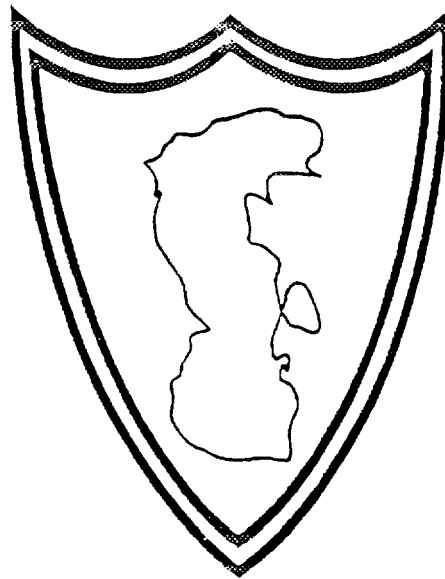




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INTERNATIONAL CONFERENCE

"КАСПИЙ - 95"



"CASPY - 95"

**CASPIAN REGION: ECONOMY,
ECOLOGY, MINERAL RESOURCES**

*ИЗДАНО В СС С А
УДК 62-002-95
К 000000*

Technical Abstracts

Moscow, June 20-23, 1995



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Organizing Committee of the Conference "Casp-95", with regret, announces that the series of plenary abstracts, which were prepared by the leadership of Ministries, Committees and Legislative Governing Bodies of Pre-Caspian States, will not be presented in our book. These abstracts will be prepared at a later time

The initial translations to English were prepared by the authors themselves, for the most part, and were prepared for print without corrections.

Organizing Committee:

Chairman, Academician G.S.Golitsyn

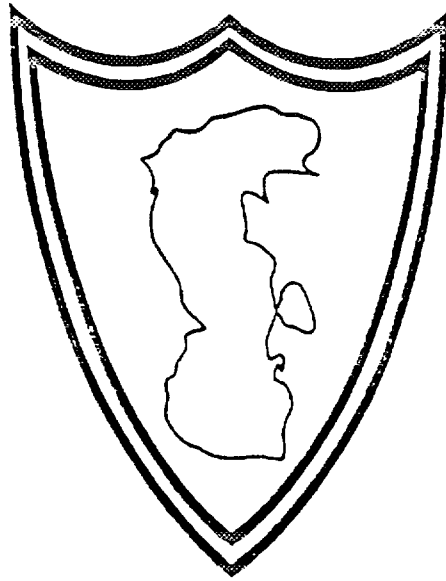
V.I.Bogoyavlensky

P.F.Demchenko

V.B.Mestechkin

A.L.Danen

"КАСПИЙ - 95"



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**SEA LEVEL'S FLUCTUATION AND
CHANGES OF WATER BALANCE**



The Nature and the Mechanism of the Caspian Sea Level Variations, According to Study Data of its Water and Bottom Isotopic Composition

*V.I.Ferronsky, V.S.Brezgunov, V.V.Romanov, L.S.Vlasova
V.A.Polyakov, A.F.Bobkov, K.Frelix*

Observance of the changes of oxygen and tritium isotope and the salt composition of the Caspian Sea water and also isotopic and the composition of the sea bottom samples during the period 1982-1994, allowed us to form an opinion about the physical picture connected with variations of the sea's level and to predict this progress.

Based on changes in the position of peaks of bomb tritium's concentration, entering into deep depressions of Northern and Southern Caspian from 1963-64, it was found out that during the periods of increasing sea level, the process of vertically moving deep, cool water (5°C) and warm undersurface water (12°C) had been accelerated. During this period the tritium peak had moved with an average velocity of about 13 m/year.

At the same time, based on isotopic data, the volume of river water and time of its stay in the North Caspian have increased by up to 1.5 times. The Northern Caspian is the main source of cool water entering into deep depressions of the Northern and Southern Caspian. This accumulation of cool water, due to the increasing river flow and decreasing surface water temperature, defines the complicated regime of the increasing sea level. But, its variations can have multiple nature depending on the cool water accumulation regime in the deep depressions.

Testing of bottom sediments' samples from deep parts of the Northern and Southern Caspian shows that the accumulation process took place in the past, during the regime of the variations of hydrotroilite layers covering the all lithologic sections in the time interval to 50,000 years. Based on the analysis of oxygen and carbon isotope consistence, which make up the base of the deep sediments, the water temperature curve line of the carbonates sedimentation zone was obtained. The variation of temperature in this zone is $\pm 4^\circ$ C in relation to the present one. At the same time, two sources of indignation of the balance of the sea level could be observed: exterior, connected with changes of the large river flow volume in time, and interior, connected with the accumulation of cool water and surface water zone temperature variations, during small changes of the river flow volume.

Analysis of the present water changing processes, based on isotopic data, one can make the conclusion that the stabilization process of the current increase of the Caspian Sea level will begin in 1996-1997 and will take 12-15 years to conclude. After that period, a lowering of the sea level will begin. Judging by the nature of this process, the current short-term routine cycle (36-40-years) of its variations will be observed.

IWP RAS, VNII GIG, IAEA

The Modeling of Water and Thermal Balance of the Caspian Sea and the Contiguous Drainage System, with the Assistance of the Model of the General Circulation of the Atmosphere

*G.S.Golitsyn, V.P.Meleshko, A.V.Meshcherskaya,
I.I.Mokhov, T.M.Pavlova, V.A.Galin, A.I.Senatorsky,
V.I.Govorkova*

The international program AMIP gives the unique opportunity to estimate the possibility of modern models of general circulation of atmosphere on the drainage system and water basin of the Caspian Sea. Analysis of sediments, evaporation flow, snow mass, radiation balance, temperature of surface and other characteristics are conducted for 24 models of the atmosphere taken and integrated, from a 10 year period, with the set water temperature of the oceans during 1979-1988. Models have different space solving methods of parametrization of physical processes. Regional analysis has produced for models of low and high permission.

Analysis show that perennial, seasonal movement of sediments is more scattered in models of low settlement than in models of high settlement; the middle year's sediments are reduced on drainage system in half of the models; maximum drainage of sediments in the summer comes 1-2 months later into the drainage system, in comparison with the results



of observations. Seasonal movement of temperature near the surface coordinates with observations in high settlement models. Maximum snow, accumulation on drainage in winter, is different, because at the beginning of integration different mass of snow on continents is given in models year movement consisting water and thermal balance will be found only every other year.

Most of models of high settlement show the presence of a signal in the sediments on drainage system which began in 1983, connections of this signal with the index of drought was found. Most models show the increase of the level of the Caspian Sea from 1979-1988, but the size of this increase varies in various degrees. Sediments in the drainage systems of the rivers Volga and Ural change the level of the Caspian Sea and evaporation of the Caspian Sea basin. The size of Caspian Sea level can differ in different models. We prefer to use those models in which the size of the Caspian Sea is correct. These are the models of high settlement.

IFA, INM RAS, GGO

Physical-Mathematical Bases of Forecasting the Caspian Sea Level

K.M. Magomedov

Proceeding from the main equations of hydromechanics (Navje-Stoks, Reynolds) describing the processes of flowing and heat mass change in atmosphere and sea, we examined different models for studying and forecasting the Caspian. Integration equations on vertical, including middle quantity, and calculation conditions of keeping mass, impulse and energy on surface division (sea-atmosphere, bottom) lead to equations of "shallow water". A new formula for velocity evaporation through thermal stream from water was written.

On the basis of equations of the "shallow water" calculation of set up-set down appearances, calculation experiments for forecasting and composing simple models can be conducted. For long-term and super long-term forecasts equations can be simplified with the help of calculation interactions.

Some solutions for equations were examined, for example, the balance equation for the middle sea level and the order of level measuring and processing.

Model of zero level was studied in detail - mathematical problem of the future of measuring the meaning of $h(t)$. Defluxion $h(t)$ from trend submissions by probability laws but not "h" itself. The results, received in the Institute of Geometry Problems on the approximation trend by harmonics with periods 32, 130, 216 and 420 years with a middle quadrative mistake of 0.3 m. Calculations showed that in natural conditions the sea level will rise to until the year 2030 (-24,3 m), after that it is expected to recede. Calculating the technogene influence and increased temperature to the years 2020-2050, the sea level will be near -25 m.

Other results of the Institute of Geometry Problems in researching level and ecology of Caspian are given.

IPG DSC RAS

Level Regime of the Caspian Sea and the Possibility of its Forecast on the Basis of Paleographic Restorations

G.I. Rychagov

In the twentieth century, the problem of the level regime of the Caspian Sea is a great actuality. Before 1977, an explorer had the following question: "How long will the level continue to decrease and to what level?" And now we can add the full owing question: "What is the reason for the level's fluctuation?" Analysis shows that the main reason is the changing climate in the range of the basin. Its forecast was constructed on calculations of accidental variations composed on the water balance. There were very many such forecasts, but they were not correct. For solving this problem we can use the method of paleographic restorations, based on a detailed analysis of the geologic-geomorphologic structure of the shore.

This method states that during the last 2 to 2.5 thousand years the sea level was not more than -25m. It gives the opportunity to suppose that the rising of the level in 1978 will not be more than -25 m and with economical activity and reestablishment flowing to bay Kara-Bogaz-Gol it will stop at -26 m. This level will be reached at the beginning of the next



century. The conduct of the Caspian level in the twentieth century (lowering 3 m from 1930 to 1977 and rising 2.0 from 1978 to 1995) is ordinary and, if all actions are made taking into consideration zones of risk (from -25 to -29 m absolute altitude), we could avoid the same negative consequences which occurred with the rising of the level in 1978.

MSU

Morphological Changes of River Deltas on the Caspian Coast of Russia

N.I. Alekseevsky, V.M. Mikhailov

Deltas of the Volga, Terek and Sulak rivers are the most changeable geographical objects on the Caspian coast of Russia. During the last 200 years the morphological characteristics of these deltas were subjected to large-scale changes. Main reasons of these changes were the following: 1) large-scale changes in level of the Caspian Sea; 2) natural and anthropogenic changes in the water flow and sediment yield in river basins; 3) natural processes of delta formation; 4) important hydrotechnical measures in the deltas.

The sea level drop during XIX and XX centuries up to 1977 was favourable for the following processes: 1) advancing of the deltas into the sea, especially in the Volga mouth with a very shallow nearshore zone; 2) erosion in main delta channels, especially in the Sulak delta with a deep nearshore zone. A break of the hydraulic connection between the Volga delta and the sea occurred when the sea level was nearly -27 and -28 m. Fast and significant sea level rise since 1978, which reached 2.2 m by 1995, caused flooding of a shallow part of the nearshore zone at the Volga mouth. The accumulation of sediments in channels began in the Terek and Sulak deltas since 1980-1981.

The anthropogenic decrease of the river sediment yield slowed down the delta formation and delta advancing into the sea. In the last time this led to wave destruction of the coastal parts of the Terek and Sulak deltas.

In the Volga delta the concentration of the water flow in a limited number of major branches and filling of many small branches by sediments take place. Channel breaks and large-scale changing in hydrographic network are typical for the delta of the Terek river with a large sediments load. The last break in 1914 led to formation of the new Kargalinsk channel system. Now some reasons for new drastic changes in the hydrographic network of this delta exist. Four successive delta lobes were formed in the Sulak mouth during the last 200 years. The largest break took place in 1929. After this a large delta lobe was formed.

Strong influence on hydrological and morphological characteristics of the deltas was effected by the following hydrotechnical measures: construction of the canals at mouths of major branches of the Volga delta and water distributor in its head; artificial redistribution of waters through canal system and water distributor in the Terek delta; manmade straightening of the main channel in the Sulak delta in 1958, and in the Terek delta in 1973 and again in 1978. These latter led to the formation of the "new" Terek and Sulak deltas at the open nearshore zone.

The assessment of possible changes of the Volga, Terek and Sulak deltas in the future were worked out on the basis of the study of happened hydrological and morphological changes of the deltas and their regularities. The assessment was made for five scenarios of the sea level changes.

MSU

The Modern Changes of Water Balances' Component of the Caspian Sea

G.S. Golitsyn, G.N. Panin

On the basis of analysis of change of water balance component of the Caspian Sea are shown the reasons of change its level.

It is shown, that within the limits of 10-15 % of accuracy the modern changes of level are caused by changes of main component of water balance - river drainage and visible evaporation. There are adduced new data on energy-mass-change of shallow water of Caspian with atmosphere.

IFA, IWP RAS



The Water Level Rise Problem of the Caspian Sea

B. Arlamadhan

The water level of the Caspian Sea started to rise from 1977 accelerating since that time to reach a rate of 15.6 cm/year in the year 1994. If the figure of 15.6 cm/y sea level rise (acceleration not included) is considered for the next 25 years, the water level of the Caspian Sea will be reaching the level of -22 m. This means that, if no action is taken, many Iranian coastal cities (Gomishan, Bandar Torkman, Khazar Abad, Badolsar, Fraydonn kennar and Rodesar) will be drowned in water. Plus major part of the recreational areas, some industrial plants and about 25 km of the railroad. We initially, exclude the accelerating coastal erosion and coastal flooding from this calculation.

The residual deviation from the water budget equation has estimated to be about +3,6 cu.km/y (taking into account that the natural discharge of Caspian water into the bay of Kara-Bogas-Gol was restored since June 1992). For the present rate of SLR (15.6 cm/y), the increase in the volume of the Caspian Sea water is 61 cu.km/y which is not consistent with water budget deviation.

In this stage of our study, we think that this amount of water does not exist at all. Some Iranian scientists report, that the area of Mazandaran and Alborz are very active tectonically. They report that the surface of the earth rises by an amount of 3 to 5 cm/y. Another report points out that the region of upshoran near Baku rise by an amount of +3 cm/y, beside the appearance of small islands around the line connecting Baku and Krasnovodsk. Consequently, in this stage of our study, we think that the major cause of the SLR in the Caspian Sea is the tectonic activities in the region especially in the mid Caspian Sea.

WRC, Iran

Runoff Dynamics in the Volga Basin: Reasons and Consequences

N.I.Koronkevich, I.S.Zaitseva, I.V.Pylev

The results of many-scale analysis (the Volga basin, territory of the former USSR, the Northern hemisphere) of annual river runoff fields and runoff forming factors distribution are produced. Important features of the influence of atmospheric centers, their action and geographical position, on natural high water fluctuations in the Volga basin are revealed.

Special attention is paid to the search of modern spatial and temporal analogies for the evaluation of possible high water variations under the influence of expected climate changes. Perspectives of impact on the Volga runoff dynamics by the complex of anthropogenic changes on the watersheds are estimated. Hydroecological consequences of discharge fluctuations are revealed and main directions to lessen negative and to make more active positive after-effects of the Volga runoff dynamics are determined.

The research was implemented with the support of Russian Fund of Fundamental Investigations (projects 94-05-17295, 95-05-15317).

IG RAS

Global Warm: the Water Balances in the Caspian Basin

P.F.Demchenko, I.V.Pylev, A.V.Frolov, I.S.Zaitseva

The water balances of river basins and internal reservoirs can be considered as the integrated indicators of climatic changes. The conducted researches have shown, that runoff of rivers of Volga's basin, entering in the Caspian Sea basin, in the latter 10-20 years appreciably was increased. This increase can be explained by changes of climate. It is shown, that the dependence river runoff from main runoff-forming factors has the ambiguous nature.

The base of hydrometeorological data (temperature of air, wind velocity, deficit of humidity, atmospheric pressure, sediments, river runoff) was used for analysis during period of tool supervision. The research of dynamics of hydroclimatical characteristics for Caspian basin have allowed to evaluate the contribution of global changes of climate in changes river runoff of basin.



The analysis of water balance of the Caspian Sea for period of modern increase of level (1978 - 1994) has resulted in to conclusion about extraordinary extremely of average sizes and parities of main components balances - river inflow to sea and effective evaporation with its surface.

The changes of hydroclimatic conditions in Caspian basin are correlated with centers of action of atmosphere in Northern hemisphere.

IFA, IG RAS, SCC "Caspian"

Abnormal Increase of the Caspian Sea Level as a Result of Many Years Exploration of Mineral Resources

B.N. Golubov

The current increase of the Caspian Sea level, beginning around 1977, is creating an abnormal event. It has an explosive character with blunt changes in moving and hydrodynamics of artesian oil and gas reserves in sedimentary basins, which are the basis of the Caspian Sea depression. In other the side, this is decreasing the surface water flow without climate changes. Quantitative estimations showed that the Caspian Sea is a thin "film" of surface water, thus lies and interacts with several kilometres mass of water-, oil- and gas- saturation rocks of sedimentary cover. The cover consist of 2 groups of fluido-dynamic systems. The first type consists of the same abnormal high pressure closed compression fluido-dynamic systems. These systems were sealed up during the natural evolution of sedimentary covers under impermeable clays and salt deposits. The second group consists of gravity- convection fluido-dynamic systems with the amount of water having pressured and unpressured horizons, bedding in subsurface zones over regional fluido-isolation. Natural reasons to provide exchange of fluids between these groups (opening and closed type) are not present or limited. The technical activity of oil and gas development companies, atomic blasts and hydrotechnical building caused the creation of technogene disstable of endogenous and exogenous geologic processes in Caspian surrounding areas which changings of regime of fluidsystems. From 1847 to 1959 this destabilization means only the creation of depression cones, as a result of pumping out fluids in the higher structure. The effect of desealing high pressure fluid closed-type systems has occurred since 1960. The result of the connection of high pressure fluids and energy saving was pressure in near-surface underground water consisting stratum. This process is accompanied by the creation of artificial tectonical waves, or plastic unloading tension waves, with velocity about 60 km/year. In 1966, technogenes excited a wave of slow deformation, going from the Alpids of Azerbaidzhan, in a north-westerly direction, to the site of young and ancient platforms. In 1980, this wave crossed with front of an equal wave, arising as a result of waves' interferation formed in the frame of North and Middle Caspian in the same centers of underground atomic blasts. In 1977, unloading underground waters to the sea took an explosive character. This, since 1980, has formed a new splash of regional seismic activity. This could not have happened, except that atomic blasts carried out on Mangyshlak broke the whole region of water in the paleogene clay isolator. As a result they could speed up the underground water flow unloading to the Caspian, providing the flow of the Aral Sea surface water to the Caspian Sea area. The effect of elastic energy servings of fluids and rocks could take place some dozens or even hundred years. This effect could cause the increase of the Caspian's water level to a total of -20 m. If this savings is exhausted, the Caspian will be depending on the climatic factors. So, without new harsh underground water invasion impulses, the Caspian water level will increase to a total of -25m to -26m. The calculation method of underground flows to the Caspian must be changed, taking into account the instability of reservoir flow conditions in time, peculiarity of the interaction of fluido- dynamic systems of different rock types.

MSU



Diagnosis of Hydrological Balance Components and Various Ranges Forecasts of the Caspian Sea Level at the Hydrometcentre of Russia

Z.K.Abouzyarov, A.V.Frolov

Unified automatic system of operational regional hydrometeorological monitoring of the Caspian Sea basin is under development. Objective analysis of pressure, precipitation, cloudiness, air temperature and wind fields has been performing 4 times a day at the 150x150 km grid since January 1, 1994. There are used both the hydrodynamic model of the atmosphere and the methods of optimal assimilation of observational data. The fields are stored in the operational data base. It is planned to upgrade this technology by increasing the number of observed thermodynamic parameters including air temperature and humidity at 2m and wind at 10m heights as well as using the fine mesh grid (50x50 km).

The sea surface temperature mapping is constructed on the basis of NOAA satellite high resolution AVHRR data. The minimal resolved element at the Earth's surface is 1.2 km. We hope that implementation of this method into operational practice will enable us to assess "effective evaporation" - one of the main components of the Caspian Sea water balance.

Various sea level forecasts starting from short range prediction of storm surges up to 1 year long range forecasts are issued. Statistical estimations show that 90 % of short range forecasts are successful. Short range forecasts are based upon quantitative relations between surge level rise and meteorological factors. Long range forecasts is issued once a year in April and is delivered to all interested users. 85 % of such forecasts for last 10-years period were successful. These are used for measures taking to protect the flooding sea coasts.

The ways of improvement of the sea level prediction for 5-6 years in advance using the method that was proposed in 1946 by N.A.Belinsky and G.P.Kalinin are considered. The method was based upon relationship of the sea level variations with preceding atmospheric processes over the North Atlantic. New ideas of assessment of long term variations of the Caspian Sea level using the wavelet (scale) mathematics techniques are also discussed.

HRC

About Distribution of Maximal Urges Levels on the Coast of the Caspian Sea

M.V.Balgov, V.F.Pisaryenko, M.V.Rodkin

Technique for calculation of probability distribution of maximal surges level in the coasts of internal water areas is proposed.

Distributions parameters describing maximal monthly on-and-off waters levels from data of long-term observation performed in coastal stations of Russian part of the Caspian Sea coast (Makhachkala, Tyuleniy Island, Iskusstvennyy Island) are evaluated.

It is shown, that the empirical distributions are well described by the exponential law. The proposal on legitimacy of given type of parametric distributions is tested using the bootstrap-method.

The recommended parametric distributions are used to calculate the probabilities of maximal probable values for given time intervals (5, 10, 20 and 50 years).

The received families of distributions can be used for evaluation of risk of economic development in coastal regions.

IWP, MITPZIMG, GC RAS

Spatial and Temporal Variations of Resent Endogeodynamic and the Caspian Sea Level Changes

D.A.Lilienberg

The Caspian Sea phenomenon has been caused by long interaction of lithosphere, atmosphere, and hydrosphere. However, tectonic mechanisms have not been taken into account by prediction estimation that lead to its poor reliability. The Caspian Sea region is a



unique structural and geological area, and is characterized by high mobility and seismic activity. Horizontal movements of the zones of collision between Euro-Asian and Arabian plates (which were not taken into account before) play the leading role in formation of its morphostructure, and create vertical movements. Mechanisms of rotation of the Earth, mantle diapirism, etc. also influence this region. Pulsation mechanism of compression and extension leads to periodic changes - rising and sinking, e.i. changes of depression's volume independently on changes of volume of watermass in it.

Oscillatory and wave type of recent tectonic movements with regular and irregular quasiperiodicity of 100-120, 50-60, 25-30, 10-15, 5-7, 2-3 and 1 year is revealed by measurements (geodetic, level, hydrogeologic, seismologic, etc.) that corresponds to analogous rhythmically of hydro and climate processes and observed on different components of geodynamic process - vertical and horizontal movements, seismicity, mud volcanism, dynamic of underground water, changes of output of oil and gas. General trend of endo- and exodynamic coincides very well. Intensity of horizontal deformations measured by repeated trilateration and GPS-observation amounts to 5-7 cm per year, vertical (in accordance with leveling and mareographic data) for the period in tens years - up to 1-2 cm per year (for short period - some cm/year). Phases of low level of the Caspian Sea coincides well with the phases of depression's extension, increasing its volume, activation of seismic activity, as well as mud volcanism, decreasing the level of underground water. Tectogenic factor can be considerable and should be taken into account in prediction estimation. Permanent monitoring as well as establishment of complex Caspian geodynamic test area is necessary. Availability of interconnection of two main factors of geodynamics of Caspian Sea requires development of more comprehensive tectonic and climatic model.

IG RAS

Numerical Investigation of Background Sea Level Influence on the Wind Sea Level Denivelation and Upon Currents at the Northern Caspian Sea

Yu.G.Philippov

This work is aimed at investigation sea-level variations, circulation, current velocity distribution and water flow in the Northern Caspian Sea using numerical methods. The problem is solved using three-dimensional non-stationary hydrodynamic model composed of two blocks: the first one describes shallow-sea level denivelations, and the second one is based on the use of three-dimensional non-stationary model for the evaluation of current velocity structure taking account of calculated sea level distribution.

The model has the following features: calculations are made simultaneously for entire the Caspian Sea, the meridional spatial steps being lengthened at the Mid- and Southern Caspian Sea areas taking into consideration effects of coverage by water and drying up of flatland areas. The influence of nearshore vegetation is also taken into account by means of varying sea surface- and bottom friction coefficients. The coefficient of vertical turbulent friction is defined from Prandtle approximation with effective length scale proportional to local depth.

All parameters of both models are evaluated using comparative analysis of observed and calculated sea level and current velocity values.

Evaluations of circulation and current velocity have been made for 8 main grades. Various wind velocity approximations have been used: constant in space and time, grooving with them and typical synoptic situations from the "wind and waves Atlas of the Northern Caspian Sea".

Certain conclusions have been made in relation to variations of sea level, water circulation and current velocity in various areas of the Northern Caspian Sea as well as of water balance between its' Eastern and Western parts at background level variation from 28 m to 24 m BS.

10



Concerning the Changes of the Caspian Sea Level

S.K.Monakhov

Surface of division water-atmosphere is examined as external sea surface. Using data of observation near-shore and island GMS for level, the main types of deformation of sea surface in diaposons of sinoptical and seasonal changing are defined.

Deformations of the sea's surface are defined by atmosphere influence, changing of wind field and the field of atmospheric pressure. Changing of atmospheric circulation above the sea is caused changing in correlation of the main types of deformations of the sea's surface.

The connection of perennial fluctuation of the sea level with the changing forms of atmospheric circulation is closer than their dependence on the river flow and sediments in the sea basin. This connection explains that the changing of forms of sea surface influences on its water yield with atmosphere.

DG

Analysis of Periodic Cosmogeophysical Processes and Measuring of the Caspian Sea Level

V.I.Kaftan

Analysis of temporary rows observations for the Caspian Sea level were made. It has an anomal lift. We found components of fluctuation of the Caspian Sea level. The highest amplitudes of fluctuation are from 10 to 90cm, which correspond to periods (208+-16, 98+-2, 55+-2, 39+-1 and 29+-0.4 years). Fluctuations of high density were found too. Periods of garmonic high and low densities coordinate well with periods of sun activity (about 80 % of the periods coincided), velocities of rotation (57 %) and middle year temperature of the north hemisphere of the earth (55 %). Fluctuations of the Caspian Sea level take place in phases with the fluctuations of cosmic and global processes. Contribution of the river Volga can be compose about 44 %. Analysis of the vertical movements of the earth surface was made For the study of the hypothesis about tectonical nature observated changing of the Caspian Sea level. Their fluctuations were found in the results of observations and data of overlapping levels. Harmonicas of fluctuations of vertical movements have periods of about (147+-8, 58+-5, 42+-3 and 28+-0.8 years). Amplitudes change from 2 to 6cm. The results don't change the hypothesis about the tributary and the withdrawal of the Caspian water can be a consequence of the compression and stretching of the earth's crust. It is necessary to conduct geodesic observations for space deformations of the earth's surface for determining the more precise contribution of this factor in the general movement of the changing sea level. The results of this analysis of complex data allow us to expect the termination of the rising the Caspian level in the very near future.

CNIIGAK

Changes of Hydromorphological Processes in the Volga and Ural Deltas in Connection with the Caspian Sea Level Rise

V.F.Polonsky, O.V.Gorelits, L.P.Ostroumova, C.V. Kasyanov

The Caspian Sea level (HS) rise from -29.0 m to -27.5 m abs. in 1978-1990 had no influence on the Volga delta level regime. This fact is caused by waste relict fan platform 35-60 km wide (-27.0 - -28.0 m abs. elevation), situated below the modern delta sea line (d.s.l.). In 1990 d.s.l. was in line -26.5 m elevation in low water period. Beginning in 1991, at the Hm=-27.2 m abs., the sea level hydraulic backwater started to progress into the delta branches in low water period. Volga delta shallow offshore zone is cutted by a number of navigable and fish-passing canals. The side runoff from these canals to surrounding areas of the shallow hydraulic backwater propagation to the delta the enhancement of the runoff of the relatively small delta branches and of the eastern delta part should be expected. This part of delta is lowest and will be inundated first.

According to our results at the Hs=-26.0 m abs. the low water period levels near d.s.l. will rise to -25.7 m abs. The strip 5-10 km width will be constantly inundated in the delta low zone, the inundation will be enhanced at the flood period. The storm surges role in the delta inundation will be of secondary importance as compared to the flood role. At the



$H_s = -25.0$ m abs in low water period the levels near modern d.s.l will rise about -24.8 abs. The strip about 10-20 km wide in delta low zone (western part) and the strip about 20-40 km wide in delta low zone (eastern part) will be constantly inundated. At the peak of the average flood all delta area will be inundated, with the exception of the protected area will be inundated, with the exception of the protected areas. The storm surges penetration will be intensified practically in low water period, the width of inundated zone will be 30-50 km from modern d.s.l.

The shallow offshore zone in front of Ural delta is small-scale. So, the Caspian Sea level rise since 1978 began to influence immediately on the Ural delta water levels. During the Caspian Sea level rise on 2-3 m since 1978 till 1994 the water levels rise near Atyrau (50 km upper d.s.l.) was about 1.7 m in low water period and 0.5 m at the high flood peak. Now the strip 10-12 m wide in the low delta zone is constantly inundated. The empirical dependencies and hydrodynamics models of the Ural delta were used for estimates of the water levels. The comparison of the estimated level surface and surrounding relief features allowed to recognize two zones at the Ural delta, with are differ in the genesis of possible inundation. At the zone, situated upper than Ural delta top, the threat of inundation by the flood water ($Q_{\text{ural}} > 1500$ cu.m/d) is dominated. The low zone - from the delta top to the branches Damba and arm Zolotoy merging - is not practically inundated in steady-state conditions at the H_s below -26.5 m abs. In unsteady conditions - the storm surges 1.5 m height at the offshore - in low water period the horizontal surface of maximal levels with the elevation -25.0 m abs. are forming at the Ural delta. The strip 5-10 km wide can be inundated in addition to the steady-state conditions.

At the Caspian Sea level rise $H_s = -25.0$ m abs. and more practically all Ural delta area will be inundated. The problem of the Atyrau inhabitants evacuation will appear in connection with the threat of the storm surges inundation. In consequence of the Caspian Sea level rise the great side runoff from the Ural delta branches to the inundated delta sections is observed already now.

IFA RAS

The Fluctuations of the Caspian Sea Level in Connection with the Changing Climate in Holocene

V.A.Klimanov

The history of the fluctuations of the Caspian's level have been studied using different methods, for example, on historical data, on stratigraphy of deposits, on the changing of old shore lines, on paleontologic data, on calculations and so on. One of the possible directions to study the history of the Caspian basin could be to find the dependence of the composing of water balance of Caspian form climatic characteristics with the following restoration of the water balance and the definition of the Caspian level with paleoclimatic data. The first experiment of such research was made for the calculation of the Caspian water balance in the optimums of Holocene and Mikulinsk interglacial (Velichko, Klimanov, Belyaev, 1988). In this work, the calculation of the Caspian water balance was made for some shears of Holocene on which we have the characteristics of the climate (temperature and sediments) for eastern Europe (Klimanov, 1989). This area was growing warmer about 8500, 3500, 1000 years ago and growing colder about 4500, 200-250 years ago the level of the Caspian was higher and about 3500 and 1000 years ago it was lower than now. And the maximum level was 200-250 years ago. Our data conforms with the curve of the changing Caspian level for the last 16,000 years (Varushchenko, 1987).

Different levels of increasing and decreasing temperature in Holocene result in the different redistribution sediment, as in river basins falling into the Caspian, as above its water basin. This is caused to change of the Caspian levels as in growing warmer as in growing colder.

IG RAS



The Climatic Factors and Limits of the Caspian Sea Level Fluctuation According to the Data from Historical Past

A.N.Krenke, V.V.Popova

The correlation between the Caspian Sea level fluctuation and atmospheric circulation according to the B.L.Dzerdzeevsky classification shows that the Caspian Sea level rising is related to the increasing meridional circulation and its fall is related to the intensification of zonal one. In the years of predominantly meridional air circulation the amount of summer and particularly winter precipitation is more comparing with the years of predominantly zonal air circulation. Vice versa the summer evaporation is higher in the zonal circulation epochs. On the base of principal components analyses it was found that Caspian Sea basin could be divided into the three regions with different feature of the precipitation changes: 1) Right bank part of the Upper and Middle Volga basin; 2) Left part of the middle Volga basin (mainly Kama basin); 3) Caucasian rivers.

For each of the regions there are evidences on climate changes in the last millennia from pit layers in the swamps or from historical documents. Winter and summer temperature anomalies are evaluated and recalculated in Caspian water balance components.

On the base of historical evidences and supposed long-term constant air circulation pattern, the extreme long-term water balance components were evaluated. They could be assumed as the limits with could be recalculated into the Caspian water level has to be treated as not climatic - anthropogeny or connected with the additional water inflow from the eastern bank of the sea (Uzboi river for example).

IG RAS

Storm Surges Forecasting on the Caspian Sea for the Assessment of Living and Economy Conditions on the Coast Line and Environment Consequences of Flooding in the Oil Production and Fishery Areas

P.E.Lysenko

Socio- and economy conditions on the coast line of the Caspian Sea depend not only on the present sea level rise but also on significant storm surges and their high. The duration of these variations may be up to several days and may reach in the northern part of the Sea up to 2,5 to 3.0 m. At the same time the annual mean Sea level rise is about 0.1 - 0.3 m per year.

At present the reliable forecast of the short-term water level variations is available only by means of hydrodynamic modeling and in close connection with the current meteorological situation and geographical peculiarities of specific areas. It is a way adopted in the international engineering and scientific projects and it allows to get some impressive results.

The three similar nested hydrodynamics models were developed by Volga Ltd. in 1993-94:

1. The model of the entire the Caspian Sea.
2. The model of the northern part of the Caspian Sea.
3. Detailed model of the north-western coast of the Caspian Sea.

These models allow to define the time variations of storm surge flooding for the natural coast line state as well as for the planned and existing protective engineering structures. Another important function of the models is the quantitative assessment of pollution propagation, ex., pollution load washed out from the nearshore fields etc.

The possibilities of the mentioned modules are also valid for the middle and southern parts of the Sea where storm surges not too high.

Up to the present time the practical applications of these models have taken place for the assessment of protective structures near the lagan village in Kalmuck Republic and within the Federal programme "CaspY". Different project proposals for Volga river delta (Russia), Emba Neft oil production area (Kazakhstan), real - time storm surge forecasting system for the north Caspian Sea region still did not find an adequate response and paying capacity clients. Evidently this phenomena is connected with some misunderstanding



that the mathematical modeling is the single source of actual and objective information which is extremely necessary for the storm surge warning, for their consequences forecasting, for engineering protective structures testing, and at last for the safe navigation.

Assimilated by Volga Ltd. technologies, based on the foreign and local experience, can provide an efficient excess to the mentioned information. Author would like to attract the attention of the potential consumers to this fact.

Presentation of this reports will be implemented on a computer in the form of computer animations.

Volga Ltd.

The Main Factors that Regulate the Level of the Caspian Sea and their Forecast on the Future

D.G.Osika

The modern, quick rising of the Caspian Sea level is not a catastrophe, but a normal display of its cyclical regime. Compression or stretching, warping or stretching, warping or rising of the earth's crust takes place during earthquakes. But seismicity, including the tectogenic one, doesn't influence the increase of the sea level, except 0,06-0,2 mm/year because of an anomalous underground water flow. There are fantastic hypotheses of transitional volumes of water from the Aral to the Caspian, and the wrong way.

The idea of reverse dependence of the level regime of the Caspian Sea from sun activity (-0,86) develops. (Superpositions of maximums of 11-years, secular and many secular cycles) is placed to the most low standing of level (-29 m) in 1977. The main factor for the level regime of the Caspian Sea is climatic, which is defined by the dynamics of the sun's activity. The rising level forecasted to the years 2005-2010 will be -26-25 m (in the middle - 25.5m), maybe in 2020 it will be 24m. After that its quasi-stabilization must come over a period of 30-40 years and lowering again to 27-28m. Changeable on statistics on seismic activity of Caucasus, Skifian and Turanian plates.

IG DSC RAS

The Role of Hydrodynamic Processes in Forming of Level Surface in Accordance with Satellite Altimeter Data

N.V.Ovinova, V.B.Lapshin, A.N.Militeev, P.P.Medvedev

The intensive rise of sea level of the Caspian Sea (from the 1978 to nowadays) accompanied with the catastrophic consequences makes very important the question of the level surface definition.

The analysis of observation data shows the considerable difference between levels' meaning for North and South, West and East coasts. For explanation this fact is needed to solve the problem for flows in sea basin with correct initial and boundary conditions: discharges of rivers, evaporation, atmospheric sedimentations, bottom discharge, with tension.

Authors use the three-dimensional numeric model for the calculation of the density, wind currents in density stratified basin.

In testing of the model the satellite altimeter data are used.

As a result of three investigations the important fact was established: long-scale fluctuations of level surface is formed by wind and density currents. This fact must be taken into consideration for evaluation of the mean sea level.

IO, CC, GC RAS

Estimates of Tsunami Danger for the Caspian Sea

E.Pelinovsky

The problem of tsunami zonation in the Caspian Sea has never been addressed until now, though it is getting more pressing recently, since the sea level keeps rising and there is a danger of floods and damages to coastal buildings and structures. The Caspian Sea is a region of weak seismicity, and we have very scarce data on real events there. These data have been used in this paper on estimates of tsunami danger to the Caspian Sea coast.



Collected data on severe earthquakes in the period of 2000 BC. - 1974 have been analyzed. The total number of quakes in the 20th century with seismic origins in the Caspian Sea or its shores and the magnitude $M > 4.1$ amounts to 85. Only one of them with $M = 6.5 - 7$ (epicenter depth - 60 - 300 km) occurred directly in the Caspian Sea basin (it originated in the Derbent trough), but it was not accompanied by a tsunami. There is only one recorded case of tsunami development during a devastating Krasnovodsk earthquake on 8 July 1895, when $M = 8.2$. The descriptions of tsunami can estimate its devastating force; the strength of such a tsunami can be scored at 2 points and higher on the Solovyov scale of intensity. We analyze also earthquake descriptions of earlier times, that can be related to tsunami. Thus, during the earthquake of 743 ($M = 4.9$) "the near shore area (the Caucasian side) with a fortress wall sank into the sea". There is a similar description there for the Derbent region in 918, when it was struck by an earthquake of $M = 6.1$. Another quake worth mentioning occurred in 957 in the Caucasus; its $M = 5.5$, and "the sea withdrew to 150 m from the shore".

Therefore, in a preliminary analysis on tsunami danger in that region we have used data on the Caspian Sea seismicity, as well as some conclusions of the tsunami wave's theory, obtained for other areas. It follows from an analysis of exceedable frequency that every 100 years there occurs an earthquake of $M = 6.7$, and this value can be taken for rough calculations in the Caspian Sea basin. We are estimating tsunami height as 0.5-1 m.

API

Temperature Composed of Paleo-Climates on the Caspian Shore

S.S.Sardarov

Fluctuations of the temperature of the earth's surface spread deep in sedimentary strata. Changing stops at the first 15-20 m, but geothermal data carry information about fluctuations of surface temperature with periods of hundreds and thousands of years from a great depth. For reestablishment of the paleo-temperature of the surface, data from geothermal measuring was used in intervals of depth from 21 to 165 m, the reverse problems of heat conductivity were solved. A polyharmonic approach on special methods revealed 2 harmonics with periods 240 years and with amplitude 1.1 C (influence stopped 250 years ago) and 1640 years and 0.5 C (influence stopped 2000 years ago). The Middle Age temperature on the Caspian shore was 0.5 C higher 1600 years ago and from the eleventh to thirteenth centuries it was 0.5 C lower than currently. Beginning from the thirteenth and the middle nineteenth century it increased, but then it lowered. We must notice transgression of the Caspian in the twelfth and thirteenth centuries. And it confirms the climatic nature of variations of level of closed basins. Restoration of temperature field of earth surface by geothermal data is natural direct geophysical method of reconstruction of paleotemperature.

IPG DSC RAS

Nonlinear Models of the Level Dynamic of the Caspian Sea

M.I.Zelikin, L.F.Zelikina, A.S.Mishchenko

The problem of the forecasting in level of the Caspian Sea is crucial both for economy and ecology of the Per-Caspian region. The Caspian Sea is a closed basin and its level is known to vary in a large scale under a number of causes including the global climate change.

There exist a lot of forecasts based on the following factors: influence of the solar activity, the atmosphere circulation, change of the Ocean surface topography, geological phenomena, the river run-off and the evaporation rate. All models were constructed using linearisation of the connections taken into account in considered model.

Last decades the linear stochastic equation of the water balance was the most popular. As a matter of fact the behavior of the level of the Caspian Sea has contradicted with forecasted one. Of course one of the reasons of this failure lies in disregarding of all factors mentioned above. But we believe that the main reason consists in using the linear equation.

The paper presents the results of study of the nonlinear stochastic equation aimed at more adequate modeling of the Caspian Sea level dynamic. The study reveals existence of more than one stationary levels which determine asymptotically behavior of Caspian Sea.



This analysis opens new approach for constructed of the more adequate models accounting all know factors affecting the regime of the Caspian Sea level and for more accurate predictions.

MI, CEMI, MSU

Hydrological Aspects of Evolution of the Volga Mouth Area Ecosystems

N.I.Alekseevsky, V.M.Mikhailov, E.G.Mjalo

Ecosystems of the Volga mouth area include abiotic and biotic components and can be divided into three types: ecosystems of delta channels, delta plain and nearshore zone. For each of these ecosystems the hydrological factors are of great importance.

Delta channel ecosystems very closely associate with hydrological, hydraulical and hydrochemical regimes of the water flows. Influence of marine factors in their coastal parts is manifested during high sea level stages and storm surges, which are determined by peculiar features of very wide and shallow nearshore zone. During the fall of the river flood ecological conditions of delta channels depend on quantities of the input of regeneration waters from delta plain. For this type of ecosystems and their water quality the following processes and conditions are very important: tendency of channel evolution (filling up, activization, stabilization), bioaccumulation, geochemical anomalies of bottom deposits, secondary pollution, etc. Changes in water quality are accompanied by transformation of bioproductivity and biovariety.

For ecosystems of delta plain the general geographical conditions are of great importance. Typical for semideserts climate becomes more softer under the influence of delta channels and lakes. Their influence on ecosystems sharply increases during flood, when delta plain is inundated by fresh waters. The Caspian Sea level rise promotes to duration of flooding, which reflects in transformation of the vegetation. Simultaneously the area of flooding in coastal for part of the delta increases. Now this process is typical for limited area, but in case of the further sea level rise it can take more large scale.

The nearshore zone of the Volga and the Northern part of the Caspian Sea are unique ecosystems, where more than 15 % of total biomass of the Caspian Sea is reproduced and nearly 75 % harvest of fish is realized. The state of this ecosystem is close to catastrophical at the sea level -30,0 m or to optimal at sea level variations between -26 and -27 m. In the last case relatively small depths of the nearshore zone and characteristics of the fresh and saline waters mixing zone of hydrological factors in the evolution of this ecosystems consists in freshing of the nearshore zone, carrying out of various chemical matters including pollutants. Accumulation of pollutants in bottom deposits, their transformation and probable involving in tropic chains present a real danger for ecological conditions of the Northern part of the Caspian Sea.

MSU

Flooding of Volga Delta, at the Peak of Spring Flood, Concerning the Conditions of the Increase of the Caspian Sea Level

P.I.Bukharitzin

In accordance with orographic peculiarities, the density of hydrographic grid and their connection with the flooding regime, the Volga delta is divided into 3 regions: central, including the delta only, and west and east substeppe ilmens. The central region, in turn, is divided into two parts: eastern and western. The border between them passes along a line: the branch Busan source - Tishklevsk sand bar.

Regular airplane monitoring of flooding of delta was started in the 1960's. The aim was to understand the influence of the Volga on the spring flood regime. The monitoring was carried out at levels from 55cm to 254cm over "0" (normal) at the Astarkhansk point. It was established, that at the level of 150cm the water was in its native channels. The flooding was noticed at the 170-190cm level and mass flooding was at the +200cm level. In the beginning, the central delta region was flooded. The flooding of zone from Astrakhan to the coast took place almost at the same time. Then the eastern and western delta zones, and finally the substeppe ilmens were flooded.



Nowadays, the flooding of delta is also divided into stages, but the water coming to the floodplain is noted first at the bottom of the most eastern zone of the central region, then the coastal zone is flooded, then middle and large ones. In the western part of the delta the middle zone is less flooding one. Last year's monitoring was carried out at the peak and recession of stages of flooding, at levels from 272 to 291 cm. The yearly increase of flooding for both individual zones (especially the lower) and the whole delta were recorded. The average value of the delta flooding has increased from 67 % to 76 % from 1992 to 1994. This could be explained, first, by the increasing of the Caspian Sea water level, that significantly changes the flooding picture of the bottom zones and, second, by step of wall breaking at the form walled lots. As the conclusion, it can be stated, that in the last 30 years the conditions of flooding over Volga delta have been significant altered.

AEB IWP RAS

Repeated Precise GPS Measurements from the Black Sea to the Caucasus: Results and Future Plans

M.Becker, E.Reinhart, H.Seeger, I.Kumkova, A.Finkelstein

The paper gives the result of the two GPS measurement campaigns performed in 1993 and 1994 on the Crimea-Black Sea - Caucasus Profile. Results are discussed in view of their accuracy and possible geophysical implications. The extension and repetition of the campaigns are discussed, especially considering the connection of sea-levels from the Black Sea and Caspian Sea. Further aspects are the permanent monitoring and separation of sea-level and tectonic height changes.

IFAG

The Caspian Sea Water Dynamics

A.L. Bondarenko, D.L. Vedeev

Natural observations produced in the Northern and Middle Caspian Sea in 1987-1989 change our ideas about nature of the Caspian Sea currents. Two main wave motions was detected: inertial waves and coastal trapped waves.

Inertial waves with period about 17.5 h observed continuously as a harmonically amplitude modulated oscillations. Each modulation consist of 15 oscillation caused by interaction of inertial waves with close frequencies. Average amplitude of inertial currents speed in the Caspian Sea is 20 cm/s, maximal - 50 cm/s.

Coastal trapped waves with periods 150-200 h and length about 200 km propagated along shelf zone with phase speed 0.4 cm/s. Amplitude of coastal trapped waves current speed was 15-20 cm/s.

The results of statistical spectral analysis of wind and currents data shows that energy of inertial and coastal trapped waves is 85% and energy of wind driven currents is only 15% of total current energy.

The results suggest that variable currents of the shelf zone of the Caspian Sea are superposition of two main wave motions: alongshore with periods about 150 h, caused by coastal trapped waves and elliptical caused by inertial waves.

IWP RAS, SCC "Caspian" RAS.

Changes in the Caspian Sea Level as a Problem of the Climate Theory

G.S.Golitsyn, V.P.Meleshko

The Caspian Sea is a closed water reservoir with the area about 400,000 sq.km and catchment area about 3 mln.sq.km. A short review will be presented of the level changes during last 15,000 yrs. and of possible role of geotectonic motions. The Sea is an integrator of the changes in runoff, precipitation and evaporation. A detailed analysis of monthly mean values of the water balance components for 1930-1986, carried out by Golitsyn and Panin (1989), has shown the changes in the level estimated from the components correlate well ($r=0,87$) with the actual observed changes. The total changes



for the decades 1930-1939 and 1977-1986 are reproduced with an accuracy of about 10% or better.

Results of an international program of the diagnosis of the Caspian Sea level changes for 1979-1988 will be presented where the data from more than 20 modern numerical climate models have been analyzed for the precipitation and evaporation for the area at the actual prescribed ocean surface temperature behaviour for this decade. It was found that detailed models with good spatial resolution can realistically reproduce the Caspian level changes. That gives a hope for estimating the level in the future at various scenarios of the atmospheric composition changes influencing the Earth's climate in general.

IFA RAS, GGO

About Opportunity of Connection of Fluid Regime of Crustal Undulations with Fluctuations of the Caspian Sea Level

A.V. Karakin, B.N. Golubov

From 1977 the Caspian Sea level has become unexpectedly to rise with velocity from 10 to 32 sm/year after long-duration fall. To present time this increase has reached 1,5 m. One of possible explanations of its phenomena is connected with proposal about technogene destabilization mineral resources. As a result of long-term operation of oil and gas deposits around of Caspian the fluid regime of this region has changed. On first stage (1847 - 1959) oil and gas output was reduced, basically, to formation of repression cones, and rendered not considerable influence on the hydrodynamic regime of the deep horizons. However, from 1960 dehermetic of highly pressure bottom horizons has become to happen. This process has excited the wave of indignations of fluid regime, which has become to distributed from Azerbaidzhan to north-east.

One of main arguments of climatological connection of abnormal fluctuations of the Caspian Sea level explanation supporters is approve about absence of effective gear, ensuring hydrodynamic connection of underground hydrosphere and surface waters. Between that such gear is known. The main stocks of free water and other fluids in crust are concentrated in crustal undulations, which represent fractured-porosity saturated beds. The earlier geomechanical model was offered, which explained the fact of long-duration existence crustal undulations, and described their dynamics. This model predicts the availability in crustal undulations of oscillatory processes, which results in periodic movements of fluid masses upwards and downwards. In particular, it can explain the fluctuations of level closed reservoirs, not connected with climatic and weather anomalies.

VNIIGeosphere, MSU

The Multi-year Fluctuations in the Water Balance and Level of the Caspian Sea

R.E. Nikonova, F.S. Terziev, V.N. Bortnik

The level of the Caspian Sea has varied significantly from year to year. Over the current century (up to and including the 1977) its long-term trend clearly has been downward, and several periods can be identified against this general trend. The relatively high sea level (roughly at -26,2 m) prevailed at the beginning of the century, which subsequently fell by 1,8 during the 1930s and 1,2 m over period from 1942 to 1977. A renewed, rather dramatic drop followed in the 1977, when level dawn to -29,0 m. This is the lowest level not only for the period of instrumental observations, which began in the 1830s, but for the last 500 years. After 1978 the sea level started to rise rapidly, which now continuing, and has already increased by over 2 m (in 1994 it was at -26,7 m).

Various factors can have an effect on the Caspian Sea level: climate, tectonic processes and economic activity. Fluctuations of the sea level can be explained mostly by changes in climate, which determines the water balance of the Caspian Sea, i.e. hydrometeorological factors, and lesser by the human activity. The role of tectonic movements is quite little and not exceed a few millimeters per year.

Human activity in the drainage basin of the Caspian Sea have a more perceptible effect on changes in its water level. Roughly 1100 cu.km of river water, including 700 cu.km from the



Volga alone, were used in the economy from 1942 to 1993. The Caspian Sea level could have risen 1,5-1,7 m higher than the current one.

Year-to-year fluctuations in the sea level is basically the result of climatic factors. Changes in the components of the Caspian Sea water balance, first and foremost, the river flow, can be explained by the following causes. The river flow depends directly on the character of atmospheric processes in its basin. More specifically, the greater the cyclonic activity in the drainage basin, the greater the precipitation, and the more substantial the flow of the rivers and the higher the sea level. Analysis of processes of atmospheric circulation shows that in 1978-1993 the level of cyclonic activity exceeded the normal.

On the whole, in this period almost 50 km³ per year more water entered the Caspian Sea through river flow and precipitation than was lost through evaporation and flow into the Kara-Bogaz-Gol gulf. This resulted in a rapid increase in the sea level (by roughly 14 cm per year).

IO RAS

Adaptation Approach to Sea Cost Processes Management in Pre-Caspian Zone

E.M.Eldarov

Concern about the people living on the Caspian Sea Coast should be the key-point of solving problems on coast flooding and submerging. On the other hand, we should realize that historical cycles of the Caspian Sea waters coming and degressing are natural, thus, to struggle against this phenomenon is unreasonable and non-perspective. More perspective approach is to analyze thoroughly and then to apply in life different ways of society adaptation to this natural phenomenon.

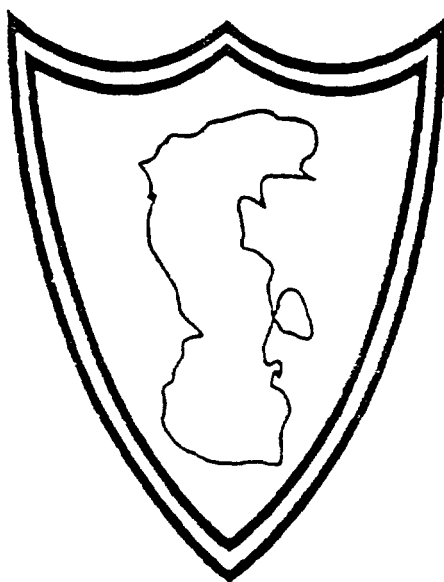
As sea-level regime forecast is uncertain it impedes long-term planning of people and economy defense measures of the Caspian Sea Coast. That is why flexible decision-making strategy targeted to periodic review of provided measures in accordance with: actual sea-level dynamics, possibilities of implementing planned measures and scientists', officials' and public views on this problem - could be the most acceptable form of management.

The work, already done for organizing defense measures on the coast of the Caspian Sea as well as great foreign experience in the field (both for sea-water and river-water flooding) enables us to formulate following adoptive management application tasks: joining the forces of all countries located at and owning the sea; regulating sea-level regime; territory defense from flooding and submerging; reducing damage from flooding; coast land-use control; coast-defenses measures control; stable financial support; maximum self-supporting; inter-regional specialization in scientific project elaboration; search forecasting; risk evaluation of territories flooding; planning the measures for cases of emergency; social defense of suffered population.

The task of adoptive management, mentioned above, is been adjusted themselves according to changing situation in Caspian Sea-coast zone.

MSU

"КАСПИЙ - 95"



"CASPY - 95"

**GEODYNAMIC OF
THE CASPIAN REGION**



Tectonic Activity of Western Pre-Caspian in Mesozoic-Cenozoic (Karpinsky Ridge)

R.G.Bersin, A.K.Suleimanov, S.I.Filin

New geological data, obtained from 1993-95, as result of regional seismic work by CDP method, testifies the presence of tectonical activity in the western part of Pre-Caspian (Karpinsky ridge) in Post-Jurassic.

The row of parts with regular seismic records is clearly selected on disorderly wave's picture on CDP time section. Indicated wave's pictures are interpreted on the section as graben zones (wide - 6-10 km, depth - 2.5-5 km). On the plane the grabens (there are four of them) are traced to Donbas direction on 170-180 km. By gravimetry data the parts of local gravity correspond to the decreasing size of these grabens.

The character of grabens' filling allows to say about their relatively young age; the southeast of them, extended to 10-12 km northern of Tuslov-Manychsk system of troughs, has not compensated even Neogene (!) rocks; the three others - are compensated only in Post-Paleozoic.

New geological data about it shows tectonical activity of Karpinsky ridge in Mesozoic-Cenozoic. It has importance in practical meaning - the question is widening oil-gas prospective lands, and this data carries some sensational changes in existencing traditional introduction of geological structures of this geostructure.

Spetzgeofizika

Deep Structure of the Joint Zone Between Pre-Caspian Basin and Turanian and Scythian Plates

*Yu.A.Volozh, A.V.Khortov, A.Ya.Brodsky, S.I.Filin, Yu.G.Yurov,
D.F.Ismagilov, V.N.Kozlov*

Recently in the North Caspian and adjacent territories considerable amounts of CDP profiles, reflecting the structure of the whole sedimentary cover, have been carried out. The profiles provided information for the seismic-stratigraphical analyses of Pre-Jurassic rocks which are uncovered in many boreholes within the Karpinsky swell, Buzachy and South Emba highs.

The Pre-Jurassic deposits are divided into three seismic-geological stages: Pre-Devonian, Devonian-Lower Permian and Kungurian-Triassic. The last two stages are subdivided into several seismic-stratigraphical units as follows: Middle Devonian, Upper Devonian, Tournaisian-Lower Visean, Middle Visean, Upper Visean-Bashkirian, Moscovian-Upper Carboniferous, Lower Permian, Artinskian-Kungurian, Upper Permian and Triassic.

According to lithological and facies features in the seismic-stratigraphical units the following seismic formations are distinguished by:

- a) carbonate and terrigenous shelf,
- b) deep basin,
- c) cone form of inner shelf and deep basins,
- d) intrabasin carbonate bodies,
- e) coastal and accumulative plains.

Sedimentary conditions of the Pre-Jurassic deposits as well as the paleobasins depth and location of main sources of material are reconstructed.

Zones of fold deformations in the Upper Paleozoic and Permian-Triassic rocks are charted. Age and genesis of the deformation are determined.

The main differences of tectonic structure between South Emba high, Karpinsky swell and South Buzachy-Mangyshlak fold-fault zone are detected.

The boundaries between Pre-Caspian basin and Scythian and Turanian plates are located and data about structure and development of the adjacent regions are obtained.

GIN RAS, Spetzgeofizika, YuMNG



Correlation Between Cenozoic Sedimentary Cover and Pre-Cenozoic Sedimentary Complex in the South-Caspian Depression

B.V. Grigoryantz, M.I. Tarkhanov

1. The South Caspian depression is a unified structural earth crust element with great information potential. It permits the possibility to base one's arguments on facts that thickness is sometimes more than 20 km. The sedimentary core was created during the Cenozoic period. It is autonomous, without roof character of folding structure of the last one. There are reverse and inverted correlations in the structure of Cenozoic sedimentary cover and Pre-Cenozoic unified basis.

2. Great energy potential of Cenozoic sedimentary cover is a result of its fluid saturation. This is caused by hydrocarbon creation, mineral transition (first of all clay) and adding deeper moving particles.

3. Forming of a folding structure without roof, so transforming the lowering to uplifts (geotectonic regime inversion) are caused in the thick (about 12-15 km) thickness of plastic, mainly in the clay Paleogene-Miocene interval of the section.

4. Autonomic folding process in the Paleogene-Miocene rocks is in the initial stage of granite forming and transforming the one stratum of the South-Caspian crust to a two stratum one. Basic and ending parts of the forming granite stratum should be connected with the complicated folding structure of this stratum, step by step transformation of the South-Caspian to a mineral-folding crust, accompanied by the transformation of clay to argillite rocks and then to slate.

5. Main geological conclusion is that formation of the earth's crust structure, inversion of folding structure and geotectonical regime could be caused by autonomous tectonics and be provided by its energy.

GANG

International Project of the Monitoring of "Caspian-Geodynamics"

*G.V. Voropaev, G.F. Krasnojen,
D.A. Lilienberg, S.K. Tatevian*

Isolated Caspian Sea presents a result of interaction between the lithosphere, atmosphere and hydrosphere. It is supposed that level fluctuations may be caused not only by hydro-climatic factors and human impact, but also due to active horizontal tectonics movements in the region. The sequence of level variations are traced in various components of the recent geodynamics. Till now the tectogen component is a "white spot" in the Caspian studies, as there is no sufficient quantitative accuracy, information about the horizontal and vertical motions in the area. To solve above mentioned problems in sea-level forecast and to avoid the social and ecological disasters efforts have to be undertaken for establishing the high precision instrumental monitoring of the endogeodynamics and its changes in space and time, as well as of interactions with climate processes.

The proposed project "Caspian-Geodynamics" is based on the precise measurements of the recent tectonic movements in the Caspian sea area with the use of modern satellite geodesy technique in combination with the ground leveling, gravimetric and hydrogeophysical observations. GPS measurements between selected tide gauges and the nearest fiducial space geodetic sites, connected with a regional control network and referred to the global International Terrestrial Reference Frame are foreseen. A connection of the coastal level measurements with satellite altimetry will allow to calculate the sea surface topography and to estimate the sea volume change more accurate. It is very important to study inclinations of the topographic surface of the sea and their periodical variations. This data is already available with an accuracy of 1-2 cm from the ERS-1 and TOPEX satellites.

The project CASPY-GEODYNAMICS could be realized only in the frame of international cooperation of the all Caspian countries and with the participations of the specialists from the West Europe and the USA. The scientific program and problems of the projects are well integrated with already active international projects WEGENER and DOSE - Dynamic of the



Solid Earth. Our proposal has been approved by the Ministry of Science and by the Expert Council on Space Research of the RAS.

RCC "CaspY" RAS, GIN RAS, IA

Systematic Aerospace Investigation of Geodynamics of Oil and Gas Reservoir Water Areas (based on examples of North and Central Caspian)

V.I. Gridin

In accordance with the opinion of the majority of researchers, the use of aerospace methods to study water area is limited by depth of vision, which equals 20-30m, with the latest technology of optic photography. The influence of the atmosphere's fog and dispersing effect of water surface reduce this depth to 10-20m. But, cosmonauts repeatedly report about "abnormal space vision", that they could visually register elements of true appearance.

Theoretical research has shown that, from the point of view of energy and physic-geology, the direct and indirect observance of the sea's bottom from aircraft could take place regardless of the depth of it. On the basis of results obtained from 1984-1990, new technology of visual-tool observing, preliminary and thematic processing of air and space photos of water areas were developed. Crews of operators of tool-visual observing were trained. From 1986-93 special photos of water areas of the Caspian, Black and Marmara seas were taken from aboard high-altitude flying planes and OS's (orbital stations). Qualitative photos of sea bottoms were obtained at significant depths of up to 450-500m. Special processing of the photos has allowed scientists to obtain new data about geodynamics and natural resources of investigated water areas.

Two systems of geodynamically active flexure-fracturing disturbances were discovered in Northern and Central Caspian. These systems dominating the North Caspian are diagonal (with north-west and north-east subsystems), and sublatitudinal-submeridional in Central Caspian. Nine large zones of disturbances were found: five north-west stretches and four north-east ones. The Astrakhan-Khazarsk zone is most clearly marked. It extends by width 35-45km from south-east to north-west, its length is more than 500 km.

In the south-east part it seems to be difficult to build graben with fracturing limitations. Indicators of geodynamically active fractures are line limitations formed of underwater relief, ridges, hollows and chains of craters were products of transformation of deep sediments. We can see some generations of fractures differ in age and genesis. Zone divides uplift by her north-west part on two blocks. They have amplitudes of displacement on subsalt deposits of 100-150m; in modern landscape it is expressed with a line bench, crests and intercrest subsidence. Zones of break take an active part in forming the modern structuring plane, formed framework of unloading tectonic strains. They control the configuration and position of the shore line of the Caspian Sea, location and stretch of valleys, beds of rivers and positive and negative deformations of sea plains. Geodynamic active zones of break control the level of tectonically joining productive sediments, making worse conditions for making wells on sedimentary cover (especially in salt and clay stratums), in upper part of fracture they make good conditions for gryphon-forming, repairing outbursts of gas-mud mass with combed down above bedding deposits. It discusses doing special research on their study and map, including this research in projects of all work on mastering Caspian region.

OGRI RAS

The Role of Destructive Processes in Forming the Depression of the Caspian Sea

V.V. Ishutin, A.V. Khortov

The Caspian Sea is a typical and special structure. It has all the signs of an inside sea, but it differs from many sea basins with one peculiarity. The Caspian Sea depression, stretched in a meridional direction, crosses different tectonic elements, such as Pre-Cambrian and Epihercynic platforms, Dneprovo-Tyanshansk structural belt, Pre-Caucasus depression and the region of Alpien dislocation. This structure belongs to the diametrical



Caspian belt. This diametrical Caspian zone was found by N.S. Shatsky (1947). The influence of this zone he found on the Russian platform. Knowing about the diametrical position of the depression of the Caspian Sea, as regarding sublatitudinal folding creations, we can say that its forming connects with the active zone of destruction of the continental crust. This meridional destructive zone looks like the south branch of the Mesensk-Caspian paleorift system. It belongs to the biggest zone of submersion. It goes from the Barents Sea through the Caspian basin to the south along the Caspian Sea. It has the diametrical position to Donetsk-Tyanshan structural belt. Intensive dislocation of transcontinental sutural belt in the range of water area of Caspian Sea is not found either in bathymetry bottom or in geophysical fields. The sharp fault in the sea of structures of the Karpinsky ridge and folding creations of Mangyshlak can be connected with stretching zones.

The area of the South-Caspian depression, "without granite window", engages special attention. It can be caused to conjugate of sublatitudinal and submeridional stretching crust. The Mesensk-Caspian rift system is more a parting structure submeridional stretching. It arose in the early Mesozoic period and showed in the Pliocene-Quaternary period in the form of exogene processes.

GIN RAS

Features of Structure and Formation Conditions of the Devonian-Lower Permian Deposits at the Northern Caspian Sea

A.V. Khortov

The revealok of the cause-effect connection of geological processes, which defined space-time relations of bodies, is one of the problems, that seismostratigraphic analysis solves. Proved regularities are used for geological model creation and allow to reconstruct the history of the objects formation and evolution. Seismostratigraphic analysis showed that the main features of the structure and formation conditions of the Upper Paleozoic deposits in Northern Caspian region are the following:

1. Structure of the Devonian-Lower Permian deposits is mainly defined by specific features of sedimentation processes at transition zone between the shelf and the basin of not-compensated sedimentation.

2. Structure of sub-salt sequence of the Northern Caspian region is identical to the one at south-eastern bond of Pre-Caspian depression, the sequence of northern part of offshore areas is like the sequence of southern part and corresponds with the sequence of South-Emba Paleozoic uplift. The same seismostratigraphic units are recognized here and similar structural and litho-facial relations are observed between them.

3. Two different processes - tectonic and sedimentary - formed the modern structure of Pre-Kungurian complex at the Northern Caspian region. Structural frame by the horizon P1 fixed buried sedimentary relief, formed by integrated influence of tectonic and sedimentary processes.

4. The Paleozoic sequence of the Northern Caspian region is connected with two sedimentary basins, changing one another in time. Its Devonian - Lower Permian part was formed under conditions of open sea at passive margin. The Middle Carboniferous - Lower Permian part was formed at the accumulative slope and bottom of the depression, partly isolated from deep basin of the Mediterranean type.

Revealing of first-rate objects for hydrocarbon prospecting at the Northern Caspian region was the result of specific seismostratigraphic analysis.

1. Large reef masses are of the greatest interest for prospect drilling. They are fixed at north-western and north-eastern parts of offshore areas - the North-Caspian and Karaton-Shaburbalinskiy.

2. Serious attention should be paid to additional seismo-stratigraphic mapping of Pre-Artian erosional cuts that can be connected with not-anticlinal traps.

3. Large Paleozoic uplifts - West Buzachi etc. - revealed at southern part of Northern Caspian region outside the area of the Kungurian salt formation development, are of considerable interest for prospecting non-sulphurous hydrocarbons.

GIN RAS



Geodynamic Model of the Juncture of the Caspian and Caucasian Morphostructures

S.A.Kasparov

The interdependence of interconnected morphostructures as a rule, must be seen on the earth's crust first. According to the geophysics data, the crust infrastructure of these objects is not compensated and is far from being balanced: partially reduced to 20 km thickness of the granite layer in the Middle-Caspian depression and it is increased up to 40 km at the foundation of the Western Caucasus which does not denote isostatic compensation at all. To this the proof is the intensive seismic activity on the juncture of these geostructures. That is why the geodynamic model of theory juncture is of great importance.

Different points of view on the processes of mesotetis closing and new non-consolidated generations of crust connecting the borderland of the Russian platform have already been discussed in special literature by the scientists. The aftereffects of these processes are considered to be collision seams which developed as described in the subduction model and the classic theory of hard and mobil borderlands of the continents. We think that this classic model can't be applied to the processes connected with mesotetis because of the great quantity of microcontinents and masses which are the splinters of baikalides formed at the destructive stage of the evolution of tetis. For us, the most representative model is the model where the vertical crust reconstruction processes are the moving forces of the geodynamic model.

The Caspian infrastructure plays the most active part here: the emergence of the enlightened mantle stock crushes the granite layer as a diapire and cleaves it according to the model of abduction in the rifting zones. Then, the huge granite layers move to the Western Caucasus from the zone of cleavage (pressure). This goes according to the model of subduction forming the active zone of Benioph in the juncture of the two geostructures.

The latter's manifestations are as follows: the system of thrust faults, and retrothrusts, rear deflection, seismic and geothermal activity, dissipative activity, hydrovolcanism and mud-volcanism. All these phenomena are widely represented on the Caspian Sea coast from the town of Makhachkala to the town of Derbent. The source of geodynamic activity is in the Caspian Sea depression, which is a negative morphostructure born in new times according to the type of the crushed roof in the rifting zone. This infrastructure develops in full accord with the laws of dissipative structures which periodically absorb fluids and energy and then dissipate them in the definite regime. The most important manifestations of these obyscal processes are the depth of the sea hollow (non-compensated depth) and the level of the sea that fluctuates.

As for the climate changes, they wholly depend on the regime of dissipation of energy. That's why climatic changes are not independent factors to regulate the water balance in the depression that is without outflow.

IG DNC RAS

Tectonic Connection of the Aral and Southern Caspian Seas in Superstructure of the East-European Craton

G.G.Kochemasov

Both sea and lakes are integral parts of the East-European craton's superstructure. Like radial-concentric superstructures of other AR cratons of the earth (Pretorius, 1973, Kochemasov, 1986 and others), it has a diameter of 5000 to 6000 km and a framework of regularly spaced, deep-seated weakness zones. At the center of its southern part of the Moscow syncline is located (1st ring). It is surrounded by increasing in diameter (D) rings with the ratio $D_{n+1}/D_n = \sqrt{2}$ (a general planetary rule). Fou. inner rings are in the craton, three outer ones are in its frame. The superstructure is cut by radial zones into symmetric-asymmetric blocks-sectors (Kochemasova, Kochemasov, 1990; Gorbatshev, Bogdanova, 1993). The NW striking diameter traced from Ian Mayer Isl. up to Badhyz is marked by a number of grabens and tectonic contacts. Ring depressions of the Aral and Southern Caspian Seas, separated by 600 to 700 km, are arranged along the 6th ring zone at equal distances from the point of its intersection with this diameter. So, they are symmetric objects or a tectonopair. Some other tectonopairs can be seen in the scheme (i.g., Alps-Novaya Zemlya, Pannonian-Pechora basins and others). About the NE striking diameter



Plateau Ustyurt and oceanic PI, Voring are symmetric. To the SE of Ustyurt's scarps an arc of the 6th ring zone was marked by R.Uzboy and L.Sarykamysh. They are arranged along fractured karst weakness zone having deep-seated roots and stretching beyond the Aral (Turgay) and Caspian (Kura) Seas. This arc is about 3000 km long, and is expressed on the surface by a chain of negative relief forms. The Ustyurt's scarp is apparently linked to this tectonic zone. Ground waters, fractures, and karsts are usual features along the arc between the Aral and Southern Caspian Seas. Periodic flooding of R. Uzboy and large water lense in the south under the Kara-Kum confirm this. Permeable lithosperic channel between the Aral and Southern Caspian Seas according to the estimation could let pass during 20-40 years 700 to 800 cu.km of water lost by the Aral Sea and acquired by the Caspian Sea situated at 70-80 m lower. Antiphase drying-flooding of communicating Aral-Caspian system occurs with various periods and apparently is field to various cycles of the earth's rotation deceleration-acceleration under varying solar activity. United earth's hydrosphere reacts to slowing-speeding cycles of rotation by drops and rises of water level according to Le Chatelier rule. Hydrosphere, like atmosphere, takes part in cincerated exchange of angular momentum between all terrestrial spheres (El Nino is part of this system).

IGEM RAS

High-Resolution Geophysics for Investigation of Crustal Recent and Modern Movements

*L.R.Merklin., Yu.A. Voloj, B.N.Golubov,
A.V.Khortov., A.N.Jacobson*

The modern Caspian Sea depression, as the tectonic structure, is superimposed with angular and azimuthal unconformity on the older crustal blocks of the Pre-Cambrian East-European platform, epi-Hercynidian Skifian and Turanian platforms and pre-orogenic Alpien fold belt. High tense state isostatic instability of the Caspian crust, hydrothermal activity and pool overpressuring prove that its reconstruction isn't finished yet. In such an unstable crustal state any serious influence can cause of tectonic regime of the Caspian depression. Long-term oil and gas exploration using hydrotechnical technologies, including underground nuclear explosives, is in the row of such kind of stimulation. The problems of hydrotechnical-geological safety in the Caspian Sea include determination and forecasting of correlation between high-frequency sea level fluctuations and cycles of modern vertical and horizontal crustal movements. They can be resolved by the Caspian Sea geodynamic monitoring along some geotraverses crossing Caspian Sea in the meridional and latitudal directions. Modern technologies of super high-resolution seismo-acoustics (mapping side-looking sonars, narrow-beam parametric and chirp profilers) integrated with differential satellite navigational systems allows to receive santimeters resolution of benchmark hypsometry in the near-bottom sediment layers. Such resolution can be compared with accuracy of land and remote measuring of earth crust deformation. The microseismic and tiltmetric measurements on the wings of familiar faults and fractures will allow to get first data on modern movements of the Caspian Sea bottom. The first stage of Caspian geodynamic monitoring have to include the experimental high resolution seismoacoustics along the profiles in the North, Middle and South Caspian Sea for determination of benchmark reflectors in the bottom sediments, their stratigraphy and connection with sea level changes, and fluid-dynamic system state. With these results we can plan to choose a grid of monitoring profiles and the optimal parameters at measurings, including proposals for microseismic, gravimetric, geomagnetic and electromagnetic high-resolution observations on the next stage of investigation, which should be also carried out directly in the regions of intensive exploration.

IO, GIN, IFZ RAS



The Main Conformity to Natural Laws of the Up-to-Date Geodynamic Processes of the Caspian Immersion Zone and Territory Along the Volga

V.A. Ogadzhanov, V.V. Tikshaev

Analysis of the information about the geodynamic phenomenons of the territory near Volga river allows us to establish close links of these phenomena to those occurring within the limits of the Caspian zone. Careful studying of the macroseismic information on historic earthquakes, one can draw the conclusion that simultaneously with the earthquake in Krasnovodsk in 1895, having the magnitude 8, another earthquake with the magnitude 6 took place in the point with the epicenter in the north-west part of the Caspian depression. The cause of this is explained by the same cycle phase of changes in the stress strained condition of the regional lithosphere and as a result of following up to date geodynamic processes:

1. Compression forces from Alpine folding of Caucasus-Kopetdag zone, having direction from south-west to north-east, to the epigercyne platform and in the same direction from epigercyne platform to the Pre-Cambrian in which zone the Caspian depression is situated;

2. Autonomous processes arising in the Caspian immersion zone (Caspian sea and Pre-Caspian depressions) caused by dilatation and dispersion of the lithosphere substance making a contribution to creating of convection and penetration from the deep stratum mantle to less deep and crust of depth's diapirs.

Transformation of the stress-strained condition of the lithosphere in the limits of the Volga-Caspian region, stipulated by the indicated processes determine the synchronous variations of the seismic activity cycle, the level of underground water in Povolzhie and in Caspian water area and also other parameters of geological structure.

VNIIGG

The New Data About Deep Tectonics and Geodynamics of Northern Caspian

M.M. Semenduev

1. As a result of interpretation of gravimetrical field of North-Caspian region is conducted zoning-block partition of Pre-Caspian syncline and marginal sites of Skifian-Turanian plate. Tectonical elements of 2 order are allocated structure Pre-Caspian syncline. The Astrakhansk arch is divided on Volga river-bed to two independent projections in Pre-Devonia complex. Left-coastal part is a part of Pre-Caspian syncline and right-coastal part - in structure of Astarakhan-Busachi - South-Emba uplift belt is binding link between structures of Ural and Donbass and represents "buried hercinite arch", about which Academician A. D. Arkhangelsky wrote 30 yrs ago.

2. Traditional representation about Archean crystal massive, bedding in basement of Pre-Caspian syncline, appears wrongful in view of following factors: a) data of drilling about opening crystalline schist and gneisses of Archean can not be extrapolated in Pre-Caspian syncline, being independent block of basement; b) reference on similarity of magnetic field of Pre-Caspian syncline with Belomorsk massive of Archean of Baltic board can not be recognized sufficiently because of different reference and forecasting areas; c) data of DSS about pinching out of "granite" bed in earth's crust of Pre-Caspian syncline are widely known; in this connection, the question about Archean crystal mass loses the geological sense.

3. The new decision of problem of boundary between ancient and young platforms in Caspian Sea, in view of mobilism ideas, is offered. Earth's crust of Skifian-Turanian plate approaches on south edge of Pre-Caspian syncline, forming tectonical overlapping of two boundaries): northern boundary of young platform and southern boundary of ancient one.

KOME PO "Soyuzmorgeo"



Researching of the Dynamic Caspian-Caucasus Seismo-Active Region as a Part of Alpiisk-Himalai Orogene Zone Problem and Perspectives

M.M.Mashimov

The Caspian-Caucasus region and the local region in the Caspian depression are examined as a part of Alpiisk-Himalai orogene zone. Secular and long periodical fluctuations of the Caspian sea level are connected by dynamics of Caspian-Caucasus region which correlated with dynamics of Alpiisk-Himalai zone. Mechanism of changing of epoch regression and transgression Caspian Sea are conditioned by movements of lithosphere platforms and permanent compression of earth is discussed. Modern data about permanent compression of the earth and horizontal movements of lithosphere platforms are discussed. Problems of global, regional and district geodynamics connected with the research of the geodynamics of the Caspian-Caucasus region and Caspian basin are examined. The character of the new epoch geodynamic research planned in the international project "Geodynamics of the Caspian Region" for 1996-2000 is given. Expected results are: 1) the estimation of parameters of the dynamic Caspian basin and Caspian-Caucasus region for the epoch 1997-2000 2) maps from space of the movements of the earth's crust in the Caspian-Caucasus region for the epoch 1997-2000, for forecasting earthquakes and developing normative documents on seismic construction 3) locating of strong earthquakes 4) topography of Caspian Sea surface and its temporary changing parameters of changing local gravitational field and local geoid.

CNIIGAK

Differentiation of Vertical Movements of the Earth's Crust in the Caspian Region and Fluctuation of the Caspian's Level

L.I.Serebryakov

In 1949 A. A. Isotov was interested in the connection of vertical movements of the earth's crust with the changing Caspian Sea level. He found upwarping on axis of Bog Caucasus ridge and lowering low land by the result of leveling 1914 and 1936. On this line we made three epochs of measurement. Consecutive in temporary comparison of measuring confirmed the Isotov's suppositions - upwarping of ridge corresponded to high level of water and downwarping corresponded to low level of water.

On the line Krasnovodsk-Ashkhabad, which goes along the basin of the Krasnovodsk bay and on the north spur of the Kopet-Dag ridge, five cycles of measurements were made. Their results confirm the conformity of relative changes in basin-ridge system with changing of the sea level. From 1975 to 1984 vertical deformations had high velocities (about 50 mm/year) because of the Kuma-Dagestan earthquake, but abnormal velocity confirmed defined conformity. Vertical movements of the ridge belonging to the Alpo-Himalayan zone are the indicator of the action of compression and stretching strains in this region, so connections of this movement with fluctuations of the Caspian Sea level produce a favorable hypothesis for endogenic reason causing these fluctuations.

CNIIGAK

About Possibility of Super Strong Tectonic Earthquake in Caspian Basin

S.M.Magidov

The work on the study of the influence of synthetic large-scale de-fluiding of rocks on the tectonic regime and seismicity is practically non-existent in literature, though the separate work about initiation of earthquakes caused by oil and gas output (S.M. Sukharev, 1972; M.N.Smimova, 1989 etc.) was written.

Extraction of oil and gas can influence the space-time display of modern movements of the earth's crust and the result can be the changing of its seismic regime. Extraction of hydrocarbons from a great depth can cause more seismic activity in tectonic regions. We received good correlations between volumes of extraction of raw hydrocarbon materials and summary seismic energy in Dagestan. Some correlations were found in Iran and other



countries. Oil extraction in Iran in 1991 composed 5.2 billion tons of oil and 750 billion cu.m of gas (prospecting oil reserves - 12.7 billion tons). Extraction in Azerbaijan composed 1.3 billion tons of oil and 300 billion cu.m of gas. Turkmenistan has extracted, since 1980, 1300 billion cu.m of gas, Kazakhstan has extracted 0.4 billion tons of oil since 1960. The Astrakhan gas-condensate field is developed. Its stocks compose 61,000 billion cu.m of gas and soon we are going to develop the Tengiz oil fields in Kazakhstan with stocks of 32 billion tons of oil. The Tengiz oil field has abnormal high bed pressure from 81 to 91 MPa.

By studying the works of Yu. M. Pucshansky (1987), V. G. Trifonov (1987) and P. N. Kropotkin (1987) we can expect the following mechanism of tectogenesis: hard plates of big length are laterally located in stratiform plastic lithosphere. The crust's fluids, especially in oil and gas fields, provide elasticity and plasticity. Elasticity is provided mainly by the gas component and plasticity by liquid. Such an elastic-plastic system (EPS) passes tectonic energy on earth's mantle to the crust, which disperses with the help of weak earthquakes. Intensive defluidization entrails can transform this elastic-plastic system (EPS) into a nonelastic and flowing system. This will lead to an accumulation of high tension and to an uneven release of energy in the form of STZ. STZ can be with magnitude of 10 according to a statement by a Russian scientist N. V. Shebalin. In this case, Azora drawing hearth (Ind's mouth) is a better place, which is not far from the Caspian. Taking into consideration intensive anthropogeny defluidization in the Caspian basin, we can expect this hearth to go on to the Caspian from north to south. It is possible that STZ will be on the North of Caspian between the Tengiz oil field and Astrakhan gas field because of the accumulation of tectonic tensions, as a consequence of great oil and gas development.

IG DNC RAS

The Catastrophic Earthquake in Dagestan (May 14th, 1970) and Its Effect on the Level Fluctuation of the Caspian Sea

N. T. Romanov, G. S. Kazarjyantz

This catastrophic earthquake has been preceded by many earthquakes (since 1948 to 1970) with 4-7 magnitude. These earthquakes were placed according to boundaries of Dagestan's tectonic block and on the joint of the Skifian-Turanian plate with folded structure.

In 1948 the Kasumkent's earthquake took place, after which seismic activity obviously increased. From 1953 to 1970 there was the heavy splash of seismic activity. The magnitude of earthquakes increased every year and on the 14th of May 1970, a catastrophic earthquake took place, with magnitude near 9 with great damage and many victims. High seismicity was safed until 1975 and then sharply decreased.

The results about seismicity of a tectonic block were examined and connected with fluctuations of the level of the Caspian Sea and depth structure of earth's crust. Then the conclusion was made that the heavy splash of seismic activity and catastrophic earthquake, had been caused receiving the water volume of 602 milliards cu. m for 23 years (1930-1953) on the Northern Caspian and consequently taking off a loading weight 602 milliards tons from Western part of the Skifian-Turanian plate, her subduction under folded structure, complication of folding consolidated rock and fracturing it. As the result of it then was a powerful shaking of the earth's surface.

IG DNC RAS

The Influence of the Geological Events on the Caspian Sea Level Changes During Late Cenozoic

M. P. Antipov, Yu. G. Leonov, Yu. A. Volozh

Geological and geophysical data suggest that recent boundaries of the water supply Caspian basin was setup since the end of Pliocene. The former large Turanian-Eastern European basin has been divided into two separate basins - the Caspian and Aral basins. It is proved by clearly defined Late Pliocene submarine fans (paleo Amu Darya). The complexly built Caspian Sedimentary Basin (CSB) consists of several more or less individualized parts: Caspian Sea, Pre-Caspian, Western Turkmenian, and Kura basins. Two crucial events of Late Miocene - Early Pliocene, namely Messinian crisis and orogenesis within the Caucasus and Kopetdag, had a dramatic impact on its formation.

The boundaries of the Pliocene - Quaternary (CSB) are marked by marginal escarps. Pre-Pliocene morphodepression was subdivided into three parts: Pre Caspian-North Caspian



(shelf), Middle Caspian (subsided shelf and continental slope) and South Caspian (deepsea depression). It should be stressed that the deep sea depression has been created due to tectonics, the shelf and coastal zone - due to erosion, and the Middle Caspian subsided shelf and continental slope - by the joint action of both tectonic and erosion processes. The South Caspian depression has been inherited from the Paleogene-Miocene Tethys basin. There are three cycles of the CSB evolution in Pliocene - Quaternary: Pliocene - Apsheron, Pleistocene, and Holocene. They are of different duration but their characteristics are nearly the same. Each cycle begins with a rapid drop of the sea level to the maximum amplitude. After that, a short-term uplift of the sea level occurs until it reaches some intermediate altitudes and remains stable to the beginning of the next stage of the uplift, with rapid reaching of the maximum amplitude. Within the end of each cycle the sea level remains constant for a long time with a water covered area remarkably decreasing. The amplitude of the initial drop of the sea level has been decreased during Late Cenozoic: pre-Pliocene - 700 m, Turkjan- 200 m, Attel - 80 m. The area of the South Caspian deep sea depression so as Caspian Sea basin on the whole have been decreased during Late Cenozoic.

GIN RAS

Autowave Fluctuations of Lithosphere and Level Regime of the Caspian Sea

G.G. Bunin

We can use optive fluctuations for analyzing and describing geotectonical processes, regularity of space-time self-organization of dissipative structure, connected with wave of elastic deformation of the accumulated type (arched, ringing, vortex structures) and also with hearth structures of ostsilator type. It generates excitement of centrifugal and centripetal autowaves. The deformational field can be in one of three conditions: chamber, excitement and restoration.

Taking into consideration topological properties of autowaves, the new geodynamic model of the Caspian Sea was suggested. The connection of fluctuations of its level with phases of periodical autowaves' fluctuations of lithosphere was determined.

For the Derbentsk (-788 m) and South-Caspian (-1025 m) depression the trajectory of attractors looks like a spiral, which twists counter-clockwise and forms a vortex funnel in the earth. This conclusion is based on cosmogeological and geomorphological data, study stretches folding underwater terrace cusp, developed at the depth of 100, 200 and 700 m, including new tectonic movements.

If the Caspian Sea's level is increasing, it has an optive periodical nature and corresponds to phased conditions of restoration and chamber. If the sea level is lowering - it corresponds to phase excitement. The elastic wave of deformation has a period of 300 years. For this period, its amplitude to the middle level of the Sea (-25.2 m) formed +7m to -6m and fluctuated in the range of +18m to -31m. The current increasing of the level of the sea will be quicker because it corresponds with the phase of excitement, which will conclude at the end of the first half of the 21st century. When the increase of the level of the sea reaches -25.2 m it will begin the phases of chamber and restoration.

IG DNC RAS

The Influence of Modern Geodynamic on Fluid-Dynamic Regime of Caspian Region Systems

B.A. Sokolov, N.A. Kasjyanova

In the example of the East Pre-Caucasus, the connection of oil-output regimes, underground waters and level of Caspian Sea with space-temporary features of modern tense-deformable condition of earth's crust is enough distinctly traced.

Pay attention to the opposite direction of changes of regimes of underground fluid-dynamic systems and ground water basin (Caspian sea) in connection with various geodynamic regimes (tectonical compression or easing of this process, relative stretching).

Similar situation is characteristic of any periodicity: from 60yrs' cycles to seasonal variability. In particular, during strengthening of tectonical compression within the limits of given region, expressed alongside with other parameters, describing tense-deformation condition



earth's crust, in increase of speeds of modern rise of earth's surface, is observed the increase of bed pressure in oil-gas pools, level of ground waters and liquid discharges on deposits, while Caspian coastal zones, at the expense of rise of earth's surface the effect of sea shoaling is created. It was observed to 1978. And on the contrary, during relative stabilization of geodynamic activity, when the restoration of elasticity of rocks happens, that is expressed in modern lowering of earth's surface, in decrease to initial significance of bed pressure, on oil field the liquid's discharges drops, at this time in coastal zones of Caspian sea, at the expense of lowering separate tectonic blocks, the effect of local flooding of sites is created, that at present is especially observed within the limits of Middle and South Caspian.

Established space-temporary connections' oil-gas saturation, level regime of Caspian Sea with geodynamic regime of territory grants the wide opportunities of use of them at forecast of effective operation of oil-gas deposits and abnormal local changes of water level in Caspian Sea.

MSU

Creation of Middle Pliocene - Quaternary Sedimentary Cover of Caspian Sea's Depression and Evolution of Its Water Mass in Connection with Fluid-Dynamics and Other Factors

B.N.Golubov, V.L.Novikov, A.E.Shlezinberg

The interpretation of seismic information about bedding conditions and accumulation of geological masses in Middle Pliocene - Quaternary sedimentary cover of Caspian Sea's depression, together with the hyposymmetry of the Caspian Sea's level data, allows us to find the morphometric parameters of its paleobasins and to see the evolution of sea water volume. It was discovered that paleobasins of the Caspian had been created, during different periods, as a result of the falling arch of the submeridian lift, which had represented in past Pontic time the subsurface erosion. Although the world ocean water level remained constant, the volume of the Caspian Sea water was increasing. The rate of this increase was at a maximum during the middle of the Pliocene period, temperate at the end of the Pliocene period and beginning of Pleistocene, and relatively reduced with high frequency oscillations of the level during the Upper Khvalynsk time. After that they have been only like "seismic shakes". The balance of salt and water have been defined by the contribution of the underground hydrosphere. The climate can not be considered an influencing factor causing the Caspian's transgress and regress. The number of interconnections forms of Caspian surface and underground hydrosphere are caused by the long history of two main types of regime formation. These types are gravitation- convection and closed compression with abnormal high reservoir pressure. The last type of regime could be represented by 3 oil and gas fields: north, middle and south Caspian. The current raising of the Caspian Sea's level could be estimated as the initial stage of water volume increase. Duration of this increase could be several dozens or hundreds of years. The peculiarity of this increase of the Caspian's level is an abnormally high ratio. This increase could eventually reach -20m to -15m (-60ft to -45 ft).

NC PB RAS, GIN RAS

The Relation of the Caspian Water Balance to the Underground Water Flow System and Seismic Activity

M.V.Rodkin, D.K.Kostein

Since the end of the 1970's the increase of the Caspian Sea level has been observed. The flooding of coastal territories and other effects have caused a tense ecological situation in the region. For example, the quick change of water-loading on the immense Caspian Sea area can initiate both visible perturbation of the underground water flow system and changes of the seismic regime in this seismically active region. It is also a fact, that calculations of the Caspian Sea water balance do not fully explain the current increase of the sea level. This discrepancy could be caused by incorrect estimations of the difference between evaporation and precipitation in the Caspian Sea area, or by incorrect calculations of the underground water flow. Considerable volumes of underground water, generally speaking, could enter from thick sedimentary stratum, but the mechanism of its very swift liberation is not



understood. In the case of considerable water volume overflow between underground hydrosphere and Caspian Sea bowl, it was to be expected that there would be the development of an interconnection between the underground water system and seismic activity on one side and a discrepancy of the water balance on the other side. The revelation of this relation would allow us to understand the more precise nature of the Caspian Sea water balance formation.

In the report, both possible screen plays of interaction between Caspian water regime and seismic activity were discussed. At the same time, some of the particularities of this interaction could be predicted with model conceptions. The regional earthquake catalogue, well regime observing data from Dagestan, Astrokhan, Gurjevsk areas and Kazakhstan and data on the variants of the Caspian water balance were used to verify this assumption (to reveal the adequacy of these possible screen plays of interaction). Based on this data, a spectrum of characteristics of data, its fractional dimension, effects of surface loading changes at the depth of the seismogene zone and regressive correlations between water balance variants and seismic regime were calculated. The results are illustrated and their possible interpretations are discussed.

GC RAS, TIV

Tendencies of Modern Tectonic Movements of Azerbaijan Pre-Caspian and Their Correlation with Oil and Gas Extraction and Anomaly Change of Sea Level

B.A.Budagov, O.D.Guseynzade, D.A.Lilienberg

The tectonical mechanism influence on anomalous oscillation of Caspian sea level has been noted by Strabon and Aristotel as back as in ancient time. In the Middle Age an attention was drawn up by the role of climatic factors, and in 19-20 centuries their role was recognized as a leading one. However, discussion on real relation between these two main mechanisms continues until now and especially strengthens in connection with erroneous prediction of Caspian sea level for 80-90 years.

In accordance with geodetic and mareographic data in Azerbaijan, recent vertical movements change its sign in time and spatial, and are of wave character. Their intensity changes from +1 to - 0.7 mm/year, and on Apsheron peninsular amounts to 0.5 cm/year. Sub-Caucasian and Sub-Caspian phases of compression and extension, rising and sinking, which change the volume of depression and, in some cases, coincide with sea level changes have been observed. Quasi-periodicity of earthquakes and eruption of mud volcanoes are also analogous to climatic rhythmicity, and strengthen within the phases of low level Caspian Sea level. The recent data shows an important role of horizontal movements, especially for Apsheron and Kobystan areas and Western part of South Caspian (where the 75 % of volume of sea water is concentrating). Therefore, certain interconnection of manifestation of tectogene and hydro-climatic factors in Caspian sea dynamics is observed. The problem is to estimate a value factor in general process that requires instrumental observations.

Data over Apsheron peninsular shows that common tectono-climatic mechanism influences on intensity of oil and gas output which increases during the phases of regional and tectonic sinking, extension and sinking of Caspian sea level.

IG ANA, API, GIN RAS



Recent Geodynamics of Lithosphere and Changing of the Caspian Sea Level

Y.O.Kuzmin, D.A. Lilienberg, V.A. Sidorov

It is characteristic for the Caspian region a presence of sufficient quantity of combined geodynamic grounds (Baskunchaksky, Tersko-Sundgensky, North-Dagestansky, Sulaksky, Apsheronky, Shemakhansky, Nebitdagsky, Tengizsky) which allow considerably improved ideas about recent geodynamic processes on anomaly behavior of the Caspian Sea level.

Systematic and combined instrumental observation have determined presence of intensive (up to 5-7 cm per year) vertical and horizontal movements of the earth's ground in the fault regions. By extrapolating results, received in offshore zone to the faults of sea bed, and using information about relative changes in tide-range data, we drew a condition about presence of modern pulsing uprising and sinking of the sea bottom in the region of Central joint zone of Caspian depression. Combined analysis of geodynamic and seismic information indicates on alternation period of strain and seismic activity, which to an essential degree coincide with phases of changing the Caspian sea level.

Detailed analysis of seismic activity in the Caspian region has shown, from 1980, the presence of intensive and sufficiently local concentrations of seismic activity in eastern part of Apsheron's threshold. This can be indicative of preparation for an earnest earthquake in the region adjacent to Krasnovodsk. We put forward of anomaly rising sea level in the zone of expecting seismic focus. In the frame of this model values are received of absolute anomaly and relative level rising from 1978, surplus water volume and so on. They satisfactorily coincide with observations. It is indicated in favor for recent geodynamics of faults of the sea bottom. Recent geodynamics can influence sufficiently on anomaly variation of the Caspian Sea level, in comparison, at the same time, with climatic factors.

IS TAS, IG RAS, S.J.C. "Ecogeocentre"

Spatial and Temporal Variations of Recent Endogeodynamic and the Caspian Sea Level Changes

D.A.Lilienberg

Caspian Sea phenomenon has been caused by long interaction of lithosphere, atmosphere, and hydrosphere. However, tectonic mechanisms have not been taken into account by prediction estimation that lead to its poor reliability. Caspian sea region is a unique structural and geological area, and is characterized by high mobility and seismic activity. Horizontal movements of the zones of collision between Euro-Asian and Arabian plates (which were not taken into account before) play the leading role in formation of its morphostructure, and create vertical movements. Mechanisms of rotation of the Earth, mantle diaoirism, etc. also influence this region. Pulsation mechanism of compression and extension leads to periodic changes - rising and sinking, e.i. changes of depression's volume independently on changes of volume of watermass in it.

Oscillatory and wave type of recent tectonic movements with regular and irregular quasiperiodicity of 100-120, 50-60, 25-30, 10-15, 5-7, 2-3 and 1 year is revealed by measurements (geodetic, level, hydrogeologic, seismologic, etc.) that corresponds to analogous rythmicity of hydro and climate processes and observed on different components of geodynamic process - vertical and horizontal movements, seismicity, mud volcanism, dynamic of underground water, changes of output of oil and gas. General trend of endo- and exodynamic coincides very well. Intensity of horizontal deformations measured by repeated trilateration and GPS-observation amounts to 5-7 cm per year, vertical (in accordance with leveling and mareographic data) for the period in tens years - up to 1-2 cm per year (for short period - some cm/year). Phases of low level of Caspian sea coincides well with the phases of depression's extension, increasing its volume, activation of seismic activity, as well as mud volcanism, decreasing the level of underground water. Tectogenic factor can be considerable and should be taken into account in estimation. Permanent monitoring as well as establishment of complex Caspian geodynamic test area is necessary. Availability of interconnection of two main factors of geodynamics of Caspian sea requires development of more comprehensive tectonic and climatic model.

IG RAS



Geodynamic Peculiarity of the Biggest Oil and Gas Fields of Caspian Region

K.S.Basniev, V.I.Gridin

The Caspian region has been studied by system-aerocosmic materials in full regional scale and such fields as Orenburg, Karachaganac, Astrakhan, Zhanazhol, Tengiz and other hydrocarbon fields have been researched in detailed scale. It's necessary to process system-aerocosmics, geology-geophysics, gas-hydrodynamic and topogeodezic peculiarities of the whole region and to create geodynamic models of fields. Our comparative analysis of all information revealed the general regularity of geodynamically structured platforms. There are two systems of active geodynamics - broken flexure breach, such as diagonal (with subsystem of north-east and north-west stretch), and sublatitudinal - submeridional. The last one is not clearly defined in the structure of the modern landscape and is mapped by individual fragments. Zones of breach control high reservoir properties of productive and covered deposits, anomaly high bed pressure (AHBP), distribution accident of wells, pipelines, railways etc. Objects of industrial and civil construction place a high concentration of contaminating substances in the lithosphere, hydrosphere, atmosphere and biosphere. Zones of breach divide uplifts to productive deposits on blocks distinguished by geodynamic activity and gashydrodynamic peculiarities. The results of this work signify the necessity of development and application of geodynamic models at all stages to fully exploit oil and gas resources. It's better to use geodynamic information during the development of fields.

GANG, OGRI RAS

Geodynamic Model of Crustal Undulations and Its Geophysical Consequences

I.P.Zhabrev, A.V.Karakin, L.I.Lobkovsky

One of the authors has offered the geomechanic model of fluid-dynamic processes in crustal undulations. The subsequent analysis of this model has allowed to reveal some of its consequences. Essence of this model consists of the following. By complex of seismic and magnito-telluric measurements in earth's crust the availability of fracture-porosity beds (crustal undulations) is fixed, which form in crust layered structure. The horizontal and vertical sizes of beds are increased with depth. Their thickness ranges from several hundreds of meters in crust's top to tens of kilometers at the depth of 15-25 km.

The elementary evaluations show, that in stationary conditions these layers should be detached and closed, transformed in single-phase environment. As far as they really exist, the gear should act, supporting them in conditions of dynamic balance. The condition of dynamic balance is supported in these undulations by periodic fluctuations and wave movements, filling them with fluids. The periods of fluctuations and undulations depend on their sizes and lie in limits from several years to decades, and up to hundreds of thousands of years.

The direction of fluid movement, basically, is vertical, and horizontal inflows are possible. These fluctuations are main reason of change of water volume in large closed basin of Caspian Sea type.

OGRI RAS, VNIIGeosphere, IO RAS



Seismic Investigations of the Crust and Upper Mantle Structure of the Caspian Basin

John McBride, Keith Priestley, Mikhail Rozhkov

The Caspian Sea sits astride the greater Alpine-Himalayan foldbelt within the south-central part of the former USSR in central Asia (locally the Great Caucasus-Kopet Dagh fold and thrust belt). Knowledge of the seismic velocity structure of the crust and upper mantle beneath the Caspian Sea will add considerably to our understanding of the development of mountain building arising from convergence of the Gondwanaland supercontinent and Eurasia in a poorly understood region that could be thought of as transitional between the Alps and the Himalayas. Neogene calc-alkaline volcanism and active seismicity along the Great Caucasus and the Alborz mountains suggest geologically recent and possibly current subduction. A major geodynamic question is how can the margin of a major Alpine foldbelt be locally submerged beneath more than 20 km of sediment that have collected in an immense hollow known as the south Caspian Basin. This area, which is subsiding so rapidly that it is below sea level, is floored by 'ocean-like' crust that has had several explanations put forward based on broad seismic velocity patterns but without any knowledge of detailed deep structure.

To define the velocity structure of the south Caspian Basin, the SYNAPSE Science Center and the University of Cambridge, with the help of the Institute of Seismology of Turkmenistan and the Geophysical Expedition of Azerbaijan, have installed six broadband digital seismographs in the region surrounding the south Caspian Basin and have operated these for about 2 years. There are two goals of this experiment: (1) to better define the complex crust and upper mantle structure in the area; and (2) to better understand regional seismic wave propagation in the region. The existence of the hypothesized 'oceanic' crust beneath the Turkmenian Lowlands to the east of the south Caspian Basin should provide large converted phases, which will be easy to distinguish in the receiver function signals. Preliminary models for the crust and upper mantle structure from analysis of the teleseismic receiver function data show evidence of large sediment thicknesses beneath the southwest Caspian and a high velocity mid- to lower crustal layer beneath the Turkmenian Lowlands. Continuous data recording allows us to record teleseismic S-waves and surface waves which are more difficult to record when operating data loggers in the triggered mode. We can measure shear wave splitting which can be used to determine mantle anisotropy. The seismograph pairs are laid in such a manner that we can measure two station phase velocities for several great circle paths crossing the Caspian Basin and use these results to determine the average crust and upper mantle shear wave structure of the region. The abundant regional seismicity allows us to measure higher frequency single station phase velocities for many paths crossing the south Caspian Basin and potentially determine the three dimensional variations in the structure.

We have also initiated a new integrated seismic study of the Alpine foldbelt and south Caspian Basin using normal incidence and wide-angle seismic data. Because the foldbelt continues orthogonally across the Caspian Sea, it is possible to conduct a seismic acquisition program over the Alpine-Himalayan belt in the marine environment along with the advantages in cost and quality of data that marine profiling entails. The normal incidence lines will traverse from continental crust north of the foldbelt, across the foldbelt itself, across the 'paleo-continent-ocean' boundary, and penetrate southward into the interior of the south Caspian Basin and the 'ocean-like' crust zone. We propose a set of parallel dip (e.g., roughly north-south) and crossing strike lines (roughly east-west) in order to cover the principal lithospheric elements beneath the Caspian Sea. By deploying land seismometers adjacent to the sea shore, and possible ocean-bottom seismometers at sea, we shall obtain detailed compressional and shear wave seismic velocity information which will help constrain the information from the reflection profiles. The large airgun array used for the reflection profile will also provide a seismic source for wide-angle recordings.

*Cambridge University
SYNAPSE Science Center / Moscow IRIS Data Analysis Center*



Recent Seismological Research of the Caspian Basin

Keith Priestley, Bullard Labs, Mikhail Rozhkov.

The paper reflects the state of recent basic seismological research of the Caspian Sea Basin. Being one of the main instruments for studying the Earth's deep structure, modern seismological techniques are based upon new data, collected with the help of modern technologies of data acquisition. Present seismic installations of the Caspian Basin, jointly operated by scientists from different countries, highly satisfy such concepts. Two major passive experiments must be mentioned here: (1) joint Russian-British program CSN on studying South Caspian Basin structure conducted by the University of Cambridge (UC), UK, and SYNAPSE Science Center (SSC), Russia, and (2) small aperture array (SAA) program conducted by the Incorporated Research Institutions for Seismology of the United States (IRIS). Both programs are being performed with the technical support of the Institute of Seismology of Turkmenian Academy of Sciences. Program (2) was mainly performed by the University of California San Diego during the past 2 years. Huge amounts of data, recorded by more than 50 instruments of so called "seismic antenna" near the city of Ashgabad, soon will be available for the scientific community through the IRIS Data Management System (if you are Internet user, check www.iris.washington.edu). In current paper, we would like to describe progress made within the framework of program CSN (Caspian Seismic Network), and relative activity at the SSC.

Caspian Seismic Network. CSN research project was started for better understanding of the seismic structure of the south Caspian Basin and the surrounding region. To accomplish this we have installed a number of broad-band digital recording seismographs around the Caspian and operated these for about two years. Data at each CSN station is recorded on a Refraction Technology 72a-02 data loggers which are equipped with either Omega or GPS timing, an external hard disks and a Guralp CMG-3T triaxial broadband feedback seismometers. During next 2 weeks one more site will be equipped with the same instruments - nearby the city of Kara-Kala (KAR). In Azerbaijan the stations LNK and BAK, later moved to Shemakha (SHE), are operated in cooperation with Dr. S. Agamirzoev from the Geophysical Expedition of Azerbaijan. In addition to the data from our seismograph network, this study incorporates data from the IRIS seismograph station near Ashgabad, Turkmenistan (ABKT). We expect, that the output of the study may find application in solving next problems:

- Clearing the character of the modern geodynamic process, playing significant role in forming the sea leveling regime of the Caspian basin, and so forming ecological situation of the coastal areas
- Establishing feasible connection between Caspian water level regime and the generating of strong earthquakes in the surrounding regions;
- Clearing the role of the Caspian geodynamics in mud-volcanic activity, sudden mud-gas outbursts, causing economic and human losses;
- Creating detail velocity structure to improve the precision of seismic sources location;
- Design of urban developing of the coastal area, that is connected with reliable data on seismic risk at this territory;
- Establishing possible connection between recent submerge of the Gulf of Kara-Bogaz-Gol and geodynamic processes. Presently more than 50 cubic kilometers of Caspian waters a year fill the Gulf. This may play significant role in terms of the induced seismicity, especially for the territory of the western Turkmenistan, where one of the largest world earthquake occurred in the year of 1895 nearby Krasnovodsk (M=8.2).

Historical Seismogram Processing. We also touch here such important aspect as re-interpretation of old recordings of Deep Seismic Sounding (DSS) experiments. DSS data improve significantly our knowledge about the structure of the area under research. For the Caspian there are many paper records of DSS data, created during the marine experiment of the year 1956. Totally there were 2500 km of the profiles, located mainly in the Central Caspian and towards south. The area covered by the profiles is overlapped by the area of seismic waves paths between the Turkmenian and Azerbaijanian recording sites. So using such data may improve seismic models which are to be created after processing the appropriate amount of data. Some records were digitized manually on the devices with rather poor precision, some have never been digitized at all. There are big archives of paper records in Russia and Azerbaijan, which are precious for science and tend to be corrupted by time because of natural decay. Also, even results produced earlier with a part of historical materials need to be re-interpreted by using advanced processing techniques, which would require advanced digitizing procedures. For this purpose DGS software package (automated digitizing



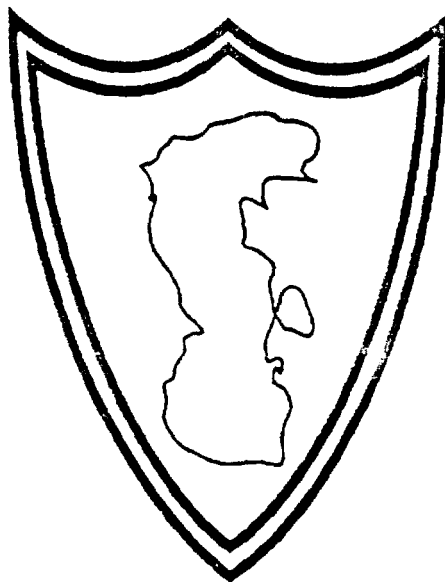
software for scanned images) working under UNIX operating system was developed at the SSC. We have already started to create an archive of digital data and images of scanned paper records related to the Caspian Basin, as well as a database of processed data and experiment's parameters. This work is being performed at the Local Area Network of the SSC equipped with SUN Workstations and PCs working under UNIX. Outside users will have an access to the database via Internet using our WWW server www.synapse.ru.

Data processing. Presently two groups of scientists - at the Cambridge University and at the SYNAPSE Science Center - work on the CSN data processing. The work at the SSC includes mainly event association with HDF and PDE catalogues, local and regional events location, and creation of epicenter's map. For this purpose we use a package SNDA (Seismic Network Data Analysis), developed by the SSC. As soon as the database of the regional events will be created at the SSC, we will use several advanced techniques, tested on another sets of data. For example, we expect satisfactory results using artificial neural networks (back-propagation, cascade correlation and clustering) for depth determination and wave field animation. This modeling will possibly require results on receiver function analysis, received at Cambridge.

Acknowledgments. The success of the CSN experiment was achieved because of great job done by SSC staff scientist Vasily Kiselevich on array operation and data collection/processing. The help of Andrey Rasskazov on hardware support, Alexey Chulkov on data processing, and Eugeny Kapitchnikov on paper preparation is also significant. We also thank Dr. Batyr Karryev for his contribution to this research.

*Cambridge University
SYNAPSE Science Center / Moscow IRIS Data Analysis Center, Russia*

"КАСПИЙ - 95"



"CASPY - 95"

**PROSPECTING, EXPLORATION AND
EXPLOITATION OF OIL AND GAS FIELDS**



The Caspian Region: Problems and Tasks of the Geological-Geophysical Research

*A.N.Dmitrievsky, V.P.Shcherbakov, I.F.Glumov,
V.I.Bogoyavlensky, Yu.B.Silantiev, A.K.Suleimanov*

The complexity of creating a uniform geological model of the Caspian region's structure is stipulated by distinctions in techniques of conducting geophysical work. Errors of geophysical research worsen with this situation. The relative error of seismic construction of the first approximations in the Caspian region has reached the several tens of percents (Karachaganak, well 1-Centralnocaspiiskaya, Karaton-Tengiz). The Caspian Sea and marginal onshore are investigated in various degrees with detailed geophysical, geological and extensive technical methods. For example, the large density of seismic research in the northern part of the Caspian has revealed about 70 local uplifts. The density of surveys in the north-western part of the Caspian is more than one order lower, it fulfills only partial regional CDP profiles.

It is necessary to create the uniform base structure of geological-geophysical profiles, referenced by deep wells, enabling to conduct the uniform correlation of geological objects, simulation of hydrocarbon systems of the region and other research. The fragments of such base geological-geophysical structures already exist. In particular, the group of CDP profiles on line Agrakhansky Peninsula - Uralsk are present. The basis of geological-geophysical data was created in OGRI, complex use of which has allowed to create an oil-gas-geological model of the region, including the Pre-Caspian depression, Northern and Middle Caspian offshore with marginal onshore. The Unique geological-geophysical integration was conducted for the territories including the area about 1 million sq.km in scale 1:500,000. Structural and thickness maps are made for seismostratigraphical complexes. Historical-geological, thermo-dynamical and other reconstruction are conducted. They characterize the peculiarities of development, evolution and oil-gas saturation.

Taking into account the ecological intensity of the Caspian region, connected with the closed nature of the marine basin and its biological uniqueness, conducted or planned prospecting work should have a minimum degree of risk. It is impossible without the use of regional and zonal oil-gas-geological models of the region's structure.

For realizations of the complex program of the regional study of the Caspian and immediate territories, it was necessary to develop the economical-legal base to attract investments from domestic and foreign oil-gas production companies and to create an international coordination center. The functions of such a given center will be directed towards the standardization of techniques of research and analysis of incoming regional information with the purpose of oil-gas-geological simulation. It allows to minimize the risk of prospecting research and further negative ecological consequences during development of the deposits.

OGRI RAS, Roskomnedra, "Spetzgeofizika"

The Main Problems of Mastering the Mineral and Raw Material Resources of the Caspian Sea Shelf

V.E.Bembeev, A.V.Bembeev, S.A.Alibekov

The Kalmyk Republic is the region with proved industrial oil and gas resources and it is the most prospective for the future search of oil and gas fields. The current oil industry is based on the fields of the Korpinsky ridge geologically timed to Mesozoic oil and gas deposits. The forecasting of resources of hydrocarbons considered by different scientific research institutes have varied in amounts, but all of them treated Kalmyk, and especially Kalmyk Pre-Caspian, as the region of the highest prospective. Forty-four oil and gas fields with initial reserves of 64.1 million tons were discovered in Kalmyk. The first summary in resources of hydrocarbons are 2810 million tons, including oil and 1208 million tons condensate. The Republic has a favorable geography and economic conditions. For example: close proximity to the biggest industrial centers of oil-refining and oil-chemical industries. It is considered a potential region of Russia for creating complexes for extraction and refining gas, oil and condensate. For this reason, the program of the regional geological-geophysical research and drilling of exploration wells, by using new



technology and technical methods, was developed in the Kalmyk Republic on public property. This is why the question of developing mineral resources and pollution should be considered a public concern. When an accident or damage to the environment occurs, the effect on the population must be addressed and resolved. Development of the Caspian basin introduces a multitude of problems. One of the most important is mastering the very rich oil and gas potential while conducting research for extensive methods of how to protect the shores, destroyed as a result of the advance of the sea. The main directions of work are to search and discover oil and gas fields, search and discover minerals, conduct geological surveys of water areas, conduct engineering research, create geological maps and conduct ecological and environmental monitoring. The water area and dry land of the Caspian Sea are characterized poorly in current geological-geophysical and geo-ecological studies, even on a regional level. For example, reliable geological data is absent for the offshore area. The first geological-geophysical data was not available until 1970, and most of the primary materials have remained off-limits to Russia and they remain the property of Azerbaijan and Kazakhstan. The studies on the shallow north Caspian are also not good quality. There is only old geological-geophysical data with the scale 1:200,000 for the dry land. The regional geo-ecological monitoring is only on the Caspian shore of Dagestan and it is missing for the shores of the Kalmyk and Astrakhan regions. Lack of sufficient data restricts the design of basic engineering solutions for improvement of the geo-ecological conditions in the Caspian basin because of the advance of the sea (total wash-out, submergence of dry land, especially in North Dagestan, in Kalmykiya and in the delta of the Volga). In 1993, the extraordinary ecological situation was announced. For this reason, the great prospectives in the sea water area, with regard to exploitation of raw material hydrocarbon fields (minimum of forecasting estimation of Russian sector - 1,5 bln tons conventional fuel) and submarine spills (it is possible to find industrial stocks of galenite, sphalerite, gold, scheelite, rutile, cinnabar, tantalum-niobate) have not been done. This situation is not possible and it can change only after developing a program of geological-geophysical and geo-ecological research of offshore and onshore Caspian Sea jointly with the programs of other countries of the Caspian basin (Kazakhstan, Turkmenistan, Azerbaijan, Iran) during the period 1995-2000 and then up to 2016. The dry land must be included in the research zone to forecast the influence of the advance of the sea.

Kalmgeolkom, "Kalmnedra", Troitzk GGP

The Geological Structure of the Caspian, Oil-Gas Potential and Prospects of Its Development

Ya.P.Malovitsky

An extensive area (about 380,000 sq.km) of the Caspian was recently increased at the expense of the next inner-continental transgression. The reasons for the increasing level of appropriate expansion of the basin contour are not yet known. But is not excluded that at the basis of this process lies the tectonical uplift of the South Caspian bottom in connection with the movement of lithosphere plates.

In the tectonical relation under the bottom of the Caspian the following main elements are located: edge part of Russian platform (salt-dome area with buried reefogene masses and zone of edge dislocation), Skifsko-Turanian Epigercinian plate (Karpinsky ridge, Busachi, Manychsky trough, Tyub-Karagansky swell, Peschannomysk-Rakushechny block, Kazakhstan bay trough, Tyulenevsky buried arch etc.), Pre-Caucasus edge trough and difficult peculiar South-Caspian pelogogen depression.

The heterogeneous structure has arisen as a result of the long history of geological developments.

The common hydrocarbon potential under the Caspian bottom is evaluated on at level not below 15 billion tn. in oil equivalent. The most prospective provinces are in the western part of the Southern and Northern Caspian. Prospects for the eastern part of the Middle Caspian (Karabagazko-Srednecaspian mass) are considerably less.

The development of oil and gas deposits are mainly located in the South Caspian near the Azerbaijan coast and Turkmenia. In communication with the break-up of the USSR there have arisen two opposite opinions: to consider whole basin as the uniform area for the use of mineral resources or to separate it into sectors. Questions of development will depend on the decision of this basic problem.



The closed basin, complexity of the organization of development of marine deposits, uniform conditions of ecology observance and other political-legal factors corrected, as the author sees it, are the first points of view.

Soyuzmorgeo PO

The Oil-Gas Saturation of Dagestan

A.Kh.Magomedov, M.O.Dzhabrailov, A.K.Suleimanov

Dagestan is one of the oldest oil-gas production regions of Russia, where already from the 18th century on in the Kayakents and Berikeisk areas the output of oil wells was being executed and to the end of the 19th century production from wells was being made. The maximum production volume was in 1970 and made up 2.2 million tn. oil and 1.6 billion m³ of gas.

To the present time the most highly productive deposits, basically, have been produced, and well production rates have decreased.

The rates of geological-prospecting work were decreasing, especially heavy in the last few years and, as a consequence of it, was the absence of opening-up large deposits, trying to compensate the reducing output from old developed deposits.

Despite the situation mentioned above, Dagestan's mineral resources are not fully explored and the region remains one of the most prospective in the Northern Caucasus. Scientifically justified forecasting of Dagestan's resources and conditions of prospective resources of category S3 indicate it.

The initial potential resources (IPR) territory on 01.01.1995 (evaluation of the Institute of Geology DSC, SevKavNIPIneft and "Dagneft") are 931 million tn., (including 313 million tn. oil and 618 billion m³ gas), from them onshore - 506 million tn. (181 million tn. of oil and 540 billion m³ of gas).

The status on 01.01.1995, showed current (extractable) stocks of industrial categories (A+B+C1) on the sum of hydrocarbon (HC) make 86 million tn.

Previously appreciated stocks (category C2) make on HC the sum of 79 million tn. The prospective HC resources (category C3) make 71 million tn. The prospective resources are basically confined to the Triassic and Cretaceous complexes of deposits. On offshore the prospective resources are not looked for for the lack of fund structures in preparation to deep drilling.

The degree of exploration of initial potential resources of HC onshore makes out 29.6 %. The highest degree of exploration (IPR) corresponds to Tersko-Kumsk region - 33.3 %. The degree of IPR exploration offshore is less than 1%.

Exploration of onshore territory is non-uniform and is, as a whole, in Dagestan 124 km of drilling on 1 sq.km and on 23.7 sq.km only 1 well. High degree of exploration is characteristic for plane and submountainous Dagestan, low one - for Tersko-Sulaksk region.

The further development of the oil-gas production branch of the republic assumes attracting to development of large traps, but with deep bedding, as well as differing ones of anticline type, which are widespread enough as in Cretaceous, as in Jurassic deposits and in concern to small depths. Besides, the development of successful new areas, including Caspian Sea offshore, is presented. In connection with this, the following directions of geological prospecting work are the most prospective:

- search and prospecting of HC pools in Triassic deposits in Dagestan Plain;
- search, prospecting and development of HC pools in Upper-Cretaceous and Lower-Cretaceous-Jurassic deposits of Submountainous Dagestan;
- execution of geological search in the limits of the Dagestan sector of the Caspian offshore with the purpose of preparations of structures under search and prospect drilling and organizing HC output on Inchkhe-More deposit and other objects offshore. By geophysical methods presently 12 structures, located at the distance of 5-7 km from the coast at the sea depths of up to 20 m are revealed. The depths of prospective horizons are within the limits of 1.6-2.5 km.

Presently, main methods of search and characterization of HC traps are seismic, which basically has a space nature and decides simultaneously the complex of tasks from search to construction of detailed model of potential deposits. It is effective enough and possible to use the vibration updating without ecological damage to the explored territory.

Thus, with success, not only the structural problems are decided, but also questions of non-structural traps are revealed, which, in prospecting, can considerably expand the



potential areas of the region and considerably lower the costs of development in connection with small bedding depth of such traps.

"Dagneft" - the main enterprise of oil exploration in Dagestan, which works with contractors - geophysics ("Spetzgeofizika", "Centrgeofizika", "Grozneftegeofizika"). "Dagneft" offers by necessary competent nonproduction work and drilling teams for realization of all work on geological prospecting and HC production. However, its limited financial opportunities do not permit organization of the mentioned work, in those measures or in that volume, which correspond to prospects of the considered territory.

With the above mentioned account for the Republic, the natural resources there are the attraction for mutually advantageous conditions for investments and close cooperation for domestic and foreign partners, as in the areas of geophysical and geological prospecting work, production and HC implementing.

The following biddings have already been conducted in Dagestan:

- together with Ministry of fuel energy on development of marine oil deposits, Inchkhe-More (the winner was the J.P.Kenny Company, The Great Britain);

- together with the Government of Dagestan on a series of prospective oil saturated areas (the winners were "Gasprom", "Dagneft" etc.)

The 1995 bidding included the right to conduct geological studies and production of gas on 31 prospective areas with summary resources of 30 million tn. oil and 32 billion m³ of gas. For the development of resources of Caspian Sea the following approach is provided: in the zone of territorial sea (10 miles) during the years 1996-07. The bidding on structures of the Duzlak-Sea, Berikei-Sea and Arablyar-Sea will be conducted; on another part of the Dagestan sector is supposed to extend a series of license blocks, on which the licensing will be conducted on the basis of agreement with "Precaspian states".

UGTEIN Dagestan, "Dagneft", Spetzgeofizika

Geological-Prospecting Work and Ecological Research on Kazakhstan Shelf of the Caspian Sea

B.M.Kuandykov

The State company "Kazakhstankaspiishelf" was founded in 1993. It was founded for the co-ordination of geological-geophysical and ecological research, prospecting and extraction of hydrocarbon materials in the Kazakhstan part of the Caspian Sea. To implement these tasks, Kazakhstan's government signed an agreement creating an international corporation with 7 leading international oil companies. "Kazakhstankaspysshelf" is the operator of this corporation. Geological-prospecting work has been conducted there since 1970 to 1993 by different companies of the former USSR. About 60,000 km of seismic profiles were made. Seventy-seven (77) local structures were founded. Drilling work took place in the Middle Caspian. Potential reserves of the shelf were estimated higher than onshore Kazakhstan. Taking into consideration the status of the "Forbidden Zone", the state company "Kazakhstankaspysshelf" conducted experimental systematic work in accordance with "Special ecological conditions while conducting geophysical work in the Kazakhstan part of the Caspian Sea". Geophysical work was accompanied by ecologic monitoring, performed by the Arthur D. Little Company with a group of scientists from Kazakhstan, Russia, Great Britain and the USA. The ecology report "Estimation of the Effects on Nature" was prepared. The Ministry of Bio-resources approved this report and project authorizing seismic work on Kazakhstan shelf of the Caspian Sea in 1995-96. It is foreseen to research 35,000 km seismic profiles using a pneumatic source of elastic fluctuations in deep sea and shallow parts and blasted sources in wells at the transition zone.

The most urgent prospective problems of strategic plans of development are the ones with increasing of technical and ecological safety of project's work. We are developing NTD in drilling and construction of offshore wells, creating offshore oil production. In accordance with the International Program on Guarding Biological Varieties of the Caspian Sea, we are going to build a fish factory in Atyrau and will pursue other ecological and social methods. Realization of the Caspian project will allow Kazakhstan to begin the next century with increasing oil recovery. There are several problems such as oil transportation and defining of the Caspian Sea status. The states of the Caspian region collaborate on questions to solve ecological problems of the Caspian and mastering of its natural resources.

GC "Kazakhstankaspiishelf"



Regional Learning of the Inside Structure of Thick Sedimentary Stratum and Crystalline Crust of Caspian Sea by the Method of Widecorner Deep Seismic Profile (WDSP) for Estimation of Prospects, Search and Prospecting of Oil and Gas Fields and Monitoring of Geodynamic Processes

L.I.Kogan, I.F.Glumov, Yu.A.Byakov

New hi-tech information of seismic - widecorner deep seismic profile (WDSP) lets us to show not only the inside structure of the thick deep layer (more than 15 km) sedimentary stratum, but also the crystalline crust which is reflected in the area of reflection and refraction waves. Conjugating of the CDP and RWM possibilities, WDSP is quicker and cheaper because we use synchronous registration as reflection and refraction waves, using only one ship. On the Caspian Sea, where the sedimentary's thickness reaches 15-20 km, and in the north-east Caspian, where the salt tectonics are widely developed, WDSP is the only method that allows the regional study of the earth crust's structure on the whole thickness, both in deep offshore (Middle Caspian, South Caspian) and in shallow offshore areas. The international project (Russia, Kazakhstan, Turkmenistan, Azerbaijan, Iran) of a regional net of WDSP profiles is proposed, which could be realized from 1995-2000 with detailed information about structures of deep sedimentary rocks (up to 20 km) and crystalline crust (up to 50-60 km). Then we can perform geodynamic monitoring of the Caspian Sea by means of modelling on the basis of seismic and seismic data of last years. The examples of the earth crust's sections in deepest sedimentary basins of Black, Barents and Caribsk seas are given. They were all collected/calculated by WDSP from 1990-1994.

CHO ATN RF, NIPIOkeanologiya, Roskomnedra

The Results of Complex Refinements of Geological Structures and Forecast of Oil-Gas Saturation of the Caspian Sea Shelf

E.V.Zakharov, A.V.Klychnikov

The offshore of the Caspian Sea in geo-tectonic relation includes: the south part of Caspian Sea of East-European platform, joint of Skifsk and Turanian plates and South-Caspian intermountain area.

Each of the mentioned geo-tectonic areas is characterized by features inherent of its geological structure - lithology-stratigraphy and formation content of cover's sediments, sizes and amplitude of tectonic elements, history of development and, as a consequence, conditions of formation and laws of accommodation of oil and gas deposits.

As a result of research, conducted from 1979 in VNIIGAS, the Caspian Sea rather extensive geological-geophysical material was accumulated, complex comprehensive analysis of which has considerably allowed us to adjust the representations about geological structures and prospects of oil-gas saturation of shelf various sectors, existence on moment of quantitative evaluation of oil-gas potential of mineral resources on 1.01.1988.

Among in essence of the new conclusions, it is possible to indicate the necessity of:

- increase of oil-gas saturation prospects of marine part of Pre-Caspian-Tyulenevsk uplift zone, as well as shelf sites, located to north-west of Apsheron peninsula and in joint zone Gograndag-Okaremsk and Chikishlyar-Fersmanovsk uplift zones;
- reduction of oil-gas saturation prospects of shelf sites, located to west of Tengiz arch and in east part of Nizhnekumsk depression.

These and other recommendations are supported by appropriate geological constructions and accounts.

VNIIGAS disposes information on features of geological structure and forecast of oil-gas saturation of mineral resources of objects of regional and zonal levels in each of the sectors of the Caspian Sea.

VNIIGAS



Excretion of Hydrocarbon Deposits Contiguous to the Caspian Sea Regions of the Pre-Caspian Depression by Seismic Non-Elasticity Parameters

M.B.Rapoport, V.E.Parnikel, L.I.Rapoport, V.I.Ryzhkov

In oil pools, the effect of anomaly increasing seismic non-elasticity data is established - absorption and velocity's dispersion. In each of these regions this effect can have the special composition of hydrocarbons, temperature and pressure of formation and other factors.

In order to study the connection of hydrocarbon pools with seismic non-elasticity CSP data is used. The similar test was conducted in the Pre-Caspian depression on the Chingiz field. The production horizons are bedding here in a depth of about 1150 m. It was obtained as results, that above of productive series non-elasticity parameters were small and they can have positive and negative values. In this case, both curves don't correlate. These curves have distinct maximums. This fact testified that there are connections of non-elasticity parameters with the formation.

In the Pre-Caspian depression there are different types of depths and pools - oversalt, subsalt, free from salt tectonic. In the process of investigation, the connection between anomalous absorption and oversalt fields Akingel, Rovnoye, Chingiz was detected. This connection gives the opportunity to use the absorption as a hydrocarbon indicator.

The additional effect was detected on structures Alakoz, South-West Koschagyl, this effect should be taken into account while interpretation: zones of crushing. These cases can be easily identified according to seismic sections.

Subsalt fields are very difficult for us due to abnormal influence of the salt. There are ways of absorption determination, giving the possibility to decrease the salt action. These methods were successfully used in Zhanazhol and Urikhtau fields.

In the Pre-Caspian region there are sides with platform- type tectonics. On the Chinarevskaya square the absorption anomalous was detected confirmed by drilling.

The above-mentioned materials testify to the fact that using the absorption as a hydrocarbon indicator allows to make prospecting more effective and reduce the cost and the terms.

GANG, OGRI RAS

Benefits of Application of Refracted Waves Method (RWM) in the Caspian Region

V.I.Bogoyavlensky, T.A.Budagova, V.K.Kuznetsov

The appearance of new methods of processing refracted wave records with constructions of time and depth sections has considerably expanded opportunities and areas of application of RWM. Advantage of RWM, in comparison with seismic reflection method (SRM), consists in opportunity of determination of boundary velocity, on size of which is possible to be judged about physical properties of environment and its lithological content; applicability of decision of various tasks in practically unlimited range of depth in difficult seismogeological conditions with intensive background of surface and repeated waves.

One of proofs showed above is the result of section's processing, fulfilled with shot sources in Astrakhansk Geophysical Expeditions in conditions of salt-dome tectonic on Dzhakuevsk area of Astrakhan swell. On part of time section is allotted area of loss of refraction waves from horizon with boundary velocity 5.7 km/s. It is explained by the availability of salt diapire fold, whose top is traced on 1.5 times with boundary velocity, 4.55 km/s (velocity in salt).

The specific prospects of RWM are opened by study of the upper part of the section (UPS) by refraction waves' records, containing it first arrives CDP SRM seismograms. Thus, practically for the first time, the opportunity of wide-scale complexes of two main seismic methods in uniform processing block of all information flow has occurred and received by repeated profiles. The information about UPS structure, received on records of refracted waves, is necessary for calculating statics and is the most reliable to study and



delimit of gas-oil pools in shallow depths. The existence of such pools is known in various parts of the Caspian region, including the delta of the Volga River (depth 50-70 m) and Busachy peninsula, where the series of deposits from a depth of about 300 m in Lower Carboniferous and Jurassic deposits are opened. This does not cause doubts of the availability of shallow bedding pools and offshore Caspian.

The authors have made the time sections of RWM of two profiles of CDP SRM fulfilled on Caspian offshore area near for Busachi peninsula by Trust "Yuzhmorneftegeophysika" PO "Soyuzmorgeo" in start-stop regime are added. The vicinity of times and significances of boundary velocity for two refracted horizons (about 3 and 3.65 km/s) gives the basis to assume similar lithologic content of UPS rocks. At the same time, by them it is visible, that both synphase axis of first (1) RWM time section have the identical character, while the synphase axes of second (2) - are bent in different parts. The similar scene is observed on time sections of reflected waves, but in a less expressed form. It can be stipulated by downturn of bed velocity in near-swell's part of structure between two refracted borders. The complex analysis of results of processing of records reflected and refracted waves gives the basis to assume the availability of hydrocarbon pool (it is the most probable gas). Thus, on part 34.2 km is located the fault, screening the pool. The quality of tracing of borders on RWM sections is higher, than on SRM. They testify to the opportunities of effective search of hydrocarbon pools by data of processing of refracted waves records.

Not less important is the application of updatings developed by us, RWM is presented for the study of regional and local subvertical rocks' fractured, information about which is necessary for revealing ways of hydrocarbon migration and optimization of development of field. Besides, such research is important and, from an ecological point of view, for study of integrity series, covering the underground accumulation of gas.

OGRI RAS

Geophysical Methods of Well Testing During Monitoring of Oil and Gas Saturation in Pools and Adjoining Geological Medium

R.A.Rezvanov

At Astrakhan, Karachaganak and other fields, situated in the Pre-Caspian depression, efficiency of geophysical methods to study initial distribution of oil and gas saturation factors and its changes in reservoir and covering deposits is limited by the complicated structures of pore space and high pressure.

Calculations made with models, taking into account peculiarities of subsalt reservoirs (caverns), have shown that the influence of pore structure on the definition of saturation factors had reduced, while using specific electric resistance and porosity factor data itself in the interpretation scheme, instead of traditionally using resistance increasing coefficient. This has been confirmed by the testing of this scheme at the Astrakhan gas-condensate field. But, at the large part of hydrodynamic isolated pores, having been saturated with water while in depositional form, it is necessary to use an independent method to value this part. At the well site, it is necessary to complete the complex GIS methods, which are less sensitive to pore structure - dielectric one in the case of wells on RNO; and neutron one in the case of cased well after filtrate penetrates zone breaking up.

The impulsive logging can be use for estimation of changes of reservoirs' saturation in time and in the case of environment disturbance, such as oil over flowings to gas and water zones of reservoir, tectogene pools creations in covering layers, pollution of fresh water stratum and so on, and standard neutron one can be use for study of gas saturation. In the most difficult situations for neutron logging (definition of oil and gas border at high pressure, evaluation of oil and gas saturation factors at a low porosity factor) it is more effective to use electromagnetic methods in the case of open hole or insulator tube casing of investigated interval. Special modifications of neutron logging are useful as a part of CIS complex to reveal "ill" wells having out of column overflowing. For the effective monitoring of these processes it is necessary to foresee the ensuring of good conditions to carry out of CIS in construction of observing and part of exploration wells.

OGRI RAS



Geotechnogene Processes in Reservoirs

N.K.Nazarov

The modern condition of prospecting work of oil and gas fields is characterized by increase of depth, output in water area, expansion geography of well construction. Requirement to economic expediency and ecological safety of work are increased, the need in simple and reliable technologies is sensed, in particular, in effective and accessible drilling solutions.

Geotechnogene effect of drilling solutions on reservoirs lead to, that prospective hydrocarbon fields do not get exposed by prospecting and exploration, and by development of the wells' discharges are restored during the several years, frequently as not reaching forecasted volumes. In the base of it lies reservoirs colmatage of solid phase of drilling solution.

The scale of non-traditional peaty drilling solution is developed in the drilling section of the State Gubkin Academy of Oil and Gas. At opening of production horizon, on wells' wall the dense layer of felt-like peat is formed, which hinders deep penetration of solid phase and parts of filter in bed. The solutions are economically and ecologically safe and are easily processed, thus peat is not filling material, and structure-formed. The effect of peaty drilling solutions on bed, in difference from conventional clayly, slightly and practically, does not cause the irreversible changes of filter characteristics in the reservoir.

Geotechnogene effect of peaty drilling solutions on reservoir was studied with help of specially created experimental installation, enabling qualitatively to evaluate and to compare the influence of solid phase peaty and clayly solutions. The qualitative and quantitative evaluation was received by methods of porometric, dissolved electronic microscopy, X-raying, petrophysic and ultrasonic research. The results of experiment are confirmed by industrial tests in Western Co. in Turkmenistan.

The call of inflow and development of fields at work with non-traditional drilling solutions is bypassed without complications, technogene effect of peaty elutriate liquids on natural structure of pool is minimal.

OGRI RAS

The Co-evolution Ideas in Development of Offshore Oil and Gas Fields

E.M.Golovachev

Co-evolution is the organic interconnection and inter-reasons for existence and development of natural, social, cultural and technical systems. It expresses requirements of time and direction to future, to noosphere.

It must be recognized, that other cultural factors and links are out of framework programs. It is necessary to develop and use bi-furkation character of process, irregularity of development and system of possibility limits. In order to make our values imperatives, it is proposed to select flexible co-evolutional strategies of development for both oil and gas fields and sea area. For example, sea areas and technical constructions would be used as places for rest, aqua-plantations, stocks, ecology monitoring stations, power plants and etc. This "orthogonal" activity, having the purpose of producing flora, fauna and socio-economic forms of life, could change the traditional opinion about humans inhabiting the environment and initial searching for socio-technical solutions.

This work lends to the change of the licensing policies- entitling rights to carryout multi-profile works to the bigger financial and production corporations. The co-evolution strategy concept includes at least three parts:

- aquasphere- cultural changes connected with the development of oil and gas fields;
- licensing policy connected with changing or developing innovation- investment funds;
- social-economical and geological investigations.

KOME PO "Soyuzmorgeo"



Fan Systems of Mesozoic-Cenozoic Deposits of Caspian Sea - Regional Object of Hydrocarbon Pools' Search

Yu.B.Sitantiev, Ya.P.Malovitsky

1. By data of paleo-geographical reconstruction, a large association of fan systems are within the Northern and Middle Caspian, which were developing during Mesozoic-Cenozoic. Its modern continuation is Volga avandelts. Fan bodies promoted formation of greater part of section of Jurassic, Maikopian, Miocene-Pliocene and partially Cretaceous deposits.

The leading role in formation and localizations of these bodies belongs accordingly to large-sized plate rivers and systems of tectonical lineaments, movings on which are proceeding at present.

2. Fan system except for own underwater fan includes paleostream, paelodelta and bar's formations.

The maximal concentration of organic matter (OM) are located in avandelta zones, where its contents reaches 5-7 %. These zones can be considered as the centers of hydrocarbon generation. In stratigraphic relation it follows to distinguish fans of Mesozoic, mainly, Jurassic time and fans of Cenozoic. First ones were developed in regime of passive margin of paleoTetis, second ones - in regime predominary midland marine basin.

Thus, Mesozoic-Cenozoic fans are part of Pre-Caucasus front of paleodelta, and Cenozoic ones are located more in the submeridional band. In the latter case, "fans" are stipulated of evacuation of terrigene OM - saturated material by river systems of paleo-Volga, paleo-Ural, paleo-Emba, paleo-Terek etc. The influence of these rivers has had an effect on formation of postPliocene series of South Caspian.

3. Capacity of sand packs of buried fan systems reaches the hundreds of meters, and volume 1,200-2,200 cu km. The area of development of separate packs makes from 5,000 to 40,000 sq.km, and clinofom's sizes reach 90-300 km and 5-40 km. It follows to take into account, that the sources of removal of detrital materials placed and within the limits of modern Caspian offshore. So for example, main source of detrital materials for Maikopian formations placed in region of Busachi-Kulalinsk archipelago.

4. Made outline of evolution of buried fans' systems of Caspian sea permits to locate the zones of development of sand bed-reservoirs, connected with deposits of river paleo-valley, deltas, avandeltas, alluvial fan, turbid flows etc. Obviously, zones of development of these reservoirs are prime objects for statements of search-prospecting work. However, in essence of the new object for the region and it is necessary to develop the technique of it searching, especially by seismic research.

OGRI RAS, PO "Soyuzmorgeo"

Prospects of Oil and Gas Fields Prospecting in Astrakhan Pre-Caspian.

S.Y. Shtun, S.V. Delia, A.V. Tolcheev

The condition of prospecting work on oil and gas in Astrakhan Pre-Caspian now is in a phase of lingering crisis. The reasons for these crises are various objective and subjective factors.

After opening and assimilating a unique Astrahanckogo sulphur-gas-condensate field, and of the same name, big arch uplift on top of subsalt middle carboniferous carbonate deposits, from 1976-88, prospecting work on local anticlinal structures, complicated arch, did not turn out successful. The search for hydrocarbon raw materials in the allochthon carbonate complex of Karakul-Smushkovsk uplift zone also were finished without positive results.

At the beginning of 1990, the prospecting was renewed in above salt deposits. The reason for this was the changing of economical conditions. It brought to discovery only one, Verblyuzhje oil field, confined to the contiguous structure of Yurassic-Low Cretaceous reservoir series in salt diapir fold. In spite of high forecasted estimates of reserves, the field is, up to now, left unprospected with no introduction to exploitation because complex block building of pool. The pool was fractured by numerous disjunctive faults with different



amplitudes. Moreover, the density of high-viscosity oils changes from block to block and depends on the stratigraphical confinement of the reservoir.

Combination of the aforementioned factors brought to necessity of the estimate of prospecting different oil-gas bearing structural-stratigraphical complexes of sedimentary cover of main oil-gas accumulation zones, which are placed within the Astrakhan area, and aimed for future prospecting work.

The main prospective of development of big hydrocarbon pools of the Astrakhan Pre-Caspian are connected with Middle-Upper Devonian terrigenous deposits. Their studying is only the beginning of studies within this region. The series of oil-gas prospective parts were excreted (A.J. Brodsky, 1994) by seismic time section on the basis of structural-formation analysis, within the Astrakhan arch. A deep well is drilled (H=6.5 km) on one of them (Volodarsk).

Within the sloped parts of the Astrakhan arch transgressive polycyclic Upper Devonian - Turnian and Upper Visenian systems of border reefs are most prospective. Such systems, within the north-eastern area surrounding the arch, are reliably mapped by seismic data as result of the application of the interactive system AIM (CGE) in limits of heavy-bedded model of media.

Definite prospects of oil and gas searching can be connected with the carbonate sedimentary complex of the Lower Carboniferous. Up to seven forecasted bed reservoirs detach here in Aleksinsk, Mikhailovsko-Venevsk and Serpukhovsk deposits by detail core analysis (S.V. Fedorova, 1991). Testing these reservoirs on line areas have given positive results - such as gas inflows, disclosed oil specters.

Like the prospecting of the subsalt complex, it is necessary to continue prospecting work on oil and gas and on oversalt deposits.

Oversalt deposits of this region are not regularly studied. The degree of drilling on them is not high. If it is 5 m per sq.km in Verblyuzhie field, so it is not more than 3 m per sq.km for a large part of the region (up to 60 %). Besides structural and structural-tectonical hydrocarbon traps, it is forecasted development of the hydrocarbon traps of lithology and combine types in examined region. The most typical example of hydrocarbon field of such type is Beshkul'skoye field.

AGE

The Oil and Gas Prosects of the Volga Delta

V.I. Bogoyavlensky, Yu.B. Silantiev, M.I. Tarkhanov, P.W. Bathurst

Significant oil and gas accumulations are proven to exist in the Northern Caspian area, the largest of which are located below the Kurgurian salt in fields such as Astrakhan and Tengis. As a result considerably less attention has been given to the potential within the Mesozoic and Cenozoic strata. The importance of these reservoirs is illustrated by the considerable number of fields within the Pre-Caspian Depression and Skifian-Turanian plate.

The main play for these Triassic to Tertiary reservoirs are salt related, with both crestal and flank plays evident. The shallow depth and simple nature of the prospects means they are relatively cheap to explore and develop although their size tends to be limited.

The area covered by these plays is considerable. In the east of the Pre-Caspian Depression one of the areas of interest is the lower Volga valley and delta where gas shows have been recorded at surface. Geophysical data has been used to trace the location of the paleo-Volga as far as the Apsheron'sky High.

The presence of oil and gas between Volgograd to Astrakhan has been known for over 50 years, several small Quaternary and Pliocene fields (Asau, Kirikily) being discovered before the Second World War. Post the war, gas flow of up to 17 metres, have been recorded offshore in the Caspian Sea from depths of between 50 and 70 metres within the Quaternary (Khazarsky stage). These sediments represent deltaic deposits of Volga.

The source of this shallow gas can therefore be taken as an indicator of the presence of gas within Mesozoic reservoirs which, because of their relatively shallow depth and resultant low development cost, are of commercial interest. The low level of reserves expected within these accumulations means that most of the gas will be used within the local communities.

The geological and geophysical work required to be carried out to successfully locate these reserves will include geochemical studies, seismic acquisition and a study of the anisotropic nature of the sediments to locate subvertical fracturing and faulting.

OGRI RAS, GANG, EG



Regional Prediction of Oil and Gas Content of the North-Western Sector of the Caspian Water-Area

B.A.Solovyev, T.D.Ivanova, S.B.Kocharyants, O.S.Obryadchikov

The North-Western sector of the Caspian water-area includes submarine continuation structures of Astrakhan area, Kalmykian and Dagestan. There are located in the area of the Pre-Caspian basin, the Eastern continuation of the Karpinsk ridge, the Eastern-Manych trough, the Prikumsk zone of uplifts, the Nogaisk step and the Tersk-Caspian foredeep trough.

The stage of possibly productive sedimentary cover of mentioned structures is different. If the Mesozoic deposits are prospective practically in the all territory of this sector, the potentially productive part of section increases downward to Paleozoic thicknesses in the North (the Pre-Caspian basin) and upward to Cenozoic thicknesses in the South (the Tersko-Caspian trough). The prerequisites of fields discovered in the carbonate reservoirs of the Paleozoic and sedimentary reservoirs of the Mesozoic are within water-area part of the Pre-Caspian basin. Continuation the swell-like structures of the Karpinsk ridge toward water-area make it possible to predict the discovery of these hydrocarbon fields, similar to structure on the land but with much higher reserves. Oil and gas prospective organogenous structures of the Triassic have been revealed on the continuation of the Eastern-Manych trough and Prikumsk zone of uplifts; anticlines with possible productive horizons are in deposits from the Permian-Triassic to the Lower Cretaceous.

The Prikumsk anticline zone has been established in the sea part of the Tersko-Caspian trough and connected with its considerable local uplifts. The desirable objects are the Derbent-Sea and Inchke-Sea in Vostochnoe. Structures on the North -Eastern platform edge of the Tersk-Caspian trough are prospective. Eroding uplifts of the Pre-Plecene surface in the intra part the Caspian deserve special attention from the point of view of oil and gas content.

Analysis of geological structures of the North-Eastern sector of the Caspian affirm to favour to possible increase of existing quantitative estimates of prospective oil and gas content in this sector.

VNIGNI

Non Anticlinal Traps in the Western Part of the North Caspian

F.B.Borkov, E.M.Golovachev

The study of the western part of the North Caspian is poor. For this reason, the prospects of oil-gas reserve estimates are inconclusive. One of the main tectonic elements is a Paleozoic- Mesozoic folded system of uplifts of the Karpinsky ridge. In this range it's possible to open oil and gas fields. It's difficult to discover fields in carbonaceous-permian carbonate deposits to the north of the Karpinsky ridge. If we look for objects of the non anticlinal type then the research area will widen because of the attention to: 1) zones of pinching out deposits from Triassic to Paleogene-Neogene age; 2) zones of jointing; 3) zones of development lithological-stratigraphic screening of reservoirs; 4) objects of littoral conditions of paleo-sedimentation; 5) object-traps of Epigertinian nature (taphtogene complex).

Then consideration should be given to paragenetic connections between seismotectonic movement and formation and the accumulation of hydrocarbons. The first research areas will be those which are situated in the range of the two regions with high deformation deposits - Subcaspiian diagonal zone folding dislocation (along zone Agrakhano-Embensk fracture) and "Chechensk wedge", at the eastern of Chechen. The biggest local uplifts such as Kulalinsk, Banky Rakushechnoye, Zhemchuzhnoye, Signal and Akhmedly are attractive in these two regions.

High density of potential resources of hydrocarbons are expected here, because of a variety of conditions for formation of medium and small oil and gas fields.

KOME PO "Soyuzmorgeo"



Geological Aspects of the Astrakhan Gas-Condensate Field Development in the Conditions of the Rising Caspian Sea Level

S.V.Fjodorova, A.F.Iljin

The rising of the Caspian Sea level makes us pay more attention to the geological aspects of the large hydrocarbon fields development in the region and study them from different perspectives.

Different standpoints for the reasons of such rising include: the disturbance of the atmospheric circulation, sun activity changes, the disturbance of the flow regime as a result of the human activity, earth crust oscillations and vertical movements. Whether one considers them separately or together, they highlight the one problem affecting the development of the ecological situation in this region: the problem of the total reworking of the geomaterial followed by the changes of the stress-deformational state of the sedimentary masses and the processes of the surrounding adaptation to the new state.

These processes can affect the large natural-technical objects including oil and gas bearing objects and the Astrakhan Gas-Condensate Field (AGCF).

In this connection, the question on the opportunity of the ecological balance preservation in the region of gas recovery in the extreme natural situation is very timely.

The new approach, namely the study of the rheological characteristic of the reservoir, allows to estimate the potentiality of the gas-condensate reservoir adaptation to the changes of the stress state and deformation processes.

The authors made the rheological model of the Astrakhan Gas-Condensate Field. The influence of the rock pressure and also the changes of the tangential stress and temperature on the rocks was analyzed on the basis of the fine laboratory tests. As a result the main rheological features of the reservoir rocks, namely, the elasticity, viscosity, plasticity were studied and the rock-under-deformation-load curves were constructed.

It was established that the differences in the rheological features of three types of rocks, namely, viscoelastic with brittle failure; elasticoviscous, semibrittle; and viscoplastic with plastic type of deformation are the basis of the geomechanical model of AGCF.

Theoretical substantiation of the results obtained from the positions of geomechanics and elasticity theory allowed to connect the accomplished definitions to the generalized rheological model of the Astrakhan GCF. The distinctive features of this model are the rheological bedding of the reservoir on the whole and the pay complex in particular and also the presence of two seals: the upper is on the top, and the lower is on the bottom. The seals consist of rocks of high plasticity and have bedding texture.

Thus, the rheological model of the Astrakhan GCF creates the conditions for the low-temperature plasticity of the object on the whole in the field of changing geomechanical conditions. This indicates the comparatively high geomechanical and geological protection and creates the preconditions for the correction of the AGCF development project in the direction of the coordination of the human activity influence on the reservoir with its natural regime.

NVNIIGG, AstrakhanGasProm

Tafrogene Complex of Middle Caspian: Tectonic and Prospects of Oil-Gas Saturation

V.I.Bogoyavlensky, Yu.B.Silantiev

1. Within the Middle Caspian the peculiar situation has developed. On the one hand regions describing a high degree of prospecting of resources have worked out hydrocarbon reserves: Dagestan and South Mangyshlak adjoin to offshore. On the other hand between these regions are present extensive, but poorly studied water area of Middle Caspian. Within this offshore the rare network of CDP profiles and some groups of coastal wells (Inchkhe-More, Peschanomys-More etc.) are present. The central regions practically are not studied by drilling; there is presently only one offshore well, with comparison of drilling results which one and previous seismic finds the considerable divergences (to 600 m - on Maikopian deposits top).

2. The multistage of offshore of Middle Caspian's basement causes the availability of powerful transitive complex. In the same time the revealed systems different ages



lineaments cause the existence of tafrogene's structures, connected with divergence of Pre-Cambrian, Paleozoic and Earlier Mesozoic continental blocks. The main stage of tafrogenesis is connected with Tetis opening; at this time formation and bedding of troughs' systems of reef of type has taken place.

As a given result of complex analysis of being present geological-geophysical information data, two systems rifts are allocated: orthogonal and diagonal. On inter-place of these systems orthogonal rift system has more ancient location and can be generically connected with system of reefs of east margin of Russian platform. Diagonal system is connected with Paleosoic-Mezosoic diverger.ce of Skifsko-Turanian belt.

3. Maximal thicknesses of volcanic-sedimentary rift series are located in limits of Skifsko-Turanian reef's system: to 5,000-6,000 km in Sulaksko-Derbentsk depression and to 3,000-4,000 km in Yuzhno-Mangyshlak one. Within the given complex of deposits are allocated two oil-gas sources (Neftekumsk and Demjyanovsk), contents of arkono-alinov organic matter in which, on the average, makes 0.5-0.6 %. In quality fluid follows claylike post-reef deposits of Late-Triassic and Early-Jurassic. The pools are typical for tafrogene and they are connected with pinching out, erosion sections, drape structures, tectonic screening etc.

4. Heterogeneity of rift systems and distinctions in post-reef development cause differentiation of prospects of given complex within the Middle Caspian. According to present representations are expected large gas-bearing of hydrocarbon systems. However, by data of conducted simulation series's warming up is established. It is true only for southern and western parts of Middle-Caspian region and zones least catogene metamorphic of tafrogene complex located in the rift's depression of central part of offshore.

Here the availability of large arching structures, the least subject to non-anticline moves, causes accumulation and preservation of predominancy of oil hydrocarbons.

OGRI RAS

Problems of Search, Prospect and Exploration of Oil and Gas Deposits on the Caspian Shore of Daghestan

A.A.Kurbanov

The knowledge of results of laboratory investigations of physical properties of rocks at high pressures and temperatures are needed for solving many problems of search, prospect and exploration of oil and gas deposits.

The analysis, conducted on the basis of nature and foreign perience of an investigation of petrophysical properties of fluid-containing collectors under conditions of stratum temperatures and pressures, shows that there are no based particular models of distribution of petrophysical properties of sedimentary basin, of the estimation and prognostication of thermodynamical situation its deep-plunged zones.

The purpose of this work - the receipt of reliable experimental and calculated data change regularities of petrophysical, geothermic and the discovering of depth processes, phenomenons of sedimentary basin.

It is essential, it was decided, that the next principal problems for achievement of this aim:

- methods were selected, contemporary technological processes were created and corrected. They allow to carry out an investigation of conduction, thermometric conductivity, heat capacity, density, and porosity of rocks;

- the selection of patterns of kern material of rocks the most characteristic of depth zones of region reflecting corresponding physical state and possible composition of investigation section;

- laboratories investigations of petrophysical characteristics of patterns, corresponding to thermobaric regimes of different depths;

- the analysis of all materials over separate more shallow section with a calculation of structural peculiarities and a composition of geological medium for creating petrophysical and geothermic sections of prognostication of depth temperatures with attractive experimental results under investigation patterns and thermograms of production organizations.



The complex of investigations to conducted petrophysical parameters of deep-plunged gas - oil saturations and seismologically active zones of Dagestan under conditions, maximum approximated to stratum (to their state insitu) at temperatures from 293 to 673ш K and pressures from 0.1 to 150 mPa. Those investigations are conductive to clearing up question about marked parameters behavior of gas, oil and water saturated rocks under stratum termobaric conditions, solution of problems of the geology, geophysics and geothermics.

According to results regional schematic maps, diagrams, graphs, tables are to be drawn up, which make the basis of recommendation on searching and prospecting of oil and gas deposits.

IG DNC RAS

Oil and Gas Hydrocarbon Resources of Dagestan Part of the Caspian Sea

D.A.Mirzoev, V.M.Pirbudagov

In the Dagestan sector of the Caspian Sea (DSCS), oil and gas reservoirs continue to onshore. They correspond to great tectonic elements such as Pre-Caucasus Epihercynic plate and Tersko-Caspian trough, which are characterized by a special geological structure and development, the peculiarity of spreading accumulation of hydrocarbons and different degrees of knowledge. Continuation to the sea of productive horizons Dimitrovsk field will be in the lateral zone of South Digestion. Oil pools of Izberbash are situated onshore and offshore. Inchkhe-More field was discovered here. The high prospective of hydrocarbon resources search is proved by many scientists in DSCS.

The initial summary of DSCS hydrocarbons resources (area - 32,000 sq.km) compose 1 billion tons and consist from almost all forecasting resources. Prospected and prospective resources are estimated at 30 million tons (Inchkhe-More). In the whole balance, gas resources dominate over oil.

The evaluation of forecasting resources of hydrocarbons (HC) was carried out at 7 oil and gas saturation lithologic-stratigraphic complexes: Triassic, Jurassic, terrigene, carbonate, Upper Cretaceous, Lower Cretaceous, Paleogene and Neogene at the depth of occurrence up to 7 km.

DSCS has certain forecasting resources of oil and gas. So, it merits to be developed. Technically, accessible for drilling, depths of bedding of productive horizons and shallow water depth (up to 200 m, 600 ft) are favourable for it. South-Digestion and Tyulenevsky fields are most prospective for prospecting of HC. In these places, geological-geophysical research with the purpose of studying deep structure and to prepare it for prospecting are to be concentrated on. To reveal lithologic-facies and seismic peculiarities of Mesozoic sediments it is necessary to drill parametric wells to a depth of about 5-7 km at the Tyulenyi and Chechen islands, Inchkhe-More area and island of Dimitrovsk field and to carry out DSZ(depth seismic zoning).

At development of DSCS it is necessary to take care of ecological security of unique Caspian basin.

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Pre-Jurassic oil and gas accumulation around the North and Central Caspian

M.I.Tarkhanov, V.I.Bogoyavlensky, Yu.B.Silantiev, P.W.Bathurst

Within the past ten years one of the main target for oil and gas exploration in the North and Central Caspian has been the Pre-Jurassic sediments. There have proved to be prospective in the epi-Geizinian, Skifsko-Turanian plate and also in the near by areas of the eastern Pre-Caucasus and the Mangyshlak-Busachi areas. The main reservoir intervals are within the Triassic.

At the present time some twenty fields, mostly oil and some relative large, have been discovered along the coast in Dagestan. The reservoir horizons are formed by the Neftekumsk



Suite of the Upper Permian to Lower Triassic age and the Anisiisk stage of Middle Triassic. An example of these reservoirs is displaced by the Solonchakovoye field.

The main reservoir consists of dolomites of the Neftekumsk Suite overlaying basement. Reservoir properties are controlled by fracturing and the development of vuggy porosity and can reach 16 % porosity and 830 mD permeability. Flow rates in excess of 250 tonnes per day (1750 BOPD) have been recorded.

The Anisiisk sediments are oolitic and bioclastic limestones with interbedded shales locally important. Porosities and permeabilities reach 17.6 %, and 225 mD and flow rates 200 tonnes per day (1400 BOPD).

In Mangyshlak approximately ten fields have reservoirs of pre-Jurassic age, mostly of Lower to Middle Triassic where vuggy porosity and fracturing are again important. Volcanic material forms an important constituent within these Triassic sediments.

Lower Triassic oolitic and bioclastic limestones and dolomites have porosities and permeabilities upto 19 %, - 15 mD. Flow rates of 120 tonnes per day (800 BOPD) are achieved.

Middle Triassic dolomites and tuffaceous sandstones have porosities of 17 % and permeabilities upto 740 mD.

Tuffaceous sands and silts within the Upper Triassic have 14% porosity and 11 mD permeability and flow upto 14 tonnes per day (100 BOPD). The Kamenistoye field is the only proven accumulation within these sediments.

Below Triassic, metamorphic basement is a proven reservoir within the Oimashinsk Field which achieved flow rates of 246 tonnes per day (1700 BOPD). Similar weathered basement is seen at Ravninniy in Dagestan.

The Upper Permian - Triassic sediments of Dagestan and Mangyshlak are believed to have been deposited in a single basin. Work by the authors reviews the main depocentres and local sub-basins, which control the oil and gas accumulations.

GANG, OGRI RAS, EG

The Hydrocarbons Potential Mineral Resources of the North Caspian.

F.P.Borkov, E.M.Golovachev, V.G.Kirjakov, V.V.Shcherbakov

Estimations of prospective oil-gas saturation of water area of North Caspian are based on extrapolation of data on the surrounding land. It can be ascertained with confidence that, as onshore, so offshore in area of the old platform there are three main stages of oil-gas saturation: Cretaceous, Jurassic and Carboniferous-Permian. Among Jurassic and Cretaceous deposits anticlines prevail. They are breasted by salt stocks of the Lower Permian period. For this reason, the main traps for oil and gas will be the traps of lithology-injective and lithology-disjunctive screens. In this case, the favorable factor is the occurrence of shallow prospective horizons (from 1,000 to 2,800 m).

The big local uplifts were found through seismic and gravimetry research in subsalt series. These uplifts are interpreted as building of reef nature like Tengiz, Novobagatinsk and Biikzhal. There are sea masses Zaburunie, Zhambai, Gurrjev, Atyrau, Ker-Ogly (part of them are situated in the "white zone" that is the zone of the shallow top - not included in the seismic work). The reef masses occur at the depth of 5,500 km. But they may occupy the main part of the potential resources, if they are produced.

On the young Epiherzinian platform of the North Caspian, except Jurassic and Cretaceous, the prospective zones should connect with those sedimentary and volcano-sedimentary deposits, which are formed in transition, taphrogenic complex. In the southern region, the prospective section increases by Maikopian and Miocene deposits from above. Oil will be prevalent in phasing composition of hydrocarbons.

The problem of the North Caspian consists not only in the possibility of the opening and exploiting oil and gas fields, but also in the necessity to do this with an ecologically acceptable method.

KOME



Structural-Lithology Heterogeneities of Northern Caspian and Prospects of Oil-Gas Saturation.

M.M.Semenduev

1. On the basis of gravimetry data we are conducting detailed tectonical zonation of Pre-Caspian depression.

Structural-lithology elements of depression, in turn, are divided on separate structural-lithology zones. Zhakamys-Baichunas uplift zone includes assumed carbonate masses: Zaburunsk, Zhambaisk, Gurjevsk, and Bajchunassk. Dzhambajsk-Emba through is broken cross commissures on 3 private depression: East-Dzhambaisk, South-Gurjevsk and Embensk.

Karaton swell includes 4 carbonate masses: Ker-Ogly, Atyrau and West-Karaton - on offshore, and Karaton - onshore. Limits of South-Karaton through deflection observe the definite law in arrangement of salt domes, they stretch in chain, forming salt ridges. South-Karaton ridge adjoin directly to Karaton swell. Ogaisk ridge has arching form, inverted by camber to south.

2. In Zhakamys-Baichunass and Karaton arching zones it is possible to expect wide development of reef objects in subsalt complex of deposits. In connection with relatively non-deep bedding of subsalt carbonate complexes (4.5-5.0 km) and vicinity of Gurjevsk and Tengiz deposits of oil-gas saturation regions, mentioned zones are prime objects for searches of oil and gas. The numerous deposits of hydrocarbons in above salt complex are connected with salt domes.

It relates, in the first place, to Triassic, Middle Jurassic and Lower Cretaceous sedimentaries. The complex analysis of minimal gravity seismic data allows to determine the type of salt structures and kinds of hydrocarbon traps, which was possible to be expected in each object. On Turansk plate the high prospects communicate with sea continuation of Busachi oil-gas bearing region. Deserving attention are South-Embinsk uplift, South-Busachi step and Kochakskays anticline zone.

In whole limits of Pre-Caspian syncline by gravimetry data, it is possible to predict 20 objects in above salt complex and 10 objects - in subsalt one. In limits of Turansk plate in shallow zone is scheduled in order of 10 anticline objects in Jurassic-Triassic sedimentaries.

KOME PO Soyuzmorgeo

Estimation of Environment Damage While Searching Hydrocarbon Raw Material Deposits Using an Example of the Northern-Eastern Caspy.

E.Kh.Vekilov, Ye.A.Krskunov, Yu.M.Polonskiy

As many scientists regard, the search of hydrocarbon deposits in shelf zones can change conditions of water area hydrobionts community, first of all fish. At this stage of marine research, also, as well as at the subsequent stages of search and development of deposits, pursuant to the acting environment-protection rules, the level of probable technogenic effect on biological objects is estimated. The most indicative results are given by quantitative evaluation of potential damage for commercial fish. Commercial fish, as a rule, are the most valuable and investigated types. Obviously, if the damage by their population appears significant, the effect on other objects will be large, and vice versa. The estimation is executed using the technique based on rules checked by practices, used in the fish industry. The technique is developed in MSU (Moscow State University) together with the GP "Rosneft" by way of development of the bases, incorporated in authorized departmental evaluation of damage.

It is established, that any technogenic load, first of all increasing death rate and slowing down fish growth in the early period of their life, changes the main parameters of the population. The influence of such loads on adult fish or on fodder base considerably less will change population parameters and the damage will not be so appreciable. Therefore, the calculations on a base of the given technique are performed in the assumption of effect of search work on fish in the early period of their development, from fish eggs up to yearlings.

Rather intensive technogenic load will be appreciable on changes of the annual survival coefficient of the model, which reflects the ratio of number of yearlings to total



number of fish eggs. This parameter is determined by results of virtual population analysis on the basis of given fishing-biological statistics for a number of years.

The effect of small or moderate intensity can be compensated by within population effects of density regulation, characteristic for the overwhelming majority of objects. Besides the estimation can be hindered because of influence of other, for example, hydroclimatic factors, usually regulating the development conditions. Therefore the calculation technique is based on allocation of the component of death rate of young fish, not dependent on its density, instead of on direct use of so-called "coefficient of fishing return" (CFR) for young ones.

Use of the CFR, as experience indicates, considerably increases probability of reception of arbitrary overestimated or underestimated evaluations.

In any case, to control the permissibility of expected technogenic load of any factor on biological objects, it is necessary to have the complex research, including determination of quantitative parameters of effect of this factor on investigated living beings during various stages of their life cycle.

The forecast of damage is based on computation of deficient part of catches, being measure of sight-for damage, with the help of the imitation simulation technique while using the experimental data. In water area of the Northern-Eastern Caspy research, enabling to perform such computations, accompanying stages of search, investigation by drilling and development of deposits were earlier performed.

Computations for a number of populations for various water areas, including some kinds of fish of the Northern Caspy, are carried out. The computations have shown, that the modern intensity of such factor, for example, as geophysical work, is insufficient to cause appreciable deviations in character of the population processes.

Results of the research permit to assume, that at observance of the requirements of the environmental protection legislation during development of shelf deposits, the effect of the technogenic factors on dynamics of reproduction of populations will not exceed influence of hydroclimatic ones.

GP "Rosneft"

Prospects of Oil-Gas Saturation of Subsalt Deposits in the Eastern Part of the Caspian Sea

T.O. Bordovskaya

Pre-Caspian depression is traditionally considered to be one of the promising oil-gas saturation regions. During last 10-15 years within the south-east part of this depression several large oil and gas fields (Tengiz, Karaton, etc.) have been discovered in subsalt complex of rocks. However, the prospective Northern Caspian water area, south-east board zone entering into the structure, are presented poorly. Good geological-geophysical studying of seaside zone of uplifts onshore, contiguous to water area, its proven high oil potential, permit to assumed the similar prospects of oil-gas saturation in the Northern Caspian shelf.

The seismostratigraphic analysis method, used in research, is nowadays one of the most accessible, since it limits the water area conduct only search seismic investigation and not drilling ny wells.

On basis of seismostratigraphic analysis, results in subsalt rocks complex we have revealed the various generic types of geological bodies and the outlines their accommodations for Upper Devonian-Bashkirian and Moskovian-Artian interval of geological time are constructed. The three prospective zones are located with point of view of oil-gas saturation. The most prospective is the central part of region, limited with north carbonate bench, and on the south terrigene bench.

This area of distribution rifting masses are precisely expressed on time CDP sections. Within this zone the most prospective object is Kashagan uplift (name of trust "Yuzhmorneftegeofizika"), being, on our opinion, the sea of continuation of Karaton uplift. The series of more small-sized uplifts, in particular Adaisk, located also within this zone, doubtlessly present the industrial interest, taking into account their high reservoir properties. Within this zone it is possible to expect the large hydrocarbon congestions in rifting reservoirs of Visenian-Bashkirian age. Evaluating as a whole, in comparison the low



potential of northern part of region, follows to note, that the transitive zone of terrigenic deposits in carbonate, limited carbonate bench, is also a prospective one.

It is possible to expect here the availability of non-structure pools in regions of contact terrigenic deposits with carbonate ones. Possible zone of distribution of non-structure pools in south-west part of region belongs to terrigenic system of underwater output cones, limited with north-east terrigenic bench.

GANG

3D Seismic by the Method of "Wide Profile" in Conditions of South-Eastern Part of Caspian Depression's Zone

G.M.Ermolaeva, A.K.Suleimanov

The 3D seismic has wide usage in industrial volume by modern technical standards. Calculating the characteristics of the wave field guarantees the increasing reliability of information about difficult geostructured objects, such as the Caspian depression. It allows a reduction of the number of research wells needed and pays all expenditures.

Practical economical and ecological problems make it necessary to find "compromise methods" which still give good results in seismo-geologic conditions. One of the most effective methods is called the method of "wide profile", developed by the company CGG at the end of 1970 (Mishon). This special method of field work and processing allows one to find the position of the reflection element in a three-dimensional space in a strip which is 100-200m wide on each profile. The engineer, who makes the interpretation, receives information about the reflections, which comes in different planes, and information about the directions of the isochronous elements in sizes equal to the width of the reflection plate. Structural building is more accurate.

Observations on the method of "wide profile" were made on the south-east boarder of the Caspian depression, 4 km from each other. In distinction from the classical scheme, where often 72- multiple accumulations were used, but we can restrict it to 12 to 18- multiple accumulations. A special method was used for calculations of field systems and for the estimated position of the "wide profile" method. This method was introduced by B.P.Nomokonov for the system of ONP.

Structural models, made by "wide profile" method are more precise than those made by CDP. In the results, the difficulties of wave picture interpretation as "tectonical breaks" in subsalt sediments are caused by lateral waves. Positive results of using the "wide profile" method were obtained by KGE and were used in several near-Caspian regions. New criteria for interpretation are being created by using "wide profile" method. The exactitude of structural models and their effectiveness at seismic investigation has been increasing.

Spetzgeofizika

The Forecasting of Oil-Gas Deposits in Coastal Part of Busachi Peninsula by Abnormal Absorption of Seismic Waves

M.B. Rapoport, V.E. Parnikel, V.P.Kolomietz

At present time within Busachi peninsula a lot of oil and gas deposits are opened. Specific prospective this region is connected with possible detection of large stocks of oil and gas in shelf part, therefore the large significance is acquired by the researches of opportunity of forecasting of hydrocarbon pools on base of deeply dynamic analysis of seismic data. The component of decision of this problem is the study of oil and gas deposits on abnormal absorption of seismic waves in the most of prospected part of peninsula.

With this purpose it was executed experimental-methodical processing of seismic records, received on Kalamkas deposits, "empty" structures of Oralbai Dolginetz Sev., prospective structures Primorskaya, Dolgaya, Kyugan, Karasaran, Tyrsymazar, which at present are not drilled. On Kalamkas deposit the complex of experiments is executed, which have allowed to receive the following results:



- by several profiles in east part of deposit the sharp and intensive positive anomaly of absorption is received, which is confirmed on area by data of tests of eight wells and practically coincides with contour of oil-gas bearing;

- the testing of various parameters of processing in these seismic-geological conditions is executed;

- the analysis of efficiency of various ways of determination of absorption, including recently developed, is conducted;

- determinate the most informative parameters, which were used at calculation of complex parameter. It has allowed to increase the accuracy and reliability of received results;

- the frequent dependence of absorption decrement in area of pool is investigated. It is shown, that this dependence has the linear nature.

The similar researches are executed on several profiles on "empty" structures Oralbai Dolginetz Sev., where the anomaly of absorption are away. The developed technique, was managed to execute the forecast of oil-gas saturation on prospective structures Primorskaya, Dolgaya, Kyugan, Karasaran, Tyrsymazar. Thus, successful experience of application of technique of analysis of absorption on Busachi peninsula testifies about opportunity of increase of efficiency of geologo-prospecting work in this prospective region.

GANG, OGRI RAS, AGE MG Kazakhstan

Environmental Protection During Geophysical Survey at the Kazakhstan Sector of the Caspian Sea.

G.Khobdabergenova

The Kazakhstan sector of the Caspian sea is considered to be the most prospective area for discovering the major deposits of hydrocarbon resources. To accelerate the assessment of the oil and gas bearing prospects in the area and exploration of shelf deposits, the Government made the decision to establish the international consortium with "KazakhstanCaspShelf" State Company as its the operator.

Considering that the Northern part of the Caspian Sea is the natural preserve zone, the production of geophysical surveys, geological exploration and extraction of hydrocarbon resources are permitted based on the observance of the special ecological conditions.

With this respect, the scientists of the National Academy of Sciences and experts from the MEB have developed the "Special Ecological Conditions" for geological surveys in the Kazakhstan sector of the Caspian Sea with the requirements for offshore seismic operations defined.

To ensure the environmental safety in realization of the geophysical survey project, the Arthur D. Little Co. (USA) has been awarded a contract by the Consortium and EIA was prepared by Arthur D. Little Co. in accordance with the Republic norms and standards.

The EIA framework, the scope of worked out materials, the level and the nature of conducted scientific studies are determined by the necessity to assess the proposed types of impact on the existing physical, biological and social environment of the Kazakhstan sector of the Caspian Sea.

The EIA compiled the data identifying the modern environmental conditions, environmental sensitivity maps synthesized by the spectrozonal images from "Landsat" satellite and verified during the field reconnaissance survey held during four seasons and also in decoding of the pictures.

The research team consisting of more than 40 scientists from Kazakhstan, Russia, Europe and USA has analysed the program to assess the impact of proposed seismic programmes on environment, modern condition of marine habitats, its sensitivity and natural anthropogenous impacts dynamics. It resulted in the development of environmental impact mitigation measures, along with the operational standards for regions with different environmental sensitivity.

In August-October 1994 the PPP programme was conducted in the shallow and transitional zones in the Northern-Eastern part of the Caspian Sea with ecological monitoring with which results of the technical project were modified and appropriate equipment was selected producing negligible impact on the environment.

IC of the Caspian Sea



The Suggestions for Setting Up Information and Analyzing Caspian Region Service for the Ecologically Balanced Development of Natural Resources.

V.I. Gridin

The complicated ecological situation is typical for the large territory of the Caspian region. The natural landscapes, which can be damaged easily and significantly with ever increasing technical forces and long exploitation periods of technical objects results in irreversible changing of the environment. Transgressive flows of dust deteriorates the region's ecological situation. Information support of work complex by development of natural resources is not satisfying demands of ecologically balanced nature usage.

It is recommended to set up a principle for a new ecology and information service. Its peculiarities are:

- international and interbranch character;
- new theoretic base of rational use of nature - the conception of influence of Earth's and space's physical fields on the natural and technogene objects;
- methods - system's method of organization and carrying out minimum service possibilities;
- conjugate (in time and space) carrying out works for underground, surface and aerospace monitoring;
- maximum use of distance controlled information service possibilities;
- joint interpretation of the whole volume of surface and depth information with development of conjugate informational document complex (including thematic maps and materials of special depth investigations) in the survey, region and detail scale;
- organization works of conjugate real time scale monitoring and critical situation monitoring.

To set up new informational and observational service, efforts of states (Russia, Kazakhstan, Turkmenistan, Iran, Azerbaijan and others) should be joint in following areas: aerospace, hydrometeorology, oceanology, engineering-geology, hydrogeology, structural geology, geodynamics, oil and gas exploration, physics geology, ground geobotanics, ecology, systematic planning.

Many years experience in working in Caspian region in these areas allows us to recommend for the setting up of a new service for the following points:

- theory based ecologically balanced use of nature;
- system methods and main points of organization, methods and technologies of conjugate monitoring;
- new methods and technologies of systematic aerospace security and conjugate processing of complex information;
- technical base of Russian space program (distance earth investigation and space communication);
- technical base of air-distance investigation subsystem;
- helicopter transportation system;
- regional conjugate monitoring centers net in Caspian region (including Orenburg, Astrakhan, Dagestan, Kalmikia, etc.);
- system of basic personnel to establish new methods (including training and re-education of personnel to use system aerospace methods and conjugate monitoring, increasing of manager quality, training of operators for tool visual surface, helicopter and plane observing, special training of cosmonauts, astronauts).

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Results of Retrospective Monitoring of Tengiz Oil Field

V.I.Gridin

Discovery of Tengiz field attracts the attention of investigators and producers to the north-east part of the Caspian region. Large volumes of geological-geophysical, geochemical and systematic aerospace work was done here.

The complicated ecological situation, higher than usual risk of extreme situations, presence of abnormally high bed pressures and the large content of hydrogen sulphide and other noxious agents in bed mixture demands deep investigation of the region. For this purpose, from 1983-92 an inventory of natural resources and technogene objects was carried out by means of retrospective monitoring methods. Conjugate process of geological-geophysical information and a large volume of systematic-aerospace allows one to obtain new data about geodynamics, deep structures and the ecology.

According to the results of the conjugated work system of diagonal (north-west stretch and north-east one) geodynamic active zones a flexure-fracturing disturbance dividing the Tengiz subsalt uplift and near saturated territories into blocks was revealed. In the limits of disturbance zones, subsalt productive horizons are characterized by better reservoir conditions and abnormal high bed pressures. Rocks-fluid-isolators are characterized by pressure of crumpling zones and better jointing. Upper part of this is characterized by high permeability for gas-liquid products of transformation of reservoir mixtures. These zones control emergencies of bore holes (well 37 at Tengiz, well 2 at Prorva etc.).

By systematic aerospace work, geodynamic activity in local structures at the west of Tengiz uplift, to the north-east part of water area were discovered. One of them (Sea of Tengiz) has been verified and confirmed by seismic.

The controlling role of geodynamic peculiarities in the distribution of external situations and concentration of polluted matter was proved on large actual materials.

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The Probable Consequences of Tengiz Oil Deposit's Development Hide the Threat for Caspian

V.N.Rodionov

The main characteristics of the Tengiz deposits are: high pressure, large productive series and good bed permeability which all provide the opportunity for intensive hydrocarbon raw material production.

The high bed pressure and the relatively small thickness covering the salt deposits, create the danger of infringement of integrity of salt cap rock, that involves the most serious consequences for the Caspian.

The brittleness of salt and formations of permeability zones happens by velocity of displacement of order 1-10 cm/year. These velocities are reached easily by intensive operation of Tengiz deposit. The danger of this irreversible change in the salt plate increases by theme, that they become appreciable only after some years after the beginning of operation.

It is assumed to create in Caspian region the geophysical centre for checking deformation covering oil beds of evaporate series, which should deliver the operative information to appropriate organizations.

OGRI RAS

Prospects of Further Offshore Exploration in Turkmenia Part of the Caspian Sea

A.S.Filin, L.I.Morozov, V.S.Solodovnikov

More than 55 % of West-Turkmenian oil and gas deposits are located in the South-Eastern part of the Caspian Sea, where the offshore oil and gas fields of Prebalkhansk zone are established, and oil and gas prospective structures of Kyzylkum trough and Turkmenia step are located. Hydrocarbon accumulation in the range of West-Turkmenian sub-basin is confined to a united oil and gas system. Pliocene deposits include parent source rocks, permeable strata for secondary oil and gas formation.



Structural-stratigraphics of regional oil and gas bearing red colour stratum of more than 3 km thickness, has high reservoir properties of sandy and aleurolite rocks, including clay formation members of area caps.

The regional oil and gas bearing section of Akchagyl-Apsheron stage is already spreaded in Prebalkhansk and Kyzylkum regions. Oil and gas content is controlled by strata variations and lithological content of the deposits.

Exceptionally favourable vertical and horizontal migration paths connect middle-Pliocene section. It is shown that the prospects of upper red colour deposits are in the first turn determined by their connection on formation breakdown with lower red colour deposits on the boundary of the Kyzylkum trough area.

The North part of the Shakhman trough, where South-Boyadag trough is located, is of particular interest. From a lithological-facial point of view, the Pliocene deposit section to the South of Boya-Dag is favourable for oil and gas accumulation in lithological and structural traps.

Increase of future oil and gas reserves is connected with additional lower red colour deposits exploration at Kotur-Tepe, Barsa-Kelmes and Burun fields at 4500-5000 m depths.

In the bordering part of the water area, a Pre-Turkmenia prospective region is marked out for rather large objects not explored by drilling. First of all, from all areas non-explored by drilling or poorly explored, attention should be paid to Fedynsky and Veber ramparts which are strongly structurally marked.

SC Petro-Russ

Results of Research on Tectonic of Turkmenian Shelf in Connecting with Prospects of Oil-Gas Saturation of Pre-Caspian Fields

B.V.Grigorjanz, M.I.Tarkhanov, V.I.Bogoyavlensky

Graben structure of the earth's crust of the South-Caspian depression is reflected in big, more than 8-10 km thicknesses of Cenozoic deposits in closeness to its periphery framing with surface and shallow bedding (up to 3 km) of Mesozoic and even Paleozoic deposits. Such accordances are more precisely shown in north-east part of depression, where Kelsky trough and Pribalkhansk uplift zone are selected in its Cenozoic surface filling.

Anomaly field of gravity, velocities section of earth's crust and drilling data allow to take precisely boundary of Yuzhno-Caspian Cenozoic graben within Kelkorsk trough, a little souther of output of Paleozoic and Mesozoic deposits in bend of Kubadag- Bolshoy Balkhan uplifts. The eastern boundary of this graben does not have such precise expression, it is most likely explained by the covering bedding of stripping uplifts on a relativity shallow depth. By this, the western boundary of covering, or allochthonous plate, is good marked the Shordzha-Gokchinsk fault line.

The structure of Pre-Pliocene deposits in Turkmenian sector of South Caspian, on the whole within the last one, is presented enough difficult, characterized disgarmonic uncore folding structure which connected to active showing of volcanic mud.

The prospects of oil-gas saturation of ancient Pliocene deposits including Mesozoic and Paleozoic can be connected mainly to near-boundary zones of Turkmenian sector of South-Caspian depression and to allochthonous plate of Cretaceous rocks of Aladag-Messariansk uplift zone. By this essential role must be branched to fault tectonic, with which necessary connected to rise of tectonic detritus zones and high rocks' jointing with favourable opportunities of hydrocarbon accumulation. Regional and detail geophysical work, including 3-D seismic investigation of anisotropy properties, must be stay important resources of secretion of such near fracture jointing zones of oil-gas saturation. There originality is determined of them time for not only to traditional reservoirs, but also to high density rocks - volcanic (in that number intrusive), metamorphic and crystal one.

GANG, OGR I RAS



The Tectonic's Peculiarities of Formation of Oil and Gas Traps in the South-Eastern Part of the Caspian Sea

Ya.P.Malovitzky, Yu.B.Silantiev

1. The South-Caspian oil-gas saturation basin was generated as a result of two different trends in tectonic processes: rifting (in Mesozoic-Eocene) and convergence (early Pliocene).

During rifting stage happened location of marine basin, component part of Tetis paleocean. On this stage the accumulation powerful (to 10,000 m) sedimentary lenses of divergence margins of marine basin is marked. The given lenses have concentrated the significant volumes of organic matter, removing from north, with party of consolidated East-European and Skifsko-Turanian plates and from south with partly Iranian, Afganian, and other subplates - fragments of Gondvansk paleo-continent.

During of subsequent stages as a result of collision consolidated northern plates and separated south subplates have arisen Caucasian, Talysh-Kopetdagsk orogenes, located on edges of ocean's relict - Tetis, characterized marine sedimentation. On periphery of orogenes were accumulated powerful series of continental plates' deposits.

2. The peculiarities of tectonic-dynamic development of South-Caspian basin have caused the considerable distinctions in structural-tectonic styles of central and margin zones.

Two central zones are inherent marine facieses, avtokhton bedding of cover and balsam type of crust. The marginal zone is characterized by development of coastal-marine and continental facieses, continental type of crust and development thrusting dislocations.

The limits of South-Caspian basin are allocated by three main structural-facies complex:

1) Mesozoic-Eocene (avtokhton), composed of subplate formations of divergence of margins;

2) Oligocene- Early-Pliocene (allokhton) with orogene facieses row;

3) Paleo- Early-Pliocene (covering).

The deposits of first complex until not opening. Probably, that in limits of marginal zone the tectogenesis of Early-Pliocene collision defines here the availability overthrust, shift and other dislocations. The bedding of main uplift's zones is connected with tectonic movements along the borders of continental microplates: Pribalhansk-Apsheron, Bitlis-Elbrussk seams of collision and Gagrandag-Okaremsk cross shift. The size of shift moves reaches at present 0,6 sm/year (the Bitlis faults).

3. Within the marginal zone Mesozoic complex has no avtokhton, and allokhton tectonic style and, is characterized by development of scaly anticlines. In direction to Central part of basin they are replaced by subplate structures of ancient-passive margins, complicated and cross shifts and faults of gravity sliding. Scheduled on given geologo-geophysical data (being present in disposal of author) scheme of localization of main centers of generation, connected with marine analogues of Pliocene series and Mesozoic paleodivergence margins, and zones of hydrocarbon accumulation, describing development of non-structure traps in Pre-Middle Pliocene complex can form the basis for drawing up complex program of regional geological-geophysical work in Turkmenian part of South Caspian.

PO "Soyuzmorgeo", OGRI RAS

Data Processing in an Airborne Gravimetry System for Oil Basin Research

N.A. Parusnikov, Yu.V.Bolotin, V.V.Tikhomirov, S.A.Trubnikov

Algorithms for data processing in a high precision airborne gravimetry system are presented. The system under discussion will provide gravitational anomaly charts with the precision of about 1 mGal. Those charts will make it possible to evaluate the Caspian Sea oil basins with a confidence level of 0.8 to 0.9.

The system includes two GPS receivers configured for the differential mode operation, an INS and three string gravimeters positioned on the INS platform. Presently the system is undergoing laboratory tests; flight experiments are planned for the summer of 1995.

The anomaly charts are derived from the data collected on a grid of aircraft routes. The major difficulty in high precision estimation of the anomaly along a route arise from the ill-conditioning and complex nature of gravimeter errors induced by the aircraft oscillations.



Two algorithms for route data processing are suggested. The first algorithm is based on adaptive smoothing of the difference of corrected gravimeter data and double derivative of the altitude data. The second algorithm incorporates the GPS and gravimeter data into the INS errors model.

The estimation precision is determined by the bootstrap technique. The results of capacity tests by computer simulation, laboratory and flight experiments are presented.

MIEA, MSU

Basis of Theory of Collateral Properties of Objects and Its Application to System Designing and Examination of Projects of Development of Hydrocarbon Deposits

P.G.Terecshenko

The processes of development of oil and gas deposits can be accompanied showings of various collateral phenomena, having appreciable influence on property of environmental. To such phenomena in geocological environment relate, for example, Caspian Sea offshore, lowering of bottom and coast, earthquake, changes of periodicity and amplitudes of fluctuations of sea level etc. On the other hand, consequences of similar collateral phenomena can render a large influence on the degree of reliability of development projects.

Recently taking into account by designing objects of their collateral properties is given great attention: the circle of types discounting environments is expanded. However, so far the scientific significance of categories main, collateral and their relation in object remains, while, not entirely clear: not find their methodology, ontology and logic significance during analysis and synthesis. This fact brakes, by our opinion, creation of evaluation and account of collateral properties of objects. Report discusses some aspects of given problem.

The analysis shows, that the occurrence of collateral phenomena in systems "object - the environment", is not dependent on nature of object and environments. It is formal attribute of various anomaly, connected with completions above common object for environment object of substratum of operations of types of updating, inclusion, distances, as well as in connection with redundancy of substratum properties.

Report submits the classification of collateral parameters of objects on collateral factors, products and effects. It is shown, that the collateral parameters of objects the most are simply established by analysis of realizing variability of objects, for example, with help of construction of columns - models of interaction of objects and appropriate external environments. The significance of representation about realizing variability of project for reliable designing is shown, the model of realization is offered.

The developed bases are intended for technologies of creation of projects of increased reliability and safety.

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Estimation of Risk and Reliability of Oil and Gas Deposit Development for the Purpose of Maintaining Ecological Safety of the Caspian Region

E.Kh.Vekilov, G.F.Fomin

As is known, estimation of risk and reliability is one of important and necessary elements of environmental protection section of preliminary project and project documentation of deposit development.

The technique of automated computation of reliability and extent of risk for oil and gas enterprises is already developed and successfully realized, this technique is authorized by Ministry of Nature of the Russian Federation.

The automated technique is intended to evaluate the reliability of technological lines in oil and gas enterprise and to determine the risk extent with the given extent of reliability during the exploration. The system permits to determine sites, units and installations of technological lines, reliability of which is not high, that in turn permits to



develop additional measures, enabling to increase reliability and thus to lower the extent of risk. Besides, the computation performed using the offered technique, are the basis for the solution of problems of the enterprises insurance.

The system permits:

1. At the stage of designing

- to determine reliability of all sites and units of technological lines of a gas-refining enterprise;

- if necessary, to determine sites and units of technological line, being a subject of modernization with the purpose of increase of reliability;

- to simulate pollution of environment at normal operation of a gas-refining enterprise and emergencies.

2. At the stage of operation.

- to determine priority directions for research and experimental-design work, purpose of which is to lower a load on environment and to increase the risk extent during oil and gas enterprise operation;

- to develop validly environmental protection measures;

- to simulate pollution of atmosphere in view of normal operation and emergencies.

The system can be successfully used for evaluation of reliability and extent of risk, determination of an opportunity of insurance of the enterprise and modeling of consequences of failures for people and environment during development of hydrocarbon deposits in the Caspian basin.

GP "Rosneft"

Laser Methods to Search Oil and Gas Deposits and Control of Ecological Conditions in the Caspian Sea Region

I.N.Knyazev

Oil and gas deposit saturates with gases ground above the deposit and will form in atmosphere a field of specific hydrocarbon gas emission of small intensity, which can be measured and deliver in conformity with contours of the deposit.

One of the most sensitive methods of registration of gas impurity in atmosphere is the laser-fluorescent method. The direct measurements of small (0.1 ppm) and ultrasmall (ppb - ppt) gas components in atmosphere are hindered due to intensive fluorescence extinction by many molecules of atmospheric gases and due to the intensive background Rayleigh and combinational scattering.

Therefore, it is necessary to apply the method of expansion of air samples in vacuum. The limiting sensitivity of the method for well fluorescent molecules is 0.01 ppt (10-14) i.e. about 10^5 molecules in cubic centimeter under standard conditions. While being installed at mobile platforms (automobile, helicopter), mapping of gas emission with subsequent correlation with contours of deposits is possible.

The use of trace and lidar measurers for harmful gas ejection level, and control of gas and accompanying gases out-flowed from gas and petroleum, as well as from processing and auxiliaries, are considered for the aim of control of ecological conditions in the region of the deposit.

IOF RAS

Ecologically Secure Technology for Deep Well Abandonment in Pre-Caspian Oil and Gas Area

M.M.Bystrov, G.A.Semenychev, B.P.Gubanov

On the Astrakhanian gas-condensate field where hydrogen sulphide content is in excess of 20 % it was established that the cement bridges, set up at well abandonment, breakdown in time from corrosive media and leak the bed gas that results in arising inside- and inter-string pressure to several hundreds of kgf/sq.km. Such situation can bring to ecological catastrophe.

The technology for well abandonment that ensures the total ecological security of producing bed isolation for million years was developed by authors. The given technology



consists of high plastic rock interval casing section removing and at the expense of rock mass energy the additional isolation bridge is formed for providing conditions for high plastic rock flow into well bore. The natural isolation bridge becomes hard and is absolutely impermeable in time.

This method of well abandonment under corrosive medium conditions is distinguished in novelty of scientific and technical solution and there is no analogy neither in Russia nor in foreign countries.

By use of this technology the economical profit is expected several hundred billion roubles due to saving of expenses on gas-oil-water shows removing inside casing and in innercasings. In the first place, it is necessary to use this method of well abandonment on the Astrakhanian gas-condensate field.

NVNIIGG

Fluid-Dynamics of Near-Fault Oil-Gas Saturation Structures of the South Caspian Oil-Gas Saturation Province (Geodynamic Aspect)

L.A. Abukova

The conducted research has allowed to justify the quant-mechanical model of behaviour of fluids' mass under effects of energy-structure of Earth and in dependence on tectonic features of studied territory. It is shown, that the activation of fluid-dynamic regime happens on some wave power-generating barriers, the sort "permitted orbits", possessing the direct analogy with structure of electronic orbits nuclear nucleus.

In specific measure such activation becomes intensive at intersection of wave barriers with tectonical faults.

The similar mechanism permits to consider near-fault zone on its intersection with power-generating wave barriers as dissipation, thermo-dynamic opened. The hydro-geological consequences of occurrence of dissipation structures in microspaces are known: they are reduced to that the underground waters are sharply changing the physical-chemical properties (increase of solution ability for account of release of firm-connection beds, having increased aggressiveness) The same effect in macro-spaces arises in zones of tectonic faults.

Areas of non-compact rocks, decrease of viscosity and increase of migration ability of underground waters and hydrocarbon fluids are attracted to zones of intersection of wave barriers and tectonic faults in fluid-dynamic relation. On territory of south Turanian plate the similar examples are far from unique.

Within the limits of the South Caspian oil-gas saturation province the series of local areas, time for, on the one hand, near-fault zones, with other hand - to wave barriers, say about fluid vertical migration leading role in formation of oil-gas accumulation zones. So, on Syrtlaly area (well.50) from underlying red-colour rock of sedimentary were observed intensive gas-shows and degasation of clay solution.

On the south wing of this structure, where the tectonic faults are advanced, surface water sources have the traces of introduction deep brine with impurity of dissolved gas and slides of oil. On area in Kydmar during drilling parametrical well (No. 807) and chalk part of section (int. 2367 m) gas-shows also were marked. From Senomanian deposits gas-shows with increase of heavy hydrocarbon contents is fixed in Isat-Kuli, Zap-Zirik, Rustam-Kala areas. The role of power-generating pulses, received of hydrosphere on wave barriers and absorbed by tectonic fault zones, it is possible to trace on interface of geodynamic fields with objects of hydro-geological testing, on which the increased concentration of iodine and bromine are established.

The high density of forecasting and forecast operational stocks of I and Br in underground waters in limits of south Turanian plate is established in West-Turkmenian depression. The gravity tendency of near-fault local areas (Keimir, Okarem, Akmaya, Gograndag, Bugdaily) with increased degree of enrichment I and Br (forecast-operational stocks) to external orbits is here preserved. It is interesting, that on these the wave barriers fall to the prospecting areas in other tectonic and lithofacies fittings: Danata, Chaaldzha, Kujlyar (with forecast stocks), Sindzhou, Tersakan (with forecast-operational stocks). And part from them (Chikishlyar, Akpatlaukh, Keimir, Okarem) are characterized more and theme, that time for or acting volcanos, or drains of non-acting volcanos, crusts of which are much more of deeper sedimentary cover.



Other proofs of large-scale vertical fluids migration from rocks, underlying the sedimentary cover, in zones of intersections of wave barriers of geodynamic field and tectonic faults on West-Turkmenian depression territories are present. In contents of sedimentogene waters here actively the introduction of waters happens, about then to testify everywhere the advanced phenomena of hydrochemical inversion. It is the most relief expressed in the area of Okarem. For example, it is known, that in well No. 3, mineralization of underground waters changes from 90.8 g/l (int. 2547-2502 m, N kr) to 270.6 g/l (int. 1328-1280 m, N ak) and further - 274.1 g/l (int. 1147-1064 m, N ap), on well No. 4 upwards on section the following significances of underground waters mineralization are fixed: 112.9 g/l (int. 2515-2455 m, N kr), 227.8 g/l (int. 1280-1067 m, N ak) and 228.1 g/l (int. 1050-929 m, N ap). In content of water-soluble gases the researchers mark the increased heavy HC contents, increasing with depth - from 0.31 % (well 3, int. 2099-1993 m) to 8.58 % (well 3, int. 2515-2455 m) and correlation of their concentration with contents of hydrogen (on well 4 and practically on that parts of section and depth it accordingly equally 12.6% and 17.0 %). It is important also to note, that the deposit exists in conditions of unsaturated waters of hydrocarbon gas (RNAC/RNL does not exceed 0.4).

On basis of research materials, partially submitted in given work, the influence on activation of fluid system of energetic potential of geodynamic field, possessing autowaves nature, is justified.

At the expense of occurrence on intersections of wave barriers and tectonic faults of dissipation power-generating structures with space temporary stability of the scales in generation of products with interaction of litho- and hydrosphere are considerably different from that, which arise in stable in geodynamic relation regions and the mechanics of continuous environments can be appreciated with positions.

OGRI RAS

Hydrocarbon Reserves of Oil and Gas Reservoirs Onshore and Offshore the Caspian Sea and Their Economical Feasibility.

Aric L. Danen, N.A. Eremin

The Caspian Sea and adjacent region have become one of the main centers of activity for the world's leading oil companies. The following oil and gas basins are located onshore and/or offshore Caspian Sea; Kurinsko-Yuzhno Kaspiisky, Tersko-Kaspiisky, Severokavkazsky, Manychsky and Yuzhno-Mangyshlaksko-Ustyurtsky. These oil and gas basins cross the borders of different states like Russia, Kazakhstan, Turkmenistan, Iran and Azerbaijan. Uzen, Kurajanbus, Tengiz, Karachaganak and several other major hydrocarbon fields are already being exploited in these basins.

The area surrounding the Caspian Sea and the Caspian Sea have been researched in detailed scale and have been studied for the last four years. Different comparative simulations and history matchings were performed on these hydrocarbon basins. The legal boundary questions make it difficult for a reservoir engineer to determine acreage and conclusively estimate oil and gas reserves for each country around the Caspian Sea. In our evaluations, we divided the offshore acreage symmetrically according to the locations of the national boundaries.

The Russian part of the Caspian Sea oil and gas basins has proved and probable reserves of 14.1 billion barrels of oil including condensate and gas reserves of 42.9 trillion cubic feet. Kazakhstan has, in the aforementioned basins, 18.7 billion barrels of oil and condensates. Kazakhstan proved and probable gas reserves are 56.4 trillion cubic feet. Turkmenistan proved and probable oil reserves around the Caspian Sea are estimated 3.1 billion barrels including gas condensate. The proved and probable gas reserves are 5.2 trillion cubic feet in the same area. Kurinsko-Yuzhno Kaspiisky basin extends to Iran and holds .3 billion barrels of hydrocarbon reserves. Azerbaijan also has considerably large oil and gas reserves onshore and offshore Caspian Sea.

For future development of oil and gas reservoirs around the Caspian Sea it is very important to study the reservoir engineering problems and their analogs in Mangyshlak area (Uzen, Kurajanbus, Tengiz, Karachaganak and others), Grozny area and Azerbaijan area. Many of these reservoir engineering problems are ecological/environmental and economical: high contents of paraffins, asphaltens, sulphur in produced oil, high oil viscosities, abnormally high reservoir pressures and temperatures. This experience can help company operations to



make the best decisions on the oil and gas field development from an ecological, environmental and economical stand point. The high potential probable reserves (257 - 368 billion barrels hydrocarbons oil equivalent) onshore and offshore Caspian Sea merits extensive studies of these problems.

Azerbaijan's neighbors Russia, Iran and Turkey are pushing for routes that will take the crude across their territory. All three now have stakes in the Caspian Sea oil and gas projects. The economical feasibility of all oil and gas projects in this area will totally depend on the stable solution of the oil and gas transportation.

GANG, OGRI RAS

Geological Correlation of Stratigraphic Scales of Caspian, Black and Mediterranean Seas' Pleistocene.

P.V.Fedorov

The Pleistocene scale of Caspian, based on development fauns of endemic molluskites, always was considered local one. It is partly related and to scale Evksin. However, availability in Pleistocene section of Black sea of the horizons with Caspian and Mediterranean fauns enables direct its correlation with scale of Mediterranean and Western Europe. The long-term research of author have shown, that the main divisions Caspian Pleistocene are reliable compared with Caspian horizons of Black sea scale; the Mediterranean horizons last one with main divisions of section of Mediterranean sea. Thus Pleistocene scale of Caspian conjugate with common scale of Europe.

GIN RAS

The New Structural-Morphological Map of the Caspian Sea Bottom for Forecasts of Oil-Gas Saturation.

I.N.Stepanov, N.A.Loshakova, G.V.Voropaev, Kh.A.K.Lakhidzhani

1. The method of second derivative (relief plastic) is used for construction of new structural-morphological map of Caspian sea bottom. It enables for the first time to see the surface of bottom in kind of stream structures - delta formations of rivers inflowing to sea.

2. The delta sedimentary of Caspian bottom's geometry is two types: - triangular form is characterized for north and centre marine basin; - onion-shaped form, as the result of Amudariya activity, fills the main part of the south, most of the deep-water territory of sea.

3. Natural boundaries of deltas, even the smallest flows, are easily established on the map. It promotes to establish belonging of the geological materials, to predict the qualitative structure of accumulation zones.

4. Geometrical forms of delta formations of Caspian bottom were possible to process morphometrically and to execute forecast accounts on volumes, of forming for the long geological term, deposits of useful minerals, in particular, oil and gas with instructions of particular points and maximal concentrations in them.

5. Availability of maps of such methods to draw up territory and land whole of Caspian basin not only reduces it into uniform whole zones of formations, transit and accumulation of substances and energy (bottom - and final zone of accumulation), but also differentiates the share of participation of each particular site in common process at viable basin.

6. Mentioned map can decide the many scientifically practical questions of development and exploitation of useful minerals from the bottoms (oil, gas, stocks of insaltry waters), as well as to lead monitoring supervision with particular establishment of sources of pollution in accordance with revealing of cleanliness of flow at movement on it upwards to point of origin.

IPFS RAS, SCC "Caspian"



The Oil and Geopolitics: The Alternate Routes of Transportation of Caspian Oil to World Markets

A.L. Valesyan

The choosing of a route for Caspian oil transportation to world markets, possessing key significance for formation geopolitics "landscape" on extensive space from Balkan to Central Asia to the beginning of 19 century, has become the reason for sharp geopolitics among rivalries.

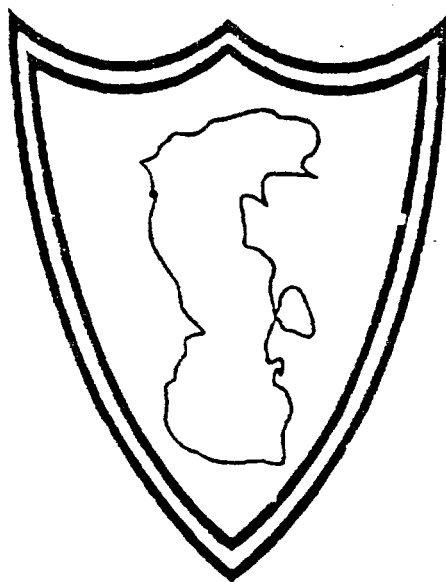
The possible routes of oil transportation are:

1. Russia - oil transfer to Chernomorsk ports of Russia;
2. Georgia - exit through Azerbaijan to Chernomorsk ports of Georgia;
3. Armenian-Turkey - through Nagorny Karabakh and Armenian to Mediterranean ports of Turkey;
4. Iran-Turkey - exit from Azerbaijan in Iran with progress on west to Mediterranean ports of Turkey;
5. Iran - progress in southern direction to Iranian ports on Persian Bay;
6. East - exit through Chinese ports to Asian markets.

Three last variants have the least chances: east - in view of the huge capital-capacity, and Iran - in view of sharp counteraction of Western countries. However, serious obstacles are present even for the most probable routes: the instability in Northern Caucasus - for Russia, problem of Chernomorsk straits - for Russia and Georgia, Karabakh and Kurds problem - for Armenia and Turkey.

The choosing and realization of final the variant are possible only as the compromise result of political "tender" in view of the interests of all interested parties, not only in economics, but also in geopolitics and strategic military plans.

"КАСПИЙ - 95"



"CASPY - 95"

**ECOLOGICAL AND ENVIRONMENTAL
PROBLEMS**



Coast Stabilization and Water Quality Under the Sea Level Variation. Main Conception and Mathematical Modeling

I.G.Kantargy, Dzh.Khsu

To solve the problem of the Caspian Sea coast stabilization under the sufficient rise of the sea water level, two problems are discussed, firstly, the strategy of the coast stabilization and shore protection by the engineering technique. And, at the second, the effect of the structures on the water exchange between formed, partial enclosed area and the sea. It's directly influence to the water quality degradation in the coastal zone.

The maximum horizontal scale of the local study coastal area is about 2-3 km, it's the maximum distance of the wave field controlling by the wave diffraction. The structures could be designed as a mean to form a stable bay beaches. Exactly, it can be connected with the morphology of the coastal area. The offshore breakwater, headlands, groynes may be applied as a shore protection structures, and the closed beaches could be built by the natural longshore sediment drift or by the renourishment. To reduce the relevant cost, the locally procurable building materials are useful. This approach is the different to the long run longshore berms, which were proposed by the official technical report, and lead to weak coastline evolution controlling.

The headland control is applying to define the regional configuration of the structures and the beaches under the maximum design sea water level. To estimate the proposed structures effect on the water quality degradation, the mathematical model of the horizontal circulation in the coastal zone is used.

The calculation examples for the local coastal areas of the Caspian Sea Russian coast are added.

MGSU, UWA

Level Regime of the Caspian Sea and a Problem of the Ecology

A.M.Butayev, S.K.Monakhov, Sh.Sh.Gasanov

The main changes in environment of coastal zone of Dagestan, occurred in the last two decades, are analyzed; reason of their occurrence and negative consequence, measure on stabilization, prevention and liquidation of these consequences, script of social and economic development of the Near-Caspian to 2005 and 2020 are given, and on the basis of it problems of ecology are determined.

Is shown, first, that modern ecological problems of the coastal zone of Dagestan (pollution of coastal waters; pollution of the rivers' mouths, channels, collectors; eutrophication of sea water; pollution of seaside territories; reduction of biological efficiency of farming lands; degradation of natural ground ecosystems and systems of life-support populated localities) in incommensurable large scales are caused by anthropogenic and technogenic effects on natural and natural-economic complexes of the Caspian basin, than the rise of the Sea level and, secondly, that non-rational economic development of the region, released during the last regression, has resulted to prevalence of negative ecological sequences of the last increase of the Sea level above positive ones.

Thereof, the realization of nonproductive measures, involved by FCP "Caspian", which has not solve problem as a whole not, can considerably aggravate ecological conditions of the coastal zone of Dagestan. In opinion of the authors, the sum of knowledge accumulated now does not permit actively to interfere in Caspian ecosystem, and therefore it is necessary: (1) to optimize management of condition of a environment within the framework of special (adaptive) mode of economic activity, established on territories, falling between marks -29.0. -25.0 m BS and in zones of influence of surges and water-rising; (2) to develop and to realize the complex of international program of the ecological monitoring of the Caspian Sea basin.

DSC RAN, DG, DSU



Balance Method of Study of Functional State of the Caspian Sea Ecosystems

A.Z.Gadzhiev, A.M.Butayev, S.K.Monakhov

From the point of view of preservation of global natural balance it is extremely important to reveal function of local ecosystems, determining their role in ecosystems of greater scale. The balance method is the most optimal for study of substance and energy exchange between local ecosystems and environment. It permits to determine allowable anthropogenic load on local ecosystems, at which they save structurally functional integrity. Nevertheless, while studying the Caspian Sea, the balance method is used basically to establish the reasons of long-term variation of the Sea level and, so far, was not practically applied to study functional condition of marine ecosystems.

During 1960-1980, after the Volga River flow regulation beginning, biological efficiency of northern part of the Caspian Sea has decreased. In this part of the Sea, the synthesis of organic substance by plankton is limited by phosphorus (phosphorus drainage in this period was less, than in the previous years). Efficiency of middle and southern parts of the Sea was simultaneously increased (here, the intensity of productive processes is determined by availability of mineral nitrogen compounds for plankton).

Based on the balance method is shown, that the increase of efficiency of middle and southern parts was caused by incoming of surplus of nitrogen compounds, formed as a result of decrease of efficiency of northern part and increase of their incoming by Volga River drainage.

The explanation of the paradox of low biological efficiency of the zone of deep water upwelling, occupying the east regions of middle part of the Caspian Sea in summer, is given in the work. It is established, that the vertical circulation here occurs within the layer impoverished by biogenic elements.

While evaluating the power balance of ecosystem of the Sea, one should account for amount of "subsidy" connected with climatic and synoptic processes influencing on vertical circulation of water and incoming of biogenic elements from accumulation zone into photosynthesis zone.

DSC RAS, DG

Water Media Condition Near the Caspian Sea Dagestan Shore under Anthropogeneous Influence

Yu. S. Sayidov, E. V. Venitsianov

The hydrological and hydro-chemical regime peculiarity of the Caspian Sea, its north-western part in particular, is determined by the flow of Volga, Terek and Sulak rivers.

Because of possible consequences of the level increasing (flood in shore areas might bring more biogeneous contamination with organic substances easy to oxidize) and anthropogeneous influence on Caspian ecologic systems, it is necessary to find out what the trends and mechanisms are of forming the water media quality as the dwelling media for biologic species.

The research works we have carried out show that: - Basic hydro-chemical indicators of the water media near Dagestan shore is following a seasonal pattern. During the period of phytoplankton massive growth, the concentration of organic phosphates diminishes to 1 - 5 micrograms per liter, silicones to 0.2 - 0.3 milligrams per liter. In autumn, concentrations of biogeneous substances increase.

- Oil products concentration in the water varies between 0.003 and 0.21 milligrams per liter and diminishes with growing distance from river mouths.

- Phenol concentration varies from 0 to 0.015 micrograms per liter and diminishes in autumn.

- Concentration of heavy metal ions in the sea water depends on supply from the rivers; the contribution of waste waters from irrigation system is neglectible and tells on the water condition only where the water is not more than 3 meters deep. A trend was noticed of heavy metal collecting in the soil of the sea bottom below the river mouths.

- In all the soil samples taken from the researched areas, polychloridebipheniles were detected. The concentrations were very low but there was wide variety of isomeres.

- Of chloride-organic pesticides, mainly DDT group substances were detected.

DSC, IWP RAS



Problems of Ecosystem Studies in the Caspian Sea

V.V.Sapozhnikov

Due to the historical development, the Caspian Sea, in the 1930yrs having been a model basin for fundamental hydrophysical and hydrochemical studies (by Shtokman and Bruevich, respectively), has no research ship equipped with a towing system at present. This prevents using modern oceanological devices like CTD "Neil Brown", AutoAnalyzer "Alpkem", etc... A correct formulae to estimate electric conductivity in salinity units has been introduced only recently. There are almost no or small evidence of biochemical studies of dissolved and particulate organic matter and its feeding value, as well as of determination of labile forms of nitrogen (urea, amino- and nucleic acids, aminosugars, etc.), of microheterotroph studies, including bacteria and protozoa, of in situ 14°C determination of primary production, etc. Even traditional estimates of zooplankton are performed with Jedy net, though, representative estimates of biomass and abundance of micro- and mesozooplankton require sampling with 150 L bottles and Jom net.

The modern equipment shall permit vertical scanning of phytopigments and estimation of chlorophyll-specific assimilation rates for each chemical and biological area. This and in situ determination of primary production could permit the development of a chart of primary production distribution and the assessment of recycling production.

During the recent 20 or 30 years the chemical composition of the Volga river discharge has considerably changed with a sharp decrease of silicon input and the prevailing part of phosphorus and nitrogen coming in organic forms. The problem of nutrient limit of primary production in summer remains unsettled.

The input of allochthonic organic matter to the Caspian Sea has increased sharply resulting in the change of microbiological chain of the ecosystem, and the influence on the higher tropic levels. We could suggest a possible further change of the ecosystem, which would be similar to the one in the Black Sea.

There is no confirmation of the possible direct localization of juvenile waters in deep water areas of the central and the south Caspian Sea, though, reliable sampling with Go-Flo bottles and the following analysis of dissolved oxygen, nitrates, nitrites and regenerated compounds of Fe, Mn, Si, and other polyvalent metals could definitely show the role of total discharge at the increase of the sea level.

VNIRO

Economic and Legal Aspects of Using of Russian Inland Waterways for the Organization of International Transportation of Cargoes from the Caspian Sea

S.Krivitsky, A.Viksne, M.Volosov

Economic and legal aspects of possibility of organization of river and sea transportation by the "river-sea" ships in the Caspian Sea and along the Volga's inland waterway are considered.

International significance of the Caspian Sea and system of developing sea ports is discussed. Substantial activation of sea shipping is to be expected in connection with construction of a new port Olja near Astrakhan and reconstruction of the ports Aktau (Kazakhstan) and Makhach-Kala (Russia). Inland waterways by which the cargoes get into the industrial regions of the White and Baltic seas and the Azov-Black Sea's basin can play an important role.

Countries of the Caspian region such as Iran, Kazakhstan, Azerbaijan, Turkmenistan show a great interest in organization of transportation by the freight "river-sea" ships in case of activation of foreign trade links with countries of Baltic and Mediterranean regions. It's shown that the most important part of program concerning use of Russian inland waterways is legal providing of transportation of foreign cargoes.

It's made a conclusion that the organization of transportation along inland waterways has an economic benefit for Russia.

A possibility of significant receipt in budget from using Russian inland waterways by foreign ships appears and that will afford the reconstruction of hydrotechnical structures and navigation equipment along the whole length of inland waterways.



Recommendations for legal providing when using the inland waterways by foreign ships are given.

"V&K", Ltd.

The Modern Conditions of Chemical and Radioactive Pollution of the Water and Sediments in the Estuarial Region of Volga River

10178

S.V.Kirianov, V.B.Lapshin, Y.S.Lukianov, P.F.Demchenko

In 1993-1994 there were held some expeditions for investigations of modern conditions of chemical and radioactive pollutions in the estuarial region of Volga river.

The main task of this work was - to obtain the information about levels of pollutions in the branches of delta and in the shallow seashore area.

The obtained data are well connected with the information about pollution of river water in the area of Verkhnee Lebyagie and sea water in the North Caspian.

It was marked that exists the zones of hypoxia in the VCC (Volga Caspian Channel) near sea board of delta and in the area of Tickovsky bank.

The main results of 1994 expedition shows that there are no any large scale influence of the anomaly high-flood on the pollution conditions in the estuarial regions.

It was noticed that concentrations of pollutions in the bottom sediments are very variable in the estuarial region. And if the average concentrations of pollutants is not high, there exist some points where the ones are extremely high. First of all that is the concentration of Ni near the Iskustvenney and Maly Gemichugny islands.

The results of radioactivity investigation shows that in the water and bottom sediments of this region there are no artificial radionuclides (in particular Cs-137), or their concentrations are neglectably small.

IO, IA RAS

Model of 3-Dimensional Currents' Dynamics and Pollution Spreading in the Caspian Sea

R.A.Ibraev

A model of currents' dynamics and spreading of passive pollutants is presented. The model is the hydrodynamical based for a comprehensive model of currents' evolution, spreading and interaction of chemical pollutants in the Caspian Sea to be developed. It will include pollutants' fluxes from sources situated on the shore, bottom and in the sea, accidental sources and their interaction.

At present the model includes:

1. Physical model
 - 3-dimension primitive equations of geophysical hydrodynamics; - equation of sea surface level evolution - advanced model of horizontal turbulent mixing
 - model of upper mixed layer and sea-atmosphere interaction
2. Model of pollution spreading
 - 3 dimension dissolvable passive pollution transport equation; - 2 dimension passive pollution transport equation on the sea surface.

Climatic currents of the Caspian Sea were reconstructed by the physical model. In the study we use mean multiyear temperature and salinity monthly data. The resolution of the grid is 20*20 km and 19 vertical levels. Detailed charts of horizontal and vertical components of flow velocity, sea surface topography is given. The circulation pattern is quite realistic and corresponds with independent studies of sea surface currents.

Presented the results of modeling of several scenarios of pollution spreading in the summer season:

- Exp.1. Forecast of dissolvable pollution spreading from permanent source
- Exp.2. Forecast of dissolvable pollution spreading from accidental output located on shelf bottom.
- Exp.3. Forecast of insoluble pollution spreading from accidental output located on the eastern and western shelf.

The experiments show the significance of taking into account of the 3 dimensional currents for successful forecast of pollution spreading in the Caspian Sea.

INM, RAS



The Methods and Preliminary Results of Accounts of Sea Level and Distribution of Impurity in the Caspian Sea

*A.S.Sarkisyan, R.A.Ibraev, N.G.Yakovlev,
V.I.Kuksa, V.S.Tuzhilkin*

The results of topography of sea level, currents and other climatic characteristics of the Caspian Sea, made on data of measurements, are submitted. As initial data, given for total model of sea dynamics, the climatic fields of temperature and saltness for August are used. The agreed, detailed mutually maps of topography of sea level, horizontal and vertical components of currents, temperature and saltness are received for the first time.

The results of simulation of several scripts of distribution of impurity are considered. Such the characteristics are designed for other 11 months.

More detailed accounts are conducted for Northern Caspian, dynamics of currents of which is sensitive to runoff of rivers and other boundary conditions. The received fields of currents permit to calculate the distribution of impurity, arriving in basin.

INM RAS, IO

Ecological Safety Standards for Marine Oil-gas Production

V.V.Anikeev, B.S.Fleishman

Ecological Safety standards (ESS) are established on the pessimistic assessment on the risk biosystem of organisms and populations death for both normal conditions and an emergency in oil and gas production complex (OGPC) operation.

The bad drilling mud influence on the marine environment and limits of safety area surrounding point source (drilling platform) were estimated.

Risk significance on an emergency in OGPC has been calculated as ratio between values of risk biosystem death in natural and disturbed marine environment.

While precisising the ecological risk significance (using expedition data and theoretical calculations) requests to OGPC reliability are decreased and scientific expenses are being compensated.

Some ESS were proposed to apply for industry exploitation of oil gas deposits on Sakhalin shelf in normal and an emergency.

IO RAS

Transboundary Context of EIA Procedure in the Caspian Region

S.C. Golubeva

The objects of human activity impacts in the Caspian region are the sea area, the air, river deltas, and the coastal zone.

The main activities of impacts are oil and pass maining and installations, thermal power stations and nuclear reactors, trading ports and terminals, agriculture.

By condition the impacts of human activity are the follow:

- pollution of the sea and coastal zone,
- pollution of the air,
- changing of the hydrological regime of the Caspian Sea.

The above listed impacts may have a transboundary context derived from the water and air circulations and the inland nature of the sea.

The transboundary context of the human impacts on the Caspian Sea and coastal zone should he taken into account on the economic activity, of every Concerned Party of the region.

Involvement, of the environmental elements into decision - making process has assumed a particular significance.

Presently in the world practice the Environmental Impact Assessment (EIA) procedure as a part of the decision-making process are used.

Legislation providing of the EIA process is based on the existing international practice, and the harmonization of EIA on the national and international levels.



Arising problems of EIA in a transboundary context in the Caspian region are complicated. To create the Caspian Sea Parties interaction plan in EIA is the first point in the program of environmental protection of the region.

Minprirody

The Influence of the Caspian Level Increasing on the Pollution of Coastal Waters

S.V.Kirianov

On the basis of data obtained by All State Observation Network in 1983-1994 prepared the assessment of the levels of pollutions in the Russian coastal waters of the Caspian Sea and in estuarial areas of Volga, Terek and Sulak rivers.

The pollution of this regions was analyzed for some groups of years with different sea levels.

The so called Index of Water Pollution (IWP) was used as integrated parameter, characterizing the conditions of pollution.

It was marked that the main pollutants for this regions are: petroleum hydrocarbons, phenols, detergents, ammonia. On the sea border of delta there periodically observed the deficit of oxygen. It was revealed that for all areas the average level of IWP is increased with increasing of sea level.

The main mechanisms of influence of increasing of sea water level on the conditions of pollutions are discussed.

Prepared the assessments of possible changes of the levels of pollutions under the increasing of sea level.

SOIFSRHEM

The Biochemical Monitoring of the North Caspian Sea Ecosystems

A.I.Agatova

The biochemical monitoring of marine ecosystems based on studies of changes of organic matter (OM) and its biochemical components, as well as its transformation rates, permits one to assess the ecosystem productivity and stability to different ecological pressing.

Our observations in the ecosystem of the North Caspian Sea during the beginning of the sea level rise (two cruises in spring and summer) permitted to determine seasonal difference in the system metabolism, as well as the influence of the Volga river discharge. The North Caspian Sea is a shallow water basin, consequently the productivity is influenced by phytobenthos. The intensity of photosynthesis of both phytoplankton and phytobenthos is minimal in May and maximal in August. This determines the amount of particulate OM with the maximum (0,5 - 1,5 mg/l) in August. In spring we observed maximal concentrations of dissolved OM (4 - 8 mg/l). In the area of the Volga discharge the concentrations of DOC and POC amount to 10 mg/l and 2 - 3 mg/l, respectively.

The river input of DOC and POC is assimilated by the marine ecosystem rather fast. The area of river and sea waters interaction is characterized by the increased activity of hydrolyzes and enzymes of oxidation and reduction processes in microplankton and microbenthos.

In spring DOM is dominated by carbohydrates, while proteins prevail in POM. In summer carbohydrates increase in DOM due to the development of microphytoplankton.

As a result of the Caspian shallow nature, sediments play a great part in the transformation of OM especially in the area of the river discharge. The biosystem of particulate material and sediments is a system of complex correlation between development and transformation of OM, which is dominated by micro-organisms.

VNIRO



Hydrogeology and Hydrochemistry of Dagestan Beach of the Caspian Sea

G.A.Akhmyetova, A.D.Gusyeynova, S.K.Monakhov

Hydrogeological and hydrochemical regime of the Dagestan coast is determined by interaction between northern and southern waters of the Caspian Sea, whereas the influence of river flow is imposed on this interaction near mouths of Terek, Sulak and Samur rivers.

The interannual variation of water salinity in the coast is in good agree with similar variation of repeatability of prevailing northern-western and southern-eastern winds. Freshening of the coastal water occurs in months, when northern-western wind prevails, whereas its salting occurs during the prevalence of southern-eastern wind. The correlation of salinity variation with wind velocity and its direction is clearly noticeable also in daily stations, however in the range of synoptic variability it decreases; this indicates formation of eddies by drift currents, as well as participation of compensatory currents in formation of solar regime of the coastal water.

By a ratio of biogenic elements in the sea water, the production of organic substance by plankton in northern part of the coast is limited by a phosphorus, whereas in southern one it is limited by nitrogen. Thus, production, as a rule, exceeds destruction, that can be explained by the increased content of the mineral forms of biogenic elements in the water being brought by rivers and by northern water of the Caspian Sea. As a consequence, the coastal water in the surface layer is well saturated by oxygen. Prevalence of destruction processes in this layer over production ones is observed in winter, as well as in summer during deep water up-welling (exacter, in the first days after its output at a surface).

Is shown, that the deep water up-welling is not always accompanied by its output at a surface. In the majority of cases, the deep water, distinguished by increased salinity and low temperature and located on depths more than 25 meters, rises up to horizon 5-10 m. The production processes are activated in the surface layer, whereas destruction ones are activated in bottom layer. The last are especially intensive in the zone of contact of thermocline with the bottom. Is offered, that the noticed mechanism of hypoxia in the bottom layer is characteristic of northern-western part of the Sea as a whole.

DG

The Balance of Strontium Isotopes in Waters and Sediments of the Caspian Sea

A.S.Batyrmurzaev, S.B.Brandt, S.Z.Gadzhiev

The isotope balances of strontium answer on questions of water's genesis, as well as regimes of meal and drainage of water. It is known, that isotope structure of primary strontium World ocean is characterized by relation $87 \text{ Sr} / 86 \text{ Sr} = 0.7093$, and in Lower Cretaceous period this size was equaled 0.7070. The core strontium, took part in tectonic-magmatic cycles, is characterized isotope factors 0,7100 and well above.

The isotope structure of strontium of waters, lakes and, especially, ocean is determined by integration till time and water balances of feeding rivers' strontium. The isotope structure of strontium in rivers and other sources is stipulated by processes of overlying from rocks, on law of displacement. The Caspian Sea is characterized isotope relation $87 \text{ Sr} / 86 \text{ Sr}$, equal 0.7103, that the some World ocean, but below such for discharging rivers into the Caspian. The water of bottom Volga's current has 0.7128, and Kura - 0.7108.

Lowered in comparison with other without drainage water (Large salt lake, USA), the isotope relation, is possible, the connection in past with world Ocean (similarly to lake Solten Si, USA) is stipulated. The isotope relations of strontium $87 / 86$ in bottom deposits of the Caspian in three various locations of testing were investigated. Salt-acid extracts and insoluble sediments were subjected to measurement. The first are characterized by relation 0.7096, and second - 0.7168.

The figures testify about opportunity of division of carbonate and terrigene phases of deposits by method of leaching and prove the absence of isotope balance in sedimentation process.

IPG DSC RAS



About Accumulation Mutagenous Chemical Substances in Bodies of Producers' Fishes of Caspian

A.R. Isuev, A.K. Askerkhanova

The ecological situation, usual in Caspian basin was reflected on physiological condition and commodity quality of main producers' fishes. Given long-term monitoring testify that among of anthropogeny factors, affecting on Caspian basin's ecosystem, chemical pollution belongs one of first locations. The investigation on revealing of accumulation in bodies sturgeon fishes and study of mutation activity of polycycle aroma hydrocarbon (PAH) and polichloration of bifenils (PCB) is conducted.

The data of experiments by mutagenous analyses of csenobiotics from liver of sturgeons' female, taking on May 1994, show, that at about 30 % studied sturgeons in liver are accumulated csenobiotics, having mutagenous activity.

From data follows, that the liver's tests of 15 sturgeons from 45 investigated had indirect mutagenous activity. Direct mutagenous activity was had the tests from liver of 9 sturgeons from 45 ones.

Thus, submitted results show, that at present in organism of producers' fishes are accumulated PAH and PCB, having direct and indirect mutagenous activity.

DSU

The Caspian Sea Benthic Ecosystem Conditions

M.G. Karpinsky

For the Caspian Sea ecosystem is natural the variability of benthos quantitative characteristics across years and seasons with relatively small biomass, that is not usual for temperate zone. Main reason of this phenomenon are two the Caspian Sea's peculiarities: the bottom community existence under very intensive grazing pressure by sturgeons and annual fluctuations of the Sea level caused changes of whole complex of surrounding factors.

For protecting from unfavorable environmental influence in isolate developed Caspian conditions were selected species were to maintain its bottom part in balance. This species are widely adaptable to different trophic conditions and environmental factors and are with high fecundity, those which can restore their biomass and abundance and those which can withstand the elimated effect. In the ecological literature such species named opportunistic species or r-strategists, are characteristic of early stages of succession and the Caspian bottom community should be termed a subclimax community with a predominance of opportunistic species.

The Faunal composition of the Caspian Sea is derived from some species belonging to the Azov -Black Seas, Mediterranean, freshwater, and Arctic complexes, its major part, about 46 % of the species, are endemic, but the total number of species in the Caspian Sea is only about 40 % as high as that in the Black Sea. In the Black Sea the variety of ecological niches is much the same as in the Caspian Sea, that indicate the potentialities of many ecological niches are far from being used completely. Beside that, the faunal composition lowering decreased the bottom community's ability for r-strategy, that showed on example of different introduced species.

In different parts of the Caspian Sea rate and character of environmental influence are different, so reaction of bottom community also os different. Studying a bottom part of ecosystem changes by influence of local environmental factors, including anthropogen factors, are the next object of investigation.

VNIRO



The Role of the "Biofilter" of the Volga Delta and Rivermouth in the Transformation of Organic Matter Discharge to the Northern Caspian Sea

M.P.Metreveli

The delta of the Volga river is a unique natural area of approximately 40,000 sq.km. The water passing through a system of canals, rivulets, small basins, muddy areas, and old channels, as well as water-meadows, couples with the filtration through thickets of higher water plants which causes a serious transformation of the water chemical composition, a development of production and destruction processes, organic sorption on particulate material with further sedimentation, etc...

High water periods are dominated by physical processes, while afterwards and in summer the role of biological processes increases.

The general qualitative and quantitative composition of organic matter transforms in the delta and rivermouth of the Volga.

The share of new primary production has been determined by the change of C:N ratio in the Volga delta and rivermouth to estimate the change of the composition of organic matter transported to the North Caspian Sea.

VNIRO

The Negative Ecological Consequences of the Caspian Sea Level Uprising

N.Mironov, N.Khaima

The Caspian sea level uprising for 2 meters from 1977 up to now have resulted in considerable charges for the worse of environmental situation: flooding and deterioration of settlements and industrial buildings (more than 200 houses only in Derbent), drainage and sewage pipes destruction, the development of ground water submersion, flooding and demolishing of beach territories, recreation and preserve zones, depression of flora and fauna.

The special environmental investigations were fulfilled in 1993 y. by PNIIS for assessment of the urbanized territories pollution, including radiation survey, heavy metals content analysis in soils, alluvium and coast deposits so as hydrochemical testing of sea, surface and ground water.

It was determined that heavy metals contents and benzo-a-pyrene concentration are as much as 2-10 and even 100 times higher than background that corresponds to the medium, high and very high contamination level.

Oil and petroleum products, heavy metals, pesticides phenols, arsenic, boron, selenium and components were determined in the sea, spring and pond water. Concentration of pollutants is as much as 60-100 times higher that this MPC for freshwater quality.

Environmental zoning in scale 1: 5000-1:10000 was produced on the base of simultaneous taking into consideration natural and technogenic factors for the next four city territories: Mahachkala, Gaspisk, Derbent, Sulack (accordingly the state of 1993 year).

PNIIS

The Conceptional Approach to the Evaluation of Reserve Potential of Bottom Natural Complexes at Sea Shoals

N.N.Mitina

It is possible to evaluate the reserve factor of natural object in regard to specific factor or the sum of factors. Therefore, we can not evaluate the object in full because the development of marking puts new problems and suggests infinite amount of required factors. The necessity to properly exploit the natural object, using complex landscapes, causes the determination of reserve potential. The following problems are to be solved in order to achieve this aim:



1. To carry out the landscape survey of the territory of water area by the complex of natural factors: lithogenic, hydroclimatic and biogenic. Due to the great map the landscapes using the quantitative methods.

2. To evaluate the ecological conditions for each of identified natural complexes - bottom or aquatic.

The quantitative methods of justification of the classification structure of bottom complexes indicate that various opponents become characteristic at diverse levels of morphological differentiation, i.e. the dominating criteria for the natural complexes of different classes are identified and substantiated in degree. The dominating component has maximum reserve potential. The environmental safety has to be considered during the working out of the component because the injury of reserve potential can result in irreversible aftereffects.

The higher ecological purity of natural object corresponds to its greater reserve potentialities. The inexhaustibility of reserve potential results in the undisturbance of environment. The reality and, therefore, the finiteness of reserve potential determine the level of environmental safety. Natural object has specific reserve potential during the period when ecologically tolerable conditions for life and health of men or the possibility of their reduction still exist.

IWP RAS

The Ecological-Topological Rows of Phytobenthos as the Indicator of Landscape-Ecological Conditions in the Caspian Sea Coastal Zone

K.M.Petrov

The original composition of the Caspian Sea submarine flora is determined by geological history, isolation from the World Ocean, and freshening. The specific marine general of red algae (*Ceramium*, *Laurencia*, *Polysiphonia*, *Dermatolithe*, and others) dominate in modern water body in spite of its brackish nature. They indicate that in Neogene the Caspian Sea was part of the united Pont-Caspian basin connected with the Mediterranean Sea and World Ocean. The isolation of the Caspian Sea caused its freshening. Only a few marine species got accustomed to it. Some of them reserved wide areal. The Caspian endemic plants *Laurencia caspica* A. Zin. et Zaberzh., *Polysiphonia caspica* Kuetz., *Dermatolithon caspicum* (Foslie) Zaberzh., *Callithamnion Kirillianum* A.Zin. et Zaberzh. developed on the base of other species. Green algae became widespread.

The characteristic feature of the Caspian Sea vegetation are the most expressed on the coast of Azerbaijan and the submarine rocks of Apsheron and Baku archipelagoes. When analyzing the spatial structure of phytobenthos, we construct the coordinative scheme, which consider the conjugated ecological-topological rows of communities. It looks like cross. *Ceramium*, *Laurencia*, and *Polysiphonia* with biomass ranging from 500 to 1500-8000 gm⁻² occupy its center (about 5 m deep story surfaces). The right, the freshening by rivers cause the development of green algae: *Enteromorpha prolifera* (O.Muell) J.Ag., *Cladofora vagabunda* Hôec, *C.serices* (Huds.)Kuetz. They replace gradually red algae and from clean thickets with biomass of 2000 to 3000 g/sq.m. To the left, the flow of sediments cause the development of *Lofosiphonia* (biomass of 3000 g/sq.m) on the rocks covered with thin layer of sand at the depth of 0.5 m. And finally, *Dermatolithon* crusts on the folds of *Mytilaster* or 1 mm fascicles of *Acrochaetium thuretii* (Bermm) Cell.et Herv. on the rocks covered with warp develop on the depth about 15 m down. Total biomass ranges from 10 to 100 g/sq.m.

The work was supported by Russian Fund for Fundamental Reserch.

SPU



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Heavy Metals and Petroleum in Ecosystem of Western Part of the Caspian Sea

O.M.Ramazanov, A.Sh.Ramazanov

The middle part of the Western Caspian Sea, adjoining to Dagestan (length of coastal line is of 500 km), plays an important role in biological efficiency of the Sea. From six rivers of the Caspian Sea, where sturgeons (*Acipenser*) are breed, three are in Dagestan.

The intensive development of resources of the Caspian Sea, is accompanied by intensification of anthropogenic load on ecosystem of the Sea. This requires duly reception of the objective information about negative effects on all elements of the ecosystem to predict the habitat and to plan the fishing and fodder base conditions.

Research results of heavy metals (HM) and petroleum (P) contents in various elements of the ecosystem of the Caspian Sea (sea water, bottoms, and hydrobionts) are submitted in present work. Heavy metals and petroleum incoming rate by wastes into a shelf zone of the Sea is calculated. Range of concentration are established, levels of distribution are determined, abnormal parts of deposition of toxic components are allocated. Is shown, that the concentration of heavy metals in all parts of ecosystem of the middle part of the Caspian Sea are comparable, that specifies absence of local zones of permanent incoming of wastes with high concentration of metals.

Heavy metals and petroleum contents in Caspian ichthyofauna are evaluated by examples of industrial fishes relating to freshwater fishes (pike-perch, bream, sazan), marine ones (goby, vobla, sprat) and passing ones (sevruga, sturgeon). Is shown, that for the majority cases, significant distinctions in the metal contents while comparing marine and passing fishes with freshwater ones, are absent, and their concentration in hydrobionts are stipulated basically by physiological factors.

The obtained results testify, that the increase of receipts of toxic components incoming, including heavy metals and petroleum, into the Caspian Sea will inevitably cause the increase of their concentration in all components of the ecosystem of the Sea, first of all in water, in suspension, and in bottoms, with their subsequent concentration in the Caspian biocenosis.

DSC RAS

On the Problem of Radioactive Pollution of Water Area of the Caspian Sea

A.Sh.Ramazanov, M.I.Akhmyedov, O.M.Ramazanov

So far in our country, as well as abroad, the problem of inevitable entrainment of radioactive elements at a surface by petroleum and thermal by-product water are practically not surveyed. For example, even for USA this problem is newest, and there is no any governmental decrees and instructions, determining how to concern to this kind of radioactive pollution, whereas petroleum-water mixture is 5-30 times more radioactive than that is allowed to be disposed by nuclear power stations.

Ignoring of this factor has already resulted to radioactive pollution of petroleum deposits, and the places of petroleum water disposal, so-called infiltration fields, have become biologically dead zones. In Dagestan there are large maintained deposits of thermal water, which, as a rule, contain increased concentration of radionuclides. This water after use without appropriate purification is disposed into the Caspian Sea, and some deposits of gushing thermal waters are located directly at the coast, therefore further inactivation can result in irreparable consequences due to radioactive pollution of the sea water.

Data of neutron-activation analysis of radionuclide content are presented by an example of petroleum by-product water of Southern-Sukhumi deposit, gamma-mapping of petroleum deposit region is performed, and is shown, that there are local sites, where the background radioactive level exceeds the standard one by 30-40 times. Total entrainment of radioactive substances by water for given deposit is evaluated.

For deactivation of the considered water, appropriate procedure is proposed, which will allow us not only to protect the water area of the Caspian Sea from further radioactive pollution, but also to execute complex use of similar waters, located on coastal zone the Sea.

DSC RAS



About Pollution of the Coastal Zone the Caspian Sea by Geothermal Mineralized Water

A.Sh.Ramazanov, O.M.Ramazanov

Geothermal water (GTW) is widely used in various branches of industry in Dagestan Republic starting in fifties. Growing production and realization of GTW require special environment-protect activities since the disposal of large amounts of GTW into the Caspian Sea results in pollution of environment.

The effect of highly mineralized GTW on pollution of coastal water of the Sea is investigated by an example of Makhachkala and Berikiya deposits of GTW. While researching general physico-chemical characteristics of waste water, attention is paid not only on the content of polluting components of the source, but also on change of their content in disposal channel and in the water of shelf zone.

The complex of hydrochemical determinations included general physical properties of water (temperature, transparency, turbidity, chromaticity, suspended particles) and chemical parameters (pH, mineralization, Corg., Norg., contents of a dissolved oxygen, ions of heavy metals, petroleum and phenols).

The performed research has shown, that GTW of above-noticed deposits by such parameters as mineralization, suspended particles, petroleum, phenols, and ions of heavy metals do not correspond to the requirements, presented to waters, disposed into fishing water object. The calculation of mean-annual entrainment of polluting substances by highly mineralized GTW has allowed us to evaluate their influence on the extent of pollution of the coastal zone of the Sea.

The results of our long-term chemical-technological researches and technological computations testify, that introduction of effective un-waste technologies, providing not only purifying of fulfilled GTW from polluting components, but also the allocation them in a kind of commodity production, will allow us to prevent further pollution of the Caspian Sea and to ensure the complex use of GTW.

DSC RAS

Natural Water Media Biological Quality Assessment for Nordic and Central Areas of the Caspian Sea

L.V. Semenyak, F. Sh.Ilzova, Yu.S.Sayidov, Yu. I.Skurlatov

During the recent years, a trend was observed in the Caspian Sea of diminishing numerical strength of the most precious fish species. Indirectly, that shows that there some unfavorable changes are going on in that area. Under these circumstances, it becomes interesting to estimate quantitatively the anthropogeneous load on pelagic environment. Living conditions of biologic species, chemical contamination levels and the ability of the Caspian Sea to purify itself are interesting too.

The worsening of natural water media quality is a complex problem because the water quality and biological fitness are determined not only by anthropogeneous contamination but also, to considerable extent, by physical, chemical and biological processes within the reservoir.

Our research works on the Caspian Sea and other reservoirs showed that photocatalytic oxidizing-restoring or free radical processes with natural hydrogen peroxide and active OH hydroxide radicals played important part for the quality and self-purifying ability of water media.

We researched the ability of the Caspian Sea water media to purify itself of organic contamination. We used, on the one hand, traditional hydro-biological and hydro-chemical indicators, and, on the other hand, kinetic indicators most adequate for the water media current condition. Contribution of Volga, Terek and Sulak rivers and their influence on self-purifying ability were assessed quantitatively. Assimilation capacity of low salinity sea water was estimated (using Kizlyar Gulf as an example) for several contaminating agents (phenoles and oil products). Forecast was made of water media contamination for the Caspian Sea north-western part with the sea level increasing.

DSC, ICP RAS



Ecologo-hydrodynamic Condition of Terek River and Junction Zone of Caspian sea

K.K.Tagirov, I.M.Saipulaev, A.Z.Gadzhiev, A.M.Butaev

The Terek river takes the central location in determination of fisheconomic value of Tersko-Caspian region of Middle Caspian. However, qualitative and quantitative changes, happening after formation New Delta, as well as wide-scale anthropogeny effect have resulted the reduction of it fisheconomic significance. Work gives the valuation of influence of ecologo-hydrochemical condition of Terek river and junction zone of Caspian region of sea.

The mineralization of Terek's water is increased from 3.6 mg/l at source to 500 mg/l to junction, and to 540 mg/l. Such tendency of water-environment salting in many is caused by increase of selection of water on economic needs and irrigation by constant growth of receipt of sewage waters; anthropogeny component of drainage of main ions in Terek for the latter 25 years has increased in 2 times.

In separate periods the contents of organic substances and biogene elements in Terek exceeds limit, that is consequence of increased quantity of nutritions substances, arriving in water-area with municipal, storm, industrial, stock-breeding and agricultural drainage waters, and serves forerunner of ecological trouble; the volume industrial and municipal drainages exceeds 10 % of river's drainage.

The important location in Terek hydroecology is took the problem of pollution by heavy metals; the contents cooper, zinc and lead exceeds of limit. Follows also to be afraid of showing of synergism by combination Cu-Zn, Cu-Zn-Cd, Cu-Zn-Ni - for it the ideal physico-chemical conditions exist nearly. In plain part of river the appreciable contribution in accumulation in water biological dangerous forms of metals introduces the secondary pollution. The definite probability of migration carried out on irrigation ground of heavy metals on tropical circuits exists.

BVU, DSC RAS

Characteristics of Surface - Active Sea Films

T.Talippova

As it is known, the concentration of biotic and organic elements in the Volga River mouth is three times higher than in other rivers of the World. They lead to the formation of thin layer of surface-active films of 0.3 mkm. The surface-active films influence on mass and gas transport through sea surface. They can be detected by remote sensing. The review of the results of the theoretical and experimental (as laboratory well as nature) investigation is presented.

The physical properties of thin (monomolecular and composite) organic films on the water surface have been studied with accent on the main mechanical characteristics: film pressure and film elasticity (Young modules). These values are responsible on the variations of the dispersive properties of gravity-capillary waves, in particular, the growth of decrement of these waves with film presence, and the appearance the second type of waves on the water surface covered by thin film - the Marangoni waves. Usually marine films are composed from some kinds of organic molecules and their specific properties as hysteresis, connection between film elasticity and concentration organic matter in subsurface microlayer and wind velocity have been observed. The mathematical model of surface film hysteresis is proposed.

The exact dispersion relations for linear waves on a fluid surface covered by a film has been obtained and calculated numerically in the wide range of viscosity and elasticity. The range of nondimensional parameters of viscosity and elasticity when the significant influence between two such modes takes place is defined. The nonlinear theory of the surfactant film effects on short wind within kinetic equation for wind wave spectrum is proposed and the results of corresponding field and laboratory tests are reported. Also the dynamics of surfactant films in the wave and current fields is studied. The properties of surface - active films in different water basin are analyzed and compared based on data obtained at different hydro- meteorological conditions. The problem of its detection and visibility by remote sensing are discussed also.

IAP



Biodiversity of the Deep-water Caspian Ostracoda

A.G. Tarasov

The investigations of the Caspian ostracods were started in 1870-ies by Czerniavsky [1882], but only in 1940 micropaleontological samples from bathyal zones were collected. The first Recent (r) and subrecent ostracods (sr) of the deep-sea area were collected by the author during the France-Russian Expedition "Mission Caspian 1994" at depths from 311 to 870 m.

In profound 10 species of the ordo PODOCOPIDA were observed. Candonidae: r+sr - *Candona* (*Candona*) (?) *schweyeri* (4 ind*m-2); Cushmaniidae: *Paracyprideis* aff. *naphhtatscholana* (16 ind*m-2); Leptocytheridae: *Leptocythere striatocostata*, sr - *Leptocythere quinquetuberculata*, *Amnicythere gracilloides**, *A. pediformis**, *Euxinocythere bacuana*; Loxoconchidae: *Loxoconcha gibboida*, *L. lepida* and *L. umbonata**. All species, except *L. umbonata* (311 m), inhabited profound zone to the border of pseudoabyssal (478 m). Deeper only empty shells and valves were observed. The absence of Recent or subrecent ostracods deeper than 500 m probably can be explained by the losses of the surfases layer of sediment during sampling and small amount of sediments which did not include living organisms.

The complete list of species includes only 3 species new (*) for this area. Probably, *A. gracilloides* was identical with extinct (*N2a-Q2h?*) *Leptocythere* (?) *verrucosa* described by Hoffmann [1966]. Other species were observed in epiprofound zones by Schornikov [1964] or in deeper waters by micropaleontologists. After re-interpretation of the data, presented by Livalent and Syleimanov [1946] and Hoffmann [1966] we should conclude that 21(26?) Recent species with wide vertical distribution occupy deep-water zones. The deep-sea complex of Recent ostracods probably includes 19(21?). 21(19) species described for Newcaspiene time were considered extinct.

AEB of IWP RAS

Geothermal Method of Providing of Ecological Cleanliness of Operation of Underground Waters in Marginal to Offshore of the Caspian Gegin

A.V. Savin

As a result of operation of Apsheron water saturation complex of Northern Dagestan in current of last 30 years, the level of underground waters in its limits was lowered on 5-10 m. The volumes of output water has made more 10 cu.km. If output water by and large has fallen in the Caspian, its level only for account of this local phenomenon was increased on 2.5 sm.

The returning of surface waters in terrestrial horizons was possible to be considered in, such case, as the measure on stabilization of sea level or, at least, as the means of draining of marginal to offshore flooding spaces (in the first place, dam sites).

For geothermal deposits the returning fulfilled fluid in bed is caused not only by ecology reasons, but it is necessary with commercial point of view. Obviously, that economically effective operation of thermal fluids can be supplied only at insignificant power-generating costs on their return filling, that is, at arrangement of refilling wells in sites of descending branches of convect's cells.

The comparison delineated by data of detailed geothermal survey of anomaly thermal flow (q) in vicinities of Makhachkala with static pressure (a), defined by test of oil and thermal wells on Middle-Miocene deposits, shows the availability steady correlation these parameters. So in sites, appropriated ascending branches of convect's cells, by a=10 atm., q=60 mV / sq.m; at a=5 atm, q=40 mV / sq.m, and in sites of descending movement of fluids, delineated on significance q less than 25 mV / sq.m follows to expect pressure, not exceeding 1-2 atm.

So, by data of geothermal survey the locations for dump can be determined of filming surface and refilling thermal waters.

IPG DSC RAS



Ecological Situation of Coastal Regions of Kalmykiya Republic in Connection with Change of the Caspian Sea Level

N.I. Borisov

The Caspian Sea is a complicated nonequilibrium dynamic natural system where interaction between general structural elements occurs: litho-, hydro- and atmosphere. Their interaction during the Holocene has formed relatively steady, uniform and integral natural object. The Caspian Sea, as the natural system, due to a feedback between structural elements, is automatically adjusting.

The retrospective analysis permits to assert, that regulating parts of the Sea are the sours Kaydak, Karakichu, Dead Kultuk and other, as well as sloping parts of the coastal plain. With beginning of instrument observations up to a middle of thirties of this century the specified regions were flooded by Caspian water and the Sea level for this time did not leave limits of marks minus 26.58-25.51.

The connection with the Caspian Sea was executed through the strait Komsomolets with marks of the bottom of minus 26.5-16.0 m. To the middle of thirties during descent of the Sea level down to marks minus 26.5 and below, the water overflowing from the Caspian Sea was stopped.

Similarly, the rise of the Sea level since 1977 will proceed so long as the level will not reach mark minus 26.0 m and the mechanism of self-regulation (type of linking to the Sea of regulating parts of the system) will not be indicated in action.

For mean-annular Sea level rise of 11.5 cm, the last will reach marks minus 26.0 m in 2001-2002. Then the Caspian Sea will be in the period of relative stabilization of the level with marks minus 26,0 + 0,7 m, without the account for seasonal changes and the surges phenomena. Mean-annular maximum level should determine the planning of measures for protection of nonproductive structures in the coastal part of the Kalmykiya Republic. From objects, to the present time already flooded and located in predicted flood zone, should distinguish some parts of the railway, objects of a animal industries, including natural pasture-lands and irrigation structures.

Arisen and predicted ecological situation is wholly connected with ignoring of natural system regime with its limiting characteristics.

SAGE No 1 GNPP "Aerogeology"

Radionuclids in Ground of Primorsk Depression of Dagestan

A.V. Davydov, A.B. Salmanov, A.M. Butaev, T.A. Miroshnichenko, A.S. Abdullaeva

The distribution of technogene and natural radionuclids has resulted to necessity of realization radiation monitoring in various regions. In this plan the definite interest presents the study of level radioactivity of pollution ground of north-western part of Caspian sea basin, where afterwards Chernobyl accident announce radioactivity sediments.

The average background contents of cesium-137 in ground of north-west part of Pre-Caspian depression makes 520 piko-curie/kg strontium - 90-134 piko-curie/kg. The contents of uranium -238 and thorium-232 in ground of Pre-Caspian depression of Dagestan is in limits clark.

However, in Nogaisk steppe ground the masses with increased levels of radiation are revealed. Veriegation of contents strontium-90 and cesium-137 in Tersko-Kumsk semi-desert ground is connected with their various sorptive and filtration ability and form of finding of radionuclids in ground.

Within the territory of Pre-Caspian depression of Dagestan the depth of penetration of cesium-137 reaches 15 sm on the horizon's profile, that testifies about high degree of vertical migration of radionuclids in soft subsand ground of given region.

DSC RAS



The Interaction and Evolution of Coastal Geosystems of Dagestan

Sh.Sh.Gasanov, S.K.Monakhov, A.M.Butaev

As main coastal Dagestan geosystems are excreted the areas of rivers Terek, Sulak and Samuk, interfluvium, formed by marine and river deposits, as well as sea's water area until outer border of quasistationary current, being western branch of cyclic water circulation in the Middle Caspian Sea

The interaction coastal geosystems, exchange of substances and energy between them is executed basically by mediator of coastal marine and ground waters. Thus the flow of pumps in coastal zone is directed on north, dissolved substances on south, and on intensity and direction substance- and energy exchange between land and sea the fluctuations of sea level influence. In particular, high-frequency (synoptic) fluctuations promote desalting ground waters and earth foliation, and low-frequency (climatic) ones cause the increase of mineralization waters and earth salting of coastal zone.

The economic development of region, taking wide-scale character in second half XX century, has changed the character of interaction coastal geosystems. On dynamics and evolution of coastal geosystems global factors (climate and economic activity in sea basin) also influence, created objective base for interest of coastal states in execution of agreed policy, exclusive any separate actions on development of resources of sea.

DSU, DH, DSC RAS

Influence of Water Surges Variations of the Caspian Sea Level on Ecological-biochemical Conditions of Soil in the Northern Dagestan Coastal Zone

A.B.Salmanov, A.Z.Gadzhiev, A.M.Butayev, K.K.Tagirov

A significant part of Northern Dagestan is periodically flooded by relatively freshening sea water due to water surges variations of the Caspian Sea level; in occasions the on-water wave is moved far into the territory on a distance up to 40 km. These surges cause the increase of feed-capacity of natural grasses and pastures, that has important significance for economy of the Republic.

Two hypotheses are put forward to explain the increase of bio-productivity of the periodically flooded regions. It is offered, that it is due to moistening of soil (N.A.Yarullina, 1983), or desalinization of it (A.Z.Gadzhiev, S.K.Monakhov, A.M.Butayev, S.A.Kasparov, 1994). Not denying importance of these factors, in given work a positive influence the surges variations of the Sea level on bio-productivity of flooded soil is explained by change of its biogeochemical structure. Some characteristic results of the research are listed in Table. Total contents of elements in soil, mg / kg.

Horizon, cm	Humus, %	Zn	Cu	Mn	Cd	Ni	Sr
Flooded region							
0 - 25	2.9	142	26	1010	0.65	180	435
25 - 50	1.4	96	18	420	0.35	143	310
Non-flooded region							
0 - 25	1.1	50	22	357	0.63	43	220
25 - 50	0.5	26	10	185	0.55	33	188

As seen from Table, soil-ground of systematically flooded region has, in comparison with non-flooded one, a thick humus layer and increased content of microelements. The content of zinc in non-flooded soil corresponds to world clark, whereas in flooded one it reaches 140 mg per kg. As is known, zinc increases drought-, heat- and salt-resistance of plants. Flooded and non-flooded soil-grounds of Northern Dagestan are characterized by copper content close to world clark. Positively influencing on water-retaining ability of plant tissue, copper improves grass crop. The content of manganese, which is the catalyst of plant breathing, in root-inhabited layer of flooded soil is 2.5 times higher than in the same layer of non-flooded soil. The higher contents of nickel and strontium in flooded soil, probably, creates favorable conditions for seed sprouting, stalk lengthening, reduction of a vegetative period.



Thus, periodic flooding by sea water positively influences on soil forming, and consequently, on bio-productivity of alluvial plains. A marine facies, apparently, determine to any degree a biogeochemical development of flooded and non-flooded soil-grounds; exfoliations of aleurite and slit, dropped out from suspension during delay of on-and-off waters, are accumulated here.

It is necessary to take into account the phenomenon of positive influence of surges variations of the Sea level on soil bio-productivity of Northern Dagestan while realizing the beach-protection activity. In particular, removal of surges by a closed dam (S.N.Kurayev, A.A.Neykovskiy, 1994) will cause serious damage to ecosystem of the coast, will lead to fast salting of soil in aeration zone, and will lead to a loss of natural pasture-lands.

DSC RAS, West-Caspian BVU

Personal for Environmental Maintenance of Caspian Region Development

A.L.Vladimirov, V.I.Gridin, L.G.Shvidchenko

Environmental maintenance in the process of developing natural resources requires a comprehensive approach to research, design, construction and exploration. Rational use of nature is hindered by the interests of individual states, regions, industries, associations, companies and enterprises. Lack of competence on the part of those executing and responsible for the whole work package under new geodynamic, environmental and economic conditions is another aggravating factor.

The Caspian region is currently enjoying a shortage of experienced personnel capable of solving a range of complicated environmental, resource conserving and economic tasks on the basis of a comprehensive approach. Specialists in concomitant (system - airspace and conventional for the rational use of natural resources, are hard to find.

It takes a long period of time to meet the needs of a certain region in qualified specialists: 5-6 years of University, 204 years of practical work and some years of mastering a package of concomitant jobs.

Specialized departments for upgrading and retraining personnel can help solve the problem. Gubkin State Academy of Oil and Gas has designed training complexes, which consist of curricular, programs and text-books, and starting 1982/83 academic year has been retraining specialists and upgrading executives in related (underground - surface - airspace) monitoring and system-air-space methods of the rational use of natural resources. The rich experience obtained in the course of retraining personnel in new techniques suggests that more and more specialists should be disposed to the comprehensive approach and that learners should be grouped and taught with respect for their specific regional needs.

To train personnel for the environmental maintenance of Caspian region development Gubkin Academy offers a variety of new forms of training: comprehensive retraining of specialists for a second degree; upgrading of executives, specialized training of operators for surface, air (helicopter and plane) visual examination and observation with the help of instruments, as well as PC operators for related comprehensive information processing; training of students in methods of related monitoring for the RE, the CIS and oversee countries; if required - training of astronauts.

The curricula used are unique. The following features characterize the educational process: The comprehensive curricula provide for priority teaching of new subjects incorporating various directions of work insufficiently reflected in existing courses. The main focus is placed on geodynamic and physico-geological aspects of natural resources development, airspace methods of collecting information, systematic methodology of concomitant processing of conventional and system - airspace data, landscape indicators and signs of decoding the studied objects.

The results of work presented by the students at the end of each course are also comprehensive. The students are encouraged to design steps of related maps and materials for remote probing as an information basis for decision - making in investment, design and management policies. Programs for related real-time monitoring for emergency situations are also developed by the students. Gubkin Academy introduced flexible training plans making it possible to tailor the content of a course to specific regional needs. Students process the data obtained from different regions and contractors, study the problems relevant for different parts of the country.



The comprehensive and regional approach is also of great importance in the process of grouping students so as to create efficient teams of learners incorporating professional workers from various branches of economy and representing both state and private sectors as well as executives and managers. Both individual and team training enables students not only to upgrade their knowledge but also allows them to work in team of specialists capable of solving complex tasks of obtaining and processing up system - airspace, surface and underground derived data employing a common technique.

The combination of training with practical system - airspace work makes learning faster and more effective. The students final reports are at the same time accounts of their practical work.

This approach to training yields both a team of specialists ready for work in a certain region and a package of related information materials and programs for related real time and emergency monitoring.

GANG, OGRI RAS

Environmental Problems Caused by Radioactivity and Their Regulation in the Republic of Kazakhstan

Linda Lehman

10184

There are numerous radiological and environmental problems in Kazakhstan which result from man-made or natural radioactivity. In the Caspian Region, near the town of Oktau, exists an older Soviet-designed breeder reactor type BN-350. This reactor has no containment, by western standards, and its spent nuclear fuel is currently being stored on site in storage pools. Its decommissioning is planned for the year 2005. Since power is vital to the region, unless replacement energy sources are found this reactor will no doubt continue to operate.

Another potential radio-ecological problem exists in the former nuclear test area called Azgir which is near to the Caspian Sea region in western Kazakhstan. In Azgir, eleven underground nuclear blasts were conducted in salt domes. These blasts created underground cavities which could be used for the storage of petroleum. At most of these sites surface contamination exists, being brought to the surface via drilling equipment.

In at least one of these blast cavities, oil has been stored which is now contaminated in excess of standards. Further, oil and drilling equipment which has been contaminated by natural radiation in the region is also a problem. These problems are currently being addressed by the regulatory authorities as well as what to do with oil which contains radiation at levels above the safety standards.

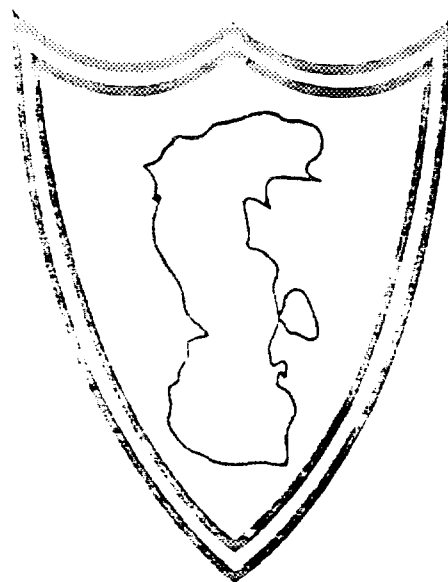
Regulation of radio-ecological problems such as those mentioned above is accomplished primarily through three state authorities. These authorities are:

- The Atomic Energy Agency of the Republic of Kazakhstan
- The Ministry of Health of the Republic of Kazakhstan
- The Ministry of Ecology and Biological Resources

The system of regulation and control follows the same plan as that used in Russia. State Environmental Reviews follow the same process as those outlined by Minpriroda of Russia.

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COMPLEX MONITORING AND
ENGINEERING COASTAL PROTECTION



Conjugate (Underground, Surface and Aerospace) Monitoring Security of Ecologically Safe Caspian Region

V.I.Gridin, A.N.Dmitrievsky, G.V. Zlotnikova

The main reasons of the complicated ecological situation, and in someplace critical, in the Caspian region are theoretical mistakes and with non-representative base of nature using methods, lack of international and interdepartmental ecological and informational security system, irregular monitoring of natural resources and technical objects. It is necessary to reorganize natural resource saving works and, first of all, to set up united regional conjugate (underground, surface and aerospace) monitoring system.

The security of scientific reorganization consists of: conception of influence of physical field systems on reformation of natural and technical objects, system methods and main points of minimally necessary complex of ecological and information works, suggestions for setting up the united system of conjugate monitoring (including state, region and object subsystems), methods for adoption of conjugate information, engineering and managing complex decisions, systematical organization, methods and technology of conjugate (underground, surface and aerospace) real time scale monitoring and critical situation monitoring, suggestion for staff accompaniment of new technology and methods introduction.

These points were tested in practice from 1991-94 in the Orenburg area and also at the Astrakhan, Karachaganak, Zhanazhol and Tengiz oil and gas fields.

Experience of applying of new methods to practice allows us to recommend the following scheme to set-up the Caspian region conjugate monitoring in the best way possible. The first step is to organize the territorial conjugate monitoring centers' system. They unite state, territorial authorities and companies in an effort to ecologically improve, from a health point of view, and ecologically save natural resources through development efforts. Their main tasks are: to inventory natural and technical objects by means of retrospective monitoring methods, to develop conjugate thematic maps and special distance investigation materials complexes as an ecological and information base for adoption of investment, engineering and managing decisions, to develop and test conjugate real time scale monitoring programs and critical situation monitoring, to provide using work complex of representative and completely natural resources and ecological information.

System organization of minimum necessary informational work complex and inter-department character of its carrying out will assistance to its effective using to security ecological balanced natural resource development.

OGRI RAS, State Duma

Evaluation of State and Change of Ecosystems of Near-Caspian Regions Using Satellite Data on the Basis of Computer Maps

A.S.Viktorov, Yu.A.Plotnikov

On the basis of complex data of space surveys, valuation of condition and dynamics of the Caspian Lowness regions were studied, which evolutionized under complex influence of Caspian Sea level descent replaced by its rise. To solve the problem, satellite pictures in ranges 515-561 nm, 635-690 nm of scale 1:500000, those in near-IR range of scale 1:500000, and spectrum-zonal color satellite pictures of scale 1:250000 (selected) were used. During interpretation, two data files of different time of survey were involved, 1977 correspond to the Sea level descend phase, and 1992 correspond the Sea level rise phase. Decoding was conducted with use of indicator attributes and computer processing of the images.

The environment condition computer maps for 1977 and 1992 for the huge territory, located between Volga and Ural rivers, and Ural river delta, have been made as a result of the work. Analyzing these maps, one can determine the general tendencies of environment, established by air-space surveys:

- Fastening of sand plains with reduction of the areas of broken sand, which can result in reduction of fresh-water under-sand lenses, being the main sources of distribution of water-supply in the region;
- Formation in all region new extensive reed thickets, accompanying by all coast;
- Local formation of near-channel lenses close to irrigation systems with occurrence of closed freatophyt plants.



These maps permit to evaluate not only condition of easy observable components of a landscape, but on the basis of indicator methods to evaluate difficult observable components as well: depths of location and mineralization of ground water, salting of soil-ground. The maps can form the basis for formation of regional geoinformational system.

NGC RAS

Neka Thermal Power Plant. The Problem and the Solution

H.Zakeri

Neka TPP located in the south-east Coastline of the Caspian sea, was designed for production of 4,440 MW of electricity power. The power plant started its operation in 1977.

Contemporary the sea level started to rise with an average of about 15 cm/year for the last 18 years.

Eversince the power plant has been facing the problem of its cooling water filtration system getting clogged by debris found in huge amount in the sea water.

These debris are mostly terrestrial materials with different sizes ranging from tiny hair roots and moss to pelces of wood and long glass leaves.

The problem was solved by changing the cooling water intake basin geometry without forced to raise the filtration capacity.

WRC

Gabion Structures in Coastal Protection Works

M.Charla, K.I.Shevcshenko

Among the various problems that have to be confronted today regarding the process of degradation of the land we live on, particular importance is being given to the "protection of beaches and coasts against marine erosion".

The causes of this phenomenon are varied and complicated, natural and man-made. The natural causes are geographical, astronomical, hydrodynamic, climatological and geological factors, to which subsidence and sea level rising must often be added. Among the causes brought about man, are reclamation projects, the river training works, the indiscriminate exhaustion of ground water, the extraction of gas from subterraneous fields, the continuous extraction of sand and gravel of riverbeds, the destruction of dune barriers, and the creation of marinas and other coastal projects.

The phenomenon of shoreline recession due to erosion was not a particular problem in the past, but in recent years it has become important particularly because of the growing demands of tourism, residential considerations and industrial development.

With the above exposition we wish to underline not so much the need for the construction of works which either did not exist in earlier times, or were very limited. Rather, we wish to point out the concept that to operate today in a land subjected to rapid development and subject to threatening problems of hydro-geological imbalance, requires the use of techniques which need to be completely updated. These techniques must take many factors into account and for that reason need to use materials and structures with different characteristics so that problems can be met on a one to the basis and in the best way.

Among these techniques it is now desirable to present and discuss a type of "flexible structure" which is often used all over the world in the field of civil engineering for the construction of erosion control projects, and has also been adopted for coastal protection works against marine erosion.

This refers to projects using gabions and Reno mattresses made of a double-twisted hexagonal mesh of annealed mild steel wire (galvanized or galvanized and PVC costed) filled with stones varying in size from 120 to 300 mm for the gabions and 70 to 120 mm for the Reno mattresses. In fact, structures using galvanized gabions, known and used since the beginning of the Century, are now widely used all over the world in river training and protection works, in soil conservation, in consolidation of road and railroad beds, in the lining of dams and canals, and in coastal protection projects. It does not seem necessary to dwell further on the characteristics of this type of structure; we merely wish to recall that in the specific area of coastal protecting structures, the utilization of galvanized and PVC coated gabions has been equally successful for more than thirty years, not only thanks to their flexibility and permeability, but also, and specifically, to the characteristics of the special PVC sleeve which effectively resists both corrosion from marine environment



and water polluted by industrial wastes which could otherwise corrode the heavy galvanization of traditional gabions.

The success and diffusion of this structure is due also to its low cost, which comes from the great simplicity of installation, the use of fill material found at the site, the utilization of local unskilled labor force and its reliability. These are motives that cause them to be used at present, not only in developing countries but also in highly industrialized countries.

In many cases these structures are consolidated and/or sealed with sand asphalt mastic which gives them great mechanical resistance to the force of waves and at the same time enables them to retain their fundamental characteristic of flexibility.

Officine Maccaferri has got a big experience in the construction of gabion protection structures on coastal line in Italy (Calabria and Puglia), the U.S.A. (California), Denmark (Romo Dam), Saudi Arabia (Al Jubail) etc. In 1993 the company has carried out two projects for the protection of the coast in two localities of the Caspian Sea, in the republic of Dagestan.

Officine Maccaferri

Ground Water Submersion Towns on the Seaside of the Caspian Sea

E. Dzektser

The current long-term rise of the Caspian sea level brought to the increase of ground water in towns, the consequence of the rise is the occurrence of the catastrophic environmental situation on the urbanized territories of the coast.

Except of that, in developed areas, inflow components of water balance exceed outflow components due to drastic and stable changes in natural hydrogeological conditions, appearance of new sources of ground water recharge and disturbances in ground water discharge. ground water levels rise or a new technogenic aquifer is formed that resulted in submersion of urban areas on an unprecedented scale in recent years.

In connection with the poor stochastic forecasting of geophysical processes it is necessary to have compiled analysis of probable conformities of sea level vibration and filtration dynamic changes of underground waters e.g. new in approach to forecasting the underground water regime as a substantiation of drainage system design.

The probability-deterministic method is suggested allowing determination of the probability (risk) of achieving extreme values by ground water levels.

The engineering protection system for minimizing the hydrogeological hazard a fashioning and acceptable risk of use and development of the coastal territories is considered as an adaptation management system.

PNIIS

Numerical Modeling of Erosion Processes in Mouth Region of the Sulak River and in the Coastal Zone of the Caspian Sea, and Engineering Applications

A.V. Magomedova, M.K. Gadzhiyev, B.D. Tagirov, A.G. Otzokov

Multicentury experience in economic of the Seaside Dagestan people in permanently varying conditions of transgression and regression periods of the Caspian Sea, modern socio-economic and ecological factors, as well as analysis of work of various shore-protect structures at the Caspian coast, results in a conclusion about necessity of transition in strategy of the shore-protect, based on the adaptive form of management by litho-dynamical processes in coastal zone of the Sea, ensuring catalization of the self-protective tendencies of a coastal dynamic system.

The scientific substantiation of specified strategy should be based on hydro-litho-monitoring of coastal zone of the Sea and numerical modeling proceeding of its erosion processes.

Proceeding from modern representations about stochastic character of processes of interaction between waves and river-bed flows with bottoms and alluvium, using the theory of rejections of stochastic processes, Sen-Venan's equations, and the theory of small amplitude waves, the mathematical models of river-bed and coast erosion of multi-granules



disconnected grounds and transport of alluvium by river-bed and along-shore wave currents have been developed, ensuring account for the main determining factors.

Based on these models, computer simulation of erosion processes in the mouth part of Sulak river, connected with the rise of the Sea level, and of along-shore transport of alluvium is executed.

The results of simulation of erosion processes in the mouth part of Sulak river are used as a basis for the now realized project on prime measures of the Glavsulak settlement engineering protection from flooding due to sea and river water rise. Results of along-shore alluvium transport simulation in the region Makhachkala - Sulak, confirmed by natural research data, indicate a sufficient capacity of a alluvium flow (more than 500 thousand ton per year) for maintenance and formation of natural and artificial beaches, as well as realization of other measures on adaptive management by coastal processes.

DPI, RSNPO "Dagestan shore protection"

Forecast of Change of Engineer-geological Conditions of a Territory of Kaspiysk City

Z.V.Kulikov

Forecast of change of engineer-geological conditions of Kaspiysk city due to rise of the Sea level up to marks -25.7 ...-24.8 m in the period up to 2000-2005 was performed in PNIIS while development of the feasibility report "Caspian". Since 1977 coastal line in the region of Kaspiysk city constantly recedes with velocity from 6.0 up to 4-8 meter per year. Width of the flooded zone from 1977 to 1993 has increased up to 20-30 m in the city limits, and up to 130 m near the northern breakwater. The rise of the Sea level is accompanied by intensive washout of the beach and abrasive ledge. Now the coastal line has suited to mark of -25 m. The most actively are washed-out slopes having steepness more than 10-15 degrees, where intensity of the abrasion reaches 3.7-5.7 meter per year for 1 linear meter of shore for period 1983-1993. Sloping shore with the steepness 4-7 degrees are washed-out less intensively (0.6-1.3 meter per year for 1 linear meter of a shore). In the city limits by 1993 the beach was not practically saved, part of the quay is destroyed. Beach-protected structures (type of cement girdle), construction of which began in 1990 and proceeds till now, default function.

Washout of the coastal territory was suspended, but washout of the bottom became more intensive. Besides abrasion became active to the north of the girdle. In the zone of predicted effects of abrasion and submerging there was recreational, industrial and communal-warehouse territory, heat power plants (being by main source of power supply of Kaspiysk city, Makhachkala city and contiguous regions), numerous hotels and campings. In the city limits as a result of abrasion will be increased depth of the submarine sloop in condition of clear deficit of along-shore alluvium.

Flooding of territory for predicted rise of the Sea level will have a velocity 20-25 meter per year behind the southern waterbreak, 1-3.5 meter per year - in the city limits, 9-15 meter per year - in the region between Turali-2 and hotel "Chaika", 0.6 meter per year - in the cape Kilechnyy will occur with velocity 20-25 meter per year. For the southern waterbreak the Sea will incorporate with lagoon, forming a-bay of about 0,7 km width.

At present about 90% of the city area is affected by the submerging. According to forecast computation, performed by VNI VODGEO, by 2000, owing to rise of a level of the sea, all urban territory will be submerged, except for banks and part of the quay to the south from cinema "Moscow".

PNIIS



Synthetic Effects and Consequences of Rise of the Caspian Sea Level

A.L.Ragozin

Besides the flooding of huge territories, the rise of the Caspian Sea level (at 229 cm in 1994) has caused development of a number of negative synergistic chain processes. The total effect of their action on nature, economy, and population of coastal regions begins to be displayed just now, but for separate elements of the system it has considerably exceeded a sum of their individual effects, observed earlier.

A characteristic example of synergism of the first level is wind-wave water rise in the Kalmykia and Dagestan coasts, occurred in March 1995 and having severity about 4%. It has resulted in significant material losses (and even in wreck of the people), which are comparable to total losses in all years of level rise.

Such damage caused by the phenomenon which is very usual for northern-western coast became possible only after creation of certain conditions by a chain of following synergistic processes: level rise, flooding and submerging of region, strengthening of wind-wave power effect at the coast, activation of abrasive destruction of surface and submarine parts of slopes, increase of depths of penetration overland and repeatability of surges.

Intensification of seismic activity in many parts of cities Makhachkala, Derbent and other settlements caused by the submerging can lead to the more disastrous consequences in a near future. Not less dangerous synergistic effects are connected with affluent by the Sea surface of river flows and increase of accumulation of material in mouth parts of large rivers; this effects already have created the conditions for disastrous outbreaks of Terek and Sulak river beds, as well as essentially complicated condition of navigation in the Volga River delta.

Processes of salting of submerged farming lands, salting and pollution of underground waters, entertainment into the Sea of petroleum and various toxic substances, including water from destroyed waste collectors, have synergistic, with each year amplifying, character. Assimilated by benthos and fishes, these substances by the trophic circuit (or by drinking water) come back to the person, that results in an increase of sick and death rate of the population. Is not excluded, that just this mechanism of the outbreak of cholera was in Dagestan in summer and autumn 1994. All these negative synergistic processes and the effects result, as a whole, deterioration of conditions of residing, health and well-being of the population, make unstable rather difficult economic and socio-political conditions in the Near-Caspian region.

Besides mutual amplifying of effects, temporal delay of the process manifestation in comparison with initiating effects and/or conditions, as well as inertia in their development are the distinctive features (general laws) of synergistic natural events. The delay is the most brightly marked by the formation of disastrous processes of rare repeatability - surges, earthquakes and other similar dangers. The inertia appears as continuation of development of processes after easing or termination of the initiating factors action. Obviously, the specified laws are characteristic not only for natural, but also for all synergistically connected with them technogenic, socio-economic and other processes. Hence the stabilization or even the recession of the Caspian Sea level will not cause the immediate termination of the losses.

In the created situation of negative consequence of the Sea level rise, including connected with increased probability of development damage-forming surges, earthquakes, abrasive washout of coast, will have an effect (due to the inertia) several decades. The last conclusion superfluous time confirms necessity of urgent realization of measures on engineering protection of the most vulnerable parts of the coast (first of all cities and other settlements) independently of further course of the Sea level.

PNIIS



History and Essential Problems of Engineering Protection of Russian Coast of the Caspian Sea

A.L.Ragozin, Yu.S.Grebnev, V.A.Pyrchenko

The question on necessity of the Caspian Sea coast protection was for the first time delivered by the State Building Comity of Russia in the beginning of eighties, when the level of the Sea has risen as whole by 0.5-1 m, i.e. it was 1.3-1.8 m below modern level. The scheme of protection of the Dagestan coast, as well as feasibility report of cities Derbent and Kaspiysk protection was developed in 1984. The first (and still unique) shore-strengthening construction of active type is began to be build in Derbent in 1989-1987, which is up to now uncompleted.

But this construction, even in insignificant kind, until recently executed protective functions in the 300-m part of the coast, transforming due to activation of edge washouts to cape-like ledge, subject to by the heaviest wind-wave power effects. The decree of the President of Russia and two decrees of Government of Russia on protection of whole the coasts were accepted in 1991-1995. Feasibility reports of urgent measures, as well as projects of protection of the most developed and vulnerable sites of the coast with total length about 34 km, are developed. Set of meetings, conferences and examinations was conducted.

At last, building of passive transient protective structures was begun in the emergency order, which were considerably destroyed during one (not strongest) water rise in March 1995. As a result, practically none effectively working capital protective structure at total Russian coast was created for 18-year rise of the Sea level, whereas already existing temporary protective structures require urgent restoration. For today, more than 400 thousand hectares of the most valuable coastal territories are flooded. Hundreds of individual residential houses, tens kilometers of railway and roads, lines of power transmittance, as well as numerous other objects of the infrastructure are destroyed. Only direct damage in the years of the Sea rise was more than \$5.5 billion and continues to grow exponentially.

This negative tendency was clearly displayed a last 2-3 years, that permits to talk about the creation at the Russian coast of the qualitatively new situation, at which even after the termination of the Sea level rise the socio-economic losses will grow for some time, and then very slowly reduce due to the inertia and the synergistic effect of mutual amplifying of water-rise, washout, earthquakes and other damage-forming processes.

On realization of the problem and the reduction of consequences of the Sea level rise in past years (i.e. at sufficient and steady financing, sharp determination of priorities and responsibility, as well as monitoring of a situation) such sum was enough for creation, for example, reliable protection of whole Derbent or Kaspiysk cities. But the analysis of acting subjective and objective factors manifests, that such administrative scheme will be hardly probable realized in the near future even in case of the statement of the Federal Program "Caspy".

More probable is further intensifying of the situation up to critical, when it will be impossible to notify, but it will be necessary to liquidate consequences of the programmed act of nature. As is known, more efforts and the means will be required considerably for this situation. Only realizing of the specified factor by the all experts, people and management of the State will make possible to change the existing situation of business with creation of protection and will cause gradual reduction of losses from rise of the Sea level at the Caspian coast of Russia.

The real help in the decision of the problem can be rendered (provided corresponding organizational efforts) by international organizations, banks and separate Near-Caspy states, interested as in stabilization of a situation in Near-Caspy region, as in improvement of modern technologies of protection of the coasts in extreme conditions, which with maximal similarity simulates probable hereafter disastrous consequence of climate warming and level rise of the World Ocean.

PNIIIS



Aircraft Ground-onboard Complex of Integrated Monitoring of Environment

*G.I. Dzhangayev, V.L. Filippov,
B.G. Gurskiy, Yu.M. Chudnyy*

The instrument-making enterprises of the former Military-Industry Complex (MIC) dispose the sufficient hardware and technical started projects for creation of an air complex integrated monitoring of environment.

At present the enterprises, being participants of a Commission of the Russian Academy of Sciences on conversion, initiatively develop the aircraft ground-onboard complex of ecological and geophysical mapping (AGBCEM) and solve the problems of investigation and operative control of conditions in zones of natural and technogenic disasters. In the basis of its construction are fixed:

- Concept of ecological mapping the State Center "Nature";
- Concept IFZ RAN about modern geodynamic activity;
- Concept IPNG RAN about prevailing effect of a system of geophysical fields on all processes occurring in litho-, hydro-, atmo-, and biosphere.

Geodynamic mapping is used as the bases for ecological one. The AGBCEM is created on base of existing developments and those in process, and will unite:

1. Onboard complex of the control of atmosphere and Earth surface in optical, IR and radiowaves ranges.
2. Ground mobile stations of quality control of atmosphere, soil, surface and underground waters, condition of the Earth crust.
3. Ground complex of physico-geological modeling of environment and formations of ecological maps.

As a whole the AGBCEM will provide data gathering, processing and issue concerning ecological and geophysical condition of the area up to 250 thousand of square kilometers with a month interval of updating.

Stages, main problems, and, in particular, the problem of its technological parameters, are analyzed in the work.

AO RPKB, GIPO, CNIAG LII

Helicopter Laboratory for Integrated Monitoring of Environment

V.L. Filippov

A experimental sample of flying laboratory (FL) of various application has been created in 1993 by the experts of NPO GIPO KNPP "Helicopters MI "KVPO (the Kazan' city) on the basis of a helicopter MI-8 MTV.

The equipment of the FL represents a device complex that is a many-sensor system for remote sounding of state of atmosphere and underlying surfaces, including, fragments of land, water basins, plants, industrial structures and various anthropogenic objects for the purpose of valuation of their condition on the basis of the analysis of results of measurements in real time-scale, as well as of the subsequent detailed processing of digital information files, connected with variation of determining elements of the space of the optical characteristics.

A base system of sensors includes:

- remote laser spectrometer (range of wavelengths is UV and visible), constructed on the fluorescent principle of reception of information signals,
- spectrozonal equipment (0,4-0,7 mm), - the IR scanner (2-14 mm),
- equipment for the control of radioactive pollution.

The primary data processing can be carried out onboard accounting for indications of the system of the flight parameters gathering.

The tests of the flying laboratory were completed under the program of Ministry of Ecology of RF in 1993 with the subsequent demonstration of development on "Mosaviashow-93" and demonstrated that the created complex with certainly necessary methodical adaptation permits to solve a wide circle of problems of special purpose, and for interests of various branches of the national economy.

The developers of the FL consider economically effective and high resulting application of the flying laboratory for scientific or control study of regions of 10-100 square



kilometers area., i.e. comparable with city size, and are ready to execute the agreed programs of work, and to execute delivery samples of the FL in necessary complete set.

NPO GIPO

Possibilities to Study Geotectonics and Ecological Conditions of Regions Using Complex Aero-methods

V.M.Kertsman

1. Complex aerocological and aerogeophysical researches performed in the GNPP "Aerogeofizika" in the FSU.

2. The GNPP "Aerogeofizika" has experience, which is unique in world practice, in realization of complex aerogeophysical of researches. It also has packages of the specialized codes for processing and interpretation of received data.

More than five million of square kilometers of area is removed in the FSU. These are regions polluted as a result of Chernobyl failure, due to activity of the enterprises: "Mayak" (Chelyabinsk-65), Arzamas-16, Krasnoyarsk-26, Nuclear Power Plants: Beloyarskaya, Rovenskaya, Khmel'nitskaya, Novo-Voronezhskaya; shooting-ranges: Novaya Zemlya, Semipolatsk.

3. Complex of a equipment, set at an aircraft, includes:

A. Aero-gamma-spectrometer with polycrin detectors $\alpha(Tl)$ with volume of 50 L with energy resolution for line 662 keV - 8% and 512-1024-channel spectrum-analyzer of gamma-radiation are used with the purposes of radioactive monitoring and geological mapping.

B. Superprecision (0.001 nT) quantum aeromagnetometer Is-2, used for mapping of structures perspective for oil and gas, as well as for lithological and tectonic mapping of upper layer of alluvium.

C. Two-channel thermovisor with changes near 3-5 mm and distant 8-12 mm a range with digital registration of a thermal field and reception of the visual image in a real time on a computer monitor, with the temperature resolution 0.2 degree, used for the effective control of distribution of petroleum pollution in a water-area.

D. The cassette universal aerosol collector (KUSA-1) selects samples of atmospheric aerosol from S to P.

Correlation optical spectrometer intended for determination in free atmosphere of spectral bands dioxide of nitrogen (NO₂) and sulfur (SO₂) at the trace below a flyby. To determine the pollution in a human breath zone are applied:

E. Satellite navigating system TNL-1000 with accuracy of binding of 5-10 m.

F. All survey data are registered during a flyby by personal computer PC-486 with registration rate from 0.1 s, are processed immediately after the day of flyby.

GNPP "Aerogeofizika"

High-sensitivity Optico-electronic Immuno- and Chemical Sensors on the Basis of the Lengmour-Blauggett Technology

V.V.Savranskiy

The bases on creation of manufacture immuno- and chemical sensors on the basis of technology protein and organic Lengmour-Blauggett monolayers and optico-electronic methods of registration are developed. Sensors have sensitivity about $10^{(-11)}$ mol per liter and can work in gas and liquid environment. Some modifications of the device are possible: from simple individual ones, working by a principle "yes-no" (for one and two pollutants) up to complex ones determining several components of chemical and biological pollutants. Independent devices in the combination with fiber lightguide can be developed for marine and field applications.

Some methods of optical registration of signals by sensors are investigated and tested. The most perspective and having record sensitivity is the method on the basis of effect of a surface plasma resonance.

The sensitivity of such method, measured in experiments, permits to register a signal from one monolayer of tested chemical substance or biological molecules, selectively reacted with a specially prepared surface of registration, that corresponds to concentration 10^9 - 10^{11} determined molecules in cubic centimeter and by some orders



exceeds sensitivity of existing sensors. The method is fulfilled at the laboratory prototype for registration of mercury atoms, as well as for determination of reaction antigen-antibody.

The more developed variant of the sensor permits to register the spectrum of combined scattering from one monolayer of registered pollutants, and using it is possible to identify pollutants similarly to usual technique of combined scattering, but with sensitivity of three and five orders higher.

IOF RAS

Mobile Center for Processing of Observation Data and Formations of Output Mapping Information

Yu.K. Veresnikov, B.G. Gurskiy, V.A. Pavel'yev

One of urgent modern problem is to develop the methods and means, ensuring the comprehensive control of environment conditions, forecasting of opportunity of emergencies, connected both with natural processes and people vital activities.

In this problem one of the most important elements is that, connected with operative gathering, processing and issue of all necessary information for a wide range of users. The main characteristic of developing complex is its mobility, possibility of location immediately near objects or regions of observation or control.

Developing mobile complex of ecological monitoring provides processing, storage, and issue of the information about distribution of various observable parameters (pollution, water line, fires and etc.) in the controllable region.

Data gathering, received practically by all channels (from telephone up to satellite) is provided in the complex.

The structure of the mobile complex also contains equipment of processing of the cartographical and accompanying information, enabling:

- to digitize topographic maps and pictures from the transparent and opaque basis at the sizes of a carrier 420x460 mm;
- to update the topographic basis using picture with issue of the cartographic information in a uniform system of coordinates of 1942;
- to put on the topographic basis any operative data of observation and control;
- to give the every possible accompanying information.

The mobile complex is placed in the universal truck on the basis of a wheel chassis of a type KAMAZ-4310, ensuring motion along all kinds of roads as well as for lack of road. Temperature range of environment may be -40 - + 50.

The created mobile complex provides practically all targets of ecological monitoring, as well as of prevention or action in conditions of extreme situations.

CNIIAIG

Long-term Changes in Surface Reflectance during Desertification - the Kalmykian Black Lands Aerospace Dynamic Experiment

B. V. Vinogradov

In the frame of the Russian part of the international Geosphere-Biosphere Programme "Global Change" we studied the regional long-term dynamics of land ecosystems and reflectance trends. They have a casual effect on mesoscale climatic changes. These long-term aerospace and ecological researches reveal an experimental effect of land degradation on change in land surface reflectivity within the representative space-time dimension. During this experiment the long-term change in spectral reflectance was monitored over 1954-1994 in the subdesert sand Black Lands Test Area on area of 80,000 sq.km. Comparison of sequential multi-time aerial and space measurements in the visible revealed an exponential increase of integral reflectance of the test area from 0.143 in 1954 to 0.261 in 1984 caused by land degradation. These remotely sensed reflectance changes had some unfavorable consequences in the course of desertification. They led to formation there the zone of ecological disaster. Further experiments revealed slight melioration of ecological situation at the beginning 1990's and small decrease of integral reflectivity.



For determination of critical levels of land degradation we described the desertification trend as an equation of growth of area of mobil sands (Y) during time of experiment 1954-1994 (X)

$$(X) = a_1 / (1 + \beta \exp(-(\alpha + \beta X + \gamma X^2))) + a_0$$

The derivatives of this equation mark the ecological critical points: in 1954 - ecological norm, in 1974-1975 - ecological risk, in 1980-1981 - ecological crisis and in 1986-1987 - ecological disaster.

The sequence (ti) of long-term change in integral reflectance value (Ri) of Black Lands Test Area in the orange-red spectral band j 0.6-0.7 mcm is derived from weighted mean area of ecological reflectance classes (S1 - fixed sands with specified reflectance value R1=0.2 S2 - middle degraded sands with R2=0.17, S3- heavy degraded sands with R3=0.22, S4- very heavy degraded sands with R1- 0.28.

ti	S1	S2	S3	S4	Ri
1954	0.65	0.25	0.05	0.02	0.143
1958	0.51	0.40	0.06	0.03	0.150
1970	0.22	0.55	0.13	0.10	0.172
1979	0.12	0.24	0.40	0.24	0.210
1984	0.01	0.04	0.35	0.60	0.261
1993	0.05	0.10	0.40	0.40	0.229

Aerospace WG, IEE RAS

Automated Information System for Data of Environment

V.V. Viskov, M.V. Rodkin, S. N. Plyushchev

Development of multi-discipline researches of the Earth, stipulated by to this accumulation of huge files, variety of formats, the development of a network of data acquisition centers etc. causes to life a new strategy of operation with data. Such strategy is to provide mutual information for the experts about location of data and give the optimum description of it. It is especially important for such multi-discipline programs as, for example, International geosphere-biosphere program (IGBP) in which experts of various branches are involved, that frequently they have not the information on those data, which could be useful in their researches. Three levels of the description of blocks of geophysical and other information are allocated: a) primary data; b) inventory directories; c) the master directory). The levels b) and c) are accepted to call "meta-data".

The authors have developed the data-search system for maintenance by information service of the various research programs. The system corresponds to the level of the master directory, i.e. is the reference information system. The information file consists of the document-descriptions of structures and contents of bases of a primary data of any structure, in other words, it contains the directory information. The system provides search of the necessary document-description using industrial key word, in elected center of data acquisition, or for a chosen region. As a base format, the format, close to NASA Master Directory-DIF, is chosen.

GC, IMM RAS

Environmental Requirements of Lending Institutions

Jeffrey L. Jeter

In recent years, the International Finance Corporation (IFC) and the European Bank for Reconstruction and Development (EBRD) have been involved on projects in the oil and Gas sector throughout the Former Soviet Union, including the area around the Caspian Sea. Prior to executing financing on any project, the IFC and the EBRD require assessment/review of several aspects of the projects, including environmental. Both the IFC/World Bank and the EBRD have published environmental requirements/guidelines for projects. While these documents are different, the basic procedures and requirements are similar. In fact, several projects have been completed for both the IFC and the EBRD, with one environmental report for both sources.



The first step taken by the Banks to address environmental issues is to have the project reviewed by their in-house environmental department. This review is aimed at identifying what development has been completed, what development is planned, what environmental work has been completed, and what (if any) environmental work is planned. Based on this, a Terms of Reference (TOR) is developed for the environmental requirements of the project.

The two main environmental requirements include an Environmental Audit and an Environmental Impact Assessment (EIA). The Environmental Audit is required to identify any possible environmental liabilities that may be associated with the project, due to development and operation to date. The EIA is the procedure for identifying potential environmental impacts associated with planned development, thereby allowing development of mitigation measures and/or assessment of alternatives.

The Environmental Audit will include a detailed inspection of all facilities and interviews with personnel involved in site operations and development. During the audit, attention will be focused on emissions to atmosphere, wastewater emissions, chemical and waste handling and disposal practices and the status of environmental permitting and compliance. Typical issues for onshore oil and gas fields in the vicinity of the Caspian Sea include waste handling/disposal and contamination arising from direct discharge of oil to unlined pits and/or leaks from existing pipelines within the fields. The issue of export systems has received additional attention (even though these transportation systems typically are not part of the subject projects) since the leak in the Komi Republic. Generally, the field work for the audit can be completed within one week, and the overall process requiring approximately four weeks.

The EIA begins with a detailed characterization of the local environmental setting. Existing data are used where available, and augmented by site specific studies as required. This process requires a detailed description of the site development and operation plans, and a detailed description of the anticipated impacts to the environment. Impacts include items such as loss of habitat for animals or emissions to bodies of water. The impacts are classified in terms of their magnitude, and if significant adverse impacts are identified, mitigation measures or alternatives must be identified. Significant adverse impacts would be items such as the loss of a unique habitat of a rare or endangered species or emissions that exceed a national standard. The EIA also includes sections on monitoring environmental conditions and the effectiveness of the mitigation measures. The length of time required to complete the EIA depends upon the complexity of the project and the amount of existing data; however, typically takes several months to complete.

An important item of the EIA is public involvement. This step is designed to allow the local population to voice any concerns they may have regarding the potential impacts that the project may have on them.

Both the audit and the EIA look at regulatory compliance. The audit covers existing permits to operate, and the history of compliance with any required monitoring. The EIA covers the ability for the project to satisfy any existing national standards (such as emissions) and permit requirements. This includes national requirements for performing an EIA. The Russian Federation has detailed requirements for performing EIA's which are required as part of the permitting process. While the specific requirements of the Russian Federation EIA are somewhat different from the IFC and the EBRD, there are similarities. It is our experience that while the required report format and data analysis procedures are different, the raw data requirements of the Russian Federation are similar to those of the World Bank and the EBRD and can be shared between the two documents. Further, we have been involved in one project where the EIA prepared for the permitting in the Russian Federation also satisfied the EBRD requirements for an EIA. Obviously, to the extent that this can be accomplished, this will minimize duplication of effort. To promote this, we suggest considering the specific national requirements during the scoping exercise.

Dames & Moore, Moscow

Problems of Creation of Data Base on the Caspian Region

Fr. Mirri

Abstract: Accessibility and management of regional "data bank" as a necessary means to face and solve vast-ranging integrated projects.

In order to face and solve, in the shortest period, a vast-ranging project, it is necessary to spot and solve problems in a regional context.



Nowadays, whoever finds himself operating in the Caspian region, is bound to re-create its own data base, which will prove to be suitable for carrying out later studies.

The changes concerning the Organizations and Institutions, devoted to collect and manage basic data, have intensified the problem and represent a major obstacle to a rapid and economic development of all the projects.

The real difficulties which the promoting Administrations and Individual consultants are bound to cope with, can be synthesized as follows:

1. Data are scattered among many Institutions which it is not often easy to spot; moreover such institutions belong to different states and operate according to non-homogeneous criteria, often in contrast with each other;

2. Data are collected and organized according to old-fashioned criteria and offer a so-called "Service of data linked together". Each individual collects and processes the data of its own authority or of the own exclusive interest, not taking into consideration the users' new requirements.

3. It is still customary to entrust the operation of data processing to same individuals who are in charge of the collection. However, these latter do not often know the problems which the single users are to cope with, and do not have suitable tools, procedures and resources.

4. There is a general shortage of official sources guaranteeing the validity of the given data.

5. There are still "secret" or "confidential" areas and/or themes which do not allow to carry out a complete and exhaustive analysis of the problems.

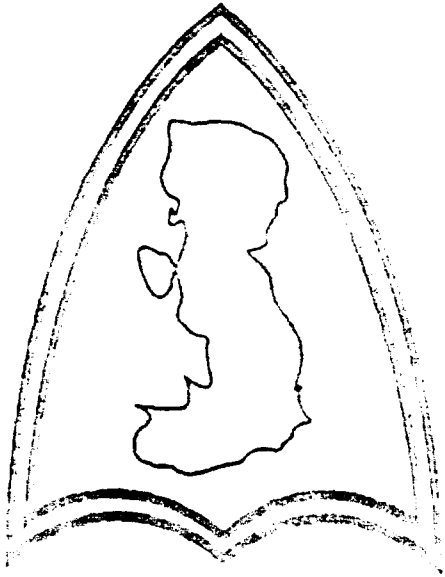
This conference, meeting-point of politicians, managers, experts and designers, represents the most qualified opportunity for debating these issues, creating normative, coordinate and technical premises and finally setting up a "base of common knowledge" which is necessary for facing and solving the regional problems.

It is important not to scatter, but to re-organize and evaluate the heritage of knowledge of the single Organizations, overcoming the strict principles which have been followed up to now, in order to offer to use-users' market, in the shortest period and at a competitive cost, reliable and ready-to-use "basic data".

"Eco Consulting" SRI Rome, Italy

ASPECTS OF NATURAL RESOURCES USAGE
SOCIAL-ECONOMICAL AND LEGAL

"CASPY - 95"



"FACITUM - 95"



Socio-Economic Consequences of Change of the Caspian Sea Level Regime within the Dagestan Republic Zone of the Caspian Sea

B.D. Tagirov

1. The continued rise of the Caspian Sea level, which was more than 2.5 m during 1978-1995, has put and continues to put huge damage to the national economy of the Dagestan Republic. At present, cities Makhachkala, Dyerbyent, Kaspiysk, the settlement Sulak, 12 populated localities, sewage and water systems, railway Kizlyar-Astrakhan' with length more than 25 km, irrigation system of the more than 50 thousand hectare area, objects of the fish industry, tens objects of communication and power, petroleum-industry, hydrometeorological stations and other objects of the national economy are in the flooded and submerged regions. Some of them are already destroyed, many are at the stage of destruction and require immediate protection or immediate displacement to safe places. As to April 1 1995, thousand of families have remained homeless, a threat to the population and economic potential of the Republic in the coastal zone becomes real. The region can undergo an economic recession, an ecological danger, and, as a consequence, a social instability.

2. In 1992 the President of Russia has authorized the order N 643-rp "About measures on protection of the population and decision of problems, connected with rise of level of the Caspian Sea", and decree of ministerial council - Government of Russian Federation of January 19 1993 N 37, a complex of urgent measures for 1993-1995 years on protection from flooding and submerging of cities, populated localities, industrial and non-productive objects, agricultural lands and other valuable lands, located in coastal zone of the Caspian Sea, is authorized.

3. The accepted measures on protection of the population are late and inadequate to development of adverse processes in the Caspian coast: predicted in the end of 1995 level of the Sea -26.5 m was reached already in 1994, and governments stipulated by decree of the RF of January 19, 1993 N 37 urgent measures for 1993-1995 for past two year and three months are funded only by 18% from stipulated means, that has resulted in extremely slow fulfillment of scheduled measures, aggravation of social, ecological and sanitary-epidemic conditions in the region, growth of damage to the national economy of the republic. Begun, but not completed by construction, the objects of engineering protection in difficult storm and ice conditions in winters are partially destroyed and are in emergency condition. Damage, put to the republic by surges waves only in 10-14, 1995 is evaluated as 200 billion rubles.

4. Usual for the coast the Caspian Sea situation was considered on the meeting of Government of Russian Federation (protocol N 26 of November 3, 1994) and the meeting of the Governmental commission on problems of the Caspian Sea (protocol N 2 of November 20, 1994) and valuation as extremely difficult and critical. By the government of Russian Federation the new decree N 13 of January 5, 1995 about "Additional measures on protection of the population and decision of other problems, connected with rise of the Caspian Sea level" is accepted. Pursuant to the specified decree and in view of budget of foundation by Building Ministry of Russia And Russian Water

Comity together with Government of the Dagestan Republic are specified the list and volumes of urgent protective measures on the Dagestan coast of the Caspian Sea for 1995.

According to the list, in the Dagestan Republic, cities Makhachkala, Derbent, Kaspiysk, settlement of urban type Sulak, 12 populated localities, railway Kizlyar-Astrakhan' of more than 25 km length are subject to compulsory protection in 1995; 800 families from houses of private sector are subject to immediate resettle, sewage collector with elements of protection in cities Makhachkala and Derbent is subject to displace.

For fulfillment of this work in 1995 to the Dagestan Republic appropriations the minimal volumes 220 billion rubles will be required. The default of specified measures can in time put to the republic damage, repeatedly exceeding costs on their realization.

RSNPO "Dagestan Shore Protection"



Social-Economic Development of the Russian Coast of the Caspian Sea under Conditions of Rising Sea Level

B.M.Shtoulberg, Ye.G.Grigoriev

Continuing rise of the Caspian Sea level produces growing negative impact on the economy and social sphere of the coastal subjects of RF - Astrakhan oblast, Republic of Kalmykia-Khalmg Tangch and Republic of Dagestan. Natural resources are being lost, conditions of their exploitation are averting, reliability of economy performance is declining, number of objects and settlements in danger of destruction is growing, hundreds and thousands of people are increasing. These processes are manifested to the greatest extent in the seaside regions of the RF subjects.

Multi-branch economical complex has been formed in the seaside region, its development in the recent decades went on without the account of the regularities of the Caspian Sea level dynamics. Urgency of economical and social problems, connected with the Caspian Sea level rise is growing under the influence of social - economical crisis in Russia. The problems of the seaside region have reached federal level, their solution should be among social - economical priorities of the Russian Federation and its regional policy.

The major economic problems are: conservation, regeneration and rational use of natural resources potential, and first of all, land fish and recreation resources, as well as oil and gas resources; maintenance and development of industrial production potential and agriculture; territorial engineering infrastructure, especially life - support systems of the population; housing capacities and social infrastructure; structural adjustment of the economy and production with due regard of market formation conditions and impact of the sea level rise; social problems are as follows: population migration and employment; maintenance and restoration of the level and quality of life; rationalization of the settlement network; provision of security system for residence.

The concept of economic and social problems solution in Russian Caspian regions envisages, as a target goal, provision of sustainable social - economic development, given maximum possible reduction of economic damage and prevention of negative processes in social sphere, conditioned by the sea level dynamics, and the lowest possible costs measures, aimed at protection of the seaside region from flooding. It is assumed, that we will not be able to effect significantly the Caspian Sea level dynamics (at least within one or two decades).

The main directions of actions is to form flexible social-production system, able to react appropriately to the sea level changes and combining elements of proportion of individual settlements and the most important parts of the shore area with the possibilities to resettle population from endangered regions and remove production facilities in rather short time and without large economic losses.

At the same time the following tasks should be solved:

- creation of flexible production system, characterized by specialization of economy in productions, which don't require highly developed infrastructure and large investments in stationary facilities and meeting skills and priorities of aboriginal population;
- formation of flexible settlement system including creation of basic settlements with complete set of services;
- provision of social protection for the population, including problems of induced migration, employment, compensation of losses and privileges, maintenance of transitional kinds of economic activite protection of settlements, agricultural lands, enterprises and farms from flooding with the account of their social significance and efficiency of functioning;
- elaboration of the mechanism for the system operation, including determination of the seaside region status, efficient regulation of legal, economic and social issues.

Mineconomiki, SOPS & ES



Insurance Against Natural Processes Instability (Environmental Insurance)

V.B.Mestechkine, A.V.Frolov, N.V.Chepurnykh, K.I.Shevchenko

The economical development of the Caspian Region proceeds under natural and environmental processes instability conditions. There are both natural and industrial causes of this instability. The instability of natural and environmental processes causes considerable economical and social damage for the Caspian Region economical development.

Environmental insurance is the effective method for damage indemnity in the field of risk natural resources using. The authors of these theses worked out the original methods and practical including law aspects mechanism of environmental insurance realization.

We dispose of insurance statistic data bases and full results of insurance marketing investigations for the Caspian Region too. The main principle of our methods is the geographic and economic identification the risk zones for economic development and natural resources using. We dispose of risk maps complicate for the Russian part of the Caspian Region. The Caspian Region environmental insurance may be realized for many aspects of natural and industrial instability risks, such as property risks, financial and investment risks, risks of civil and professional responsibility and the other kinds of risks. The analysis of the insurance marketing results and the risk maps for the Caspian Region demonstrated the potential success of the environmental insurance for all participants of the insurance process: insureds, insurers, federal and regional government bodies. This is to be expected the positive public opinion to environmental insurance in the Caspian Region.

*NGNWP "Resurs", Roskomvod, KEPS, SCC "Caspian",
Officine Maccaferri*

Management and Stability of Social, Economic, Ecological Development of the Caspian Region

N.V.Chepurnykh, A.L.Novoselov

1. The Caspian region of Russian Federation is of great interest for employers as: potential market, proximity to the sources of raw materials, transport ways, possibility of different trades development (like fishery, oil extraction etc.). At the same time, sea-level change gives reason to the flood of territories, the low-lying shore subject to the short-term flood influence, so that give reason to the great risk for these territories economic mastering. The stability of region development is assumed the stabilization and development of economy, improving the well-being of people with the same time improvement of the human environment. For the management for stable development of the Caspian region it is necessary to solve the complex problem of social and economy-ecological analysis of the region, which includes investigation of variants of different kinds of economic mastering realization and it's influence on social, economic and ecological state of the region; the risk estimation of specific kinds of commercial and industrial activities; working out the program of measures for the region development.

2. The comprehensive investigation of variants of different kinds of economic mastering realization is assumed prediction and analysis their social, economic and ecological consequences. It's specially necessary for those kinds of economic mastering, which exert serious influence on the nature (the natural resources using, anthropogen influence etc.), the well-being and the health of people. For this problem solve it is nice to use the method of multicomponent modeling, which assumed an exposure of causal and investigation relations in the region on the base of theory of graphs and the expert estimation method. Multicomponent modeling lets make prediction and analysis of results of economic mastering variants and work out strategy of social, economic and ecological development of the region from system method of approach position.

3. The risk of realization of specific kinds of industrial and commercial activities consists from the economic mastering risk and ecological risk. The economic mastering risk consists from



internal risk (it depends from organization, technical fitting out and conditions) and external (it depends from stability of consumer market, competition factor etc.). For ecological risk estimation there is exists the method of risk computation on the base of normative net discount value, which easy can be move to index of net discount value come from parameters of specific economic object.

4. working out the program of measures for the region development demands an estimation and selection of measures of investition distribution in accordance with the time and financial sources; forming of calendar plan of measures doing; an estimation of development program effectiveness. The estimation and selection of measures are basing on the using of the method funcial-value analysis with the theory of graphs. It lets determine the rational collection of measures and raise the effectiveness of the development program on the first stage. The other problems were realized by the plans theory method and the estimation of investition effectiveness. It is important to say, that working out program can be done on the base of model of different difficulty and detalization, what lets solve the problem in conditions of different informational provision. It is necessary to remember about strategies change of nature factors (economic, political, social and cultural, international etc.) during solving these problems.

5. The realization of supplied complex problem demands to use special set of instruments: methods, algorithms and soft ware products, which were devised and approved by authors during the solve of some practical problems of management.

KEPS

Socio-economical Development of the Caspian Region of Russia

Yuri M. Plotinsky

In this paper we have considered the adaptive strategy of sustainable development of Russian Caspian seashore. The basic results have been obtained under investigation the Federal Program "Caspian Sea", but we take into account the influence of some other Federal programs.

Long range planning are based on the scenarios of evolution of economical, geopolitical processes and are estimated different types of risks. Also this strategy must correlates well with the conception of Russian National Security and take into consideration the interests of foreign countries.

In this paper we tackle the some variants of decision problems in social, ethnical, demographical areas. The answer is based on the strategy of regional urbanization. We propose several schemes for conflict resolution are produced these processes.

Increasing geopolitic role of this region, instability typical for neighbour countries will cause the building of military bases.

A number of factors initiate the development and modernization of regional transportation networks. A primary consideration is the necessity of search the safety ways for oil transportation from this region.

MSU

River Basin Agreement in Russian Federation

V.A. Kalashnikov

Numerous long-terms programs, conception on the federal, regional and territorial levels aren't necessary effectiveness, because they leave out of account changes in the economic mastering, industrial and economic situation in the country, and undo because of the lack of worked through mechanism of realization. During the way to the market economy expedients the correction, coordination, coordination of available natural protection, medical-sanitary, water economic and other program in the limits of river basin agreement (hydrological basins of water objects). Committee of Russian Federation of water economy (Roscomvod) worked out methodical guaranteeing, offered the mechanism of



realization and organized preparation, coordinated with the government bodies of Russian Federation, with the interested in it ministries and departments, with scientific, projecting and social organizations. The main aim of agreements is the creation of yearly conditions for realization of specific top priority measures, directed to the serious progress in the field of rational joint using, protection of the natural resources and restoration of water objects, else to the coordination of water economic activities and river basin regulation of water resources.

Agreement provides the realization of coordinated measures and the possibility of timely giving a more precise definition in accordance with the taking place changes of priority of problems, financial guaranteeing and the real realization of earlier planned measures. River basins agreement can be considering as the kind of yearly realizing program of natural resources using, financed by the regional budget and wanted the federal support for the measures of full river basin or national meaning. Established system of procedures for preparation, examination, concording of substantiating documentation and the project of river basin agreement, else it's examination and signing, conforms to world practice of organization of the rational water using mechanism, providing of stability of economic water mastering and realization of joint authority function. Taking into account accumulated practical experience, Roscomvod think that it's necessary to consider such problem as the using of this experience during the treatment of the mechanism of management of other natural resources using. The initiative report of this problem "Bases of the regional natural using relations" was sent to the regions.

MSU

Social-Economical Aspects of the "Volga Revival" Program

I.K.Komarov, V.V.Naidenko

Introduction. Critical ecological situation formed in the basin of Volga river - the largest region of the Russian Federation - needs an immediate action taken that will provide a major improvement of the social-ecological situation.

The Volga basin includes 6 economical regions, 26 provinces, 6 republics with the population or more than 100 different nationalities. Total population in this region makes 40 % of the total Russian population level. The region produces 45 % of industrial production and about 50 % of agricultural production.

Because of intensive urbanization process in the basin the ecology condition of the environment was declining dramatically, and, as a result, people's medical problems and social problems increased. During many decades industrial, energetical and agricultural potential of the country was concentrated in the Volga basin. Real abilities of region's ecological systems and their adaptation to enormous antropogenic loads were not considered.

Social-Economical Aspects of the "Volga Revival" Program.

When the basic statements of "Volga Revival" were elaborated, the main attention was devoted to science- technical problems of stabilization and reconstruction of environment conditions in the basin. The most important of the considered problems are: ecological condition of Volga's reservoirs, protection and rational use of fish resources.

Canalization system of cities, industries, agricultural objects, systems of closed and circulating water supply. Collection and clearing of rain waters.

Atmosphere condition. Clearing and recuperation of gas waste from stationary and moving sources.

Ecological problems of hydro- and termoenergetics.

Ecology of industrial production. Little waste and non-waste technological processes. Processing and utilization of waste.

Ecological monitoring. Methods and means of measuring of ecological monitoring system. Maps provision - ecological, air and space recordings. Mathematical provision for ecological monitoring.

The goals and means of solving this ecological problems were defined.

The program works on a set of arrangements for solving several particular problems: the development of economical and legal mechanisms of rational environment use and protection; protection and development of water ecosystems; processing of waste; high-temperature processing of fluid and solid toxical industrial waste; use of bio-gas, sun, and wind energy; increase of work effectiveness of city maintenance; processing or gas waste;



providing high quality drinking water for the population; decrease of negative effect of thermoenergetic industries on environment; clearance of waste waters; creation of ecologically clean agricultural industry; creation of a net of specially protected territories; creation of environment on-land and space monitoring systems; creation of little-waste and non-waste technological processes, processing and utilization of production waste; protection, reconstruction, and rational use of forest resources.

Federal Program "Volga Revival" is formed with consideration of: real country's moving rate to market economy; comprehensive analyses of ecological problem's priorities and needed steps for solving it; creation of effective mechanisms for this program's realization. Committee Russian Academy of Science, Nizhnevartovskaya academy of architecture and construction

"V&K"



**List of the Companies Participating in the International Conference "Caspy-95"
(Moscow, June 20-23, 1995)**

RAS - Russian Academy of Sciences
OGRI RAS - Oil and Gas Research Institute RAS
IFA RAS - Institute of Physical Atmosphere RAS
GIN RAS - Geological Institute RAS
NGC RAS - Scientific Geoinformation Centre RAS
IOF RAS - Institute of Common Physics RAS
IMM RAS - Institute of Mathematical Modeling RAS
IWP RAS - Institute of Water Problems RAS, Russia
MI RAS - Mathematical Institute RAS
IO RAS - The State Oceanological Institute RAS
AEB of IWP RAS - Astrakhan Expedition Base of the IWP of RAS
IA RAS - Institute of Astronomic RAS
GC RAS - Geophysic Center RAS
CC RAS - Computing Center RAS
IPFS RAS - Institute of Edaphology and Phorosyntes RAS
IEE RAS - Institute of Ecology and Evolution, RAS
MITPZiMG - International Institute of Forecasting Theory of Earthquake and
 Mathematical Geophysics RAS
INM RAS - Institute of Numerical Mathematics RAS
IAP - Institute of Applied Physics RAS
ICP RAS - Institute of Chemical Physics, Russian Academy of Science, Moscow
SC PB RAS - Scientific consortium by Biosphere Problems RAS
KEPS - Commission by Study of Productive Forces RAS
GANG - State Academy of Oil and Gas
NVNIIGG - Nizhnevolskiy Geology and Geophysics Scientific Research Institute
VNIIGAS - Russian Natural Gas and Gas Technology Scientific Research Institute
PNIIS - Production and Research Institute for Engineering Construction Survey
CNIIGAK - Central Scientific Research Institute of Geodesy, Aeroplane Photography
 and Cartography
CNIAG - Central Scientific Research Institute of Automatic and Hydraulic
NPO GIPO - Scientific Research Association State Institute of Applied Optic
VNIIGIG - Russian Scientific Research Institute of Hydrogeology and
 Engineering Geology
VNIIGeosphere
MSU - Moscow State University
CEMI - Central economic - mathematical Institute MSU
MGSU - Moscow State Building University
MIEA - Moscow Institute of Electronic and Automatic
SPU - Sankt-Petersburg University
LII - Flying Scientific Research Institute
IG RAS - Institute of geography RAS
State Duma
RFFI - Russian Fund of Fundamental Investigation
Roskomnedra - Committee of Russian Federation by Geology and Natural
 Resources Usage
Mintopenergo - Ministry of Fuel and Energy of Russian Federation
Minnauki - Ministry of Science and Technical Politic of Russian Federation



Mineconomiki - Ministry of Economy of Russian Federation
Minprirody - Ministry for Environmental Protection of Russian Federation
MChS - Ministry of Extraordinary Situations of Russian Federation
Roskomvod - Russian Committee by Water Economy
Roskomgydromet - Russian Federal Service by Hydrometeorology and Monitoring of Environment
Roskomryb - Russian Committee by Fishing Economy
VNIRO - Russian Federal Research Institute of Fisheries and Oceanography
RAO GAZPROM - Russian Stock Company "GAZPROM"
AO LUKOIL - Stock Company "LUKOIL"
GP ROSNEFT - State Enterprise "ROSNEFT"
SC PETRO-RUSS - Stock Company PETRO-RUSS
HRC - Hydrometeorological Research Centre of the Russian Federation
SOIFSRHEM - State Oceanographic Institute Federal Service of Russia for Hydrometeorology and Environmental Monitoring
GGO - Main Geophysical Observatory of Roskomgydromet
GNPP "Aerogeology" - State Scientific Research Enterprise of "Aerogeology"
SAGE No1 GNPP "Aerogeology" - Space-aero-geological expedition No 1 GNPP "Aerogeology"
GGP "Spetzgeofizika" - State Geophysical Enterprise "Spetzgeofizika"
GGP "Zentrgeofizika" - State Geophysical Enterprise "Zentrgeofizika"
PO "Soyuzmorgeo"
YuMNG - Yuzhmorneftegeofizika trust PO "Soyuzmorgeo"
KOME PO "Soyuzmorgeo" - Complex Experimental Expedition PO "Soyuzmorgeo"
CHO ANT RF - Black Sea's Department of Academy of Technological Science of Russian Federation
NIPIOkeanologiya
SOPS & ES - Counsel by Location of Productive Forces and Economical Cooperation
"Ingeocentre" - Scientific Technical Enterprise "Ingeocentre"
S.J.C. "Ecogeocentre"
"V&K" Ltd. Energetic ring company "V&K"
NGNWP "Resurs" - "Result" Ltd.
Scc "Caspay" RAS - Scientific- coordinative Centre " Caspy Volga Ltd.
NEC "Sinaps" - Scientific Engineering Centre "Sinaps"
IC "ROSGAL - Russian-America Insurance Company "ROSGAL"
MIC - Military Insurance Company
IC RIC - Insurance Company "Russian Insurance Centre"
MGO-Main Geophysical Observatory, Sankt-Petersburg
Aerospace WG
Astrakhangeolkom
AstrakhanGasProm RAO GAZPROM
AGE - Astrakhan Geophysical Expedition
Kalmgeolkom - Geological Committee of Kalmykiya
Kalmnedra -State Enterprise "Kalmnedra"
Troitzk GGP - Troitzk State Geological Enterprise
UGTEIN Dagestan - Management of Geology, Fuel, Energetic and Usage of Dagestan Mineral resources



"Dagneft" - Stock Company "Dagneft"
DPI - Dagestan Politechnical Institute
DSC RAS - Daghestan Scientific Center, Makhachkala
IG DSC RAS - Institute of geography of DSC RAS
IPG DSC RAS - Institute of Geothermic Problems DSC RAS
DG RAS - Dagestan Hydrometeocentre
DSU - Dagestan State University
RSNPO "Dagestan Shore Protection"

West Caspian BVU - West-Caspian Managing Roskomvod
BVU RAS

"Kazakhstankaspiishelf" - State Company "Kazakhstankaspiishelf"
IC of the Caspian Sea - International Consortium of the Caspian Sea Researches
AGE MG Kazakhstan - Alma-Ata Geophysical Expedition of Ministry Geology
of Kasakhstan

IS TAS - Institute of Seismology, the Turkmenision Academy of Science
API - Aserbaijan Politachnical Institute

IG ANA - Institute of Geography of Academy of Science of Aserbaijan

MOBIL
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IAEA - International Atomic Energy Agency
TIV - Verdginia Technology Institute
Cambridge University
IFAG - Institut Fur Angewandte Geodasie
UWA - University of Western Australia
WRC - Water Research Center
Schlumberger Geco-Pracla
CGG - Compagnie Generale Geophysique
Sovfransgeo
Officine Maccaferri
EG - Exploration Geosciences Ltd.
MIDAC - Moscow IRIS Data Analysis Center
OGDEN Environmental & Energy Services
E&P International Environmental & Loss Prevention
ENSIGN Geophysics Ltd.
AGRA Earth & Environmental
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