflection (%R_o), rank of coal samples were also determined.

4.The results and discussion

4.1. Geological characteristics of Galandrud coalfield

Mesozoic coal sediments of central Elburz, containing heteropic facies, have been formed by replacing each other over time. Its origin is at link with a sediment megacycle which has been started from Upper Triassic (Karnian) continuing to Middle of Upper Jurassic (Kimmeridgian) [1]. This sediment megacycle has been formed as a result of the continuous progresses and

regresses of the sea, so that various facies of sedimentary depositions have been created as the formations in central Elburz zone (Fig. 2) [7].

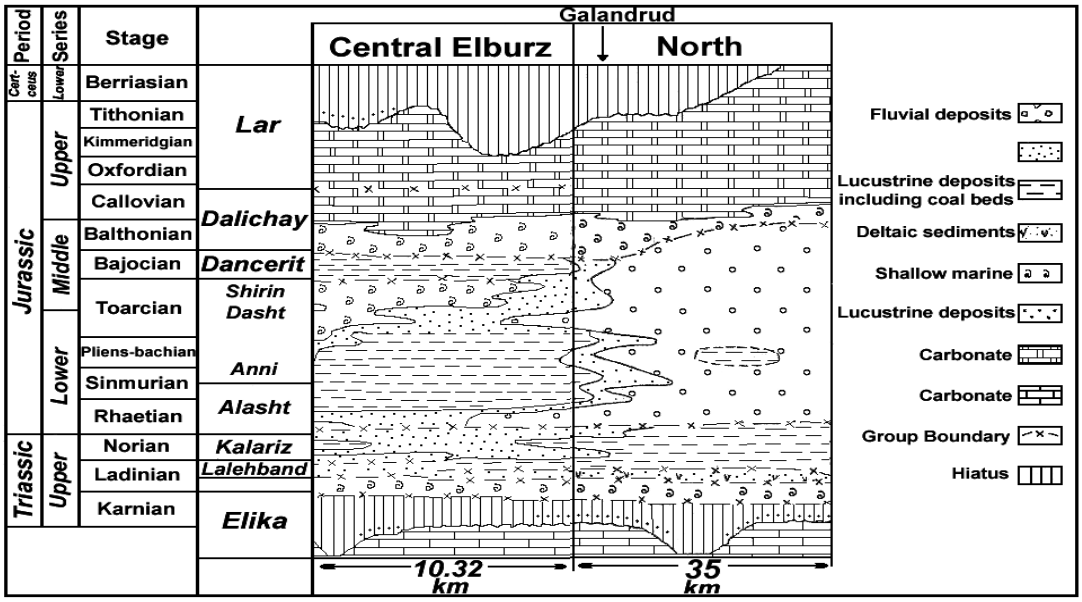

Fig. 2. Cross section of the study area illustrating the stratigraphic relationship of upper Triassic-Jurassic in the central Elburz zone of northern Iran [7].

In Galanderud region, following the previous Camarian orogenic movements, sea regress at Middle Triassic has caused sedimentation of limestone as thick as 1200m, which is known as Elika formation. These sediments have been characterized by wide-layer dolomitic limestone with grey colours ranging from bright to dark, containing intermediate layers of bituminose limestone and yellow-green marles. They appear manifestly 50° at East side of above-mentioned region that, in most points, have tectonic contact with Shemshak coal sediments and some times with cretacues sediments (Fig. 2). Such Sediments represent littoral environment of Galanderud in time of Upper Triassic.

The study of sedimentary rocks of Galanderud region indicates that most expansion and dispersion among producing rock-units in the region's surface is associated with coal sediments of Shemshak formation which, in turn, represents incessant sedimentation from Upper Triassic to Middle Jurassic. This formation in central Elburz is comprised of 4 parts (Ekraser, Lalehband, Kalariz and Javaherdeh) which are folded as syncline structure with axis of WNW-ESE [13]. The Ekraser part has the same age as Upper Triassic (previous Norian) and is comprised of identical layers of argillites and silts with thickness of more than 200m. Its clay limestone layers at lower part contain bioclast as ammonite fossil and represents deltaic-marshy environment. The Lalehband part with argillite lithology (siltstone, claystone) has cross-bedding and carbonaceous xylems. Such lithology is characterized by marshy facies [5] and indicates that at Upper Triassic (Rhaetian), marshlands and small ponds had been created locally within central Elburz zone and deposited sediments like Lalehband part. Thickness of this part is more than 500m and there is a lack or shortage of coal seams, this part is known as BRM (Barren Measures) (Fig. 3).

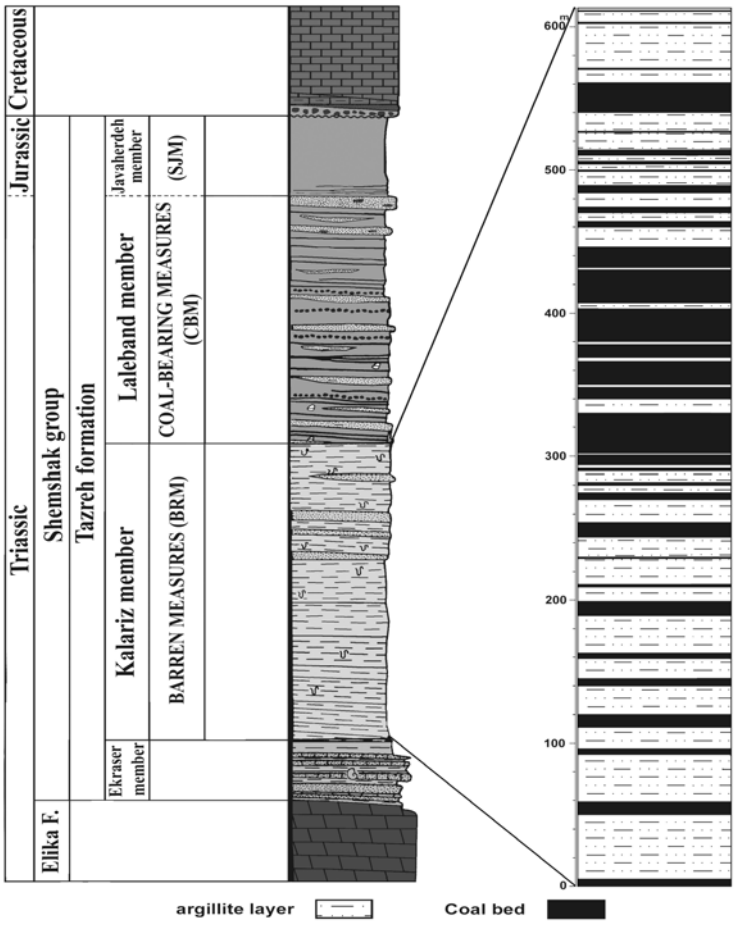

Fig. 3. The generalized stratigraphic sequence of the Galandrud coalfield.

The Main coal-containing part of central Elburz Shemshak group is characterized by alternative argillite and silt layers with coal beds. The Kalarize part with thickness of about 600-700 m has been located between two keybeds of sandstone. These sediments have been deposited in alluvial-deltaic environments which are ideal conditions for plant growth (as Cycadofites) [14]. In Galanderud region, this part of shemshak has 32 coal seams with approximate thickness of 50cm with mainly Atoctone origin, of which 17 layers are of thicknesses that are workable. Due to these characteristics, this section of kalarize part is known as so-called CBM (Coal-Bearing Measures) (Fig. 3).

In parts of Galanderud region, because of existing faults, these stones have been severely broken and fragmented, and set as small foldings [8]. Sediments covering this coal-containing part with lithology of fine and mid-grained conglomerate, big-grained sandstone, and tenuous and thick layers of silt along with fossils of ammonite are indicative of marshy-marine environment in the region. This part with thickness of about 300m is forming Javaherdeh part of Shemshak formation and is known as SJM (Super Jacement Measures), due to existence of only tenuous coal stringers and carbonaceous plant remnants.

Sea progression in time of Cretacues has caused mass conglomerate sediments to be covered by mass fine limestone with marl intermediate layers. These sediments in Galanderud region are formed due to tectonic activities (thrust faults) with tectonic contact adjacent to Shemshak and Elika formations.

Presence of magmatic activities due to tensional phase of previous Cimarian orogeny has triggered the coal seams adjacent to these magmatic mass to be metamorphosed into coke [12].

These activities are also the cause of hydrothermal metamorphism (often silication) of limestone in the region.

4.2.Characteristics of coals with tradional coal parameters

Analysis of 17 samples taken from coal beds of Galanderud indicates that moisture of this region's coals varies in the range of 0.88-1.37%, depending on different oxidation degrees of coals (Table 1). The ash-remains from coals are considered one of the main characteristics of coal. Zoubekov (1967) suggested that the colour and type of produced ash can indicate the type of maceral constituent of the coal. For instance, fusite maceral produce a compact ash with a brown or dark-grey colour. Presence of durite maceral leads to production of a powdery ash with colour ranging from bright-grey to white. Clarite leave a fine powder with reddish brown colour and ash from vitrite maceral has a bright-yellow colour [12].

The ash content of coals of Galanderud region, which mainly is in the form of grey compact particles, varies from 12.2-18.6%. Its high percentage can be associated with coals' formation environment. The coals forming in the marshy environment have high ash percentage due to pollution with clastic materials, (Thomas, 1992). As a whole, Galanderud coals have meltable ash, because of high percentage of ferroxide, calcium, and magnesium (40-60%) [2].

Table 1.

Geochemical properties of the Galandrud coals obtained from proximate [8].

Layer No.	Moisture (%)	Ash (%)	Volatila Matter (%)	Total Sulphur($\%_{wt}$)	Vitirnite Reflation($\%R_o$)
1	1.37	15.00	33.60	1.05	0.89
2	1.18	16.80	35.30	0.59	0.90
3	1.09	12.90	38.00	1.09	0.88
4	0.88	15.40	29.06	0.99	0.92
5	1.11	14.08	28.30	0.54	0.89
6	1.15	15.06	38.10	0.69	0.91
7	1.07	17.60	38.50	0.55	0.90
8	1.12	16.00	32.90	0.59	0.89
9	1.06	15.50	36.50	1.01	0.88
10	1.11	17.90	36.50	1.01	0.88
11	1.12	12.20	32.90	0.59	0.88
12	1.05	15.60	37.20	0.49	0.89
13	1.11	16.20	38.00	0.48	0.90
14	1.04	13.20	35.50	0.45	0.91
15	1.10	13.30	39.30	0.62	0.90
16	1.12	18.60	39.00	0.56	0.90
17	1.15	17.20	39.30	0.60	0.90

The volatile matters content of these coals varies from 28.3% to 39.3% that is generally increasing from the bottom layers towards the surface in some coal beds (Fig. 4). Due to performance of existing sub-faults in the region, the amount of volatile matters is showing an abrupt decrease (layers 4, 5, 8, 11& 14) or increase (layer 3) (Fig. 4). Basing on the amount of coals' volatile matters, according to ASTM (1991) classification, Galanderud coals is classified as a group of high volatile Bituminous B (>31%).

In Galanderud's coals, the level of Sulphur (organic and mineral) is so low that they are considered low-sulphur coals forming in Liminic sedimentary environment with fresh water [10]. Total sulphur amount of these coals in different coal beds range from 0.45 to 1.01 % of wt. Pyrite sulphur of coals is also very low so that pyrite mineral is only observable at some coal beds (for example layer 28) in the form of fine and dispersal particles with framboid texture (Fig. 5).

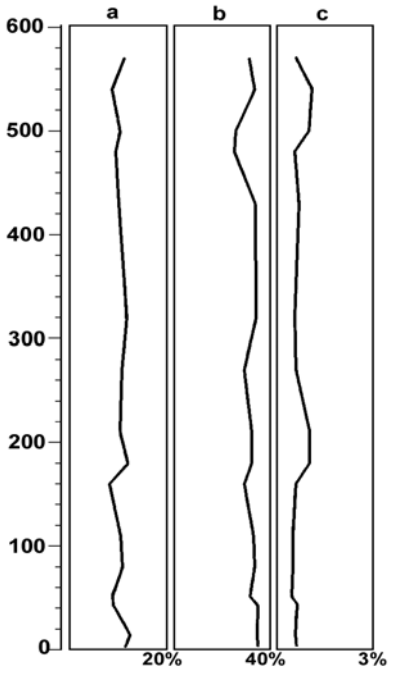

Fig. 4. Geochemical properties variation diagram: (**a**) ash (%), (**b**) volatile matters (%) and (**c**) total sulphur (%wt) of coal beds of the Galandrud coalfield.

Calorific value of Galanderud coals has been estimated between 7430 to 8880 kcal/kg. Rank of these coals is based on Russian classification, which is one of the most common classification methods for estimation of coal rank [6]. The rank is varying from gaseous degree (at surface layers) to greasy gaseous (at bottom layers) (Table 2). This trend of increasing rank of coal beds from surface to bottom is according to Hilt Law (1873): "In a vertical sequence of any locality in a coalfield the rank of the coal same rise with increasing depth." (Fig. 4).

Table 2.

Rank of the Galanderud coals is based on Russian classification method [6].

Russian classification	Name in Iran	Carbon (%)	Vitirnite Reflation(%R_o)	Vitirnite Reflation(%10R_a)
σ	Brown coal	76	0.43	58-66
D	Flaming	77	0.63	70-76
Γ	Gaseous coal	82	0.81	77-81
)-(	greasy coal	85	1.00	82-89
K	Metallurgical coal	89	1.32	90-97
Oc	Skinny coal	90	1.80	100-107
T	Thin coal	91	3.24	108-115
A	Anthracite	92	4.30	130-145

Generally, the coal is comprised of two mineral and organic parts. Study of thin and polished sections of coals and also XRD analysis in Galanderud by Goodarzi and colleagues (2006) demonstrates that mineral composition of these coals is formed mostly of dolomite (more than 90%), siderite, quartz minerals, and a little of kaolinite (clay mineral), sphalerite and galen (Fig. 5). Based on the study by Stasiuk et al. (2006) that determined the maceral constituent of Galanderud coals, vitrinite group (containing more than 30% of collotelinite) forms virtually half of the macerals in coals (47%) which are not unexpected given the fact that these coals are bituminite. Results of this analysis showed that macerals belonging to Inertinite group especially fusinite (25/25%) are in the second rank by more than 36%, and macerals belonging to liptinite group are forming only a few percentage of maceral constituent of organic part in Galanderud coals. Pores and gaps present in macerals are filled by silica, carbonate and pyrite [9] (Fig. 6).

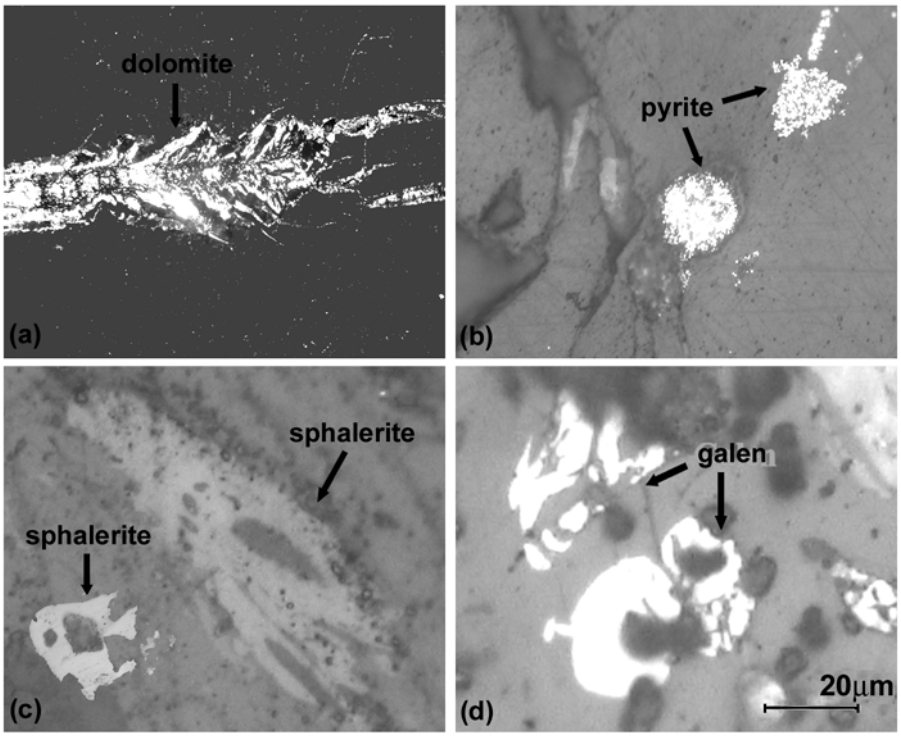

Fig. 5. Some selected microphotographs of minerals formed in Galandrud coals: (a) Dolomite that has filled into cracks. (b) Pyrite with framboid texture. (c) Sphalerite. (d) Galen.

In our opinion, estimated values by Stasiuk and colleagues are not general for all 32 layers of Galanderud coal. We suggest that the fusinite maceral present within some coal beds of Galanderud region are far more than estimated amount, for the following reasons. First, in some coal seams (for example layer 26), coal powdered charcoal by coals is so high that makes their extraction more difficult in mine. Due to powderiness of fusinite [7] the strong powderization factor of coals can be associated with the presence of high percentage of fusinite maceral in these coals. Second, the type and colour of ash produced from these coals, which are in the form of grey compact particles, represent the predominance of fusinite maceral compared to other macerals. Third, since fusinite maceral is rich in carbon and developed from remains of charcoal [6], our study of thin and polish sections proves that charcoal is the main component of these coals in some coal beds. Charcoals in thin sections like opaque minerals are seen as black and woody materials (Vitrinite maceral) is visible in some points in the form of fragment or bands with bright red colour (Fig. 7).

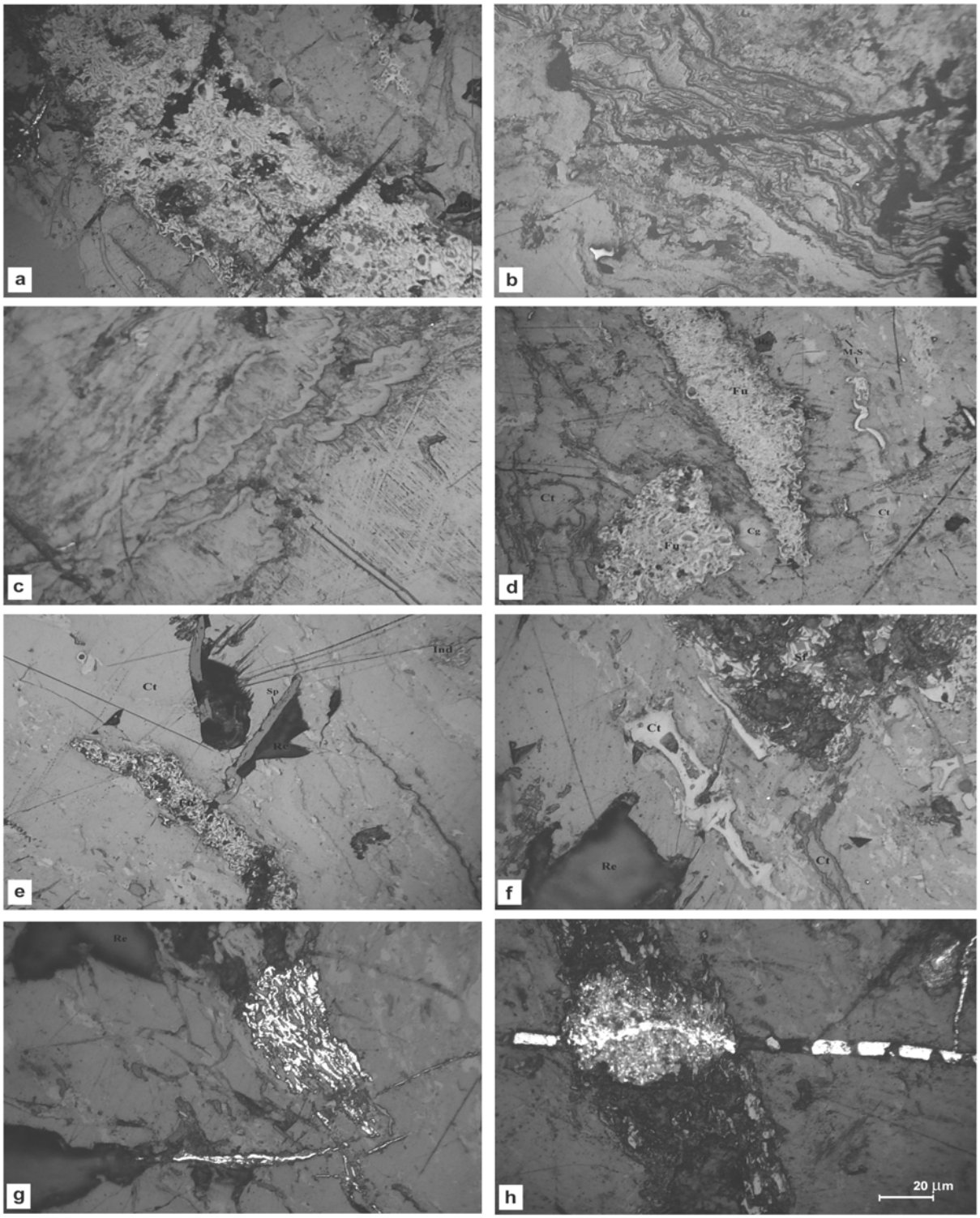

Fig. 6. Photographs of macerals in Galandrud coal: (a) Collotelinite and Fusinite. (b,c) Collotelinite. (d) Fusinite, Collotelinite,Corpogelinite and Micro-sporinite. (e) Fusinite band, Collodetrinite, Inertodetrinite, Micrinite, Resinite and Sporinite. (f) Semifusinite cell walls filled by clay minerals and calcite, Resinite, Cutinite, Macrinite into Collodetrinite. (g,h) Fusinite band that mineralized cell walls filled by framboid pyrite and fragments other macerals, pyrite mineral had filled crack chambers.

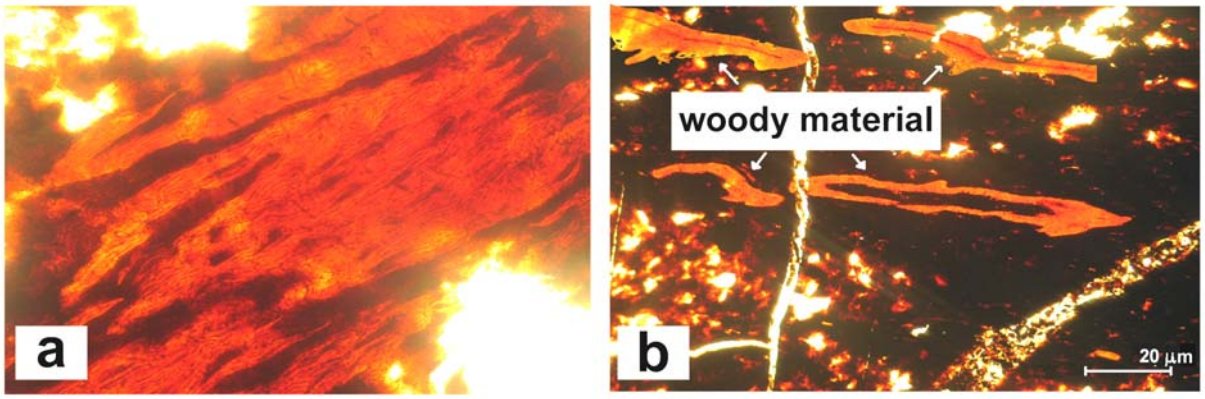

Fig. 7. Showing composition coals by thin section: (a) The thin red bands running horizontally across this view are thin shred of well-preserved woody materials. (b) Woody material and the black materials is either charcoal or opaque mineral matter.

4.3.Metamorphism of coals

In Mesozoic sediments of Iran, Metamorphism of deposited coals is remarkable in a wide spectrum and indicates great complexity. Rapid local changes of coals' metamorphism in a relatively short interval and irregularity between them shows complete lack of discipline, and this has caused researchers to present different views on metamorphism of different coalfields in Iran.

Most of the researchers such as Sinintichokov & Slender (1971-72), Losxmin (1975), Solovitskky et al (1997) have designated coals' metamorphism in Iran more than the variety of natural regional metamorphism. However, they have not rejected the idea that magma permeation or tectonic movements have locally caused the increase of metamorphic degree of coal seams [12]. Metamorphism degree of coals in Galanderud region of central Elburz has been investigated by method of vitrinite reflection (%R_o). The value of %R_o at different coal beds of this region is fluctuating between 0.88 and 1 (Fig. 4). Location of carbonaceous sediments of Galanderud in center of syncline and deep under ground with calorific gradient of about 25˚c/km [3] has led to coals that are affected by regional metamorphism.

However, non-steadiness and bilateral changes of coal metamorphism in these coal beds indicate existence of another metamorphism in evolution course of metamorphism in Galanderud region. Effect of calorific metamorphism (tangential) on coal seams of Galanderud, due to none-adjacency of volcanic permeation matters (dyke and floods) to coal beds, is not far unexpected. Nevertheless, abrupt changes of coal metamorphism for some coal beds of Galanderud have made some researchers to consider involvement of friction metamorphism in this case.

The concept of friction metamorphism in coals of Iran was originally proposed by Cgernomazov (1969) and Alekseyeva (1972). They believed that tectonic movements and local faults' activity within carbonaceous sediments have caused metamorphism and change in carbonaceous degree of coals, in addition to replacing coal seams [11]. The existing tectonic pressure at central Elburz and activity of abundant faults in Galanderud region has led to replacement of the most coal beds. The tectonic pressure has caused severe fragmentation of coal seams due to increasing heat, in addition to locally increasing the metamorphism degree of these coals in layers. Such phenomenon is seen clearly at fourth layer of Galanderud region. Coals of this layer contain predominantly vitrinite maceral of kind (Collonite) with vitrinite reflection of 1 %R_o and of low volatile matters (29%). The existance of these characteristics in coals is indicators of friction metamorphism [12]).

5. Conclusion

Coals of the Galanderud region, located in central Elburz in northern Iran, which have been deposited in a fresh water Liminic sedimentary environment and with humus origin, are of Bituminuse B with high volatile matters (35%). In our study area, 32 coal beds have been

detected 17 of which are workable. These coals have high ash and low sulphur content and their rank is increased from surface to bottom by reduction of volatile matters. Therefore, the type of coals is varying from gaseous to greasy gaseous. In regard to metamorphism of Galanderud coals, there are zonal metamorphism which is due to predominant tectonic pressure in the region and activity of the existing sub-faults. In addition, friction metamorphism has occurred that in some layers caused a local increase in the rank of the coals.

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MƏRKƏZİ ƏLBURS REGİONUNUN KÖMÜR YATAQLARININ GEOLOJİ VƏ PETROQRAFİK XÜSUSİYYƏTLƏRİ (İRAN İSLAM RESPUBLİKASI)

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Məqalədə İranın şimalında yerləşən Mərkəzi Elburzun Gələndrud rayonunun daş kömürləri (0.80-0.83 R_o%) uzərində aparılmış tədqiqatların nəticələrinə baxılmışdır. Müəyyən edilmişdir ki, Üst Trias - alt Yura yaşı Şimşək formasiyasının daş kömür çöküntüləri 32 kömür layından təşkil olmuşdur. Bu kömürlər külün miqdarının (12.2-18.6%), uçucu komponentlərin (28.3-39.3%) və istilik vermə qabiliyyətinin (7430-8880 kcal/kg) nisbətən yüksək miqdarları ilə səciyyəvidirlər. Gələndrud rayonun kömürlərində kükürdün miqdarının aşağı (0.45-1.05 $\%_{wt}$)

olması rayon kömürlərinin şirin su mühitində əmələ gəlməsini göstərir. Mineral kükürd yalnız bəzi kömürlü laylarda narın dənələr və səpələnmiş pirit formasında rast gəlir. Bu kömürlərin mineral tərkibi dolomitdən (80%-dən artıq), sideritdən, kvarsdən, sfaleritdən və galenitdən ibarətdir. Onların üzvi hissəsini təşkil edən inqredientlər əsasən vitrinit (kolotelinit) və inertinit (fuzinit) qrupundandırlar. Onlardakı boşluq və çatlar karbonatlarla və kvarsla dolmuşlar. Kömürlərdə uçucu komponentlərin miqdarı səthdən dərinkilərdə yerlışən laylara doğru tədricən azaldıqca, kömürlərin kömürləşmə dərəcəsi artır və kömürlər yağlı növlərindən qazlı növlərinə keçirlər. Gələndrud rayonun kömürlərinin kömürləşmə dərəcəsinin dəyişmə prosesinə, regional metamorfizmdən başqa tektonik hərəkətlər, çatlaşma və eroziya metamorfizmidə təsir edmişlər.

EXTRACTION AND TRANSPORTATION OF GAS IN CASPIAN REGION

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Necessity for energy carriers are being increased in the world, and in this connection, discovering and exploitation of new hydrocarbon ate reserves are of special importance. From this standpoint, exploitation of new perspective oil and gas deposits in the Caspian region caused increasing of large-scale foreign oil companies in this region. As a result of this, large-scale capital stream is ongoing in the offshore countries. For instance, $60 billion of foreign capital was invested on oil and gas industry of Kazakhstan and $40 billion was invested on Azerbaijan for last 10 years.

If oil industry was the chief field in Caspian region for last 20 years, then the raise of gas industry is being expected for next decade. Changing of the situation in this direction can be explained by many reasons. The followings can be included here of course:

- Discovery of deposits with large reserves in shelf zone of the Caspian Sea and surrounding zones;
- Increasing need for natural gas in the world market;
- Support by foreign capitalists for the initiatives on creation of multi-field gas-pipe line nets;
- Providing the sustainability of gas transportation into the world market regardless the influence of various factors;
- Each of the Caspian Sea region countries supports the determination of directions of natural gas exportation in conformity with its economic and geopolitical interests.

Main-pipes lines were built in some directions from Caspian-offshore regions to the world market under the influence of above mentioned factors within the last years. It is interesting that, present economic and geopolitical condition in the Caspian region had great influence on choosing of the directions of each main-pipe line. In connection with it, oil and gas pipe lines were laid in various directions from the Caspian region countries.

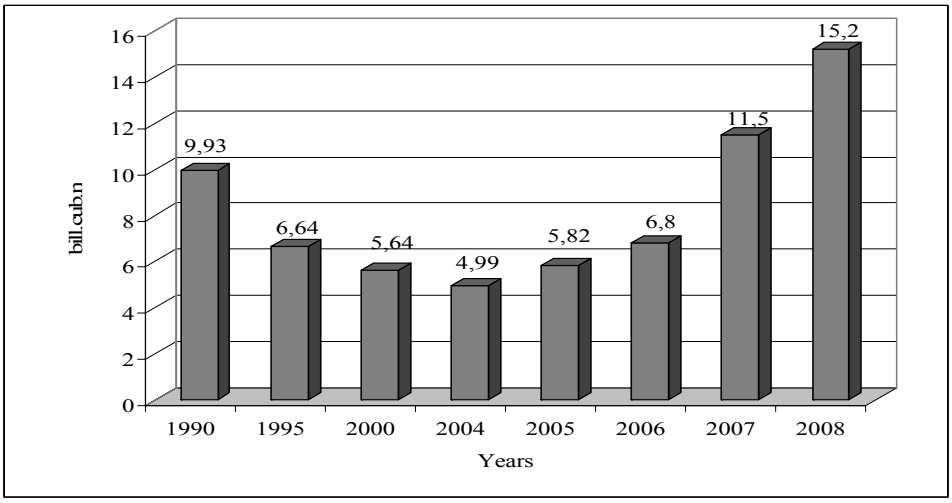
Extraction and transportation of gas to foreign countries in Azerbaijan

Along with oil extraction, rich gas reserves are also exploited in Azerbaijan. Maximum capacity of gas extraction in the Republic was observed during 80s years of last century. Gas extraction made 14,9 billion m^3 in that period and 11-12 billion m^3 of that capacity that was the remained part within the republic were transported to neighborhood Southern Caucasus republics. The main part of the produced gas fell into the share of Bahar deposit in the sea: However, gas extraction in the republic gradually decreased in the following period. Import of gas is already started through Mozdok-Baku pipeline from Russia to meet demands of Southern Caucasus republics.

After Azerbaijan gained its independence, attention was increasingly paid to the strengthening of exploration and boring work in the sea shelf to provide energy supply of the republic. Capitals of foreign companies with necessary capacity directed to prospective gas deposits played stimulant role in development of gas industry in the republic. It should be noted that Azerbaijan imported 2-4 billion m^3 natural gas from Russia during 2002-2006. However, nearly twicely increase of gas price ($1m^3$ -$235) imported to Azerbaijan from Russia in 2006 made the republic reject this offer. In comparison with it, Russia exported its gas to Armenia for $80, Belarus-$120, Tajikistan-$90 and the Baltic region republics-$170-180 that had strained relation with Russia. Such step of Russia against Azerbaijan can be explained definitely by its willing on putting economic and political pressure on our republic. Russia's such kind of attitude

influenced on the intensification of work in gas extraction field of Azerbaijan. As a result of this, gas extraction increase cold in the republic (Fig. 1).

Gas extraction in Azerbaijan for 1990-2008



Gas is mainly extracted on the account of Shah-Deniz deposit in Azerbaijan. Gas extraction is implemented in 5 wells here. The quantity of boring wells will be increased in the second stage of Shah-Deniz project. As a result of this, it is meant to extract more thon 12-14 billion m^3 natural gas from the deposit. Gradual increase of the extraction will provide opportunity for 15-20 billion m^3 gas transportation from Azerbaijan to Europe annually during 2015-2030.

Increasing of gas extraction became possible mainly on the account of Shah-Deniz deposit in the sea. Capacity of gas reserves reaches 1 trillion m³ in this deposit. Exploitation of such rich deposit created opportunity for not only providing internal demands, but also gas transportation. As a result, Baku-Tbilisi-Erzurum pipeline started to be built. The gas-pipe line called Southern Caucasus was put into operation in the first quarter of 2007. Length of the main-pipe line is 970 kilometer and its diameter is 42 inches. 8 billion m³ of natural gas is intended to be transported in the primary stage, while later on 16 billion m³ via this route. Exploitation of Shah-Deniz deposit will be carried out in some stages. Presently, the first stage of this project is being completed. In general, $15-20 billion capital is required for complete exploitation of Shah-Deniz deposit.

Increasing of demand to energy carriers in the EU countries caused discussion on the various main-pipe line projects. One of these projects is Nabucco project. Through this main-pipe line with the length of 3, 3 000 km, natural gas is to be transported to EU countries from Central Asia.

Nabucco project presented in 2004 provided primarily import of natural gas from Persian Gulf. But nuclear program of Iran made the realization of any international project impossible regarding this country. Therefore, attention focused on the Caspian region as the raw material source, more precisely – Azerbaijan and Turkmenistan.

According to Nabucco project, 26-32 billion m³ gas will be exported via this pipe line. Building of gas-pipe line is to be completed in 2013. Attracting issue here is extremely greatest value of this project. According to primary estimations, €7,9 billion is required for construction of this pipe line. The source of such capacity resource is not completely determined and therefore, the future of Nabucco main line remains undecided.

If Nabucco project is realized, Azerbaijan will not only become a transit country, but also will gain a chance to transport its natural gas to European market.

Turkmenistan's opportunities of gas export

Turkmenistan realizes State Program on development of oil-gas industry to provide construction and commissioning of international pipelines. According to this, gas extraction is expected to be increased from 72 billion m^3 in 2007 till 250 billion m^3 in 2030 in the republic. Under the program on development of gas industry in Turkmenistan, gas production is intended to be increased in 120 billion m^3 in 2010. Gas export will be 53 billion m^3 in 2009, and 42 billion.m^3 of them will be transported to Russia, while other 11 billion m^3 to Iran. Turkmenistan is interested in participating in projects on construction of gas pipe-lines in all directions like other Caspian region countries. As it is known, natural gas is exported only in two directions from Turkmenistan in this period: Middle Asia-Central gas pipe-line in the north direction from the territories of Uzbekistan and Kazakstan to Russia and relatively small Korpeje-Kurdkuyu (Iran) gas pipe-line in the south direction. Transportation power of the pipe-lines does not provide export oppurtunities of Turkmenistan completely. Therefore, negotiations are carried out on projects about the construction of gas export pipe-lines of the republic, agreement is reached and treaties are signed.

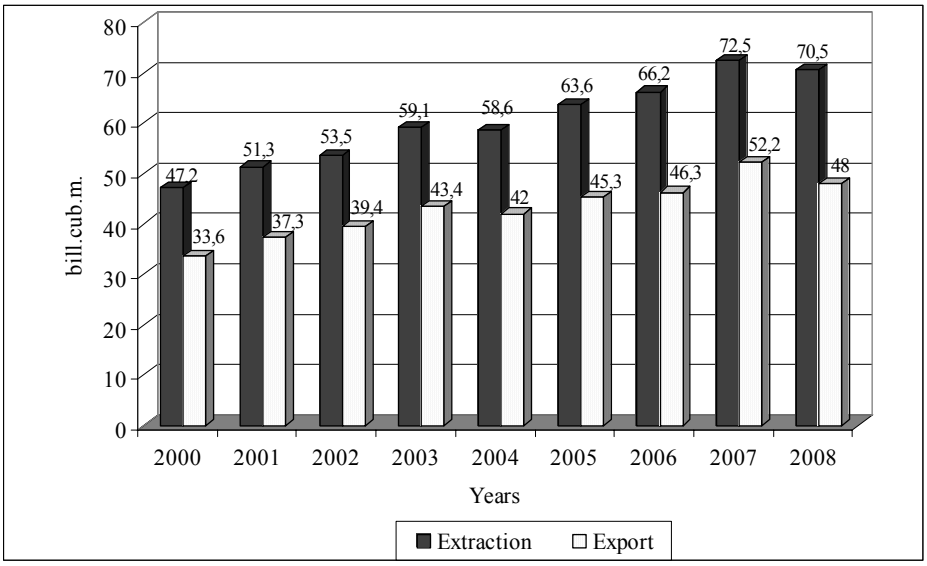
The projects causing special interest in this line are the followings:

- Transcaspian gas pipe-line
- Caspian gas pipe-line
- Gas pipe-line constructed in the direction of China.

As is known, one of the greatest gas deposits of Turkmenistan is Dovletabad. Main part of the gas produced in the country is provided mainly through this deposit. However, new perspective deposits were discovered and exploited in the country during the last years. One of these deposits is Southern Elotan-Osman gas deposit. Natural gas reserves founded here is estimated at 5-6 trillion m³ capacity. Due to this estimation, Elotan-Osman gas deposit occupies the fifth place in the world.

Dynamics of gas extraction and export in Turkmenistan within last decade opens new, wide doors for construction of new main-pipes (Fig. 2). It should be noted that, 50 billion m³ of the natural gas exported from Turkmenistan in 2008 fell into the share of Russia (1).

Extraction and exportation of natural gas in Turkmenistan for 2000-2008



Turkmenistan offered Russia a joint exploitation of Southern Elotan deposit early in 2006. However, Russia's "Gazprom" company stated its unwillingness to participate in this project. For such reasons, Turkmenistan directed its interest to China. Consequently, building of Turkmenistan-China Trans-Asia gas pipe line was already started in 2008.

Gas pipe-line in China direction

The gas-pipe line constructed in China direction intends to export 30 billion m^3 of gas in a year. Kazakhstan and Uzbekistan also joined Trans-Asia gas pipe project. The part of the main located in the territories of these countries, is constructed on the account of China's investment. But Turkmenistan does its construction work on its own account.

A pipeline's construction will be completed in 2010. Increasing tension between Turkmenistan and Russia regarding gas export made it urgent for Turkmenistan to sign a new treaty on gas export with China. According to this agreement, 40 billion m^3 of natural gas will be exported annually to China through this gas pipe line.

Caspian gas pipe-line

Impossibility of construction of new gas pipe-lines in Afghanistan and western directions, as well as Russia-Turkmenistan positions coming closer in this sphere created a circumstance for Caspian gas-pipe line project.

With the initiation of Russia, Kazakhstan, Russia and Turkmenistan signed a joint agreement on the construction of the Caspian gas-pipe line in 2007. Via this gas main, 10 billion m^3 of natural gas is intended to be exported in the Russia's direction every year. Complicacy and financing problems of negotiations concerning construction of main pipe line remain its building undecided in the future. Western European investors do not yet take interest in construction of Caspian main pipe line, whose length is 700 km.

Transcaspian gas pipe-line

Increase of gas extraction demanded widening opportunities for its export in Turkmenistan. Thus, the Russian party put various pressures upon Turkmenistan since the gas was exported mainly in north direction. Therefore, in Turkmenistan gas extraction dropped from 81, 9 billion m^3 as it was in 1990, to 13, 3 billion m^3 in 1998. Consequently, Turkmenistan signed relevant treaties with Azerbaijan, Georgia and Turkey on the construction of Transcaspian gas pipeline in 1999 by discussing the building of alternative gas export pipes line with foreign countries. But later its realization was impossible, because of a total agreement was not gained between the parties on this project. Despite that, the Transcaspian project is still on the agenda, and USA and EU countries have special interest in its realization. It should be first explained as an attempt of decline of energy dependence of western countries from Russia.

Turkmenistan party does not take interest in Transcaspian gas-pipe-line project. Change of administration in Turkmenistan created conditions for the project's being again on agenda. Along with it, explosion happened in gas-pipe-line from Turkmenistan to Russia (because of Russia's fault) compels to close projects on perspective gas export of the republic from west, east and south directions.

Stability Foundation is established in the country for productive application of incomes gained from oil and gas industries and with the purpose to diminish influence of economic crisis covered the world last years in Turkmenistan.

Development program of oil-gas industry was approved until 2030 for provision of continuous development of fuel industry in Turkmenistan. According to this program, oil extraction will be increased by 110 mln ton, while gas extraction-250 billion m^3 until 2030 in the country. Such capacity of the extraction will cause to the increase of natural gas and oil export. Taking it into consideration, Turkmenistan put forward a proposal to UN General Assembly on adoption of special convention on "protection guarantee of international main-pipe-lines" in September, 2008.

Russia's policy in energy supply issue of Caspian and Central Asia region

Azerbaijan, Kazakhstan and Turkmenistan were obliged to use the Russian's territory in oil and gas export for many years. However, pressures put regularly upon these countries by Russia caused construction of new pipelines in other directions (ceasing oil and gas export to market because of different reasons).

At the same time, western countries directed large-scale investments and new technologies to these countries. The policy pursued by new independent states in this field and business activity of western countries in the Caspian region definitely provoked Russia and the latter was obliged to change its policy on the Caspian region to change the existing situation. Large-scale investment was required for exploitation of oil and gas deposits revealed in the Caspian region, whereas Russia did not put investments on this region as compared with western countries. In spite of is, Russia proposed to carry out some interesting joint projects to the regions countries for last years.

Except of Caspian gas pipe-line project to be built in the eastern coast of Caspian Sea, Russia forwarded two different proposals to Azerbaijan. The first of them is importing natural gas to be extracted in Azerbaijan in compliance with world market price since 2010. The second, re-exporting natural gas of the same capacity exported to the north of Azerbaijan as "swap" form in the northern part of Iran. Supposing, Russian's geo-political interests stand behind the second proposal. So, constructed Iranian-Armenian gas pipe-line is not yet explored, since natural gas lacks in the northern areas of Iran and there is no proper infrastructure for this region in southern zones.

With such proposals Russia, at the same time, impedes participation of the pre Caspian countries in Nabucco project. It should be noted that, the European Union worked up a strategic program on energy safety till 2050. One of the most important proposals is the establishment of Caspian Development Corporation. The company will be engaged in purchase and transportation of natural gas from the Caspian region and Central Asia.

Collision of economic and political interests of Russia and western countries concerning energy export prevents construction of large pipelines. Decrease of tension over the issue will create suitable conditions for realization of various international traffic projects.

Hydrocarbon reserves of Iran in the Caspian region

Caspian part of Iran is a poorly studied field from viewpoint of existence of oil and gas resources. It occupies the fourth place for discovered oil and gas in the world, and the second-for gas resources, presently. The capacity of gas resources revealed here is 28 trillion m^3. According to data of Iranian National Oil Company, 10 billion barrel of oil and 560 billion m^3 of gas were revealed in deposits of the Southern Caspian. According to the prognosis of Iranian National Gas Company, natural gas extraction by increasing twicely will reach 274 billion m^3 in 2012 (3).

The southern part of the Caspian Sea has not yet been studied throughly, since it is the deepest part of the sea and proper equipment lacks there. As is known, the specialists from Azerbaijan carried out boring-exploration work in Iranian coasts of the Caspian Sea due to Iranian side's appeal as early as in 1977-1978. Consequently, the geological-exploration work was stopped because two boring wells negatively resulted for oil and gas.

Exploration of new deposits in Caspian Sea and directing large-scale investments by foreign oil companies caused increase of the Iranian party's interest to the southern Caspian. Isolation of Iran from international projects and grand oil companies' never directing their ivestments to this country definitely hinder geologic-explorative work in the sea. But despite that, the Iranian party carried out a geophysical research in southern Caspian with the help of other foreign companies and revealed 16 perspective oil and gas fields as a result. Tabbas, Zabol, Zakhedan, Jaraban and Cabakhar are perspective deposits. Boring works are required to fulfill first for putting these fields into use. We can't hope for exploitation of these deposits in near future taking into account 700-metre height of the sea-depth here and perceiving importance of

putting large-scale investments. Thus, foreign investors do not put investments on Iran yet and the Iranian internal financial and technical opportunities are still restricted.

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XƏZƏR REGİONUNDA QAZ EHTİYATLARININ HASİLATI VƏ NƏQL EDİLMƏSI

Ç.N. İSMAYILOV

Məqalədə Xəzər regionunda qaz ehtiyatlarının mənimsənilməsi və nəql edilməsinə dair vəziyyət təhlil olunur. Bu regionda neft və qaz ehtiyatlarının qeyri-bərabər yayılması bölgədə formalaşan boru kəmərləri şəbəkəsinin coğrafiyasına bilavasitə təsir edir. Region ölkələrinin geoiqtisadi və geosiyasi maraqlarına uyğun olaraq hər birində ayrılıqda müvafiq ixrac boru kəmərləri layihələrinə üstünlük verilir. Bunun əsasında Xəzəryanı ölkələrinin enerji sektorunda yeritdiyi müxtəlif siyasi və iqtisadi yanaşmaları açıqlanır. Xüsusi olaraq qeyd olunur ki, Azərbaycan, Qazaxıstan və Türkmənistan çoxşaxəli boru kəmərlərinin inşasına üstünlük verdiyi halda, Rusiya bu ölkələ öz təsiri altında saxlamağa can atır.

THE INTEGRATED CRITERION OF ECOLOGICAL SAFETY OF INTRODUCTION OF HELIOENERGETIC SYSTEMS

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Perfection of estimation system of an ecological efficiency when introducing helioenergetic systems for producing heat in comparison with the thermal boiler-houses working while burning traditional fuel, through the system of integrated criterial factors is offered in the given work.

The criteria of a condition of an ecosystem should answer a number of general requirements from which it's expediently to allocate the followings:

a) sufficient sensitivity in relation to parameters $e_i(\varepsilon_{\text{птг}})$ of ecosystems, answering to the given criterion;

b) necessary constructability allowing rather simply to define numerical value of criterion;

c) sufficient universality from the point of view of possibility of comparison of efficiency of the nature protection functions realized in an ecosystem.

Formalizing requirements to integrated criterion of a condition of an ecosystem, it can be presented as a functionary:

$$J[\varepsilon_{\text{птг}}] = \Phi\left[\varepsilon_{\text{а}}\left(\sum_{i=1}^{n} e_i\right); \varepsilon_{\text{в}}\left(\sum_{i=1}^{n} e_i\right)\right], \quad (1)$$

where $\varepsilon_{\text{а}}\left(\sum_{i=1}^{n} e_i\right)$, $\varepsilon_{\text{в}}\left(\sum_{i=1}^{n} e_i\right)$ - a vector, accordingly, characterizing parameters of an ecosystem which are given in to management and not influencing on integrated criterion of a condition.

For an ecological estimation of a heat power boiler-house we will consider the integrated factors consisting of criteria of an estimation of pollution of air, water environment and soil which will consist of criteria with controllable and uncontrollable parameters.

$$J_k[\varepsilon] = \Sigma W(\varepsilon_{\text{атм}}) \cdot \Sigma W(\varepsilon_{\text{вода}}) \cdot \Sigma W(\varepsilon_{\text{почва}}) \cdot W(\varepsilon_{\text{метеор}}) \cdot W(S) \cdot W(Ч) \quad (2)$$

where $\Sigma W(\varepsilon_{\text{атм}}) = \left(\frac{C_{1\,атм}}{ПДК_{1\,атм}} + \frac{C_{2\,атм}}{ПДК_{2\,атм}} + \ldots + \frac{C_{i\,атм}}{ПДК_{i\,атм}}\right)$ - the criterion of an ecological safety of atmosphere;

$\Sigma W(\varepsilon_{\text{воды}}) = \left(\frac{C_{1\,воды}}{ПДК_{1\,воды}} + \frac{C_{2\,воды}}{ПДК_{2\,воды}} + \ldots + \frac{C_{i\,воды}}{ПДК_{i\,воды}}\right)$ - the criterion of ecological safety of the water environment;

$\Sigma W(\varepsilon_{\text{почвы}}) = \left(\frac{C^{*}{}_{1\,почвы}}{ПДК_{1\,почвы}}\right)$ - the criterion of ecological safety of soil;

$W(\varepsilon_{\text{метеор}}) = \frac{\vartheta_{ск}}{\vartheta_{\max}} \cdot \frac{\beta_{влаж}}{\beta_{\max}} \cdot \frac{T}{T_{\max}} \cdot \frac{Z_c}{Z}$ - the criteria of influence of weather conditions (a wind, rain, snow temperature) on environment reaction;

$C_{i\,атм}$, $C_{i\,воды}$, $C_{i\,почвы}$ - accordingly (g/m^3), concentration of the harmful substances inherent in emissions at combustion of fuel, thrown out in atmosphere, in water objects together with technical water from boiler-houses, ground concentration of corresponding harmful substances, falling in soil; $ПДК_{i\,атм}$, $ПДК_{i\,воды}$, $ПДК_{i\,почвы}$ - accordingly (g/m^3), maximum permissible concentration of harmful substances in atmosphere, in technical dumped water, in soil; $\vartheta_{ск}$, $\vartheta_{\max}$ - speeds of a wind accordingly average (on a wind rose) during the operation of installation and maximum in the given region; $\beta_{влаж}$, $\beta_{\max}$ - relative humidity accordingly

average during the operation of installation and maximum in the given region; T, $T_{\max}$ - temperatures according to a season of operation of installation and maximum in the given region; Z_c, Z - quantity of sunny days and quantity of days for a season of operation of installation.

We will consider the criterion of alienation of the territory of earth occupied under installations (thermal boiler-houses and helioenergetic). First of all, the territory of heliosystem considerably exceeds the territory of location of a boiler-house, as the area of solar systems depends on the capacity of installations. The alienation territory leaves a crop rotation, loses direct sunlight and is exposed to less fall of rain, snow, there is a poor vegetation on it and it is used a little by fauna. For definition of efficiency of ecological safety we will carry the area of considered installation of individual capacity to the area of a solar power plant of the same capacity and we will receive the criterion of alienation of territory

$$\Sigma W(S) = \frac{S_{уст}}{S_{гел.уст}} \cdot \frac{C_{ст}}{C_{ст\ рег}} \qquad (3)$$

$S_{уст}$ – the area of corresponding installation (a boiler-house or a solar power plant);

$S_{гел.уст}$ – the area of alienation of the territory occupied with a solar power plant, i.e. occupied helioenergetic modules of a simple design; $C_{ст}$ –cost of the land in an installation site, tenge; $C_{ст\ рег}$ – average cost of the land in region, tenge;

$$S_{гел.уст} = [(l \cdot H \cdot \cos\alpha) \cdot m + M] \cdot n \cdot 1{,}2 \qquad (4)$$

where: l and H– width and height of the module of passive action, m; cos$a$ – a module angle of slope to horizon, hailstones; m– number of modules in line; n– number of lines; M– pass factor between numbers of modules, M=1,2; 20 % for the general non registered expenses of territory, factor – 1,2;

The area of the helioenergetic installation with modules of a simple design can be chosen as the equivalent to the capacity of a thermal boiler-house. If the capacity of boiler $1 \cdot 10^6$ Vt, then capacity corresponding the heliosystem with modules of a simple design will be:

$$N_{\text{гел. сист}} = N_{котел} = 1 \cdot 10^6 = G \cdot Q_p^H \cdot \rho \cdot \eta_{котел} = S_{гел.уст} \cdot Q_{пад} \cdot \cos i \cdot \gamma \cdot \nu \cdot \xi \cdot \eta_{КПД} \qquad (5)$$

where G –the fuel consumption burnt in a boiler-house (for gas); Q_p^H – the lowest warmth of combustion of fuel; ρ – density of submitted fuel (gas); $\eta_{котел}$ – EFFICIENCY of boiler installation; $Q_{пад}$ – the maximum capacity of the solar radiation falling on a horizontal surface of the earth, $Q_{пад}$ =750 Vt/m^2 (for Aktau in June); cos$i$ – a corner considering the position of solar modules; γ – the factor considering degree of overcast of a firmament during the day; ν – the factor considering daily changes of the falling solar energy; ξ – dust content factor of lightpassing coverings of helioreceivers (ξ =0,85); $\eta_{КПД}$ – EFFICIENCY of the module of a simple design, $\eta_{КПД}$ =0,3. Then

$$S_{гел.уст} = \frac{1 \cdot 10^6 \cdot}{Q_{пад} \cdot \cos i \cdot \gamma \cdot \nu \cdot \xi \cdot \eta_{КПД}} \qquad (6)$$

$S_{уст}$ - the territory (for example, a boiler-house), including the building of a thermal boiler-house, a platform under warehousing of materials, container, reserve fuel for the station with the capacity 1 МВт, it is possible to accept equal 20×30 *м*, $S^*_{уст}$ – the area of an effective helioenergetic installations depending on degree of perfection of modules and the established capacity it is possible to calculate as:

$$S^*_{уст} = S_{гел.уст} \cdot \eta_{С_{о.э.}} \cdot \eta_{эфф}^{сел} \cdot \eta_{аккум.системы} \qquad (7)$$

where $\eta_{C_{o.э.}}$ – factor of degree of concentration of sun rays on installation of an adapting surface of the flat module of a type «a hot box»; at unitary refraction of rays in concentration $\eta_{C_{o.э.}} = \frac{1}{C_{o.э.}} = 0{,}52$, at double $\eta_{C_{o.э.}} = \frac{1}{C''_{o.э.}} = 0{,}37$ where $C_{o.e}$– the optiko-power factor depending on an overall performance of a solar collector, for unitary, $C_{o.э.} = 1{,}9$, for double $C''_{o.э.} = 2{,}7$; $\eta^{сел}_{эфф}$ – the factor considering applications of selective coverings of the adapting surface, accepted 0,9; $\eta_{аккум.системы}$ – the factor considering application in the system of the thermal accumulator of a solar energy, accepted 0,85.

Calculations on the areas of alienation of the territory by the resulted technique are carried out and following values factors of alienation are received $W(S)$:

for a gas boiler-house: $W(S) = 0{,}06 \cdot \frac{C_{cm}}{C_{cm\ рег}}$;

for a boiler-house working on black oil: $W(S) = 0{,}1 \cdot \frac{C_{cm}}{C_{cm\ рег}}$;

for a boiler-house working on coal: $W(S) = 0{,}25 \cdot \frac{C_{cm}}{C_{cm\ рег}}$;

for effective helioenergetic installations: $W(S) = 0{,}35 \cdot \frac{C_{cm}}{C_{cm\ рег}}$.

Integrated factor analysis of ecological safety of introducing installations shows that the most ecologically adverse are the application of the thermal boiler-house working on coal, containing a considerable quantity of firm particles and slags, oxides of sulfurs, carbon, nitrogen etc. and having smaller in comparison with black oil and natural gas the lowest warmth of combustion of fuel. A considerable share of loss of heat from incompleteness of combustion of fuel. Coal boiler-houses occupy rather large territory for storage of firm fuel and recycling wastes, and also uses technical water.

The boiler-houses working on highsulphide black oil, have higher indicators on the lowest warmth of combustion of fuel (almost in 2 times) that affects capacity and an installation overall performance, the exit of slags decreases, the quantity of harmful substances with smoke gases in atmosphere decreases. Consumption of technical water is lowered, and it is absent in some designs of boiler-houses at all. The area under capacities for black oil storage is much less than the territories, given for technological needs of the boiler-houses working on coal. In the boiler-houses working on gas, harmful ecological loads are considerably lowered in comparison with other kinds of fuel, but wastes of products of combustion in atmosphere remain. Block boilers have appeared recently which are much more compact than stationeries. However there is an important factor that boiler-houses are adhered to a gas highway and cannot work in the independent mode isolated from external relations. Therefore the first three criteria in an integrated indicator are inherent only in boiler-houses and are absent in helioenergetic systems. It is necessary to accept the criterion of ecological safety and labour input for boiler-houses is higher, for example, for a coal boiler-house $W(Ч)$=1, a black oil boiler-house $W(Ч)$=0,8, gas $W(Ч)$=0,6, and for helioenergetic installations $W(Ч)$=0,1. The danger of manufacture, preparation and personnel training, appointment of round-the-clock watch and manual work share should be also taken into consideration while appointing this factor. The analysis and the above-stated reasonings lead to the following indexes:

$$J_k[\varepsilon] = \Sigma W(\varepsilon_{атм}) \cdot \Sigma W(\varepsilon_{вода}) \cdot \Sigma W(\varepsilon_{почва}) \cdot W(\varepsilon_{метеор}) \cdot W(S) \cdot W(Ч) \le 1 \qquad (8)$$

$\Sigma W(\varepsilon_{атм}), \Sigma W(\varepsilon_{вода}), \Sigma W(\varepsilon_{почва}), W(Ч)$ for boiler-houses are the defining in a substantiation

of ecological compatibility of the project when introducing installations.

Reliability of heliosystem work in the season of prospective operation is connected with uncontrollable parameters, basically with the energy of solar radiation. However we can already say that reliability and stability of work is shown by the technics of advanced world Powers. It is improved by introduction of more effective sun heating modules, accumulators and settles down on the aloof areas (roofs of houses), it does not demand the man's constant control , its operation is simple. The architecture of modern town-planning provides for making special roofs with the built-in heating modules. This the technology of future.

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ИНТЕГРАЛЬНЫЙ КРИТЕРИЙ ЭКОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ ВНЕДРЕНИЯ ГЕЛИОЭНЕРГЕТИЧЕСКИХ СИСТЕМ

Б.Ж.ТУРКПЕНБАЕВА, Т.ОМАРБЕКУЛЫ

Предлагается совершенствование системы оценки экологической эффективности внедрения гелиоэнергетических систем для выработки тепла по сравнению с тепловыми котельными, работающими при сжигании традиционного топлива, через систему интегральных коэффициентов.

FEATURES OF GEOLOGICAL STRUCTURE AND GOLD-BEARING OF THE GOSHA DEPOSIT (THE LESSER CAUCASUS, AZERBAIJAN SECTOR)

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In the paper there have been considered the geological structure and the terms of the formation of Gosha gold-bearing deposit. There has been emphasized the importance of fractured, fault, ring and linear structures in the formation of the structural habit of the deposit. Analysis of peculiarities of forms and structure of the ore bodies in the deposit enabled to identify morphological types among them which are given below: zones of hydrothermal-modified rocks; quartz-sulphide veins and veinlets; stockwork formations. There have been also considered the results of statistical analysis of the distribution peculiarities of gold and concomitant ore elements in ores and in the enclosing rocks in the deposit. On the basis of results of the claster analysis there has been performed grouping of the ore component and there have been made a conclusions about their sources.

General information of the deposit. It was discovered in 1966 and is a typical volcanogenic deposit with a progressive ore-formation. It is linked with a contrast andesite-basalt (lower Bajocian-Zegamchai suite)-rhyolite (upper Bajocian-Gyzyldjin suite) formation. The deposit is a constituent part of the Gosha ore magmatic system (OMS) (1, 2, 5), including the Itkyrylan, Boyuk-Kishlak, Safarly, Perizamanly, Okzyuzlin and other manifestations. It is located in the far north-west part of the Shamkir uplift. Complex mosaic-block structure of the Gosha OMS with a system of faults of different types, is closely linked with a deep structure of the earth crust. It is proved by the results of geophysical investigations (seismic sounding, gravimetric and magnitometric survey).For the Akhmedabad-Gosha volcanic-tectonic complex which exists in the recent plan as an anticline of a near-latitudinal strike of the same name, wide range spread of the alternating lavo-, tuff – and eruptive breccia is typical. They are accompanied by the crushing and fluidization of the enclosing rocks and flows of ignimbrites. Their magmas possessed the same property as the rocks of acid ore-bearing sub-volcanic intrusions, andesite – dacites, rhyolites with numerous extrusions – their root facies (8). In the central part of the structure there occur small stocks of quartz diorites with a pear-shaped widening and branching in the upper parts. There also occur dykes of mainly neutral acid composition. The dykes are of a submeridional and north-east strike. Of the same strike are fractures, quartz-ore veins and zones of hydrothermal-modified rocks. It looks as if they set against the quartz-diorite intrusive and then go on towards the SW along the Gosha-Itkyrylan faults as far as more than 3 km till the Itkyrylan gold-bearing deposit (2, 3, 5).

The Gosha deposit itself is related to a conjugation of two fault dislocations of different directions of a different age, extension and orientation which is expressed in the surface by a zone of increased dislocation, including middle Jurassic subvolcanic, late Jurassic intrusive bodies and dyke formations. Most of them are linear magma-controlling faults of the pre-Jurassic location and they are of the north-west (general Caucasian) strike. They are traced along the axial line of the Akhmedabag-Gosha anticline having asymmetric structure – the north slope is steep (up to 45^0) as compared with the south one, having dip angle of about 20^0. Younger fault dislocations linked with the formation of the volcanic-tectonic complex are of significantly less extension and depth of location. Manifestation of extending tensions determined location of two systems of dislocations – near – latitudinal, transverse and near-meridional of a thrust type, breaking the area of the deposit into several geological-structural blocks with the amplitude of dislocation of 80-100 m. Less intensive fledge dislocations in many cases are ore-enclosing ones. The first system of dislocations which is of the west-north-west strike ($270\text{-}285^0$) with dip of the plane southwards under steep angles ($70\text{-}80^0$) till the vertical one and coinciding in time with the

opening of old fractures and with the formation of new ones, is expressed by intensive fracturing and crushing of rocks with the further hydrothermal change till the formation of secondary quartzites. Rather high thickness (about 100 m and more) and intensive hydrothermal processing of rocks as well as existence of faults of dyke bodies of small intrusions with a steep dip angle and zones of tectonic breccia of cataclasites etc., demonstrate large depth of the fault zone which is traced along the arch of the Akhmedabad-Gosha paleovolcanic complex. And tectonic movements repeated many times. For this reason the faults have several planes of the ruling. They are accompanied from the suspended and the lying blocks by series of echelon local fractures, by zones of the crushing of 2-2,5 cm thick with a tectonic clay and friction plane. The total amplitude of displacements along a group of close dislocators of the fractures is 8-10 m. Gold-bearing zones, in particular, № 1, 2, 3, 5 etc., are related to these zones.

The pre-ore age of these fault structures is proved by the relation to some of them not only of the zones of veinlet-impregnated ore mineralization, but of the subvolcanic bodies as well.

The second system of faults: near-meridional, transverse as related to general Caucasian and NW faults. They are of submeridional ($355\text{-}10^0$) to the NE ($40\text{-}50^0$) extension with steep dip angles ($70\text{-}85^0$) westwards and eastwards. Submeridional faults are more wide spread in the deposit (mainly, thrusts). In some intervals having curved, they acquire north-east strike. To these systems of faults, to be more exact, to their suspended blocks “filled” with hydrothermal-modified rocks (till the secondary quartzites 0,2-2,0 m thick), the richest zones of gold-sulphide mineralization are related (zones № 4, 10, 11, 12, 13 etc). Besides the rectilinear, relatively wide range movements, during the further stages there were formed radial, arch and ring faults. Along these faults there occur compensation subsidence of some blocks. They, due to symmetric (negative and positive) magnetic anomalies, zones, systems of small echelon shaped fractures, geomorphological ledges, linear and arch areals of changes of the rocks etc., are very well seen in the cosmic images. Moreover, the subsidence to a greater extent took place in the central part of the deposit, where the arch faults are characterized by a steeper dip.

Mineralization of the gold-pyritaceous type is concentrated in dilation veins of a different orientation and in the zones of hydrothermal development of lava-pyroclastic thickness of andesites of the lower and rhyodacitic porphyries in the upper Bajocian in the form of metasomatic bodies. The quartz veins by their morphology are usually of a different range. Together with relatively large ordinary veins, there occur short, not strike and dip cured veins. They have complex up dip branching with a transition into zones of thin veinlets and brecciation. Ore bodies are zones of most intensive modified hydrothermally modified rocks, impregnated with gold-bearing sulphides of productive mineral associations – pyrite, chalcopyrite etc., which are characterized by the veinlet character of the formation.

Metasomatic changes of the enclosing rocks. Intensive pre-ore propyllitization, silification and kaolinization are the peculiar features of the deposit. The propyllitic fields are characterized by a zonal structure. This reflects the increase of temperature and acidity of solutions towards the centre of the deposit. Among the field of propyllites, locally along the zones of the fracturing and fault dislocations the secondary quartzites are located, finishing processes of the pre-ore metamorphism. They mainly formed in the acid rocks. For the reason of heavy hydrothermal processing, the initial composition of the rocks can be hardly recognized due to relicts of the initial structures and impregnations of quartz. It is quite possible that the secondary quartzitic metasomatites were formed mainly in the acid rocks and rarely in tufts. Main minerals of the secondary quartzites – alunite, diaspore, dykite, sericite and kaoline form different paragenesises. Besides the above mentioned main minerals, there often occur pyrophyllite, zynyite and barite. The most important thing for the identification of the zoning in metasomatites is the presence of sericite. The secondary quartzites in the form of a line 100-150 m wide, spread along the fault zones. Judging by the outcropping of the rocks, they have stratal, raincoat like form. They steeply ($70\text{-}85^0$) subside westwards and eastwards. This structural plan of the secondary quartzitic metasomatites is validated by the data of the drilling and hypsometric

position of facial boundaries. Irrespect of mineral types of the secondary quartzites, they form in the hydrothermal – ore system the upper above – ore zone being indicators of the mineralization at depth. This requires their re-estimation in respect of the determination of the ore bodies underneath. Formation of secondary quartzites was accompanied by the entry of chlorine, precious and nonferrous metals. Moreover, the amount of the ore components was increased by 1-2 orders in propyllites and by 1-2 orders – in the secondary quartzites. The main way of the deposition of the matter at the ore stage – is the filling of the fractured cavities and pores. Metasomatosis prevails at the pre-ore stage; it manifests itself significantly in the beginning of the ore stage and accompanies the deposition of the ore matter as a side phenomenon in the near-vein space.

Structure of the ore bodies and zones of mineralization. The deposit is stripped by five horizons. It is formed by a system of quartz-sulphide veins and veinlets of a small extension (quartz-sulphide morphological type), by a series of close steeply diping mineralized and vein zones, (morphological type of mineralized and vein zones) and by the stockwork zones (morphological type – zones of the stockwork veins). Ore bodies of a vein type are localized in the central part of the deposit. Their dip is steep, nearly vertical. They are ore bodies №№ 4, 10, 11 12, 13. They have rather distinct geological boundaries and insignificant near-ore change of the enclosing rocks, demonstrating the prevalence of the process of the filling during the ore deposition. A typical feature of the mineralized and vein the zones is that the gold is distributed rather uneven and from there exist distinct ore columns. They are ore bodies №№ 5, 5-west and 3 in the south flank and №№ 1 and 2 in the north flank of the field. The ore zones are represented by the silicified, kaolinized (with the formation of the quartz-kaoline association) and pyritized hydrothermal modified rocks, penetrated by the quartz veinlets. One can identify the zones of intensive peritization with small lenses, veinlets, pockets and with impregnation of pyrite, chalcopyrite, sphalerite and magnetite. The vein filling is composed mainly of quarts – often of adulyar and rarely of carbonates. The rest of the minerals, including the ore minerals in amount of 30 species, are admixtures. For this reason, composition of the vein mass in the Gosha deposit should be considered as quartz. The quartz – kaoline mass with the above mentioned ore minerals and quartz fillings form ore zones having distinct boundaries with the enclosing rocks, though the latter are mineralized and with gold. Just for this reason, the contour of the vein-like and lens-like gold – ore bodies determined by the testing, very often goes beyond the ore-bearing zones. The veins are characterized by a steep dip ($60\text{-}90^0$) and presence of numerous apohyses. Thickness of the veins varies 0,2-0,3 up to 1-2,5 m with the extension of 20-30 up to 300-400 m. Some veins stretch as far as the Itkyrylan field and are traced far beyond it. Taking into account the spatial relation of these ore bodies to a united structure of a near-latitudinal strike, one can judge about prospects of determination of commercial concentrations of gold in the secondary quartzites in the Itkyrylan field to the west of Arangeran mountain. The most favourable structures for the determination of gold-ore mineralization are the near-vent secondary quartzites of the separated volcanic structures.

Along their dip the ore bodies are located echelon-like. The main structure enclosing the stockwork gold-ore mineralization are the wedge-like nodes of conjugation of the fault dislocations of different trends. These nodes were stripped in horizons of gallery № 4 by crosscut № 2 and gallery № 7 by crosscut 2-a.

The mineralized zones and ore bodies are characterized by significant extension – 700-800 m and more with thickness from several meters up to 15-20 m, and in some zone it is 30-50 m and more. Amount of gold varies in a wide range (from “traces” to 60-90 g/tn) not only in ore-bearing zones, but in the enclosed quartz – pyritaceous (with a subordinate chalcopyrite) ore bodies of a lens-vein form. In some intervals (and sections) they are characterized by a high amount of gold. In relatively enriched intervals of the ore zones there prevail samples with amount of Au 2,0-12,0 g/tn.

The average amount of gold in the preliminary investigated ore bodies is 5,47 g/tn with the average thickness 3,1 m. Amount of Au in the modified rocks in the ore-bearing vein zones

is from “traces” to the first hundreds of g/tn, including significant gold-ore intervals – from 3-4 to 100-130 g/tn, average amount in the deposit – 19 g/tn. It is interesting, that according to the data of the survey, in the horizon of gallery № 2 (200-210 m lower than the outcrop of vein bodies) in ores of the vein zone № 4, the amount of Au is 9,7 g/tn. This demonstrates the gold potential not only in the zone of oxidation of the deposit, but in its primary ores as well. Amount of Cu in the ore zones from the first hundreds to 3,5% (there prevail samples with amount of Cu up to 0,3-0,4 %), Zn and Pb – up to 0,1-0,2%, Co – 0,01-0,02%. Areas, corresponding to the conjugation of the ore-enclosing structures of different orientation, are the most typical of the formation of the ore columns with the same mineralization, enclosing veins. The ore columns occur in bunches of the veins related to the areas of the crossing, conjugation and branching of the fractures. The most favourable for the formation of the ore columns are the bendings of the ore-enclosing structures, nodes of the crossing of the pre-ore faults and zones of the fracturing of gold-quartz veins, apophises, bunches and pinches, areas of combination of mineral associations of different ages etc. This takes place in zones №№ 1, 2, 4, 5, 9. The length of the ore zones along strike – 100-450 m with thickness 0,8-8,1 m. The traced not complete extension along dip is 30-60 m to 210 m and more (3, 5, 6).

Peculiarities of distribution of gold and the concomitant components in the deposit. Zones of metasomatites in the Gosha gold-ore deposit differ not only by the spatial position, mineral composition and by the intensity of change, but by the amount and character of behaviour of gold and concomitant ore elements – Ag, Cu, Pb, Zn, Mo, Co, As, Hg, Bi, Mn, Ti (7, 9).

Gold, being a leading ore component of the deposit is characterized by extremely uneven dissemination. Its amount varies $(4,5 – 390,0)\cdot10^{-2}$ g/tn and is $16,51\cdot10^{-2}$ g/tn on the average. The amount of silver just like gold varies in a wide range – $(4,0\text{-}568,0)\cdot10^{-2}$ g/tn and is $128,2\cdot10^{-2}$ g/tn on the average. Amount of copper is $7,23\cdot10^{-3}$ g/tn elements is hardly the klark one.

The rocks composing the interstitial zone of the gold-ore bodies are characterized by higher amounts of the ore elements, especially of gold, silver, copper, cobalt and mercury (Table 1). Amount of gold varies $(2,7\text{-}700,0)\cdot10^{-2}$ g/tn and is $98,0\cdot10^{-2}$ g/tn on average. Amount of silver is $(4,5\text{-}800,0)\cdot10^{-2}$ g/th and it varies in a wider range than gold. Amount of copper is higher than the klark one. At R 5% level of significance (r=0,310) there has been determined significant relation between pairs of elements (Table 2): Au-Ag, Pb-Zn, Au-Cu, Cu-Pb, Co-Bi, Au-As, Mn-Co, Mn-Co, Co-As, Zn-Co, As-Bi, Co-Bi. The rocks in the inner zone are characterized by higher amounts of main (Au and Ag) and concomitant components (Table 3). Microscopic investigations revealed thin-disperse nature of this zone. They exist in pyrite, chalcopyrite and arconopyrite.

Table 1

Statistic parameters of distribution of the ore elements in sulphidized zones of hydrothermal-modified rocks (n=45%)

Elements	Amount	$\overline{X}$	S2	V
Au ($x10^{-2}$ q/t)	2.00-1500.0	150.5	435.9	1.45
Ag ($x10^{-2}$ q/t)	5.00-2800.0	645.0	1745.4	1.32
Cu ($x10^{-3}$ %)	0.5-51.70	9.2	85.6	1.54
As ($x10^{-3}$ %)	0.55-7.00	1.3	0.3	0.65
Hg ($x10^{-6}$ %)	1.00-85.0	4.8	0.45	0.50
Zn ($x10^{-2}$ %)	0.4-150	35.4	151.6	2.5
Pb ($x10^{-3}$ %)	0.5-4.30	0.85	0.1	0.42
Mo ($x10^{-4}$ %)	0.3-15.6	5.4	8.7	0.1
Co ($x10^{-3}$ %)	2.0-450.0	150.5	251.6	0.9

Mn ($x10^{-3}$ %)	1.0-30.0	4.6	8.4	0.95
Ti ($x10^{-3}$ %)	1.00-6.5	2.8	0.6	0.4
Bi ($x10^{-3}$%)	15.0-35.00	26.6	10.4	0.3

Table 2

Correlation matrix of distribution of the ore elements in sulphidized zones of hydrothermal-modified rocks (n=45; >>0,300, reliability 95%)

	Ag	**Cu**	**Pb**	**Zn**	**Co**	**Mo**	**As**	**Hg**	**Bi**	**Mn**	**Ti**
Au	0.654	0.421	0.105	0.085	0.023	0.016	0.540	0.125	0.098	0.123	0.145
Ag		0.245	0.216	0.125	-0.420	-0.120	0.240	-0.143	0.175	-0.145	-0.216
Cu			0.310	0.140	0.120	0.213	0.310	-0.117	0.066	0.054	0.105
Pb				0.545	0.195	0.061	0.055	0.017	0.098	0.095	0.024
Zn					0.245	0.078	0.129	0.021	0.078	0.215	0.044
Co						0.088	0.256	0.044	0.044	0.127	0.019
Mo							0.038	0.016	0.099	0.111	0.015
As								0.218	0.411	0.012	0.150
Hg									0.315	0.022	0.133
Bi										0.113	0.083
Mn											0.428

Correlation analysis (Table 4) (at R 5% level of significance r+0,300) has determined a relation between the pairs of elements: Au-Ag, Pb-Zn, Au-As, Au-Cu, Bi-As, Bi-Hg, Mn-Ti, Cu-Pb, Cu-As. Negative significant relation has been determined between Ag-Co. By the claster analysis of R type there has been conducted clastering of elements by groups in every studied zone. The results of the grouping of elements in weakly hydrothermal modified rocks demonstrate that at R 5% level of significance (r=0,38), three groups of elements have been identified: 1) Au-Ag-As-Cu-Bi-Hg; 2) Zn-Pb; 3) Mn-Ti.

In rocks composing the interstitial zone of ore-metasomatic column, at R 5% level of significance (r+0,380) two groups of elements have been identified: 1) Au-Ag-Cu-Bi; 2) Pb-Zn. Somewhat below this level one can identify an independent group Mn-Ti. In the central zone represented by sulphidized hydrothermal-modified rocks, at R (5%) level of significance (r=300,0), four discrete groups of elements have been identified: 1) Au-Ag; 2) Cu-As-Bi; 3) Pb-Zn; 4) Mn-Ti.

Table 4

Statistic parameters of distribution of elements in the intensively hydrothermal modified rocks (n=42)

Elements	**Amount**	$\overline{X}$	**S2**	**V**
Au ($x\cdot10^{-2}$ g/t)	2.70-700.0	98.0	75.4	0.9
Ag ($x\cdot10^{-2}$ q/t)	4.50-800.0	142.4	3254.3	0.99
Cu ($x\cdot10^{-3}$ %)	1.00-970.0	33.2	3.9	2.8
As ($x\cdot10^{-3}$ %)	0.40-120.5	2.9	2.7	1.1
Hg ($x\cdot10^{-6}$ %)	1.00-5.20	1.9	0.5	0.43

Zn ($x \cdot 10^{-2}$ %)	0.70-930.0	12.4	21.7	2.33
Pb ($x \cdot 10^{-3}$ %)	1.40-	9.3	15.1	1.50
Mo ($x \cdot 10^{-4}$ %)	0.40-5.20	2.0	1.9	0.85
Co ($x \cdot 10^{-3}$ %)	2.00-1500.0	56.7	1820.5	1.36
Mn ($x \cdot 10^{-3}$ %)	0.80-5.40	1.4	42.0	0.89
Ti ($x \cdot 10^{-3}$ %)	0.30-955	3.1	8.5	0.88
Bi ($x \cdot 10^{-3}$ %)	0.40-24.00	15.85	32.5	0.45

Table 5

Correlation matrix of distribution of the ore elements in the intensively hydrothermal-modified rocks (n=42, r>0,38, reliability 95%)

	Ag	**Cu**	**Pb**	**Zn**	**Co**	**Mo**	**As**	**Hg**	**Bi**	**Mn**	**Ti**
Au	0.566	0.429	0.134	0.128	0.129	0.019	0.346	0.009	0.099	0.008	0.103
Ag		0.126	0.135	0.131	0.049	0.124	0.129	0.017	0.143	0.019	0.058
Cu			0.416	0.135	0.128	0.217	0.317	0.051	0.416	0.121	0.014
Pb				0.535	0.136	0.091	0.120	0.025	0.100	0.066	0.095
Zn					0.312	0.044	0.211	0.074	0.200	0.216	0.145
Co						0.166	0.318	0.016	0.310	0.314	0.128
Mo							0.097	0.009	0.036	0.009	0.026
AS								0.218	0.311	0.121	0.024
Hg									0.222	0.144	0.015
Bi										0.027	0.009
Mn											0.315

Analysis of the position of elements in groups enables to divide them into three groups according to their genetic features: 10 Au-Ag-Cu-As-Bi-Pb-Zn; 2) Co-Mo-Hg; 3) Mn-Ti. The first group includes elements of a hydrothermal origin. The main argument in favour of this conclusion is, first, regular increase of their amount in the direction from the enclosing rocks towards the mineralized zone. The second group includes elements having no proper places in clasters and their composition does not indicate zone of their location. By their genetic features they have been considered as polygenic, i.e. they can be mobilized out of the enclosing rocks. Elements from the third group Ti-Mn are characterized by nearly stable amount in all the three zones and they always have close positive relation between each other. They are petrogenic and they are borroved from the enclosing tuffaceous rocks.

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QOŞA YATAĞININ GEOLOJI QURULUŞU VƏ QIZILLIĞI (KIÇIK QAFQAZ, AZƏRBAYCAN HISSƏSI)

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Məqalədə Qoşa qızıl yatağının geoloji quruluşuna və əmələ gəlmə şəraitinə baxılır. Yatağın struktur xüsusiyyətlərinin formalaşmasında qırılma, çat, həlqəvi və xətti strukturların əhəmiyyətli rolu müəyyən edilmişdir. Filiz kütlələrinin quruluşu və formasının xüsusiyyətlərinin təhlili, onlar arasında aşağıdakı morfoloji tipləri ayırmağa imkan verir: hidrotermal dəyişilmiş süxur zonaları, kvars - sulfid damar və damarcıqları və ştokverklər. Ətraf süxurlarda və filizlərdə qızılın və onu müşayiət edən filiz elementlərinin təyin olunma xüsusiyyətlərinin təhlilinin statistik nəticələri verilmişdir. Klaster analizi nəticələrindən istifadə etməklə, filiz komponentlərinin qruplaşdırılması aparılmış və onların mənbələri haqqında nəticələr göstərilmişdir.

WATER MEDIUMS PURIFICATION FROM PHENOL BY POLYMERIC SORBENT

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For phenol sorption from aqueous solutions P, N-containing sorbent obtained on the base of phosphochlorinated PB has been used. Experiments were carried out in dependence of sorbent concentration, contact time and phenol concentration. Equilibrium sorption characteristics have been investigated by Langmuir and Freundlich Models and it was established that at initial phenol concentration up to 346.0 mg/l sorption obeys Freundlich equation, and under higher initial phenol concentration – Langmuir equation. For analysis of experimental kinetic data pseudo-first and pseudo-second-order models have been applied. It was confirmed that under lower initial concentration sorption kinetics is described well by pseudo-first-order model, but under higher concentration by pseudo-second-order model.

Keywords: Sorption; Phenol; P, N-containing sorbent; Isotherm; Kinetic

Phenol and its derivatives are raw materials or solvents in the chemical and also petrochemical processes and occur in wastewater of a number of industries such as oil refineries, petrochemical units, paper, textile, synthetic rubber and pharmaceutical enterprises [1,2]. Almost all phenolic compounds are highly toxic at the concentrations upon their discharge into the receiving effluents. They can exert negative effects on biological processes in water and are considered to be of priority among carcinogenic pollutants.

The presence of phenolic compounds even at low concentrations can be an obstacle to the reuse of water because of unpleasant odour. Thus, the removal of phenols from such industries and wastewater streams is considered to be necessary before discharging to the environment and becomes a major environmental problem [3-5].

Various physico-chemical and biological methods have been applied to remove phenolic compounds as well as toxic organic pollutants from wastewater. Among these techniques the use of organic and inorganic natural sorbents for sorptional removal differs by its efficacy. A variety of sorbents include clays [6,7], activated carbon [1] and polymeric products (resins, polymers) [3,8].

By the comparative studies [9] a high sorption ability of activated carbon due to its vast surface area and affinity for many organic chemicals was determined. However, activated carbon is costly regenerated (high temperature and/or steam is needed) and has a high extent of granulation and also tends to sorb most organic chemicals indiscriminately, making it difficult to selectively recover certain organic chemicals for reuse.

These deficiencies caused a growing interest in developing alternative sorbents. Polymeric sorbents can be considered as an alternative to activated carbon due to their wide variations in functionality, surface area, porosity and fine regeneration by various solvents. For this aim industrial and synthesized (in laboratory conditions) sorbents can be used. In these works analysis of equilibrium and kinetic characteristics of sorption process was realized which allows to evaluate the efficacy of using sorbent. It was found that the indicated characteristics are caused by series of factors, one of which being a type of sorbent. Thus, offering of each new sorbent presupposes an analysis of the indicated characteristics, which also allows to clear up the peculiarities of sorption mechanism.

This study focuses on investigation of sorption characteristics of the sorbent on the basis of polybutadiene (PB) towards phenol in equilibrium and kinetic aspects. Sorption equilibrium was presented by Langmuir and Freundlich models and for kinetic data analysis pseudo-first-order and pseudo-second-order kinetic models were used.

Experimental

For obtaining of sorbent the initial polymer, i.e. PB, was treated by reaction of oxidative chlorophosphorylation with PCI_3 in the presence of oxygen with following aminolysis of the obtained modificate by diethylamine. Detailed synthesis describing is presented in earlier published works [10,11].

Structure of phosphochlorinated PB was studied by NMR- ^{1}H, ^{13}C, ^{31}P [12] and product of aminolysis by IR-spectroscopy. It was established that sorbent included such functionally-active groups as $–P(O)(OH)[NH(C_2H_5)_2]^+CI^-$; $-OP(O)(OH)[NH(C_2H_5)_2]^+CI^-$; $-P(O)(OH)_2$; $-OP(O)(OH)_2$ type.

In present investigation sorbents with the particle range of 0.4−0.43 mm were used

Standard solutions were prepared by dissolving 2g of "analytical reagent" grade phenol in 1l of distilled water (ρ=1.034 g/l; pK_a=9.89).

The test solutions were prepared by diluting of standard solutions to the desired concentration.

100 ml of phenol solutions of various initial phenol concentration are placed into 250 ml reaction flasks and a fixed sorbent amount is added to each of them. All sorption experiments were carried out using batch equilibrium tests. The suspension containing sorbent and phenol solutions were agitated on a mechanical shaker for 12 h (at 293 K). Then, the contents of the bottle were filtered and residue was analyzed for residual concentration of phenol.

Kinetic experiments were carried out using of known amount of sorbent and at different initial phenol concentrations. After fixed time intervals the corresponding aliquots were analyzed to determine phenol concentration and registered.

Each experiment was performed twice under identical conditions and average values were used for future calculations.

The concentration of residual phenol in the adsorption media was determined spectrophotometrically. The absorbance of the coloured complex of phenol and 4-aminoantipyrine was read at 500 nm [13].

Results and discussion

Sorption of phenol onto sorbent was investigated as a function of concentration of sorbent and initial phenol concentration. The results are given as the units of sorbed phenol quantity per gram of sorbent at any time and at equilibrium, q and q_{eq} (mg/g), respectively, as well as unsorbed phenol concentration in solution at any time and at equilibrium, C and C_{eq} (mg/l), respectively, as

$$q_{eq} = (C_0 - C_{eq}) \cdot \frac{V}{W} \qquad (1)$$

and sorption yield as

$$S_Y = 100 \frac{(C_0 - C_{eq})}{C_{eq}} \qquad (2)$$

Fig.1 shows the amount of phenol removed as a function of sorbent dosage in their solution. Sorbent dosage was varied from 1 to 20 g/l. It is evident that for the quantitative removal of phenol from the solution of concentration 1.240 g/l, sorbent dosage of 1g/l is required for 82.6 % removal of phenol. The same regularities are observed for phenol solutions of different concentrations and respective yields. The further increasing of sorbent dosage up to 2 g/100 ml leads to the increase of phenols removal up to 84.3 %, the accretion being negligible. The data show that an efficient removal can be reached at the sorbents concentration 10 g/l.

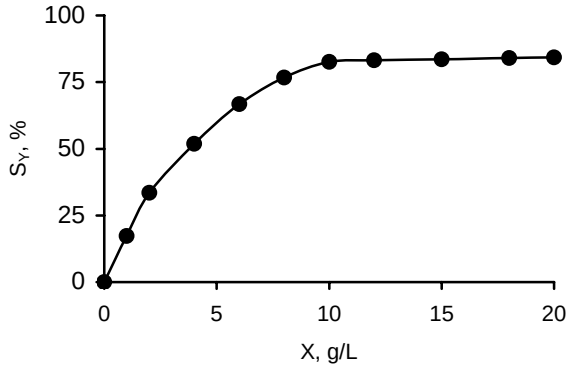

Fig. 1. Effect of sorbent dosage (X, g/l) on sorption yield (T=293 K; C_0=1.240 mg/l).

In Table 1 the effect of initial phenol concentration on the sorbed phenol quantity per gram of sorbent and sorption yield at equilibrium is shown. As seen from the Table with increasing initial phenol concentration q_e increased, too, that may be related with the increase of interaction between phenol and sorbent. At first, rate of q_{eq} increasing is fast, but at high initial concentrations of phenol it is stabilized. It means that sorbent included a limited number of active centers for sorption.

Table 1

Change of phenols amount in sorbent and sorption yield at equilibrium in dependence from initial phenol concentration

C_0, mg/l	41.62	96.83	346.0	530.0	824.3	1018.3	1240.0	1702.0
q_{eq}, mg/g	3.82	9.12	31.99	49.16	75.50	90.81	102.40	121.88
S_Y, %	91.8	94.2	92.4	92.8	91.5	89.1	82.6	71.6

The sorption yield is high (S_Y>90%) at comparatively low initial concentrations (C_0 <1000 mg/l), but as initial phenol concentration increases sorption yield gradually decreases. At lower concentrations all sorbate molecules present in sorption medium can interact with active centers, that's why sorption yields were higher. Lower values of sorption yields have been observed at higher concentrations because of saturation of sorption centers.

Before studying phenol sorption equilibrium it was necessary to determine equilibrium contact time required for phenol (the time required for reaching equilibrium after contact with sorbent). The preliminary tests showed that phenol sorption is fast at the initial stages and becomes slower near the equilibrium. Fig.2 presents the plot of phenol sorption yield versus contact time for sorbent at initial phenol concentrations 96.83, 530.0 and 1240.0 mg/l, respectively, at 293 K with contact time of 240min. Sorbent concentration in all experiments was 10 mg/l. As seen from Fig.2, the rate of phenol removal is very rapid during initial 60 minutes and decreases thereafter.

It is revealed that there were no considerable changes in phenol removal after 120 min of contact time for different initial concentrations.

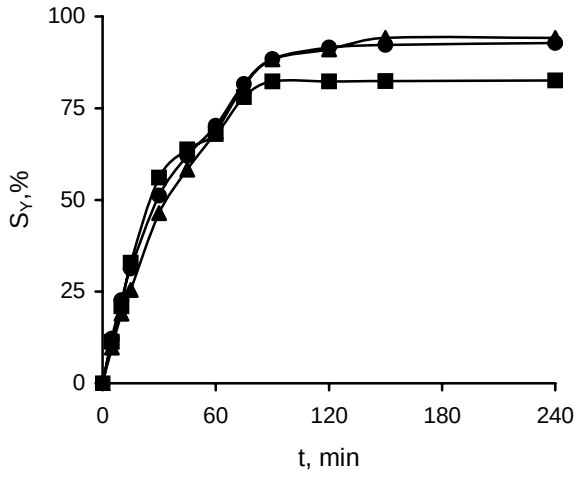

Fig.2. Effect of contact time (t, min) on sorption yield for different initial phenol concentrations: ▲-96.83; ■-530.0; ●-1240.0 mg/l (T=293 K; X=10 g/l).

Fig.3 presents the plot between the equilibrium phenol values in solution and in sorbents, i.e. sorption isotherms.

As seen from Fig.3, equilibrium in system "sorbent-phenol solution" is reached for equilibrium phenol concentration in solution 483.2 mg/l and 121.88 mg/l in sorbent.

At first sight, this isotherm belongs to L2 type of isotherm in accordance with isotherm classification by Gules described in [14]. However, by more detailed describing of local sites of isotherm deviation from the common pattern of L-isotherms on its initial site (up to q_{eq} 26.1mg/g) can be observed. Therefore, isotherm has a stepwise character. It is known [14] that sorption isotherm stages show either orientation change on the surface or formation of polymolecular layers. The second assertion does not find its confirmation with regard to limiting phenol solubility in water, that equals 86.95g/l in accordance with literature [15].

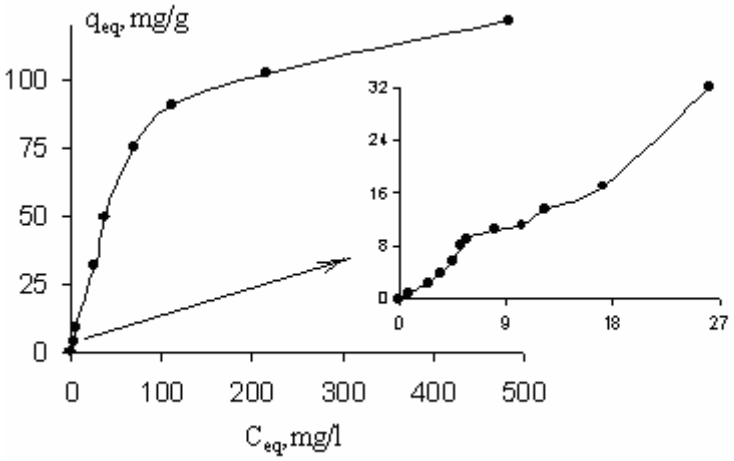

Fig.3. Isotherm of phenol sorption from water by polymeric sorbent (T=293K; X=10g/l)

Thus, the obtained isotherm can be divided into 3 sites. Intervals of equilibrium phenol concentration in solution are 0-5.63(1); 5.63-26.1(II); 26.1-483.2(III) mg/l respectively. As seen from isotherm character, Sites I and II obey S1 type of isotherm, and the third site corresponds to L2 type of isotherm.

In all probability, with increasing phenol concentration in water the character of sorbate orientation on the surface changes.

It is known that equilibrium data can be analyzed by using commonly known sorption isotherms, which provide the basis for the design of sorption systems [3-5]. The most widely used isotherm equation for modeling the sorption data is the Langmuir equation, which is valid for monolayer sorption onto a surface with a finite number of identical sites and is given by equation (3).

$$q_{eq} = \frac{q_{\max} K C_{eq}}{1 + K C_{eq}} \qquad (3)$$

where K is the adsorption equilibrium constant including the affinity for binding sites (l/mg) and q_{max} is the maximum amount of phenol per unit weight of sorbent to form a complete monolayer on the surface (mg/g). The equation represents a practical limiting sorption capacity when the surface is fully covered with phenol. q_{max} and K can be determined from the linear plot of C_{eq}/q_{eq} versus C_{eq} [1].

The Freundlich model is an empirical equation based on sorption on a heterogeneous surface. It is given as:

$$q_{eq} = K_F \, C_{eq}^{1/n} \qquad (4)$$

where K_F and n are the Freundlich constants that indicate relative capacity and adsorption intensity, respectively. The Freundlich equation can be linearized by taking logarithms and its constants can be determined [1].

The isotherm constants and correlation coefficients by linearized isotherms of Langmuir and Freundlich were estimated and tabulated in Table 2.

Table 2

Isotherms constants for phenol sorption on sorbent at different concentration intervals

Concentration intervals		Langmuir Model			Freundlich Model		
C_0, mg/l	C_{eq}, mg/l	q_{max}, mg/g	K, l/mg	R^2	K_F, (mg/g)·(l/mg)$^{1/n}$	1/n	R^2
0-96.83	0-5.63	-	-	-	1.006	1.1847	0.9681
96.83-346.0	5.63-26.1	131.58	0.010	0.1732	1.955	0.8017	0.9109
346.0-1702.0	26.1-483.2	140.85	0.014	0.9957	9.977	0.4315	0.8758

As seen from Table 2 at the comparatively low initial concentrations (Sites I and II) the Freundlich Model exhibited a slightly better fit to the sorption data than the Langmuir Model. At these sites sorption mainly takes place on the energetically heterogeneous surface and interaction force between sorbate molecules is larger than interaction force between the solute and sorbent. In this case phenol molecules tend to place on the sorbent surface in the form of chains and clasters. Their such kind of disposition is promoted by high solvent sorption, phenols monofunctionality and enough polarity of sorbents surface. But with increasing of concentration (Site III) the Langmuir Model is more suitable. Apparently, in this Site phenol molecules have another, namely a parallel, orientation.

Kinetic models are used to examine the rate of the adsorption process and potential rate-controlling step, i.e. mass transfer or chemical reaction. The capability of pseudo-first-order and pseudo-second-order kinetic models were examined in this study.

The pseudo-first-order equation of Lagergren is generally expressed as follows [2]:

$$\frac{dq}{dt} = k_1 (q_{eq} - q) \qquad (5)$$

where k_1 is the rate constant of pseudo-first-order sorption (min^{-1}).

Integrating this equation for boundary conditions: t=0 to t and q=0 to q_{eq} gives

$$\log(q_{eq} - q) = \log(q_{eq}) - \frac{k_1}{2303} t \qquad (6)$$

A plot of $\log(q_{eq} - q)$ against of t should gives a linear relationship with the slope of $K_1/2.303$ and intercept of ($(\log q_{eq})$.

The pseudo-second-order kinetic rate equation is expressed as:

$$\frac{dq}{dt} = k_2 (q_{eq} - q)^2 \qquad (7)$$

where k_2 is the rate constant of pseudo-second-order sorption (g mg^{-1} min^{-1}). For the same boundary conditions, the integrated form of equation (7) becomes

$$\frac{t}{q} = \frac{1}{k_2 q_{eq}^2} + \frac{1}{q_{eq}} t \qquad (8)$$

The second-order rate constant can be determined from the intercept of the linearized pseudo-second-order rate equation.

The plots of equations (6) and (8) are shown in Fig.4 and 5. Values of corresponding parameters for the models are presented in Table 3.

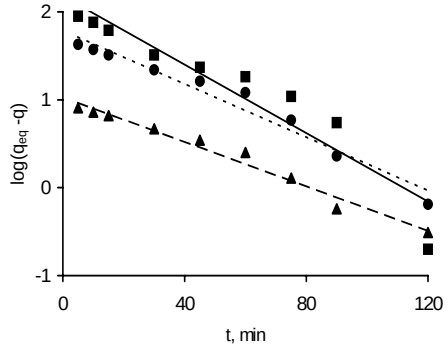

Fig.4. Pseudo-first-order sorption kinetics of phenol at different concentrations ▲-96.83; ■-530.0; ●-1240.0 mg/l (T=293 K; X=10 g/l)

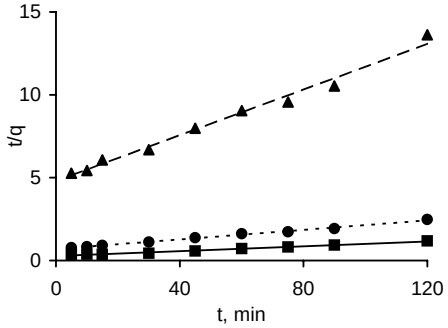

Fig.5. Pseudo-second-order sorption kinetics of phenol at different concentrations ▲-96.83; ■-530.0; ●-1240.0 mg/l (T=293 K; X=10 g/l)

Table 3

Kinetic analysis of phenol sorption by various models

Initial concentration, C_0, mg/l	$q_{eq,exp}$, mg/g	Pseudo-first-order			Pseudo-second-order		
		κ_1	$q_{eq,cal}$	R^2	κ_2	$q_{eq,cal}$	R^2
96.83	9.12	0.029	10.73	0.977	0.001	14.45	0.9866
530.00	49.16	0.035	62.22	0.964	0.0003	69.44	0.995
1240.00	102.40	0.044	150.73	0.8865	0.0002	136.99	0.9858

The results show that at initial phenol concentrations 96.83 and 530.0 mg/L the correlation coefficient obtained both for the first-order kinetic model and second-order kinetic order are high enough. The theoretical q_{eq} values found by pseudo-first-order kinetic model gave more reasonable values. Thus, at these initial concentrations pseudo-first-order model describes phenol sorption better.

At the initial phenol concentration 1240.0 mg/l correlation coefficient obtained for pseudo-second-order model is higher and theoretical values of q_{eq} are more suitable. It means that at given initial concentration value are involved new active centers into sorption process.

Thus, according to a change of the initial phenol concentration in solution, sorption nature changes too, that can be explained by participation of the active centers of different nature in sorption processes.

Conclusions

In present investigation the ability of P, N-containing sorbent on the basis of phosphochlorinated PB for sorption has been studied in equilibrium and kinetic aspects. It was found that sorption isotherm can be divided conditionally into 3 sites. The first 2 sites, corresponding to initial phenol concentrations 0-96.83 and 96.83-346.0 mg/l obey the Freundlich equation, and the third Site with phenol concentration 346.0-1702.0 mg/l – the Langmuir equation. Phenol sorption kinetics was studied by using pseudo-first and pseudo-second-order models. Under comparatively low initial phenol concentrations the results point to better correlation of obtained data for pseudo-first-order model. With increasing initial phenol concentrations the better correlation is provided by pseudo-second-order model.

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FENOLUN SULU MƏHLULLARDAN POLİMER SORBENTLƏ TƏMİZLƏNMƏSİ

A.M. MƏHƏRRƏMOV, R.M. ALOSMANOV, K.N. ORUCOVA, A.Ə. ƏZİZOV

Fenolun sulu məhlullardan sorbsiyası üçün fosfoxlorlaşmış polibutadien əsasında alınmış P,N tərkibli polimer sorbent istifadə olunmuşdur. Prosesə sorbentin miqdarı, sorbsiya müddəti və fenolun qatılığının təsiri öyrənilmişdir. Sorbsiya izoterminin təcrübi nəticələri Lenqmür və Frendlix modellərilə işlənmiş və tədqiq olunan sistem üçün modellərin parametrləri hesablanmışdır. Müəyyən olunmuşdur ki, fenolun ilkin qatılığının 346.0 mq/l-ə qədər qiymətlərində sorbsiya izotermi Frendlix, yuxarı qiymətlərində isə Lenqmür tənliyinə tabe olur. Təcrübi kinetik nəticələr psevdo 1-ci və 2-ci tərtib modelləri ilə tədqiq olunmuşdur. Fenolun aşağı qatılıqlarında prosesin kinetikasının psevdo 1-ci tərtib, yuxarı qatılıqlarında isə psevdo 2-ci tərtib modellərinə tabe olması müəyyənləşdirilmişdir.

THE FAUNISTIC AND BIOLOGICAL CHARACTERISTICS OF FISH PARASITES OF THE ABSHERON PENINSULA COASTAL WATERS OF THE CASPIAN SEA

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The analysis of the biological characteristic of fish parasites fauna in the water bodies has a big theoretical and practical significance because it gives a data for identification of parasites' life circles and their ecological peculiarities in a specific condition of any water body, adaptive responses of parasites to impacts of different ecological factors, patterns of distribution within the water area, and assists in the preparation of measures against fish diseases.

123 fish species were found in the Caspian Sea and deltas of its basin's rivers up to date. The fauna of Caspian ichthyoparsites were investigated in many areas of the sea by specialists of Azerbaijan [4, 6], Russia [1, 2, 5, 7] and Iran [8, 9, 10], and more than 390 species of parasites were found in (on) Caspian fishes. However before our investigation, there was no any literary data about the parasites of fishes of the Absheron Peninsula coastal waters, so the ichthyoparasite fauna of this sea area was not analyzed.

Material and methods

In 2002-2006 in the Caspian Sea near the coast of the Absheron Peninsula 678 fishes of 23 species, including *Huso huso, Acipenser gueldenstadti, A. stellatus, Clupeonella delicatula caspia, C. engraulliformis, Alosa caspia caspia, A. kessleri kessleri, Salmo trutta caspicus, Rutilus rutilus caspius, R. frisii kutum, Chalcalburnus chalcoides, Cyprinus carpio, Syngnathus nigrolineatus, Liza auratus, L. saliens, Atherina mochon caspia, Neogobius bathybius, N. kessleri gorlap, N. melanostomus affinis, N. fluviatilis pallasi, N. caspius, Bentophilus magistri abdurahmanovi,* and *B. macrocephalus* were investigated by the method of full parasitological dissection [3]. The parasites of all taxonomic groups were collected, identified and studied.

The research results and their discussion

Following 76 species of the fish parasites were found as a result of our researches: Cryptobia borelli, Eimeria rehimae, Glugea bychowskyi, G. schulmani, Pleistophora schulci, P. tuberifera, Myxidium rhodei, Sinuolinea sakinachanumae, Sphaerospora caspialosae, S. donecae, Chloromyxum truttae, Myxosoma branchiale, M. circulus, Myxobolus bramae, M. cyprini M. diversicapsularis M. exiguus, M. muelleri, M. musculi, M. pseudodispar, Trichodina caspialosae, Trichodina jadranica, T. partidisci, Polypodium hydriforme, Dactylogyrus chalcalburni, D. crucifer, D. frisii, D. nybelini, D. turaliensis, Ligophorus heteronchus, L. szidati, L. vanbenedenyi, Nizschia sturionis, Diclybothrium armatum, Mazocraes alosae, Paradiplozoon chazaricum, P. homoion, Amphilina foliacea, Eubothrium acipenserinum, E. crassum, Bothrimonus fallax, Proteocephalus gobiorum, Aspidogaster limacoides, Bunocotyle cingulata, Monovitella cyclointestina, Saccocoelium obesum, S. tensum, Dicrogaster contracta, Asymphylodora kubanica, Skrjabinopsolus emiarmatus, Sphaerostoma bramae, Pronoprymna ventricosa, Diplostomum chromatophorum, D. gobiorum, D. paraspathaceum, D. rutili, D. spathaceum, Tylodelphys clavata, Posthodiplostomum cuticola, Clinostomum complanatum, Ascocotyle coleostoma, Capillaria gobionina, Thominx tuberculata, Cystoopsis acipenseris, Eustrongylides excises, Capillarospirura ovotrichuria, Cyclozone acipenserina, Cucullanus sphaerocephalus, Cucullanellus minutes, Anisakis schupakovi, Porrocoecum reticulatum, Contracaecum microcephalum, C. spiculigerum, Corynosoma capsicum, Leptorhynchoides plagicephalus, and Pseudotracheliastes stellatus.

The list of the parasites named above consisting of 1 species of Flagellata, 1 species of Coccidia, 4 species of Microsporidia, 14 species of Myxosporea, 3 species of Ciliata, 1 species

of Coelenterata, 13 species of Monogenea, 1 species of Amphilinida, 4 species of Cestodes, 1 species of Aspidogastrea, 18 species of Trematoda, 12 species of Nematoda, 2 species of Acanthocephala, and 1 species of Crustacea.

Though the Absheron Peninsula coastal waters are brackish (approximately 13‰), only 25 species (*Eimeria rehimae, Glugea bychowskyi, G. schulmani, Pleistophora tuberifera, Sinuolinea sakinachanumae, Sphaerospora caspialosae, S. donecae, Trichodina caspialosae, Ligophorus heteronchus, L. szidati, L. vanbenedenyi, Nizschia sturionis, Mazocraes alosae, Proteocephalus gobiorum, Bunocotyle cingulata, Monovitella cyclointestina, Saccocoelium obesum, S. tensum, Dicrogaster contracta, Pronoprymna ventricosa, Capillaria gobionina, Cucullanellus minutus, Anisakis schupakovi, Corynosoma caspicum, Pseudotracheliastes stellatus*) from 76 species, which were found here, are typical marine. Other 19 species (*Cryptobia borelli, Pleistophora schulci, Chloromyxum truttae, Polypodium hydriforme, Amphilina foliacea, Eubothrium crassum, Sphaerostoma bramae, Diplostomum chromatophorum, D. gobiorum, D. paraspathaceum, D. rutili, D. spathacum, Tylodelphys clavata, Posthodiplostomum cuticola, Clinostomum complanatum, Eustrongylides excisus, Porrocoecum reticulatum, Contracaecum microcephalum, C. spiculigerum*) are typical freshwater, and 32 species (*Myxidium rhodei, Myxosoma branchiale, M. circulus, Myxobolus bramae, M. cyprini, M. diversicapsularis, M. exiguus, M. muelleri, M. musculi, M. pseudodispar, Trichodina jadranica, T. partidisci, Dactylogyrus chalcalburni, D. crucifer, D. frisii, D. nybelini, D. turaliensis, Diclybothrium armatum, Paradiplozoon chazaricum, P. homoion, Eubothrium acipenserinum, Bothrimonus fallax, Aspidogaster limacoides, Asymphylodora kubanica, Skrjabinopsolus semiarmatus, Ascocotyle coleostoma, Thominx tuberculata, Cystoopsis acipenseris, Capillarospirura ovotrichuria, Cyclozone acipenserina, Cucullanus sphaerocephalus, Leptorhynchoides plagicephalus*) are euryhaline.

Typical marine species of parasites can infect fishes only in brackish waters of the Caspian Sea, euryhaline species of parasites can infect them both in brackish and fresh waters, but typical freshwater species can infect the fishes only in fresh waters. The freshwater parasites infect fishes in freshwater and just after that are carried by infected fishes to coastal waters of the Absheron Peninsula. This supposition is corroborated by the fact that all the freshwater species, which we found are endoparasites, they live only in fish organism and have no direct contact with external environment.

Some parasites, including coccidians, microsporidians, infusorians, monogeneans, also round worm *Cucullanellus minutes* and crustacean *Pseudotracheliastes stellatus*, use only one host in their life cycle, i.e. they have simple life cycle. Some endoparasites (coccidians and microsporidians) have spores, these parasites penetrate fish when it stochastically swallows their spores. The nematode *C. minutus* infects fish when it swallows eggs of this worm. For reliable penetration of fish, these kind of parasites produce a lot of spores and eggs.

Ectoparasitic infusorians and crustaceans actively search the appropriate hosts and settle on the surface of their body, fins, and gills. This group of parasites is adapted to catch their hosts better than endoparasites, therefore they are less productive.

Reproduction processes of all ichthyoparasites with simple life cycle, which we found, take place on (or in) organisms of their hosts. They comparatively have a short life cycle and multiply very fast, they can rest very big abundance in favourable environmental condition and infect their hosts very intensively.

The species of fish parasites, which we found in the Absheron Peninsula coastal waters, circulate in nature by 14 ways, which are shown below. The development stages of parasites in external environment (EE) and their reproduction phases, and the names of parasites, which use any circulation way, are also shown.

First way of circulation is "- EE - fish (reproduction) -". It is typical for flagellate *Cryptobia branchialis,* coccidian *Eimeria rehimae,* microsporidians *Glugea bychowskyi, G. schulmani, Pleistophora sulci,* and *P. tuberifera,* ciliates *Trichodina caspialosae, T. jadranica,* and *T. partidisci*, coelenterate *Polypodium hydriforme*, monogeneans *Dactylogyrus*

chalcalburni, D. cruciser, D. frisii, D. nybelini, D. turaliensis, Ligophorus heteronchus, L. szidati, L. vanbenedenyi, Nizschia sturionis, Diclybothrium armatum, Mazocraes alosae, Paradiplozoon chazaricum, and *P. homoion,* crustacean *Pseudotracheliastes stellatus*.

II way of circulation is "- EE - oligochaete - fish - (reproduction) -". It is typical for round worm *Capillaria gobionina*.

III way of circulation is "- EE - oligochaete (reproduction) - fish - (reproduction) -". It is typical for myxosporeans *Myxidium rhodei, Sinuolinea sakinachanumae, Sphaerospora caspialosae, S. donecae, Chloromyxum truttae, Myxosoma branchiale, M. circulus, Myxobolus bramae, M. cyprini, M. diversicapsularis, M. exiguus, M. muelleri, M. musculi,* and *M. pseudodispar.*

IV way of circulation is "- EE - amphipode - fish - (reproduction) -". It is typical for amphilinida *Amphilina foliacea.*

V way of circulation is "- EE - copepode - fish (reproduction) -". It is typical for tape-worms *Eubithrium acipenserinum, E. crassum,* and *Proteocephalus gobiorum*.

VI way of circulation is "- EE - bivalve mollusk (reproduction) - fish (reproduction) -". It is typical for aspidogastrea *Aspidogaster limacoides*.

VII way of circulation is "- leech (reproduction) - fish (reproduction) -". It is typical for blood flagellate *Cryptobia borelli.*

VIII way of circulation is "- EE – oligochaete - nonpredatory fish - fish-eating bird (reproduction) -". It is typical for round worm *Eustrongylides excisus*.

IX way of circulation is "- EE - copepoda - fish - fish-eating bird (reproduction) -". It is typical for round worms *Contracaecum microcephalum* and *C. spiculigerum.*

X way of circulation is "- EE - crustacean - fish - seal (reproduction) -". It is typical for round worm *Anisakis schupakovi* and proboscis worm *Corynosoma caspicus.*

XI way of circulation is "- EE - gastropod mollusk (reproduction) - EE - leech - fish (reproduction) -". It is typical for fluke *Sphaerostoma bramae*.

XII way of circulation is "- EE - gastropod mollusk (reproduction) - EE - gastropod mollusk - fish (reproduction) -". It is typical for fluke *Asymphylodora kubanica.*

XIII way of circulation is "- EE - gastropod mollusk (reproduction) - EE - copepoda - fish (reproduction) -". It is typical for flukes *Bunocotyle cingulata* and *Pronoprymna ventricosa.*

XIV way of circulation is "- EE - gastropod mollusk (reproduction) - EE - fish - fish-eating bird (reproduction) -". It is typical for flukes *Diplostomum chromatophorum, D. gobiorum, D. paraspathaceum, D. rutili, D. spathaceum, Tylodelphys clavata, Posthodiplostomum cuticola, Clinostomum complanatum,* and *Ascocotyle coleostoma.*

23 species of fish parasites, which were found in the Absheron Peninsula coastal waters, circulate by first way, 14 species – by third way, 9 species – by 14th way, 3 species – by 5th way. All other ways are used by 1 or 2 species of ichthyoparasites. 23 species circulate without intermediate host and all them realize they reproduction only on (or in) fish.

We could not show circulation ways of 14 species, because their life circles are not known. These species are *Bothrimonus fallax* tape worm*, Monovitella cyclointestina, Saccocoelium obesum, S. tensum, Dicrogaster contracta,* and *Skrjabinopsolus semiarmatus* flukes*, Thominx tuberculata, Cystoopsis acipenseris, Capillarospirura ovotrichuria, Cyclozone cipenserina, Cucullanus sphaerocephalus, Cucullanellus minutes,* and *Porrocoecum eticulatum* round worms*, Leptorhynchoides plagicephalus* proboscis worm.

In all circulation ways of Caspian fish parasites in the coastal waters of the Absheron Peninsula there can be shown 21 manners of environment transition, which are small parts of a transition from one phase of life circle to another. These manners of environment transition are: "EE - fish", "fish - EE", "EE - oligochaete", "oligochaete - fish", "EE - amphipode", "amphipode - fish", "EE - copepode", "copepode - fish", "EE - bivalve mollusk", "bivalve mollusk - EE", "EE - gastropod mollusk", "gastropod mollusk - EE", "gastropod mollusk - fish", "leech - fish", "fish - leech", "fish - fish-eating bird", "fish-eating bird - EE", "EE - crustacean", "crustacean - fish", "fish - seal", "seal - EE".

Conclusion

The parasitological research of fish was carried out in the coastal waters the Absheron Peninsula in 2002-2006 and 76 species of parasites were found.

The Absheron Peninsula coastal waters are brackish (approximately 13‰), but among of all ichthyoparasite species, which were found here, only 25 species are typical marine, other 19 species are typical freshwater, and 32 species are euryhaline. Freshwater parasites infect fishes in fresh waters and just after that carried by infected fishes to coastal brackish waters of the Absheron Peninsula. So all freshwater species, which were found, are endoparasites and they have no direct contact with external environment. The ichthyoparasites of this area circulate in nature by 14 ways. In all the ways of circulation of Caspian fish parasites in Absheron Peninsula coastal waters there are 21 manners of a transition from one phase of life circle to another.

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XƏZƏR DƏNİZİNİN ABŞERON YARIMADASI SAHİLLƏRİ BOYUNCA BALIQ PARAZİTLƏRININ FAUNİSTİK VƏ BİOLOJİ XARAKTERİSTİKASI

S.N. MƏMMƏDOVA

2002-2006-cı illərdə Abşeron yarımadası boyunca Xəzər dəyizində 23 növdən olan 678 balıq tam parazitoloji yarma üsulu ilə tədqiq olunmuş, nəticədə 76 növ parazit tapılmışdır. Bunlardan 25-i tipik dəniz, 19-u tipik şirin su növləri, 32-si isə evriqalin növlərdir. Bu parazitlər təbiətdə 14 yolla dövr edirlər, bunlardan 23 növü aralıq sahibsiz inkişaf edir və ətraf mühitdə deyil, baliqda çoxalır. Parazitlərin öz mühitini dəyişməsinin bir neçə üsulu müəyyən edilmişdir ki, bunlardan balıqdan birbaşa xarici mühitə keçmə üsulundan daha çox istifadə olunur.

THE RATIO OF EPIPHYTIC ASCOMYCETES AND BASIDIOMYCETES YEASTS IN VARIOUS BIOTOPES

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In this article the data on revealing of ratio of epiphyte ascomycetes and basidiomycetes yeasts in different biotopes are cited. It is established, that the prominent features of phyllosphere of the plants, growing in any biotope, prevail at representatives of basidiomycetes affinitet. Nevertheless, the average-annual share of basidiomycetes kinds has appeared to be various in different biotopes.

Multiple analyses of quantity and diversity of yeasts allowed us to reveal out some specific features of the relation of an ascomycetes and basidiomycetes kinds in phyllosphere of various types of phytocenosis (1,2).

The specific peculiarity of phyllosphere of the plants, growing in any biotopes is always a great share of yeasts of basidiomycetes affinitet. Nevertheless, the average-annual share of basidiomycetes kinds has appeared to be essentially various in different biotopes (Fig.1). The highest share of basidiomycetes yeasts was in characteristic plants of a forest. Here the average number of ascomycetes consists of more than 100% from the total number of epiphytic yeasts. Considerably highest share of ascomycetes (about 28%) was in phyllosphere of a meadow. Obviously the relative abundance of ascomycetes on the leaves of meadow grasses increases due to the conjugate substrata (first of all due to entomophilic flowers). In general the wind pollinated plants are prevailed in the forest. The yeast communities of these plants differ from the community of phyllosphere, so the basidiomycetes yeasts are always predominated in the forest. The share of ascomycetes kinds of the yeast fungus on marsh plants appeared to be highest and almost made half from the general abundance of yeast fungus. Probably, it is connected with some microclimatic features of this biotype and with greater resistance of basidiomycetes kinds and with the conditions of low humidity.

However on a bog we could analyze the least quantity of kinds of plants (only two), the probability of casual overestimate of a relative abundance of ascomycetes yeast therefore are rather high (5,6).

On the plants in a city stripe the share of basidiomycetes makes 83%. If consider that the aggregate number of yeasts, in the whole, on plants of antropogenous habitats was the lowest, and the share of epiphytic ascomycetes yeasts in general are always below than the basidiomycetes yeasts, then it is no wonder, that in conditions of anthropogenic load of ascomycetes kinds could make only 17%, whereas we as well analyzed the leaves of entomophilous grasses. Besides that the city vegetation is the most rarefied, which seriously reduces mutual insemination by yeast cells and due to it there increases general share of different kinds (9, 10).

As it was already mentioned before that the mass development of ascomycetes yeasts in phyllosphere is mainly connected with a phase of flowering of entomophilies plants. Here essential distinctions between the forest and meadow biogeocenoses can be seen as well (Fig.2). In a forest the share of ascomycetes kinds of yeasts on leaves and flowers is strongly differed. If on leaves its average number never exceeds 20%, then in plants in the time of flowering it quickly reaches almost 60%.

In autumn when the time of active mass flowering passes away it sharply falls almost up to zero. On meadow grasses the share of ascomycetes also rises in flowers during their mass flowering, but kept at a high level (in the order of 40-50%) up to the end of the vegetative period. It is obvious that it is possibly connected with greater differences between the time of flowering

among meadow plants and accordingly more long preservation of a substratum (flowers nectar), necessary for the maintenance of high number of kopiotrophe ascomycetes kinds. Unlike the phyllosphere of forest plants where the share of ascomycetes kinds approximately never change during their vegetation, on the leaves of meadow grasses we observe some significant differences in a relative abundance of ascomycetes yeasts (from 10% up to 40% for a vegetative season). Thus the splashes in the abundance of ascomycetes fall to the period of their mass flowering of dominating kinds of plants. And so the increase in share of ascomycetes kinds of yeasts in phyllosphere meadow plants is connected, first of all, with its increase in nectarproducing flowers.

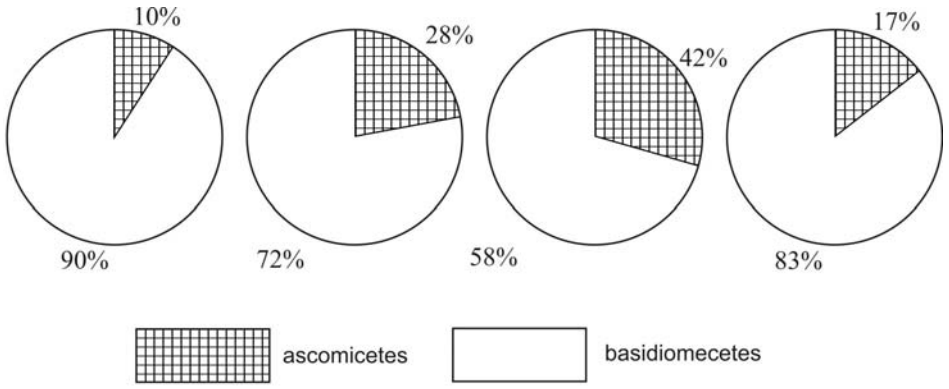

Fig.1 The ratio of a number of ascomycetes and basidiomycetes yeasts in phyllosphere of various biogeocenoses (on the average for a year and on all plants)

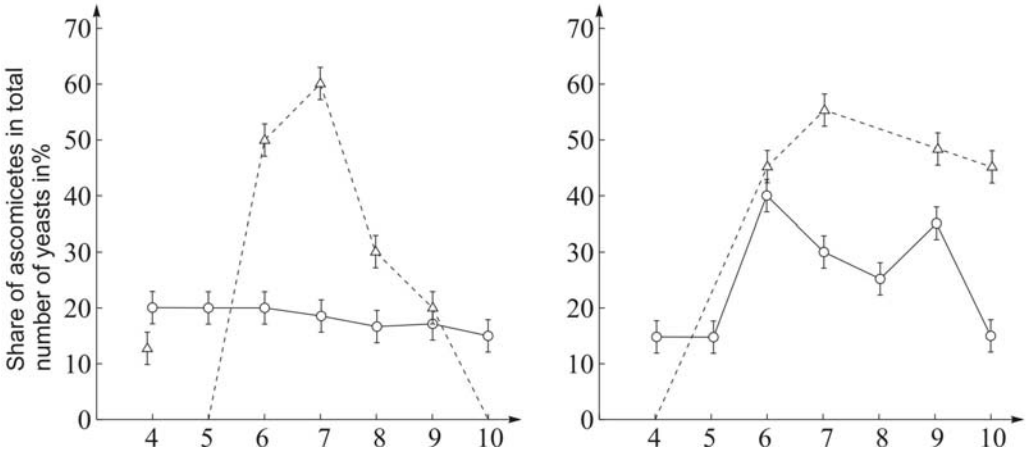

Fig.2 The changes of a relative abundance of ascomycetes yeasts during the vegetative period in forest and meadow biogeocenoses

The ratio of ascomycetes kinds of yeast mushrooms on wind pollinating and entomophilous plants

The ties of ascomycetes yeasts with some flower nectars mostly appear when relatively comparing the abundance of epiphyte ascomycete and the basidiomicete kinds on entomophilous and the wind pollinating plants (Fig.3). On the leaves of plants of both groups the ratio of ascomycetes kinds of yeasts could be approximately met the same on the average not more than 25 percent. In the time of their vegetation it can practically never change, but only to the autumn to some extent could grow up to 30 percent. In flowers of entomophilous plants could be met some other conformity to natural laws. The ratio of ascomycetes kinds could considerably grow (up to 60%) in summer months just in the period of mass flowering of plants. In flowers of wind pollinating plants in their generative period could also be met some growth of ascomycetes part but less considerably of course. It is evident that the pollinators could be happened to be more effective of vectors of mutual distribution and spreading of ascomycetes yeasts than the wind,

but main parts of growing ascomycetes yeasts, that is, by the nectarbearing pollitionable insects of flowers. The specificity of the dynamics of ascomycetes and the basidiomicetes kinds of yeasts depends on the distribution of arboreous and meadow plants.Learning of all the kinds of yeast mushrooms of philosphere in the period of their vegetation of plants showed that, in the character of dynamics the amount of some ascomycetes and basidiomicetes yeasts also have a number of principle differentiations.

The number of basidiomicetes kinds are usually more stable, and in cases of their changing it would be possible to notice some certain seasonal trends of course. And it is so characteristic for the most investigated kinds of autumn plants growing of all epyphite yeasts on the leaves stipulating mainly gradual increasing of *Cryptococcus albidus* and *Rhodotorula glutinis*. It witnesses that the dynamics of a number of such kinds were mainly conditioned with some seasonal changes of hydrothermal factors of the environment.

The dynamics of the amount of ascomycetes kinds of yeasts, contrarily, in most cases had some explosive character which can never be connected with the changes of weather conditions. Most kinds of ascomycetes yeasts bring in phillosphere some momentary splashes of their number while the predominating basidiomicetes kinds can be met for a distance of all the ontogenesis of plants. For example, on the leaves of touch-me-not was fixed some short-term dominating of yeasts of *Tarulaspora delbrucku* on fresh leaves in the middle of June, while the other times of ontogenesis, up to a full disappearance of plants in the end of October this kind could have never been discovered. With the similar way behaviored themselves some other kinds of ascomycetes yeasts in the phillosphere.

It was established that such kinds of short-time growth in amount of ascomycetes yeasts and a sharp growth in their ratio in an epiphyte community is connected with their physiological specificities, and as well as with certain specificities of ontogenetic cycles of plants, in particular, with the changes in number and the content of escudates. The majority of kinds chosen by us the ascomycetes yeasts, in the whole are being characterized considerably by a narrow spectrum of consumed substances. And, on the other hand, the majority of chosen by us kinds of ascomycetes yeasts were being assimilating not more than eight sources of carbon out of 40 compounds used for their specific differentiations.

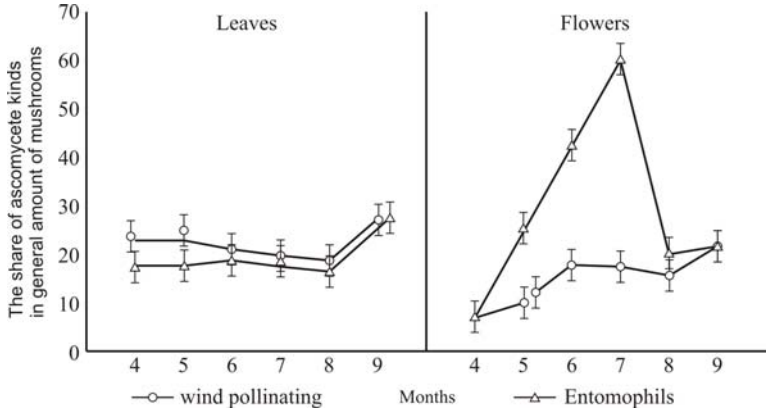

Fig.3 The average relative abundance of pollinating of ascomycetes yeasts during their vegetation period

Conclusion

1. It is established that the number and a variety of yeasts are some specific features of a ratio of ascomycetes of basidiomycetes kinds in phyllosphere of various types of phytocenosis.

2. It is revealed out that the mass development of ascomycetes yeasts in phyllosphere is mainly connected with the phase of flowering of entomophilous plants.

3. Unlike the phyllosphere of forest plants where the share of ascomycetes does not almost change during the vegetation, on leaves of meadow grasses significant differences could

be observed in a relative abundance of ascomycetes yeasts of course.

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EPİFİT ASKOMİSET VƏ BAZİDİOMİSET GÖBƏLƏKLƏRİNİN MÜXTƏLİF BİOTOPLARDA YAYILMASI

S.İ.ƏLİYEVA

Məqalədə epifit askomiset və bazidiomiset maya göbələklərinin müxtəlif biotoplarda yayılma nisbəti verilmişdir. Müəyyən olunmuşdur ki, hər hansı biotopda yayılmış bitkilərin fillosferasının xarakter xüsusiyyəti bazidiomiset affinitet nümayəndələri üstünlük təşkil edir. Buna baxmayaraq bazidiomiset növlərin orta illik payı müxtəlif biotoplarda müxtəlifdir.

INFLUENCE OF WATER-LEVEL FLUCTUATION OF THE CASPIAN SEA ON COASTAL ZONES OF AZERBAIJAN

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The Caspian Sea holds a special position in the economy of the Azerbaijan Republic. The coastal regions of the Caspian Sea have considerably developed on account of exploitation of the rich oil and gas reserves and development of proper industrial spheres. Along with it exploitation of the health resort-recreation reserves in the Caspian Sea coastal zones has also positively influenced the region's development tendency.

The water of the Caspian Sea surrounds the coasts (shores) of the Republics of Azerbaijan, Kazakhstan, Turkmenistan, Russia, and Islamic Republic of Iran. Total area is 390 thousand square kilometers, coastline length – 6380 kilometers, and water volume is 78 thousand cube kilometers. Watershed of the Caspian Sea makes 3.6 billion square kilometers, and the main part of its water balance falls to the share of rivers. The water level of the sea is currently -26.5 meters below sea level. During the last 500 years its level has changed 6-7 meters. The southern coasts of the Caspian Sea are characterized by subtropical climate and the northern coasts by continental climate.

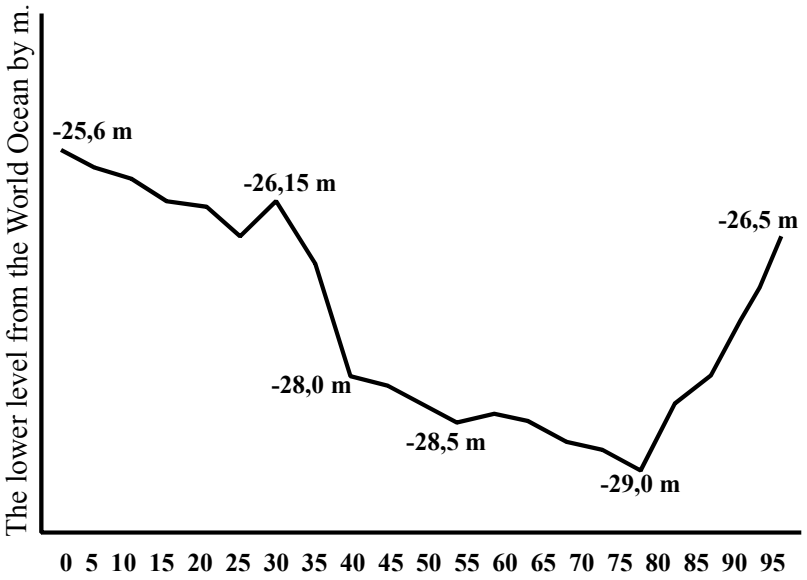
One of the main ecological problems of the Azerbaijan Republic is a damage in coastal zones resulted from the water level fluctuation of the Caspian Sea. In case of water level drop of the Caspian Sea, a necessity emerges to rebuild all hydro technical settings, as well as ports. The territory of the shelf zone for location and development of the sea fauna is reducing, and the fish encounter difficulties in passing into the river for spawning. Negative changes also take place in this zone's hydrometeorological regime. In case of level decrease, the socio-economic life of the coastal zone is being considerably damaged, the ecological condition worsens, boggy zones are formed, houses and lands become submerged.

According to the gained information, the water-level fluctuation of the Caspian Sea was 3.2 meters during the last century. The lowest level was observed in 1977. At that time, the water level reached the critical point (-29 meters). Starting from 1977 as a result of 2.5 meter rise in sea level, water flood caused huge damage to shores of Azerbaijan because the coastal zone was less inclined and thickly developed. Average annual rainfall increased in 40-60 mm, and the water volume in rivers falling into the Caspian Sea increased in 10-11% during 1978-1995. All these factors have directly influenced to the increase in water of the Caspian Sea. Since 1996 water level has decreased a little.

The level of the Caspian Sea decreased in 1996-2000, but growing trend was observed again in 2001. Since the sea level increased to about 30 centimeters in 2001-2005; the level was observed to drop to 3-5 centimeters in 2006 in comparison with previous years. Recent years the water level fluctuation of the Caspian Sea remains relatively stable.

The sea level monthly becomes the subject to changes: its rate fluctuates within the interval between 30-40 sm. The level reaches its highest point in July-August and lowest point in December-February. Also, as a result of the influence of long-lasting winds, the level of water outlet and ebb processes take place. This process, especially, becomes clearly visible in the Northern Caspian. Here, in strong south east winds the water outlet can reach 4,5 meters and ebb – 2.5 meters.

Water level fluctuation dynamics of the Caspian Sea for 1900-1995



Source: The National activity plan on environmental protection. Baku, 1998

Studying of the Caspian Sea, as well as mainly hydrometeorological conditions of the ports in its coasts is very important. The reconstruction of the ports related to the water-level fluctuation and geographical matters of the development characteristics of the Caspian Sea are constantly investigated.

The transport that's the important sphere of the AR's economy and sea transport that's included into its composition have great importance in commercial-economical relations of the country. The country's sea transport carries out its activities via Baku sea port.

Baku sea port lies about 2 kilometers with the coastal zone in the north of the nonfreezing Baku bay, in the south of the Absheron peninsula. The place chosen for the construction of the port is considered tobe convenient from natural-economical point of view. The natural factors had great role in formation of the territory of the port and port economy. Baku sea port is situated in the bay of the same name that's the biggest one and most convenient for the depth in the Caspian Sea basin. It's very important for the functioning of the port economy, as well as the construction of the hydrotechnical equipments. The depth of the sea, wave and wind conditions (regime), the air temperature, currents, water-level fluctuation, and etc. factors had their influence on the formation of the Baku sea port.

At present, Baku sea port functions uninterruptedly the whole year and unloading and transportation of loads are realized during the whole day in 5 terminals of the port:

1. The main load terminal;
2. Absheron oil terminal (Dubendi);
3. The bay terminal;
4. The sea passenger station;
5. The container terminal.

The water-level fluctuation of the Caspian Sea negatively influences to the port economy. For example, the water-level fluctuation of the Caspian Sea has caused the port economic damage about some $ 1 billion till 1996. In order to avoid it, all of the construction-installation issues in the port must be done by taking into consideration the water-level fluctuation of the Caspian Sea.

The climate and tectonic factors are considered to be the main reasons of the water level fluctuation of the Caspian Sea. The water level fluctuation of the Caspian Sea is observed over thousand years. The major factor influencing the water level is climate inconstancy in the Caspian Sea basin. Another reason of the increase in water level is related to the increase of the sea surface at high altitudes and as a result of this, decrease of evaporation instead of increase.

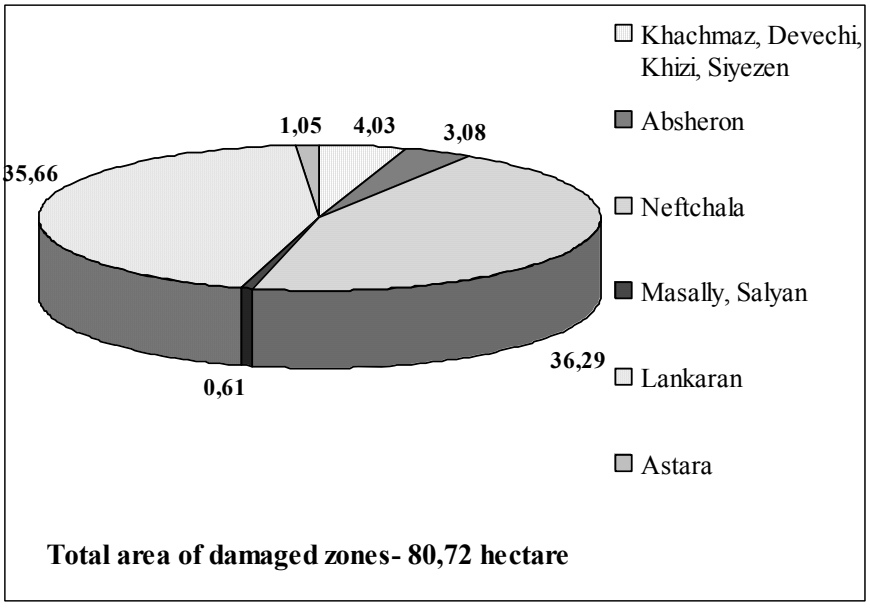
The water level fluctuation of the Caspian Sea is primarily explained by the inconstancy in the water volume of the Caspian Sea. The main reason of the water level fluctuation of the sea is a change in its water balance elements. The river flow make 80% of the water balance income and about 85% of it falls to the share of water from Volga River. By the way, it's worth to mention that 75 billion tons of oil products are flown into the Caspian Sea via rivers, and 95% of it falls to the share of Volga River. As we know, the carbohydrates causes serious discords to aquatic environment as being combinations hardly broken into pieces. Along with it, the water polluted by domestic waste and industrial pollution cause its biological pollution. Observations show that river flows are subjected to changes in high intervals on average. The reason of it is the hydrometeorological processes in wide water shed of the sea.

In general, it was defined that the water lever fluctuation has periodic character and depends on the global processes in a climate. Along with it, it's worth to remember the tectonic processes in the Caspian Sea. Mountain formation processes in mountainous systems surrounding the Caspian Sea from the west, south, and south-west still take place nowadays. As a result of these tectonic processes, light and average seismic earthquakes are observed in the depth of the sea.

As was mentioned, along with the natural processes, it should be paid attention to anthropological influence to the water level fluctuation of the Caspian Sea. A dam constructed in the strait connecting the Caspian Sea with the 'Garaboghazgol' bay can be shown as an example. The dam was built to forestall the decrease in water level and caused the water increase in 10 cube kilometers in the Caspian Sea annually. Consequently, the water level started to increase, and special water permeable fields were established in 1985. Along with it, domestic waste and oil spots on the water surface of the Caspian Sea resulted from the oil leakage are visual examples of the anthropological influence.

80.72 ha of the Azerbaijan Republic were submerged and the coastal zones were damaged at great amount as a result of increase in water level from 1978 to 1998; 89,1% of it falls to the share of Neftchala and Lankaran administrative regions. Sea water in the region has moved forward the land about 300-500 meters. The beaches were submerged, communication systems (motorways, railways, and electric lines) were subjected to water flood and fish industry was seriously damaged as well.

Regions suffered from increase in water level of the Caspian Sea



Source: The National activity plan on environmental protection. Baku, 1998

Abrasion processes in coastal territories of Absheron have intensified, the beaches were submerged, and Baku sea port and coastal technical services have become worthless. Along with

it, Bibiheybat oil and gas extracting administration's ponds filled with well water leaked into the sea and landslide threat and ecological tension in coastal territories of Absheron has increased.

Abrasion processes have intensified in northern territories, ecological situation has been disturbed, region's attractiveness has been negatively influenced, and the number of resting people has reduced.

At present, long-lasting methods are utilized little in forecasting the water-level fluctuation in the Caspian Sea, because many scientists relate the level fluctuation to climate elements. However, this forecast is usually short-term and doesn't last more than 4-6 months.

Generally, it's difficult to estimate the economic damage resulted from increase in sea level and potential expenses for population protection or deportation in case of future increase in sea level. Intensive and periodical fluctuation of the water level in the Caspian Sea makes the people living in the coastal zones and economic spheres connected with sea always face great troubles. At the same time, this means the increase of ground water and submergence of oil-fields and industrial objects that is considered one of the main problems of the ecology of the Caspian Sea.

Some negative factors are observed in case of increase in the water level:

- Submerged lands has become worthless, boggy lands have been formed, and humidity has increased;
- The quality of drinking water from underground sources (water well and underground water supply) has distinctly worsened;
- Social infrastructure has been seriously damaged.

The opportunity to control the coastal zones in Azerbaijan can be improved by giving accurate information and forecast about the water-level inconstancy in the Caspian Sea. It is possible to improve the control system in suffered regions related to the level increase in the Caspian Sea. With this purpose, it would be primarily expedient to implement the following measures:

- Primarily creation of control plan over seaside zones;
- Ppreparation of information system forecasting the sea level fluctuation.

The Caspian Sea plays peerless role not only in the Republic's economy, but also in the people's health. If to take into consideration the level fluctuation in the Caspian Sea, in future we can get positive consequences in allocation of population and economic fields and increase in economic rationality.

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XƏZƏR DƏNİZİNİN SƏVİYYƏ TƏRƏDDÜDÜNÜN AZƏRBAYCANIN SAHİLYANI ƏRAZİLƏRİNƏ TƏSİRİ

Z.T. İMRANİ

K.Z. ZEYNALOVA

Azərbaycan Respublikasının iqtisadiyyatında Xəzər dənizi özünəməxsus yer tutur. Xəzərin sahil rayonları zəngin neft və qaz ehtiyatlarının istismarı və müvafiq sənaye sahələrinin yüksəlişi hesabına çox inkişaf etmişdir. Bu məqalədə Xəzər dənizinin səviyyə tərəddüdü zamanı dəyən zərərin qiymətləndirilməsi müəyyənləşdirilmişdir. Sonda isə dəyən zərərin azaldılması baxımından bəzi tövsiyə xarakterli elmi nəticələr verilmişdir.

SOME LEGAL ASPECTS OF ENVIRONMENTAL PROTECTION IN AZERBAIJAN (ON THE EXAMPLES OF SUSTAINABLE DEVELOPMENT AND AIR POLLUTION)

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In 1987, the World Commission on Environment and Development - the Brundtland Commission - defined Sustainable Development as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Azerbaijan, the largest of the three republics of the South Caucasus, occupies the southern part of the isthmus between the Black Sea and the Caspian Sea. The country has a total land area of 86,600 km^2. In 1988-1990 the national democratic movement in Azerbaijan campaigned for the restoration of the Country's independence.

The Constitution of Azerbaijan declares general principles, laying the foundation for the development of national environmental policy. During almost 20 years of independence, Azerbaijan has steadily improved its system of environmental protection. The first National Environmental Action Plan of Azerbaijan (NEAP) was developed during late 90th with the support of World Bank. It was historical time when different countries of Eastern Europe, the Caucasus and Central Asia identified problems requiring urgent actions in political, social, economical and nature protection fields.

The NEAP stresses the importance of policy reform and of integrating environmental policy to economical questions as well. The first NEAP of Azerbaijan has had a very positive effect on the development of environmental and natural resource protection, thus proving the value of NEAP as a policy instrument.

One of the main aspects of modernity in Azerbaijan is the National Programme on Environmentally Sustainable Social and Economical Development of Country, as requested in Presidential Decree 612. The Programme covers the environmental aspects of the country's overall development strategy. It determines main areas of sustainable development and includes a plan of action for 2003-2010 "to address the initial phase of the resolution of the current problems".

Azerbaijan's future economic growth relies in large part on the successful development of its oil and natural gas resources. Crude oil and oil product exports make up over 70% of exports, and oil-related revenue makes up nearly 50% of budget revenue.

Azerbaijan faces significant challenges in terms of promoting environmental protection. Key areas of environmental issues and problems identify air quality, limited water resources, nature protection (which includes protection of forestry and biodiversity, sturgeon stock as well), management of the environmentally unsound waste and industrial pollution (from oil production, energy and transport), oil-contaminated sites, the Caspian Sea water level fluctuation, coastal and marine pollution, degradation of soil resources and land use (in particular desertification). Protection of the natural and cultural heritage is the special block, which contents conventional aspects.

Furthermore, institutional and administrative capacities require strengthening, in particular as regards implementation and enforcement. Civil society also needs support in order to become a valuable partner for the government in the development and implementation of environmental policy.

The Law on Environmental Protection is the main piece of national environmental legislation. It defines ecological expertise as "the identification of conformity of the environmental conditions with qualitative standards and ecological requirements in order to

identify, prevent and forecast the possible negative impact of an economic activity on the environment and related consequences".

While the environment is protected by law and pollution is controlled by regulations, in fact, concern for the environment has been secondary to economic development. It is therefore important that environmental legislation and management should be given a higher priority to meet the future needs of Azerbaijan.

One of the substantive legal rules in Azerbaijan is the Law on Air Protection establishes the legal basis for the protection of air, thus implementing the constitutional right of the population to live in a healthy environment. It stipulates the rights and obligations of the authorities, legal and physical persons and NGOs in this respect, sets general requirements for air protection during economic activities, establishes rules for the State inventory of harmful emissions and their sources, introduces general categories of breaches of the Law that will trigger punitive measures.

The system of air emission charges is very similar to the systems used in most other countries of Eastern Europe, the Caucasus and Central Asia. Charges, which are levied on 88 different pollutants, vary according to the degree of hazard of the pollutants. Charge rates range from virtually zero for several pollutants to 10.1 million manats per ton for the most toxic components. The applicable charges vary among regions to reflect differences in environmental conditions. The base rate is multiplied by a regional coefficient between 1 and 5. The highest values are in Baku - Sumgayit area – most hot spot of the Country.

Talking about protection of the atmosphere and prevention of climate change, we found in some substantive sources that the closure of a number of heavily polluting industrial enterprises since 1991 has led to a substantial reduction in air pollutants. In 1990 the volume of pollutants was approximately 2.1 million tons, but in 1998 it had declined to 352,000 tons. A number of problems remain. Most air filters at the working enterprises are in poor condition, and air pollutants from motor vehicles are on the increase. To help resolve worldwide air pollution problems, Azerbaijan ratified the United Nations Framework Convention on Climate Change and the Vienna Convention for the Protection of the Ozone Layer. In 2000, Azerbaijan ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change. As a Party to the Convention Azerbaijan has undertaken to develop, implement and disseminate national and regional programmes to reduce the expected impacts of climate change.

The main purpose is to draw up a national plan of action to minimize the negative impact of climate change on the country's economy and the health of population, also informing the international community. Work on this project has proceeded to:

- Prepare a national inventory of greenhouse gases;
- Assess opportunities for reducing the use of greenhouse gases and draw up proposals to implement a national policy in this regard;
- Evaluate the impact of climate change on ecosystems and major sectors of the economy, and prepare adaptation measures to minimize losses resulting from such an impact.

The key principles for the introduction of economic instruments for environmental protection are laid down in the Law on Nature Protection and Environmental Management of 1992 and the Resolution 122 of the Cabinet of Ministers on the Payments for Nature Use in accordance with the Application of Charges for Natural Resources, Discharge of Pollutants to the Natural Environment and Rates of Charges for Environmental Pollution. The Law on Environmental Protection reconfirms the legal validity and basis for economic instruments and its article number 23 specifies the principles for using economic incentives for environmental protection by means of charges for natural resource use and environmental pollution. The only instrument aimed at controlling air pollution from stationary sources is the charge on air pollution. There are several possibilities also by space investigations from various satellites, such as NOAA, Nimbus, LandSat etc.

The system of air pollution charges is very similar to the system used in the former Soviet Union. The charges were introduced in 1992 and are levied on 88 pollutants, according to their

toxicity. The charge is paid every quarter, and the amount due is based on expected or actual emissions. The non-compliance fee applies when a company's emissions exceed the allowable limits, and the fee is 5 times higher than the base rates of the air pollution charges. The environmental effect of the charge and the non-compliance fee is rather limited due to their low tariff levels, the failure to enforce the legal provisions and inefficient collection.

The Law on Air Protection also calls for changing the ambient quality standards from the old standards (called GOST during Soviet time) to those consistent with international guidelines and standards such as the health-based air quality guidelines of the World Health Organization (WHO).

The standards require not only changes in quantitative values, but also changes in the whole data collection, processing and analysis systems, which are resource- and time-consuming.

Reducing pollution and damage to human health cost-effectively requires an integrated approach to urban air quality management. An important step in developing an urban air quality management strategy is to be able to monitor and evaluate air quality. A good monitoring and modeling system is essential for policy-making suited to the primary objective of protecting human health. There are several key tasks for understanding the nature of urban air pollution, above all collecting data on ambient pollutant concentrations and developing an emissions inventory. Most monitoring stations in Azerbaijan appear to be measuring CO_2, SO_2, NO_x and total suspended particles regularly. However, no data are available for fine particulates (PM10 and PM2.5), although they are far more damaging to public health than suspended particulates. In addition, ground-level ozone is not monitored in big cities where ozone levels are high. Ground-level ozone originates from transport emissions and could form summer smog. The six most important pollutants to monitor regularly are what the World Health Organization terms the "classical" pollutants: lead, PM2.5/PM10, carbon monoxide, sulfur dioxide, nitrogen dioxide and ozone.

In 2000 there were thrown 908 000 tons of pollution waste to atmosphere, 43% of which are transport pollution. Thrown pollution waste of stationary sources – 515 000 tons, of which about 430 000 tons extremely hazardous waste. Thrown pollution waste of gaseous and liquid substances counted 96% of total volume, which has sulfate anhydride – 35000 tons, carbon monoxide – 26 000 tons, nitric oxide – 24 000 tons. The main hazardous organic substances are most dangerous and their thrown level significantly decreased on 14% in comparison to the indicators of 1999. It should be noted that total value of pollution waste decreased on 59 000 tons or on 10% comparable to 1999.

As regards the environment, support is focusing on implementing multilateral environmental agreements, in particular the UN Framework Convention on Climate Change and its Kyoto Protocol and UNECE conventions. As we already mentioned, Azerbaijan ratified the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer. The Ministry of Ecology and Natural Resources is the national coordinating body that develops and establishes necessary regulatory and legal framework to control the trade in and use of ozone-depleting substances (ODS), to enable Azerbaijan to fulfill its obligations under the Montreal Protocol.

The National Ozone Centre was established to help it phase out ODS. The initial country programme for the phase-out of ODS was compiled in 1997, and several projects in cooperation with GEF have been implemented since then. The total consumption of ODS in Azerbaijan decreased from 966 metric tons of ozone-depleting potential (ODP) before the ratification of the Protocol to 13.6 metric tons ODP in 2002, fulfilling the obligations under the Montreal Protocol. This drop of almost 99% has been achieved through structural changes in industry and a significant decrease in the production of refrigeration equipment. It is foreseen that ODS consumption will continue to fall and that by the year 2005 it will be negligible or nil. Azerbaijan has been a Party to the UNECE Convention on Long-range Transboundary Air Pollution since 2002, but has not ratified any of the Protocols. The Government intends to ratify

the Protocol on Persistent Organic Pollutants (POPs), the Protocol on Heavy Metals, and the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) in the near future.

Today we're living in the world of rough economical growth, but on the other hand, industrial development shall not decrease a quality of natural surround of humanity. The nature protection aspects are secured a broad consensus among stakeholders (government, civil society and international partners) concerning the urgency of the measures to protect the national environment, thus setting a common basis for future actions. In 2007 Azerbaijan signed Memorandum of Understanding (MOU) on the "Clean Development Mechanism" projects. According to EU reports, by 2020 atmospheric emissions by European countries will decrease by 30%. As follow these figures, Azerbaijan will reduce the country's greenhouse gas emissions contributing to climate change. Germany – partner country in this agreement - uses modern technologies to reduce its greenhouse gas emissions, contributing to its energy efficiency. The purpose of signing the MOU is in order that Azerbaijan may apply Germany's experience in the country.

Approved by Presidential Decree State Programme on Poverty Reduction and Economic Development for 2004-2008 and up to 2012 is envisaged to play a significant role in the medium term; as a comprehensive strategy with a multi-sector approach, it influences now and will develop the environmental sector within the context of overall national priorities.

The Programme covers a long-term period and will be revised annually as the envisaged policy measures are implemented and yield results. Among other things, it addresses the role of environmental conditions as a cause of poverty as well as a tool to reduce it. Based on the assumption that "economic development which upsets the environmental balance cannot be sustainable", it obliges the Government of Azerbaijan to promote balanced growth and to bring about improvements in some of the key economic sectors: to improve the investment to the climatic aspects, to increase access to credit among businesses and entrepreneurs, to develop the infrastructure, to encourage small and medium enterprises, to develop the industry and agriculture of different regions, to improve the environmental protection, to reform energy generation and distribution, and to promote tourism, including rural tourism and the ecotourism as well.

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AZƏRBAYCANDA ƏTRAF MÜHITIN MÜHAFIZƏSININ BƏZI HÜQUQI ASPEKTLƏRI (DAVAMLI INKIŞAF VƏ HAVA HÖVZƏSININ ÇIRKLƏNMƏSI TIMSALINDA)

L.Ə.BAYRAMOVA

Məqalə qlobal və yerli səviyyələrdə narahatlıq doğuran ən mühüm bəşəri problemlərdən olan - ətraf mühitin mühafizəsinin Azərbaycanda həllinə həsr edilmişdir.

Müstəqilliyini bəyan edəndən sonra Vətənimizin təkrarsız təbiətini qorumaq üçün bir sıra ciddi addımlar atılmışdır. Təbiətimizin mühafizəsi sahəsində hüquqi bazanın qurulması, Azərbaycanın bir sıra mühüm Beynəlxalq Konvensiyaları ratifikasiya etməsi, Minilliyin İnkişaf Məqsədləri ilə həmahəng olaraq, Regionların Davamlı İqtisadi İnkişafı Dövlət Proqramının icra edilməsi gənc respublikamız üçün fundamental nailiyyətlərdir.

Məqalədə ətraf mühitin mühafizəsinin bir aspekti olan – hava hövzəsinin təmizliyinin təmin olunması məsələlərinə diqqət yetirilir.

NOTES ABOUT THE CONDITION AND STATUS OF BIRDS IN SHIRVAN NATIONAL PARK

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Notice

According to the category of IUCN (1a), Shirvan National Park (SNP) has the greatest area among 5 national parks, which acts nowadays as a special protected area of Azerbaijan. SNP was founded in 2003 and represents semi-desert and steppe ecosystem. The observations were held during 2001-2006 before and after foundation of National Park on the place of Shirvan State Reserve and Bendovan State sanctuary. Generally field researches were conducted during summer fire practice of students, so summer complex of ornitofauna was researched more regular. Seasonal dynamics was researched only in 2006.

Literature review

Study area

Location: Azerbaijan and the study region mark one of the most eastern spot on the fringe of geographic Europe. The study area is located within Azerbaijan's Transcaucasian Kura-Aras lowland, the Greater Caucasus border to the north and the Lesser Caucasus to the south.

Climate: The study region is characterized by arid subtropical climate (Museyibov, 1998). Continental climatic effects prevail, as the surrounding mountains cut off maritime tropic air from the north and west, whereas the opening of the Kura-Aras basin to the east encourages continental tropic air and polar air to stream in (Franz, 1973). Summers are dry and hot. Winter temperatures are rather mild and rarely reaching 0^0 C.

Plant cover: The semi-desert formation at SNP is represented by six associations, as there are: 1. Suaedetum, 2. Artemisieto –Petrosimonietum, 3. Artemisieto- Ephemeretum, 4. Artemisieto – Salsoletum dendroica, 5.Psammophytetum, 6. Grasses – Annuals –Ephemeretum (Aliyev, Gadshiev, 1986).

Fauna complex: The main conservation object of SNP is the Goitred Gazelle (*Gazella subgutturoza*). Common mammals of the national park area are: Grey Wolf (*Canis lupus*), Golden Jackal (*Canis aureus*), Jungle cat (*Felis chaus*), Red Fox (*Vulpus vulpes*), Wild Boar (*Sus scrofa*), European Hare (*Lepus europaeus*) and Badger (*Meles meles*) (Kovalev, 2000; Zuccow, 2005 – in the fauna chronik of the national park). Most characteristic and known reptiles are Levant Viper (*Vipera lebetina*), Dice snake (*Natrix tesselata*), Grass snake (*Natrix natrix*), Greek Tortoise (*Testudo qrecca*), Caspian Turtle (Mauremus caspica), Lake frog (*Rana ridibunda*), Green Toad (*Bufo viridis*). Basically nothing is known on insects and entomofauna the region. The Caspian Sea, not under protection yet, is especially important for the species of Sturgeon inhabiting the Caspian. In spite of all mentioned, the appearance of the rich ornitofauna of Azerbaijan has its significant place in the SNP. Imperial eagle (*Aquila heliaca*), Little Bustard (*Tetrax tetrax*), Marbled Teal (*Marmaronetta angustriostris*), Black Francolin (*Francolinus Francolinus*), Pygmy cormorant (*Phalasrocorax pygmaeus*) and Red-breasted Goose (*Branta ruficollis*) are globally significant species of ornithofauna in SNP (The chronicle of the preserve – Etzold et al 2004; Succov 2005).

The analysis of the material

Exceptional diversity of the fauna in the area, which belongs to the semi desert landscape and which at first view does not posses rich flora, became of interest to us after our first excursion in the area of National Park. Data on Bandovan and Shirvan preserves are not included into this material, as our observations, performed during the course of 6 years (2001-2006) cover

only dry landscape of SNP and the water area of lakes created as a result of Shirvan collector exploitation.

The oil well operations of "Shirvan Oil" as well as the intervals during the operation of collector seriously influenced the variety of species of avifauna in the Shirvan State Preserve. Above mentioned factors mostly influence water birds, which use the water in the lake during the winter stay and migration. As you can see in the graph below, the number of the species (26) registered in 2001 is the highest in comparison to other years. This is explained by the fact that the collector worked non-stop during that year. We observed the sharp decrease of water level in Gizil-Gaz Lake and in the ponds around it during the course of subsequent 2 years.

In general, various formations created by the vegetation life in the area of the National Park create conditions for the abundant variety of fauna. Therefore, as the drying of the lakes results in the extinction of water and water shore vegetation, the changes in the number of insects and other invertebrate animals, which create another key circle in the food chain as well as reptiles and birds raven upon them is inevitable. Although, once the idea of purposeful drying of lakes created big anxiety, then protection measures of the water and marsh areas in accordance with the Ramsar convention influenced SNP as well. The observations performed on the flyovers and day-and night clinics built in SNP let us say the following:

31 out of 66 species registered during the nesting period are water and water shore birds (Grebes, cormorants, pelicans, storks, gooses and sandpipers). 21 species are the representatives of perching birds. The wild birds are the most widely spread group in the area in comparison to the bird fauna of the republic (8 out of 36 species). Other species are the members of gallinules, cranes, doves and nightjars. When speaking of numbers, coots among the water birds and little bustards among the ground birds comprise the majority during the nesting period.
(See table 1).

According to M. Patrikeyev (1991) 76 species of waterbirds and 9 species of predatory birds are registered here during nesting period. The winter helicopter count of 1993 has shown number in 6034 wintering waterbirds from which one pelicans - 63 individuals, flamingo- about 300, swans - 742, ducks - 3354, harriers - 10 and coot - 1187 (Sultanov, Mustafayev, 1994).

In the winter, numerous larks, finches and buntings are all around, and Little Bustards gather in large flocks in the vast plain of the park (S. Schmidt, K.Gauger, N.Agayeva, 2008). During the nesting, species with protection status are met in the area of the National Park: White and Dalmatian pelicans (*Pelicanus roseus and P. onocrotalus*), Pygmy cormorant (Phalacrocorax *pygmeus*), Purple Heron (*Ardea purpurea*), Greater Flamingo (*Phoenicopterus rubber*), Mute Swan (*Cygnus olor*), Mallard (*Anas platyrhynchos)*, Red –crested Pochard (*Netta rufina)*, Ferruginous Duck (*Aythya nyroca*), White- tailed Eagle (Haliaettus *albicilla)*, Imperial Eagle (*Aquila heliaca*), Black vulture, Griffon Vulture, Kestrel, Black francolin, Purple Swampen, Little Bustard, Stone Curlew Black Tern, Turtle - Dove, Nightjar, Kingfisher, Barn swallow, Calandra Lark, Crested Lark (Bird Life International, 2004).

OBSERVATIONS ON THE SHIRVAN NATIONAL PARK

№	Species	7. 06.01	19. 06. 04	02. 07.05	26.02.06	13.05.06	05.11.06	25.11.06
1	Podiceps niqricollis						4	
2	Pelecanus crispus						8	
3	P. onocrotalus						1	10
4	Phalacrocorax carbo				1			
5	Ph. pygmaeus				20-25	1		
6	Egretta alba	+				12	3	2
7	Eg. garzetta	+				1	3	1
8	Ardea cinerea	+	2	+	1		1	

9	A. purpurea	+						
10	Plegadis falcinellus	1						
11	Phoenicopterus ruber						4	
12	Cygnus olor		7		8			
13	C. cygnus				1			
14	Tadorna ferruginea	+			120-150			
15	T.tadorna				53			
16	Anser albifrons						2	
17	Anas platyrhynchos				2		10	7
18	A. angustriostris						4	
19	Netta rufina							15
20	Aythya ferina				?	1		10
21	A. nyroca							
22	A.fuligula							
23	A.marila							
24	Haliaettus albicilla					1		
25	Buteo rufinus	1						1
26	Aquila heliaca							1
27	Aegypus monachus						2	1
28	Gyps fulvus						2	
29	Circus aeruginosus	+			2♀+1♂	4	7	5
30	Falco tinnunculus		+					
31	Yirtici- sp.							
32	Francolinus francolinus	+ By the voice	7♂		By the voice	3-4/1 ha		5 (2 ♂, 3♀)
33	Porhyrio porhyrio		+		By the voice			
34	Vanellochettusia leucura		1					
35	Himantopus himantopus		2					
36	Fulica atra			3 eggs, 1juv.	>1000	1	1000	1250
37	Otis tetrax				<1000	2 (on the road)	40-60	
38	Burchinus oedicnemus			2		1		
39	Glareola pratincola	+	10-12 pair					
40	Larus argentatus		5					2
41	L. ridibundus	+	3					
42	Sterna hirundo	+						
43	Chilodonias niger			20-25				

44	Ch.leucoptera				<100			7					
45	Columba livia	4				+		adi					
46	Streptopelia turtur							2					
47	Caprimulgus europaeus	+			1								
48	St. senegalensis species	6 + nest											
49	Alcedo atthis												1
50	Merops apiaster	1	+			+		6					
51	Upupa epops		+			+							
52	Gorvus frugilegus								9				
53	G.cornix	+	+		+		+	+	4		+		
54	Hirundo rustica	+				+		25-30/1ha					
55	Motacilla alba	3											
56	Lanius cristatus		+										
57	Lanius minor	+											
58	Melsnocorypha calandra		+					numerous					
59	Galerida cristata	+	+					2					
60	Sturnus vulgaris		+					7-8					
61	Pica pica	4 nest				3/1ha		3/1ha	9		2/1ha		
62	Oenanthe oenanthe	+						common 3/1ha					
63	Turdus merula							3 +1 nest					
64	Fringilla coelebs					3							
65	Passer montanus					25		48	14				
66	Emberiza melanocephala	+											

These indicators emphasize how SNP needs attention, care and protection. We consider that the area is now open for the observations in terms of ecological forecasting which is convenient for the modern requirements of the environmental protection, and formation of public opinion in positive direction will be achieved as it plays a great role in the activity of the national park.

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ŞIRVAN MİLLİ PARKINDA QUŞLARIN VƏZİYYƏTİ VƏ STATUSUNA DAİR QEYDLƏR

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Məqalədə Şirvan Dövlət Qoruğu ərazisində Milli Park elan olunanadək və sonrakı 3 il ərzində aparılan müşahidələr öz əksini tapmışdır (2001-2006-cı illər). Əsasən ekskursiyalar tələbələrin çöl-istirahət təcrübəsi dövrünə təsadüf etdiyindən ornitofaunanın yay kompleksi daha müntəzəm, mövsümlər üzrə isə 2006-cı ildə ardıcıl müşahidələr aparılmışdır. Nəticədə qeydə alınan 66 növün rast gəlinmə dövrü, sayı və yuvalamasına dair məlumatlarla yanaşı, həmçinin İUCN-nin kateqoriyalarına uygun mühafizə statuslu növlərin də siyahısı dəqiqləşdirilmişdir.

SURFACE WATER AND THE CASPIAN SEA

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Caspian sea is the world's largest closed reservoir occupying the space about 436 thousand of sq.m. It is in a zone of semi-deserts and deserts of the moderate and subtropical belts. Territory ТШО settles down on северо - east coast of Caspian sea which is the western border of this territory. The site directly adjoining Caspian sea in the location of the Tengizsky deposit, is a component of Near-Caspian lowland. High-rise marks of a terrestrial surface in this zone fluctuate from-25m to-16m. East half of territory represents the raised plain formed by low sandy dunes and hills, towering on 5-10м over level of Caspian sea. The site crosses some drying up streams. Waters of a superficial drain flow in general in the parties of Caspian sea. The basic waterway of region, the river Ural Mountains, runs into Caspian sea approximately in 100 km to the north of the Tengizsky deposit. Thus, a prepotent surface water in immediate proximity to considered area includes numerous quarrels and Caspian sea. Соры or плайи represent low sites of desert in which water quickly accumulates during rains then slowly evaporates, leaving mud plains, pools, saline soils or the salted sites.

Caspian sea shares on three natural физико – geographical region: Northern, central and Southern Caspian sea. Territory ТШО is located at coast of Northern region. Though on the area Northern region is approximately equal to Southern and Central regions, in it contains only about 1/100 volumes of waters of Caspian sea. That is connected with its primary мелководностью – depths make no more than 10-12 m. thus about 68 % of the area of Northern region it is necessary on the sites having depth of 0-5 m.

Because the sea is internal, the important role for its water balance is played by the running rivers. Over 130 rivers flows down to Caspian sea, but from distribution on a coastal line is non-uniform. The most important rivers Severo – east part of the sea are волг, Ural Mountains and Emba. Presumably in connection with increase in volume of deposits since 1978 the sea level height increases.

On a site of a coastal line of Caspian sea there passes дамбовая system in the extent about 40 km. Initially the dam has been constructed for protection of the western road round the Tengizsky petrocraft. To a construction of a dam territory ТШО was periodically flooded with inflow of Caspian sea and wind нагоном and historically is in essence a part of a bottom of Caspian sea. For this reason the understanding of features of Caspian sea and its influence on territory ТШО is the extremely important for understanding of existing ecological conditions. Over the last 50 years fluctuations of height of a sea level have made to 3 m. There are two types of fluctuations of height of level of waters of Caspian sea – long-term fluctuations in connection with change of a regional climatic mode, and the short-term fluctuations caused storm or wind.

In connection with wide prodeleting low, concerning the equal earths connected with Northern region of Caspian sea., even insignificant change of height of level of sea waters can lead to flooding of extensive areas. This phenomenon plays the important role in ecology of a coastal zone северо – east part of the sea where rising of sea level on 10 sm can lead to territory flooding on 10 km. The coast of Northern region represents flat (песчано – saline) accumulative plain with extensive shallows. In 1929 – 1977 level of Caspian sea has fallen to 3,2 m to a mark of 29 m concerning an average level of Baltic sea, having left the big areas of the bared sand. However, since 1977 the sea level rose with average rate of 10 sm/year (1,8м) and now makes 27,2 m. Various explanations are offered these long-term fluctuations, beginning from changes of a global climatic mode and before topographical changes in region in connection with geophysical processes. Various attempts of the forecast of lifting of a sea level on the near future

for the purpose of planning of protection of existing and prospective petroworkings out have been undertaken.

As a whole the northeast coast is characterised: 1) small отлогостью a shelf and coastal zone that excludes probability of influence of waves on coast; 2) absence of receipt of adjournment far from устьев the rivers; 3) the important role of wind currents in carrying over and hashing of adjournment. In Northern region of Caspian sea storm нагон, caused by strong winds, can conduct to considerable changes of a sea level for a short time interval. Primary winds during the winter period blow from the east and the Southeast, and in summertime – from the West, the northwest and the northeast. On east site, from the river Emba and on the south to a bay the Member of the Komsomol (Karatonsky area), these winds cause storm нагон in height 1,2-1,3 m (10 sm/hour) which proceeds days and conducts to flooding coastal a site depth of 35-40 km. During these нагонных events there can be superficial waves in height of an order of metre and the following with five-second intervals. During the winter period such wind нагон usually bears blocks of ice which can damage the dams surrounding existing petrocrafts.

The mineralization of waters of Caspian sea as a whole averages about third of mineralization of ocean waters (12-13 %). A mineralization приповерхностного a layer in Northern region of Caspian sea from 5-10 % in the central part and more low around river Volga delta, to higher levels along east coast where receipts of river water the volume of deposits is insignificant, small and evaporation is strong. For thermal shelf waters the wide range of temperatures of the air, typical for Northern region is characteristic. The average temperature приповерхностного a sheet of water makes 24ºС and more low 0 ºС in the winter in the summer that is accompanied by formation of ice fields during the period from December till March. Though on shallow sites of Northern region the oxygen exhaustion, as a rule is not found out, it is observed in those places where is available rich with organic substance soft or where it is small mineralizations приповерхностного a layer. It creates the phenomenon of weak vertical displacement of water weights on sites where the benthonic layer becomes exhausted on oxygen. In these conditions hydrogen sulphide is often developed.

As the basic sources of pollution of Caspian sea the operations conducting to dump in the rivers, development of shelf both coastal oil and gas deposits and industrial emissions of coastal cities are defined. These sources of pollution have led to that Caspian sea is recognised by one of the most polluted sea reservoirs of the former Soviet Union. The average level of the maintenance of hydrocarbons in coastal areas of northern region and east part of Caspian sea for the last 10-15 has grown concerning maximum permissible concentration (maximum concentration limit) to 4-7 maximum concentration limits. That has been connected with flooding of petrocrafts in Northern region of Caspian sea. The basic pollution is caused by industrial emissions, including arriving from oil refining factories and from the large rivers.

On different points estimations of a background state of environment on tests of a surface water were repeatedly spent. Tests have been analysed on the maintenance of metals and hydrocarbons for an establishment of background concentration of a surface water for the purpose of comparison with the analytical data on potentially amazed sites. This data shows that a surface water in territory ТШО is alkaline, высокоминерализованными and rather poor quality (not potable water). The data on hydrocarbons testifies that in a surface water low levels of the maintenance of hydrocarbons are marked, is possible as a result of oil-field operations.

The highest are levels of the maintenance of hydrocarbons in the tests taken with east and West side of a dam.

There are three basic problems which should obtain the permit in programs of preservation of the environment in pool of Caspian sea: 1) forecasting of lifting of level of waters of Caspian sea; 2) an estimation of potential influence on quality of waters of Caspian sea and 3) definition of presence of hydraulic communication between мелкозалегающими ground waters and waters of Caspian sea. Level of waters of Caspian sea is subject to considerable fluctuations, now the sea level rises. The program of an estimation of lifting of level of waters of Caspian sea is realised. For definition of influence on quality of sea water of direct emissions as

a result of activity TCO or other operations near to proceeding around the rivers, and also as a result of potential dump the estimation of waters of Caspian sea is spent to ground waters. The program on monitoring of quality of waters of Caspian sea consists in definition of types and distributions pollutes along that part of a coastal line of Caspian sea which is border of territory TCO for an estimation of potential possibility of fatal ecological influence of these загрязнителей and the best definition of problems on protection of quality of waters of Caspian sea. Besides, the tentative estimation of the sources which are settling down outside of territory TCO to which influence the site of a coastal line of Caspian sea within territory TCO can be exposed is spent.

Communication of ground waters with Caspian sea for definition of existence of hydraulic communication between Caspian sea and lie down ground waters is estimated also.

The West Kazakhstan territorial centre under the control of ecological pollution spends for ТШО. The program of sampling for definition of quality of waters of Caspian sea. The primary purpose of the given Program is definition of types and distribution pollutes along that part of a coastal line of Caspian sea, which adjoins to territory TCO to estimate potential of fatal biological effect pollute and it is better to define problems on protection of quality of waters of Caspian sea.

The secondary purpose consists in definition of sources of potential influence from outside the operations which are carried out on small lie down « salt » deposits. The sampling program is under construction so that to provide comparison of a zone near coast of Caspian sea, activity ТШО adjoining to sites, with the zones of territory ТШО adjoining to sites of activity on existing saltest petrocrafts.

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ПОВЕРХНОСТНЫЕ ВОДЫ И КАСПИЙСКОЕ МОРЕ

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Минерализация вод Каспийского моря в целом составляет в среднем около трети минерализации океанских вод (12 -13%). Минерализация приповерхностного слоя в Северном региона Каспийского моря от 5-10% в центральной части и ниже в районе дельты реки Волга, до более высоких уровней вдоль восточного побережья, где поступления речной воды ничтожны, мал объём осадков и сильно испарение.

В качестве основных источников загрязнения Каспийского моря определены операции, ведущие к сбросу в реки, освоение шельфовых и береговых нефтегазовых месторождений и промышленные выбросы прибрежных городов.

На разных пунктах неоднократно проводились оценки фонового состояния окружающей среды по пробам поверхностных вод. Пробы были проанализированы на содержание металлов и углеводородов для установления фоновых концентраций поверхностных вод с целью сравнения с аналитическими данными по потенциально поражённым участкам. Эти данные показывают, что поверхностные воды на территории ТШО являются щелочными, высокоминерализованными и сравнительно низкого качества (не питьевая вода). Данные по углеводородам свидетельствуют, что в поверхностных водах отмечаются низкие уровни содержания углеводородов, возможно в результате нефтепромысловых операций.