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EARTH SCIENCES

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EARTH SCIENCES

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## METEOROLOGY

### GEOPHYSICIST COMMENTS ON HOW SOLAR ACTIVITY MAY AFFECT WEATHER

Moscow GUDOK in Russian 28 Feb 86 No 50 (18385), p 4, cols 4-8

[Excerpt] The connection between the sun and the lower atmosphere is attracting more and more interest. Studies of sun-atmosphere ties are aimed at understanding their complex nature and using the knowledge obtained for improving long-term weather forecasts.

Our correspondent A. Yakovlev asked Doctor of Physical-Mathematical Sciences, Professor G. Ivanov-Kholodnyy, an associate of the Institute of Applied Geophysics, to tell about what science has made known in this complex problem.

"My first question, and quite a natural one, is: can there be any doubts regarding the sun's influence on the weather?"

"We take the position that changes in weather and climate are determined largely within the atmosphere, while solar activity is an extra factor which 'disturbs' the atmosphere markedly. Therefore, in working on long-range forecasting, we study interrelationships between various phenomena on the sun and their 'echoes' on Earth."

"Does this mean that a kind of 'bridge' between the sun and earth exists in space?"

"There is such a bridge--it is the solar wind. The magnetosphere resists penetration of solar particles to earth--it pulsates, contracts and 'breathes.' Scientists call this process geomagnetic disturbance. The solar wind nevertheless penetrates into the magnetosphere, sharply raising the temperature of the particles. But how can it reach the atmosphere itself, unless easier and 'well-trod' paths exist somewhere? It turns out that they do exist--over the earth's south and north magnetic poles. The lines of force of the planet's magnetic field converge there, forming shapes like funnels. It is through these funnels that particles of the solar wind seep into layers of the atmosphere, giving rise to polar auroras and magnetic storms--the cause of many 'stresses' on earth."

"How does this hypothetical 'trigger mechanism' operate; isn't the region of geomagnetic disturbance located too far from the troposphere? Wouldn't the solar wind dissipate in the ionosphere, without leaving a trace?"

"A hypothesis which has become more and more popular lately is that the atmosphere's layers--the ionosphere, the mesostratosphere and the troposphere--form a kind of dynamic unity, and that changes in the upper layers undoubtedly affect the lower ones. It is just like saturating a puffy pastry that has many layers with liquid syrup; we pour it only on the top, but the saturation reaches even the crust on the very bottom. Even if particles of the solar wind remain in the ionosphere, pulses generated through their action will release an accumulated reserve of energy in the lower atmosphere. As soon as this happens, meteorologists will record the beginning of climatic fluctuations.

"This is only an hypothesis as yet. But it is supported by many scientists who are conducting research in line with the program 'Sun-Troposphere'."

"Long-range weather forecasts are the ultimate goal of these studies, we recall. Is it now possible to speak of progress in this field?"

"Yes, perhaps. Colleagues of ours from the Main Geophysical Observatory (Leningrad) have discovered a connection between extreme weather phenomena and periods of solar activity. This applies particularly to droughts. Their spread is connected with cycles of the sun's activity: a 22-year cycle is characteristic for some regions of the earth, an 11-year cycle for others (including the territory of the USSR)."

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# THERMODYNAMIC ESTIMATE OF CLIMATIC SYSTEM EFFICIENCY

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 13 Apr 84) pp 1020-1025

[Article by A. S. Ginzburg, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] Estimates are presented of the maximum useful work which can be performed by the Earth's climatic system assuming average insolation. In the lower latitudes the flux of incoming radiation is greater than the flux of departing thermal radiation. The relationship is opposite in the higher latitudes. The efficiency is defined as the "maximum useful work which can be performed by the system." The maximum possible efficiency of the Martian atmosphere under year-round average conditions is also studied. The estimates obtained demonstrate both common features and basic differences in the climatic systems of the Earth and Mars. The efficiency of the atmosphere and entire climatic system of both planets is near the maximum and simultaneously close to the quantity of generation of kinetic energy in the atmosphere. However, on Earth equalization of temperature occurs not only due to generation and dissipation of kinetic energy, but also due to transfer of other types of energy from warmer to cooler areas, particularly due to evaporation and condensation of water vapor. On Mars, the thin atmosphere of the planet is incapable of transferring large quantities of heat, resulting in great temperature contrasts, attributable to nonuniform heating of the planet by the sun. References 17: 13 Russian, 4 Western.

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CSO: 1865/103

UDC 551.583:551.583.7

# CONTEMPORARY CHANGES IN CLIMATE AND PALEOCLIMATE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOGRAFICHESKAYA in Russian No 6,  
Nov-Dec 85 (manuscript received 29 Jul 85) pp 36-42

[Article by M. I. Budyko, State Hydrology Institute]

[Abstract] Previous studies by the authors have indicated that the world temperature will increase by 2.5°C between 1970 and 2070. Conferences since the mid-1970s have confirmed the probable increase in world temperature due to

anthropogenic effects. Since the 1970s, new approaches have been developed in which the sensitivity of the climatic system to anthropogenic effects is studied based on empirical materials concerning contemporary changes in climate and data on the climate in the geological past. This article discusses the possibilities afforded for studying anthropogenic change by the use of paleoclimatic material. Extensive paleoclimatic and paleogeographic materials are summarized. References 23: 15 Russian, 8 Western.

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CSO: 1865/140

UDC 541.182.2/.3:546.36

#### DETERMINATION OF NONGLOBAL COMPONENT AGAINST BACKGROUND OF GLOBAL RADIOACTIVE POLLUTION OF ATMOSPHERIC AEROSOLS

Leningrad RADIOKHIMIYA in Russian Vol 27, No 5, 1985  
(manuscript received 6 Dec 84) pp 669-673

[Article by Z. G. Gritchenko, V. M. Flegontov and K. Sinkko, Finnish Center on Radiation and Nuclear Safety, Helsinki, Finland]

[Abstract] An attempt is made to determine the nonglobal component in global radioactive pollution of atmospheric aerosols, made possible by the advent of precision semiconductor gamma spectrometry. A figure illustrates the main changes in global  $^{137}\text{Cs}$  pollution at low altitudes in the middle latitudes of the northern hemisphere, 1975-1982, based on determination of the ratio of  $^{137}\text{Cs}$  to  $^7\text{Be}$  observed at 11 points in the northern hemisphere. Variations in data normalized on the basis of this assumption were plotted. As an example, the data for a location in Sweden indicate elevated concentrations of  $^{137}\text{Cs}$  at low altitudes. If there were not methodological errors in the measurements of  $^7\text{Be}$  and  $^{137}\text{Cs}$  in the area, there is probably a source of  $^{137}\text{Cs}$  pollution nearby, causing its level to exceed the global pollution level. Figures 2, references 15: 5 Russian, 10 Western.

6508/5915  
CSO: 1865/157

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#### ASSESSMENT OF CONTEMPORARY CHANGES IN GLOBAL CLIMATE

Obninsk GIDROMETEOROLOGIYA: SERIYA "METEOROLOGIYA", SOVREMENNYYE IZMENENIYA GLOBALNOGO KLIMATA in Russian No 8, 1985 pp 1-52

[Article by K. Ya. Vinnikov, State Hydrological Institute]

[Abstract] On the basis of empirical data relating to change in the global thermal regime during the period of instrumental meteorological observations the author reviews the observed trends in mean air temperature and their causes, as well as the patterns of regional changes in climate associated with change in the global thermal regime. It was concluded that the mean annual air surface temperature, averaged for individual hemispheres or the entire earth, is

one of the most important characteristics of contemporaneous climatic changes. Quite reliable data on change in mean temperature during the last century are now available. During the course of this period there was a predominance of a tendency to an increase in air temperature, as a result of which during the last century the mean temperature in the northern hemisphere has increased by approximately  $0.5^{\circ}\text{C}$ . This almost precisely coincides with the temperature change which according to the theory of climate should occur as a result of an increase in carbon dioxide content. This is indicative of a decisive influence of anthropogenic factors on the mean trend of air temperature during the last century. It appears possible to give a quantitative description of the main features of change in mean temperature with time with allowance for the influence of variations in atmospheric transparency and increase in  $\text{CO}_2$ . The influence of anthropogenic factors on the contemporaneous change in climate can be considered demonstrated. Regional climatic changes accompanying changes in mean air temperature are virtually not dependent on the factors influencing the global climatic system. The processes of cooling and heating of the northern hemisphere during the last century have been accompanied by significant changes in precipitation and other meteorological elements. Figures 6, tables 7; references 123: 39 Russian, 84 Western.

5303/5915  
CSO: 1865/133

## OCEANOGRAPHY

### MANNED SUBMERSIBLE 'OSMOTR' DEVELOPED AT SHIPBUILDING INSTITUTE

Leningrad LENINGRADSKAYA PRAVDA in Russian 10 Jan 86, p 1

[Text] Leningrad (TASS)--A model of a manned submersible craft called "Osmotr" has been added to the "family" of submersibles designed by scientists and students of the Shipbuilding Institute.

The craft is intended for practical exploration and scientific investigation of deep levels of the seas and oceans. It consists of two compartments: controls are located in a forward compartment, and divers undergo compression in the other compartment, in which the pressure is gradually raised to the level corresponding to the pressure of the water.

With the development of the "Osmotr", its designers have made a new contribution to accelerating the advancement of Soviet underwater technology. They had already designed the underwater biological laboratory called "Chernomor"--an efficient submersible for studying and exploring the ocean. In line with an assignment from specialists of the USSR Academy of Sciences' Oceanology Institute imeni Shirshov, the "Chernomor" has been successfully tested at a special proving area in Gelendzhik.

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CSO: 1865/170

POLISH SHIPYARD BUILDS COASTAL-SHELF RESEARCH CATAMARANS

Moscow VODNYY TRANSPORT in Russian 6 Feb 86, p 1

[Text] A catamaran of the "Iskatel-2" type opens a new series of research vessels for the USSR. Specialists of the "Wisla" shipyard in the Polish ship-building center of Gdansk have begun installing equipment on board this vessel.

Engineers of the "Prorem" design bureau in Gdansk drew up the plans and specifications of this modern vessel for the study of shallow coastal waters of the Soviet Union, which is to be done under the program "Shelf". The catamaran, which is about 50 meters long, will become the largest seagoing vessel produced at the "Wisla" yard, which has specialized in the construction of fishing seiners up until now. Modern apparatus, a special onboard computer, and the design of both hulls will make it possible to study the water and seabed effectively from the "Iskatel", even in stormy weather. Four catamarans in all will be built by "Wisla" in this series. Plans call for turning over the first vessel to the client in the second half of this year.

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METAL CONTENT OF OCEAN WATER STUDIED WITH RADIO SPECTROMETER

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 29 Jan 86, p 3

[Excerpt] Dushanbe--A new step toward the extraction of metals from ocean water has been taken by associates of the Tajik Academy of Sciences' Institute of Chemistry. They have developed methods for determining the presence of copper and other elements in aqueous solutions, with the aid of radio spectrometers.

An interest in the Tajik scientists' work was taken by associates of the Pacific Oceanology Institute of the USSR Academy of Sciences' Far East Research Center.

In line with a joint agreement between these institutes, a specialist from the Tajik chemistry institute was included in the crew of the scientific vessel "Akademik Aleksandr Vinogradov" by the Far East scientists. A field radio spectrometer was taken on board this vessel. Information on the concentration of metals in water was obtained with the aid of this instrument.

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# CRUISES OF OCEANOLOGY INSTITUTE'S SHIPS NOTED ON ANNIVERSARY

Moscow VODNYY TRANSPORT in Russian 8 Feb 86, p 4

[Article by G. Bregman, USSR Geographical Society]

[Excerpt] A meeting of the scientific council has taken place at the Oceanology Institute imeni Shirshov. Progress which this leading institution of the USSR Academy of Sciences has made during the past 40 years was reflected in speeches by scientists and on the display stands of an extensive exhibition. Recollections of Academician Petr Petrovich Shirshov, former minister of the merchant fleet and an outstanding oceanologist and polar researcher, were shared with great respect by those who took part. Shirshov would have been 80 years old on December 25, 1985. His memory was honored also by a meeting held yesterday at the Moscow affiliate of the USSR Geographical Society.

The Oceanology Institute was created in the USSR Academy of Sciences 40 years ago, at Shirshov's initiative. This institute has become a major center for study of the ocean. Thanks to P. P. Shirshov, the institute's founder and first director, the scientific ship "Vityaz" was built in the years right after the war.

Cruises of scientific research vessels belonging to the large fleet of the Institute imeni Shirshov are currently in progress in various parts of the world's oceans. The new "Vityaz" is en route for the first time to the Pacific Ocean, where investigations are to be made in the area of the California Current. The scientific ship "Dmitriy Mendeleev" will also come here. A large expedition on board the "Akademik Kurchatov" is continuing a cruise in the Atlantic. The "Akademik Mstislav Keldysh" is sailing to the Indian Ocean. Participants in a cruise of the motor ship "Professor Shtokman" are already conducting geological and geophysical research in the western part of this ocean. Scientists of the USSR, the German Democratic Republic and France are working here in line with a UNESCO program.

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CSO: 1865/170

## ROLE OF BIOGENIC SILICA IN FORMATION OF Fe-Mn MICRONODULES

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 1, Jan 86 (manuscript received 5 Jun 84) pp 120-126

[Article by V. V. Petrova, V. N. Svalnov and G. V. Karpova, Geology Institute, USSR Academy of Sciences]

[Abstract] The literature contains but a few references to Fe-Mn micronodules. These authigenic formations are similar in composition and structure to macronodules. Little is known of the mechanism of their formation. Micronodules occur widely in many types of oceanic sediments and are easily extracted by coring or drilling, providing information on Fe-Mn accumulation in the entire sedimentary cover. An analysis of the mineralogy and distribution of Fe-Mn micronodule samples was made using materials collected on the 28th cruise of the "Dmitriy Mendeleev." The chemical composition, structural and textural characteristics and hypothetical mechanism of their formation were determined more precisely. The samples studied were from the radiolarian zone of the Pacific Ocean in test ranges situated near 9°N and 152, 146°W. The cores, 4 to 7 m in length, penetrated the entire age interval from the Middle Oligocene to the present time. The size of the micronodules varies from fractions of a millimeter to 2 mm. They are rounded, opaque, black in color, frequently smooth and lustrous, dense, but sometimes crumbly, the latter predominating in the surface layers and Quaternary deposits. They have a layered structure caused by nonuniform distribution of individual chemical elements, the intermediate zone commonly being enriched with silica and retaining the cellular structure of the initial skeleton of radiolarians. A possible mechanism logically explaining micronodule formation is proposed. Figures 1; references 13: 6 Russian, 7 Western.

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CSO: 1865/174

## POST-SEDIMENTATION TRANSFORMATION OF OCEANIC Fe-Mn NODULES AND ENCRUSTATIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 1, Jan 86 (manuscript received 31 May 84) pp 80-88

[Article by L. Ye. Shterenberg, V. A. Aleksandrova, L. V. Ilicheva, A. V. Sivtsov and K. L. Stepanova, Geology Institute, USSR Academy of Sciences; Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry Institute, USSR Academy of Sciences, Moscow]

[Abstract] Some researchers have postulated diagenetic processes (although these transpire only with the participation of organic matter) for explaining the mechanism of mobilization of ore and accompanying elements in the formation of Fe-Mn nodules in abyssal sediments. These nodules have increased iron and cobalt contents in their upper layers, with their main Mn mineral being vernadite, whereas the lower part contains much Mn, Ni and Cu, the main Mn-ore phase being todorokite. A series of such samples of Fe-Mn encrustations and nodules recovered from the ocean floor was studied in detail by macro- and microscopic methods, chemical and spectral analyses and x-ray diffractometric analysis. The tabulated data indicate that the macroelements, and especially the trace elements in the rocks on which or through which Fe-Mn encrustations and nodules developed, could scarcely exert any significant influence on post-sedimentation processes, as is clear from the low contents of these elements and the low ratios between Mn and Fe, Ni and Cu in rocks in comparison with these same parameters in Fe-Mn nodules and encrustations. Post-sedimentation transformations of ore and nonore minerals in the inner parts of nodules or encrustations may have occurred, but this did not occur always or everywhere along the same lines, this being governed by a number of still unknown factors. In the lower (internal) parts of Fe-Mn nodules and encrustations new mineral phases appeared and there was an increase in their content of trace elements without participation of diagenetic processes in the pelagic sediments underlying and surrounding these ore formations. Figures 4; references 15: 9 Russian, 6 Western.

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## GLOBAL QUANTITATIVE CONTINENTAL AND OCEANIC SEDIMENTATION BALANCE DURING LAST 150 MILLION YEARS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 1, Jan 86 (manuscript received 18 Oct 84) pp 3-11

[Article by A. B. Ronov, V. Ye. Khain and A. N. Balukhovskiy, Geochemistry and Analytical Chemistry Institute, USSR Academy of Sciences; Moscow State University, Moscow]

[Abstract] For the first time it was possible to gain an overall comprehension of development of the earth's sedimentary cover during the last 150 million

years. This was made possible due to the availability of maps of lithological formations of the continents, shelves, continental slopes and the first seismic layer of the ocean for all periods from the Late Jurassic to the Pliocene. Analysis of these maps and integration of the best information in the literature made it possible to plot a series of graphs which give the best representation of this aspect of the earth's development: temporal change in area of distribution of sediments in pelagic region of oceans; distribution of total masses of deposits on continents, shelves and continental slopes, in oceans and in earth's sedimentary cover as a whole; temporal change in total volumes of deposits on continents, shelves and continental slopes and ocean floor; temporal change of relative contribution of deposits of continents, shelves and continental slopes and ocean floor to formation of sedimentary mantle; change in mean rates of sedimentation on continents, continental margins and in oceans; change in mean rates of erosion and rising of continental block during Late Mesozoic and Cenozoic; change in mean rate of erosion and rising of continental block during last 150 million years; mean distribution of most important types of Upper Mesozoic and Cenozoic formations and facies of their accumulation on continents, continental margins and in oceans; temporal change in most important types of formations during last 150 million years; volumes and distribution of most important types of volcanic formations on continents, continental margins and on continental block as a whole; temporal distribution of most important types of volcanic formations on continental block. Figures 11; references: 11 Russian.

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UDC 535.36:535.51:551.521.31

#### APPROXIMATE TRANSFER EQUATIONS FOR POLARIZED RADIATION IN MEDIA WITH STRONGLY ANISOTROPIC SCATTERING

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 21 Dec 83; after revision 4 Sep 84)  
pp 1043-1049

[Article by E. P. Zege, L. I. Chaykovskaya, Physics Institute, Belorussian Academy of Sciences]

[Abstract] Recent studies provided a number of simple approximate solutions of low-angle transfer equations for calculation of the characteristics of light fields in media with strongly anisotropic scattering. This article gives similar equations describing the process of transfer of polarized radiation. Equations are derived for elements of the transfer matrix similar to non-polarized radiation transfer equations. Figure 1; references 10: 9 Russian, 1 Western.

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CSO: 1865/103

## GEOPHYSICAL ASPECTS OF HETEROGENEOUS VORTEX SHEET DYNAMICS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 27 Feb 84; after revision 19 Jun 84)  
pp 1011-1019

[Article by V. P. Goncharov, V. M. Gryanik, Atmospheric Physics Institute,  
USSR Academy of Sciences]

[Abstract] Precise solutions are obtained for equations describing the evolution of a vortex sheet, corresponding to nonuniformly vortexed formations of the "star" type, uniformly rotating without shape distortion. The method used to solve the equations is conversion to Cauchy integral equations which can be solved for linear vortex density. A geophysical interpretation of the results is presented. A vortex sheet of finite length is a dynamic rotating object. It is important to consider external flow. An increase or decrease in the tangential velocity jump would be observed. However, in contrast to the temperature field, which evolves as a passive factor, a front as a vortex object not only acts of itself, but also interacts with the flow, yielding significant restructuring of the Bergeron mechanism. Figures 2; references 21: 16 Russian, 5 Western.

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UDC 551.465.1

## CLASSIFICATION OF BLACK SEA SURFACE WATER BASED ON TEMPORAL T,S ANALYSIS

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 5: GEOGRAFIYA in Russian  
No 1, Jan-Feb 86 (manuscript received 22 May 85) pp 56-62

[Article by M. G. Osheverov]

[Abstract] Regionalization and classification of waters are usually based on T,S-analysis. Until recently in classification of surface waters, the specifics of the seasonal changes in thermohaline characteristics were practically ignored. A previous work classified waters of the Sea of Japan based on analysis of a set of diagrams in polar coordinates indicating the phase and amplitude of annual fluctuations for each of the characteristics. The method of cluster analysis is best suited for classification. An example is presented, involving T,S-analysis of the surface waters of the Black Sea. Clusters are distinguished by analysis of distances between points and centers of clusters in the space of characteristics. The classification of the surface waters of the Black Sea obtained by cluster analysis agrees with classifications obtained by traditional methods, but is more detailed, not contradicting the basic physical-geographical and hydrologic characteristics of the Sea, thus confirming the expediency of considering the seasonal course of thermohaline characteristics in classification of surface waters and the suitability for this purpose of the method of classification of temporal T,S curves by cluster analysis. Figures 3, references 11: 7 Russian, 3 Western.

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# STOCHASTIC MODEL OF TIDAL EVOLUTION OF EARTH-MOON SYSTEM WITH CYCLIC CHANGE IN RESONANT FREQUENCY OF OCEAN

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 5, 1985  
(manuscript received 12 Mar 85) pp 1082-1086

[Article by B. A. Kagan and N. B. Maslova, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Leningrad Division]

[Abstract] Previous studies attributing tidal evolution in the earth-moon system to the resonant properties of the ocean which change under the influence of continental drift have not considered the possibility of cyclical restructuring of the resonant properties of the ocean. This restructuring should be accompanied by weakening of semidiurnal and strengthening of diurnal natural oscillations as the continents converge, with the opposite effect as they drift apart. This should lead to a change in the dissipation of tidal energy in the paleocean. The present article discusses the aftereffects of this change. It is limited to a study of the case in which the moon revolves around the earth in a circular equatorial orbit and the ocean tides are described by a single-mode approximation. Figure 1, references 11: 8 Russian, 3 Western.

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CSO: 1865/164

UDC 552.321.5:552.47

# SERPENTINITES AND GABBROIC ROCKS OF CLARION FAULT (CENTRAL PACIFIC OCEAN)

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 12, Dec 85 (manuscript received 3 Feb 84) pp 28-42

[Article by Ye. Ye. Lazko, Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry Institute, USSR Academy of Sciences, Moscow]

[Abstract] Successful dredging on the steep slopes of the Clarion transform fault was carried out on the 28th cruise of the "Dmitriy Mendeleev" in 1982. Sampling was at depths from 6 to 4.7 km in a region with the coordinates 14°13'N and 147°21'W, about 1,100 km to the southeast of the Hawaiian Islands. In addition to basalts, one dredging yielded abundant fragments of serpentinites and various gabbroic rocks from a depth greater than 5 km. The recovered rocks, which included apoperidotitic serpentinites, gabbroic varieties, dolerites, basalts and hyaloclastites, characterize the earth's crust at the top of the mantle. The peculiarities of composition of the ultramafic and gabbroic rocks are evidence of their identity to many similar rocks found in mid-oceanic ridges and transform faults in other oceans. A complex evolution apparently took place prior to entry of the serpentinites into the crust. Traces of plastic deformation in their microstructure may be associated with diapir rising of the initial peridotites from the upper mantle, most likely in the axial zone of the East Pacific Ocean Rise. The gabbroic rocks are

crystallization products of basalt melt fractionated in a closed magma hearth. It is postulated that the processes of generation of the oceanic lithosphere in the northern part of the East Pacific Ocean Rise correspond closely to the widely accepted model of its formation in zones of separation of lithospheric plates. It seems that the tectonic processes determining crustal evolution after its formation here also are essentially the same as in the mid-oceanic zones of other oceans. Figures 7, tables 7; references 30: 13 Russian, 17 Western.

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CSO: 1865/127

UDC 911.2:551.46/49

#### SOME PROBLEMS IN STUDY AND EXPLOITATION OF SHELF IN FAR EASTERN SEAS

Leningrad IZVESTIYA VSESOUZNOGO GEOGRAFICHESKOGO OBSHCHESTVA in Russian  
Vol 117, No 6, Nov-Dec 85 (manuscript received 24 Jul 84) pp 532-539

[Article by Ye. V. Krasnov and L. A. Segizbayeva]

[Abstract] The status of natural resources on the shelf of Far Eastern seas is reviewed. This includes the petroleum and gas of Sakhalin, titanium and magnetite sands of the Kuril Islands, mineral construction materials, mammals and fish, invertebrates and algae and various types of food, energy and recreational resources. Biological resources play a very important role. The seas of the Far East already yield more than 40% of national fish production and this must be increased. Fish farms have been established and must be expanded. Shipping is a highly important aspect of use of Far Eastern seas. Tides offer a great potential source of energy. All these forms of economic activity exert an influence on one another and on the environment as a whole. The petroleum industry, for example, has a great influence on the fish resources and an increase in hydraulic construction results in significant changes in the dynamics of sedimentation and currents, build-up and erosion of shores. The ecosystems of the shelf are highly vulnerable to anthropogenic agents. One of the points of departure in such an evaluation, a requirement for future planning of environmental safeguards against a background of maximum possible economic exploitation, is a physiographic regionalization of the shelf; work on this is continuing, but a preliminary regionalization map has been prepared and accompanies this review. Among the measures already taken for preserving the environment (although much remains to be done) are the following (each of which is discussed): ecological monitoring and determination of admissible concentrations of pollutants; banning or restriction of the catching of mammals, fish and invertebrates; establishment of different types of preserves. References: 16 Russian.

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CSO: 1865/122

## INDUCTION OF SYNTHESIS OF BACTERIAL LUCIFERASE BY PHENOBARBITAL

Moscow MIKROBIOLOGIYA in Russian Vol 54, No 5, Sep-Oct 85  
(manuscript received 2 Nov 83) pp 750-754

[Article by V. S. Danilov and O. K. Shibilkina, Biology Faculty, Moscow State University imeni M. V. Lomonosov]

[Abstract] The influence of phenobarbital, a typical inducer of monooxygenases in higher organisms, on the activity of enzymes of the bioluminescent chain of *Photobacterium fischeri* bacteria was studied. The growing of these bacteria with phenobarbital results in the increased synthesis of bacterial luciferase and components of the luminescent electron transfer chain. The culture medium, methods for determining the cytochrome P-450, protein, bioluminescent activity and degree of purity of the reagents were described by V. S. Danilov in an earlier study (MIKROBIOLOGIYA, Vol 54, No 4, p 587, 1965); the activities of enzymes in the bioluminescent chain were determined by a method described by N. A. Baranova, et al. in DOKL. AN SSSR, Vol 262, p 1001, 1982. It is shown that phenobarbital, on the one hand, being the substrate for the bacterial cytochrome P-450, inhibits bioluminescence both in vivo and in vitro, but it is also effective in inducing the luminescent system of *P. fischeri*. Data from measurement of activity and substrate specificity of enzymes of the luminescent chain and data from inhibitory analysis indicate that phenobarbital in a growing culture of *P. fischeri* manifests the well-studied properties of a typical inducer of monooxygenase systems. This phenomenon cannot be explained on the basis of any other concept concerning bacterial luciferase. The experiments suggest the possibility of using other effective inducers of synthesis of the cytochrome P-450 such as 3-methylcholanthrene and  $\beta$ -naphthol for stimulation of a luminescent system. Figures 3; references 18: 7 Russian, 11 Western.

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CSO: 1865/98

UDC 543.423.056:553/32

## METALS OF PLATINUM GROUP IN ABYSSAL FERROMANGANESE NODULES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 4, Dec 85  
(manuscript received 4 Feb 85) pp 992-996

[Article by G. N. Baturin, E. I. Fisher, A. N. Kurskiy and T. V. Puchkova, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow; All-Union Marine Scientific-Production Association for Marine Geology, Riga; Central Scientific Research Geological Prospecting Institute for Nonferrous and Precious Metals, Moscow]

[Abstract] There has been but limited information published on the content of platinum and metals of its group in ferromanganese nodules on the ocean floor, and many of these data are contradictory. This matter was studied using 30

samples of nodules from different regions of the world ocean, each sample constituting material from several nodules from the same station. The ore elements were determined by the chemical and chemical absorption methods. Platinum content was determined by the atomic emission method with sorption concentration on activated charcoal from a sample of 1-5 g. These results and data in the literature on these elements in Fe-Mn nodules are summarized in Table 1. The platinum content determined by different methods gives mean values of 80 and 358 mg/ton for Atlantic Ocean nodules. Other data for other oceans also reveal distinct differences. The best average content for the world ocean would be 160 mg/ton; corresponding estimates for other elements of the platinum group are palladium--6 mg/ton; iridium--7 mg/ton; ruthenium--8 mg/ton; rhodium--13 mg/ton. Tables 2; references 15: 4 Russian, 11 Western.

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UDC 550.341+550.345

#### VARIATIONS IN FIELD OF MASS VELOCITIES IN PLEISTOSEIST ZONE OF UNDERWATER EARTHQUAKE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 4, Dec 85  
(manuscript received 27 May 85) pp 849-852

[Article by B. V. Levin and S. L. Solovyev, corresponding member, USSR Academy of Sciences, Mining Institute imeni A. A. Skochinskiy, USSR Academy of Sciences, Lyubertsy, Moscow Oblast; Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] An approximate method is proposed for evaluating the field of vibrational or mass velocities of bottom material in the pleistoseist zone of an underwater earthquake and the effects caused by them as a function of earthquake magnitude and the properties of the bottom material or water layer. The method is based on accumulated seismic observations and the general laws of the mechanics of continuous media. Since the process of transmission of a seismic signal through rock in the pleistoseist zone is characterized by mass velocity amplitudes of  $10^0$ - $10^2$  cm/s, which are considerably less than the speed of sound, this process can be examined in an acoustic approximation. In the formulated problem the medium is considered homogeneous and the process adiabatic. A mass of seismic data was used in determining the empirical dependence of magnitude on the parameter  $R_i V_i$ , where  $R_i$  is hypocentral distance to the measurement point and with adequate distance from the epicenter can be assumed equal to the epicentral distance and  $V_i$  is the mass velocity at the measurement point. The expression  $M = 2 \lg R_i V_i - (1.13 \pm 0.38)$  describes the considered phenomenon in the magnitude range  $3.5 < M < 7.5$ . This expression, on the basis of a mass velocity measurement at one fixed surface point, makes it possible to ascertain earthquake magnitude with an error comparable to the standard error in determining magnitude and to construct the velocity field in the pleistoseist zone for average bottom material. Figures 3; tables 1; references: 10 Russian.

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CSO: 1865/137

# FEATURES OF DEEP STRUCTURE IN NORTHERN EURASIA DETERMINED FROM RECORDS OF SURFACE SEISMIC WAVES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 4, Dec 85  
(manuscript received 7 Jan 85) pp 845-848

[Article by A. V. Lander, A. L. Levshin, L. I. Ratnikova and A. N. Yakobson, Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences]

[Abstract] The registry of surface seismic waves in remote northeasterly regions of Eurasia makes it possible to outline major sedimentary depressions and areas of continental riftogenesis. In the absence of expeditionary data, surface wave records were used in studying the shelf of the Barents Sea and the Verkhoyanskiy and Cherskiy Ranges in northeastern Siberia. In the Bering Sea the averaged section of the crust could be determined. There were anomalously low velocities of transverse waves in the upper part corresponding to sedimentary rocks; there was no well-expressed "granite" layer. Low Rayleigh wave velocities along several trajectories indicate the existence of a deep depression between Franz Josef Land and Novaya Zemlya. Records for other wave trajectories indicate a platform nature of the shelf to the west of the Kheys-Rybachiy Peninsula line. In the southern part of the shelf there is an intermediate structure between the deep Southern Barents Depression and the adjacent part of the continent. The records revealed reflected surface waves associated with the boundaries of crustal blocks of sharply different structure. For the Verkhoyanskiy Range the dispersion curve gives a crustal thickness of 40-44 km and wave parameters typical for ranges of moderate elevation in regions of predominant tectonic compression. In the Cherskiy Range crustal thickness is 38-47 km in the western, higher part of the range; the wave parameters for the upper mantle seemingly confirm the postulated existence of the major Momskiy continental rift. Figures 4; references: 8 Russian.

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CSO: 1865/137

UDC 552.1:53

# SEISMOTECTONIC EFFECT OF MANTLE INHOMOGENEITIES OF OCEAN ACTIVE MARGINS

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 285, No 4, Dec 85  
(manuscript received 5 Feb 85) pp 840-844

[Article by S. A. Boldyrev and A. B. Yefimov, Earth Physics Institute imeni O. Yu. Shmidt, USSR Academy of Sciences, Moscow]

[Abstract] The active margins of oceans are characterized by strong geodynamic processes; most mantle earthquakes occur there and their focal energy attains the highest values observed on the earth. It may be that tectonic processes and stresses in this part of the upper mantle (600-700 km) are governed by density inhomogeneities. This article gives estimates of the stresses caused

by density inhomogeneities. As a first approximation it is assumed that density and velocity variations are related linearly and this makes it possible to determine the distribution of anomalous masses on the basis of the velocity section. The study was based on the three-dimensional velocity field of P waves for a large region which included the Kuril-Kamchatka island arc and adjacent parts of the Sea of Okhotsk and Pacific Ocean to depths of 650 km. Specifically, a study was made of this problem for the section across the arc structures near southern Kamchatka in the depth range 50-650 km. The upper 50-km layer was taken into account separately. It was assumed that velocity changes are determined exclusively by density variations despite a constancy of mineralogical composition. The density distribution duplicated the velocity section. The stressed-strained state of the upper mantle was computed numerically for stipulated density inhomogeneities at the points of intersection of a rectangular grid with a 50-km interval. The elasticity theory equation was solved with stipulated mass forces in some rectangular region for different conditions of coupling with the adjacent medium, also considered elastic but with undisturbed homogeneous density. The interrelationship between velocity and density inhomogeneities makes it possible to estimate the stress deviators for the mantle. Mantle density anomalies in the ocean-continent transition region cause movement of the viscous medium in the gravity field. Denser focal zone matter and the ocean block sink and the mantle matter of lesser density under the sea margin forms an ascending flow. Upper mantle viscosity in the active margins may not be less than  $10^{23}$  P. The medium can be visualized as a system of two or many phases with movement of one relative to the other. The proposed computation method makes it possible to estimate the most general properties of deep matter in the active margins. Figures 3; references 14: 11 Russian, 3 Western.

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CSO: 1865/137

#### SEAMOUNTS EXPLORED ON SEVENTH CRUISE OF 'VITYAZ'

Moscow ZEMLYA I VSELENNAYA in Russian No 6, Nov-Dec 85 pp 53-58

[Article by A. M. Gorodnitskiy, doctor of geological and mineralogical sciences, and A. A. Nal]

[Abstract] The "Vityaz," scientific research ship of the Oceanology Institute, on its 7th cruise, beginning 17 July 1984, emphasized the study of seamounts in the Mediterranean Sea and North Atlantic. Later joined by the "Rift," the two ships explored the so-called Azores-Gibraltar tectonic zone. In the Tyrrhenian Sea a special study was made of underwater volcanoes, some in the central part of the sea, whereas others extend along the coast of Corsica and Sardinia. Over Vercelli Seamount a detailed study was made of bottom relief and a magnetic survey was carried out. Vercelli appears to be an enormous block rising 1,000-1,100 m above the surrounding sea floor. However, no magnetic anomaly was discovered, although volcanoes made up of basalts generate such anomalies. The seamount was investigated by the "Zvuk-4" telecontrolled apparatus.

Vercelli consists of some dark rocks without sediments. It was also explored by the "Argus" submarine. Heat flow measurements were made, and the flow was found to be small. An oriented rock sample was taken for the first time under water. Whether the seamount is of volcanic or nonvolcanic origin is unknown. Vasilov Seamount rises 2,840 m above the surrounding bottom and its highest point is 739 m below the surface and was inaccessible for submarine or diving bell. Bottom relief was studied, the anomalous magnetic field was measured, heat flow was registered and geological work carried out. A gradient magnetic survey was made with a new magnetometer. Vavilov Seamount is clearly an underwater volcano with a multistage history of eruptions. It was formed under water and never was an island. In the Atlantic Ampere and Josephine Seamounts were studied. The boundary between the African and Eurasian lithospheric plates is located in this region; Ampere is on the African plate and Josephine on the Eurasian plate. Ampere is of particular interest due to the widely publicized report that it reveals ruins of structures built by ancient inhabitants of Atlantis. Exploration by the "Zvuk-4," "Argus" and divers revealed that the observed phenomena all have a natural explanation. Ampere is an ancient volcanic structure which was once an island. Detailed exploration also confirmed that Josephine had a volcanic origin. Figures 5.

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CSO: 1865/121

#### COMPUTER PROCESSING OF OCEANOGRAPHIC DATA AT FAR EASTERN SCIENTIFIC CENTER

Moscow PRIRODA in Russian No 1, Jan 86 pp 29-40.

[Article by Viktor L. Perchuk, doctor of technical sciences, director, Automation and Control Processes Institute, Far Eastern Scientific Center, USSR Academy of Sciences]

[Abstract] The procedures used in collection of oceanographic data by scientific research ships are reviewed as background for a discussion of the computer-data bank complex developed in the Far Eastern Scientific Center for user-oriented analysis and dissemination of the collected information. The Automation and Control Processes Institute has developed and set up a data bank of oceanographic information for the Pacific and Indian Oceans. Data for the Far Eastern region collected since 1875 are collected at the Obninsk Oceanographic Data Center and stored in the format of the World Data Center on magnetic tapes. Data from more than 4,000 expeditions are available. These data, to be useful to the user, must be transformed to formats corresponding to the special type of data base control system (DBCS) developed at the institute and most convenient for the user. Such data are stored on magnetic disks. There is provision for obtaining data simultaneously from several data banks in other parts of the country; this part of the system should be realized in the course of the 12th Five-Year Plan. There are several different operating regimes for the system. [Similar systems could be developed for exploitation and dissemination of geophysical and astrophysical data.] A series of programs is available facilitating exploitation of the data

bankby users for solving specific problems. Various subsystems exist for such purposes as screening out of blunders and errors. Shipboard collection and processing systems have been developed by the institute, such as the DISTERM complex developed for the "Akademik Korolev," a system of computers operating at three levels. Figures 6.

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#### OCEAN SURFACE TEMPERATURE FIELD VARIABILITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 4, Feb 86  
(manuscript received 2 Apr 85) pp 969-972

[Article by S. A. Molchanov, L. I. Piterbarg, A. A. Ruzmaykin and D. D. Sokolov, Moscow State University imeni M. V. Lomonosov; Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences; Applied Mathematics Institute imeni M. V. Keldysh, USSR Academy of Sciences, Moscow]

[Abstract] This is essentially a continuation of research published earlier by the authors (S. A. Molchanov, et al., GEOPHYS. ASTROPHYS. FLUID DYNAMICS, Vol 30, pp 242-259, 1984) on development of a more accurate representation of ocean surface temperature field variability. Equations are derived and analyzed for the annual variation of the ocean surface temperature field and a more precise correlation function for the field of deviations and the possibility of presence of well-expressed anomalies or intermittence in temperature distribution is evaluated. The heat budget equation vertically integrated in the upper quasihomogeneous layer of the ocean is used as a point of departure. It was found on the basis of the derived equations that synoptic wind fluctuations exert a significant influence on advection of the climatic field of ocean surface temperature and on the feedback factor in the ocean-atmosphere system and generate an additional heat flow. In most middle-latitude ocean regions horizontal heat exchange in the ocean surface temperature field can be attributed to anomalous drift currents and not the macroscale turbulence associated with synoptic eddies. Anomalies sporadically generated by such processes as storms or hurricanes can persist for a considerable time. Their influence must be evaluated taking into account a whole series of factors, such as dependence of the heat exchange coefficient on the ratio of size of anomalies and the spatial scale of drift currents, extinction of anomalies due to heat exchange with the atmosphere and the correlation structure of the field of sources. Figures 1; references 12: 6 Russian, 6 Western.

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## THERMODYNAMIC MODEL OF SEA ICE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 4, Feb 86.  
(manuscript received 25 Mar 85) pp 965-968

[Article by B. A. Kagan, V. A. Ryabchenko and A. S. Safray, Leningrad Branch, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences]

[Abstract] A thermodynamic model of sea ice was developed for incorporation into the seasonal thermodynamic model of the ocean-atmosphere proposed by the authors earlier in IZV. AN SSSR: FIZ. ATMOSF. I OKEANA, Vol 20, No 1, pp 48-56, 1984. This could be used in reproducing the annual cycle of sea ice in the northern hemisphere. In formulating the model it was assumed that in the polar region the ice cover has the form of a film of finite thickness with the presence of snow and melt water on the surface possible. The annual cycle was broken down into three periods: winter, with snow on the surface, with the temperature of the active surface being lower than the freezing point of water and with ice melting or building up on its lower surface; spring, when the ice surface is covered with snow and melt water, ice melting on its lower surface; summer-autumn, with the ice surface covered with meltwater, melting or build-up of ice occurring on both surfaces. The equations derived in the article, in combination with the thermodynamic model equations published earlier, modified with allowance for movement of the northern limit of the region of ice formation and ice transport from the polar basin, reproduces the main features of sea ice seasonal variability. Computations revealed an asymmetry of the annual variation of ice area and thickness, total snow disappearance in summer, a phase shift between fluctuations of ice area and air temperature and a change in heat flow direction in the snow-ice cover throughout the year. Figures 1; references 10: 4 Russian, 6 Western.

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UDC 532.591

## CAPILLARY SOLITONS IN DEEP WATER

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 286, No 4, Feb 86  
(manuscript received 21 Jun 85) pp 840-844

[Article by A. S. Monin, corresponding member, USSR Academy of Sciences]

[Abstract] Until now there have been no soliton solutions of the precise equations of an incompressible fluid for waves at the surface. Such solutions were obtained for capillary waves in deep water, but only with a discontinuity on the axis of the solitons, still leaving no continuous soliton solutions. The solutions for capillary waves were obtained making use of contributions along these lines made by G. D. Crapper and W. Kinnersley (J. FLUID MECH., Vol 2, No 4, pp 532-540, 1957; Vol 77, No 2, pp 229-241, 1976). Crapper obtained a solution for periodic capillary waves of finite amplitude, but with

certain limitations; these have now been removed and a general solution obtained. General solutions were obtained by Kinnersley, but no effort was made to find solitons. New formulas are derived describing periodic capillary waves of finite amplitude, as well as an explicit equation for the wave profile. In the family of solutions obtained there are no solitary waves with a velocity potential continuously changing along the streamline, and obtaining such a solution remains an unsolved problem. Figures 1; references: 2 Western.

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UDC 553.31:552.4:57

INFLUENCE OF BIOGENIC FACTOR ON FORMATION OF MICROSTRUCTURES OF ABYSSAL  
FERROMANGANESE NODULES

Kiev GEOLOGICHESKIY ZHURNAL in Russian Vol 46, No 1, Jan-Feb 86  
(manuscript received 31 May 84) pp 109-116

[Article by G. N. Baturin and V. T. Dubinchuk, Oceanology Institute imeni  
L. P. Shirshov, USSR Academy of Sciences, Moscow; USSR Ministry of Geology,  
Moscow]

[Abstract] Structure of ferromanganese nodules was studied using samples from the Clarion-Clipperton zone and the area of the Mid-Pacific Seamounts for clarifying the role of the biogenic factor in their formation. Research techniques were centered on electron and scanning microscopy and microdiffraction. Nodules in both regions were primarily of colloform and spheroidal ultramicroscopic structures of ore matter containing disperse biogenic detritus, as well as formations of biomorphic appearance. In the Mid-Pacific Seamounts region Fe-Mn nodules most characteristically had coccoid, tubular and broomlike biomorphic structures, each of which are described and illustrated. The morphology of these different types of formations was compared with specific forms of bacterial flora and microflora. Although some researchers attribute all microscopic segregations of Fe and Mn hydroxides of spherical, oval and rod-shaped configuration to a bacteriogenic origin, it is emphasized that purely morphological comparisons are not convincing proof of the direct participation of microorganisms in ore formation processes. The role of bacteria in formation of Fe-Mn nodules and encrustations requires more in-depth research in marine microbiology. All recent research does indicate that on the surface and within nodules there are abundant populations of specific Fe- and Mn-oxidizing bacteria. The question of the functional importance and mechanism of Fe and Mn oxidation by microorganisms remains open. Figures 2; references 37: 27 Russian, 10 Western.

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SOME ASPECTS OF USE OF UNDERWATER TECHNOLOGY FOR COLLECTING LANDSCAPE-  
GEOLOGICAL INFORMATION

Kiev GEOLOGICHESKIY ZHURNAL in Russian Vol 46, No 1, Jan-Feb 86  
(manuscript received 28 Jan 83) pp 100-109

[Article by V. Kh. Gevorkyan, A. I. Dmitriyenko, M. L. Zaferman and A. L. Sorokin, Geological Sciences Institute, Ukrainian Academy of Sciences, Kiev; Polar Fisheries and Oceanography Scientific Research Institute imeni N. M. Knipovich, Murmansk]

[Abstract] An underwater landscape is defined as part of the sea floor with a consistent structure and dynamics. The underwater landscapes of the northern fisheries basin have been studied for more than a decade by the Polar Fisheries and Oceanography Institute and the Geological Sciences Institute. This has involved collection of great volumes of data over great areas using high-resolution techniques and equipment. Emphasis has been on use of the trawled "Triton" camera and visual study from manned submersibles, supplementing traditional methods. There has been synchronous data collection by photography, visual observations, depth sounding and collection of benthos and bottom material by trawl and dredge. Underwater landscapes from the shore to depths of 1,000-2,000 m have been mapped. The "Sever-2" and "TINRO-2" submersibles, in use since 1975, hold two or three observers; they move at 0.5-1.0 knot at distances as little as 3-4 m from the floor. Their use in obtaining data on bottom relief, bottom material, water transparency, animal and fish life and plankton is described. Aerial surveys play an integral part in this work, providing much information on morphological structure of underwater landscapes. The submersibles concentrate their efforts on key areas. Office processing and interpretation techniques are also described. Numerous interrelationships are studied on the basis of data plotted along profiles. Some of the products of such work are illustrated and discussed. Detailed geological, geomorphological and landscape maps are but a few of these products. Figures 2; references 19: 15 Russian, 4 Western.

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UDC 532.59:551.466.3

QUASILINEAR THEORY OF EVOLUTION OF SURFACE WAVES UNDER INFLUENCE OF WIND  
IN BASIN WITH UNEVEN BOTTOM

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 24 Apr 84) pp 1299-1307

[Article by S. Yu. Dobrokhotoy and V. M. Kuzmina, Moscow Civil Engineering Institute; Water Problems Institute, USSR Academy of Sciences]

[Abstract] A quasilinear theory of evolution of surface waves under the influence of wind waves was developed for the particular case of a basin with

an uneven bottom. The model was formulated on the assumption that the basin bottom and mean wind velocity are dependent on both the horizontal and vertical coordinates and time. In the case of arbitrary wavelengths the equation for the free interface between air and water must take into account all dispersion terms, but any effort to make allowance for bottom irregularities and a variable mean wind velocity makes the derivation of the pertinent equation extremely difficult. In the course of developing the model it was found that application of the methods proposed by V. P. Maslov makes it possible to write and solve this equation. The asymptotic solutions which are obtained in reality constitute a generalization of the solution obtained by J. W. Miles in J. FLUID. MECH., Vol 3, Part 2, pp 185-204, 1957. The appendix gives the explicit form of these solutions. Figures 1; references 13: 12 Russian, 1 Western.

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#### THEORY OF SELF-SIMILAR DEVELOPMENT OF JET IN FLUID OF UNIFORM DENSITY

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 3 Apr 84, after revision 2 Oct 84)  
pp 1290-1294

[Article by S. I. Voropayev, Oceanology Institute, USSR Academy of Sciences]

[Abstract] This is essentially a continuation of the author's earlier laboratory experiments for research on development of a circular jet penetrating into a stratified or density-uniform fluid (IZV. AN SSSR: FAO, Vol 21, No 9, 1985) in a continuing effort at laboratory simulation of the evolution of jet currents in the upper layer of the ocean, so-called "mushroom-shaped currents" or "eddy structures." The limiting case of jet or jet current development when the influence of stratification can be neglected is considered in order to give a theoretical explanation for experimental results obtained earlier. The model used gives a qualitatively and quantitatively correct description of the phenomenon as it develops into a self-similar regime in which initial conditions exert no influence on observed parameters. A similar model can be formulated for a density-stratified medium. At great distances from the jet a self-similar regime is attained, as is described by an expression which makes it possible to ascertain this distance. Since there is no longer any dependence on initial conditions after reaching a self-similar regime, the key jet parameters, such as velocity of propagation of the leading edge of the transverse jet and its transverse dimensions are determined by the nondimensional jet momentum parameter. Figures 3; references 10: 7 Russian, 3 Western.

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## NEW FORM OF WAVE EQUATION FOR STRATIFIED MEDIUM

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 6 Jul 84, after revision 22 Oct 84)  
pp 1252-1259

[Article by O. A. Godin, Oceanology Institute, USSR Academy of Sciences]

[Abstract] An equation without divergent coefficients was derived for describing sound propagation in a layered medium with a piecewise smooth dependence of sound density and speed of sound on depth. This fundamental equation served as a basis for deriving new forms of wave equations for a stratified medium for: 1) elastic shear waves with horizontal polarization in a solid; 2) electromagnetic waves; 3) acoustic waves in narrow tubes. This involved use of new independent variables, Cartesian coordinates. It is emphasized that allowance for microstructure of properties in the propagation medium must be made not only for sound in a stratified fluid, but for other waves as well. Examples of this are presented (as a simplification, only monochromatic waves are examined). After comparison of different forms of the acoustic wave equation, there is detailed consideration of reflection of a plane wave from a thin homogeneous layer with arbitrary laws of change in density and speed of sound in the layer. Determination of the coefficient of reflection from a thin layer requires a great number of iterations in order to achieve the necessary accuracy. References 11: 9 Russian, 2 Western.

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UDC 552.56.124.4:550.85(265)

## STRUCTURE OF CONCENTRATIONS OF FERROMANGANESE NODULES

Moscow SOVETSKAYA GEOLOGIYA in Russian No 10, Oct 85 pp 31-38

[Article by I. N. Goryainov, All-Union Marine Geology Scientific Research Institute]

[Abstract] Nonuniformity is one of the characteristics of ferromanganese deposits on the ocean floor. The article reviews the variability and anisotropy of these deposits on the basis of materials in the Soviet and foreign literature. The principal parameters characterizing the internal structure and morphology of deposits are density, degree of continuity, content of key components in nodules, extent of deposits and complexity of contours of deposit. Each of these parameters is discussed in detail. Among the indices used are the nonuniformity of mineralization and the coefficient of asymmetry of the contents of manganese, iron, copper, nickel and cobalt. With one and the same variability, expressed by the variation coefficient or the nonuniformity index, the internal structure of the deposits may be different. This is attributable to the presence within the deposits of "windows," ore-free sectors. The extent of such a "window" governs the parameters and morphology of

the ore deposits. Within ore deposits most of the ore-free sectors are small and very small "windows." However, most of the ore-free area is concentrated in several large "windows." The most correct method for determining the anisotropy of properties of nodule deposits is an analysis of the autocorrelation radii computed for different directions. The anisotropy of deposits conforms to the anisotropy of relief; relief and deposits have a very close orientation and anisotropy index. Fe-Mn nodule deposits are characterized by a broad range of extents and various configurations; a table gives a preliminary classification of deposits with respect to these parameters. Figures 3; tables 2; references 14: 12 Russian, 2 Western.

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## HYPERBARIC COMPLEX FOR SIMULATING DIVES TO 400-500 METERS

Moscow IZVESTIYA in Russian 30 Dec 85, p 6

[Article by A. Blokhnin, correspondent]

[Abstract] The article reports on a unique hyperbaric complex that has been built in the laboratory of hyperbaric physiology of the USSR Academy of Sciences' Institute of Evolutionary Physiology and Biochemistry imeni Sechenov in Leningrad. It has a research chamber for animal experiments which simulates conditions of great underwater depths. Complexes similar to it are said to exist only in France and the USA.

The author of the article witnessed state acceptance tests of the new complex. They involved a monkey nicknamed Nick, which was put into the complex seated in a clear plastic case. The chamber is described as a steel cylinder about as tall as a man and with a volume of 9 cubic meters, which is wrapped with heat-insulating material. There are windows made of thick quartz glass for observing inside the chamber, and there are manipulators for moving objects inside.

Doctor of Biological Sciences, Prof. I. Demchenko, head of the laboratory, explained that the complex is intended for studying physiological adaptation to pressures of 40-50 atmospheres, which correspond to underwater dives to 400-500 meters. He indicated that the studies focus on the effects on the organism of the trimix breathing mixture consisting of mostly helium with small portions of nitrogen and oxygen, which is necessary for life support in such conditions. He mentioned in this connection a record dive made by humans in the Gelendzhik Hyperbaric Complex, and their experiences with the superhigh heat conductivity of this mixture, in which they could not keep prepared hot tea warm. Other associates of the laboratory pointed out the importance of the new complex for providing data to assess candidate divers' resistance to hypoxia, immune-system stability, and other protective systems. It is indicated that the chamber can hold more than one test animal, and it is equipped with a special evacuation compartment in case an animal must be removed in the course of an experiment.

Other laboratory associates who are identified are Candidate of Medical Sciences V. Kostkin, head of the group of morphologists, and S. Cheremenin, head of the complex's automation group.

Two photographs are given showing Cheremenin at the controls of a manipulator, and Nick the monkey seated in his case inside the pressure chamber.

## TERRESTRIAL GEOPHYSICS

### MICROMOTORS FOR SUPERDEEP DRILLING EQUIPMENT

Vilnius SOVETSKAYA LITVA in Russian 19 Feb 86, No 42 (12955), p 4, cols 4-5

[Text] In a previous issue, we reported that a micromotor of a new design was among the improved equipment for drilling a unique superdeep borehole (11 kilometers) which Soviet geologists are conducting on the Kola Peninsula. This motor was developed by specialists of the Kaunas Polytechnic Institute (KPI).

"The participants in this experiment praised the micromotor highly, and they ordered a whole series of them for use in drilling the deepest boreholes in the world," related docent Styaponas Gechis of KPI's chair of electric machines. "This work has been completed: 90 micromotors have been built. Each of them can be held easily in one's hand; the machine's diameter does not exceed 6 centimeters. Micromotors installed in unique devices will withstand a temperature of 220 degrees and a pressure of 2,000 atmospheres. These conditions are characteristic of boreholes at depths of 10 kilometers and more.

"We cooperated closely with Kiev specialists in the process of designing the series of little motors, which utilize the latest achievements of science and technology. Our plans include the development of electric machines which will make it possible to reduce the size of equipment for superdeep boreholes and lower the cost of expensive drilling work substantially."

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## DEEP DRILLING EFFORTS TO CONTINUE: BENEFITS, PLANS OUTLINED

Moscow APN DAILY REVIEW in English 5 Aug 85

[Article by Vladimir Mazur, candidate of sciences, RSFSR Deputy Minister for Geology: "The Clue to the Exploration of the Earth's Depths"]

[Text] A vast program of exploring the depths of the earth's interior on Soviet territory was launched more than two decades ago. The course of its implementation in the Russian Federation is described by Vladimir Mazur, candidate of sciences (geol.-mineral.), Deputy Minister of Geology of the republic.

This idea of exploring the earth's crust and the geological history of our planet has attracted scientists since olden times. But there was no technical opportunity to implement it. It turned out that man can explore outer space quicker than the earth's deep layers. Here it takes decades to explore each kilometer. A depth of not more than five kilometers is accessible to modern drilling. It is true that the Soviet Union and the United States have wells seven to nine kilometers deep. They were drilled in search of oil and gas in sedimentary basins and, as a rule, revealed the same layers which outcropped on the edges of the basin. Solving purely practical problems of prospecting, these wells gave little for understanding the structure of deep areas of the earth's crust and the upper mantle. This region known as the tectonosphere is of the greatest interest for research. The energy which causes the movement of the earth's crust is concentrated in the tectonosphere. It is in the tectonosphere that melts rising to the surface and triggering off volcanic eruptions are formed. We should study complex physical and physico-chemical processes which take place in the tectonosphere in order to elucidate the origin and regular features of the development of different geological structures. During hundreds of millions and billions of years of geological history endogenic processes--earthquakes, eruptions and orogenesis (mountain building) take place. Researchers have to reconstruct the picture of the life of the planet's interior predominantly from the traces left by these processes in the structure of the crust and the upper mantle.

As a rule, various methods are used either separately or combined. For instance, a geologist explores the structure of a surface and then, extrapolating the data, assesses the content of several of the upper kilometers of the earth's crust. The role of geophysics in modern earth sciences and its sphere of application is great. But these and other indirect methods do not give an answer to the question of the composition and age of rocks because

different rocks may possess similar properties. In some cases this hinders the geological interpretation of data obtained. Such a difficulty has become a particular hindrance when due to the depletion of mineral deposits lying rather close to the surface, the necessity has arisen of studying in detail the deep layers of the earth's crust.

A new stage in exploring the earth's interior in the Soviet Union has begun with the discussion of ultra-deep drilling project. Technological progress linked with the drilling of single super-deep boreholes has made it possible to create new reliable ore-crushing drilling tools--drill bits, turbo-drills, and light-alloy drill pipes without which one cannot reach the deep interior. While just ten years ago we spoke of ultra-deep drilling as of an experiment, now it has gone far beyond the framework of this definition. Soviet scientists have designed a number of instruments for drilling a network of super-deep boreholes which will contribute to the exploration of the structure of deep layers of the earth's interior on the USSR's territory.

The program envisages the drilling of 22 super-deep boreholes. Twelve such boreholes are designed for studying oil- and gas-bearing areas, while others will be used for exploring ores and the tectonic structure of regions. An important section of the program is regional geological and geophysical studies, the final objective of which is the construction of typical models of the tectonosphere for areas with different geodynamic situations of the basic oil- and gas-bearing regions in the USSR.

The third ultra-deep borehole (Kola borehole) which has reached the mark of 12,064 meters has already assessed the structure of the earth's ancient complex--the Baltic shield. The technological facilities and the experience accumulated by the Soviet school of super-deep drilling have provided a good basis for a further rise in the efficiency of drilling such boreholes. The best achievements of Soviet engineering are used to implement the super-deep drilling program which, combined with studies made from the high atmosphere and from space vehicles and geophysical and geochemical investigations, prospecting on land and at sea, will speed up geological studies of the earth's deep layers in the USSR.

The Urals "Stone Belt" has long been famous for its ore deposits. But today it is explored so much that in order to discover a deposit new theoretical prerequisites based on exploring the deep structure of the Urals are a must. The Urals ultra-deep borehole in the vicinity of the city of Nizhniy Tagil will be a major component of the program. We are convinced that here, as with the Kola super-deep borehole, interesting geological discoveries will be made.

It is common knowledge that the production of oil and gas in Western Siberia and their transportation to the European part of the USSR are important parts of the USSR's energy program. Practically the whole increment of gas extracted in this country during the current five-year period is achieved in Western Siberia. The extraction of oil in Tyumen Region steadily grows. Tyumen oil makes up more than half of the USSR's oil output. But practically only the upper part of the sedimentary section to a depth of 5,500 meters has been explored here. Scientists believe that in Tyumen Region oil and gas deposits

can be found at large depths too. Is this so? Is the lower sedimentary rock layer of practical interest? These questions will be answered after drilling another ultra-deep well which will appear within the area of the world-famous Urengoy deposit. The well will be eight to ten kilometers deep.

The Timan-Pechora oil- and gas-bearing province is another major region of interest in the super-deep drilling program. This is a region in the USSR's European North, where a developed oil and gas industry has already been established. Here, like in Tyumen Region, there is an opportunity to use efficiently the sedimentary deposit section which is promising for oil and gas prospecting. The drilling of ultra-deep boreholes in Timan-Pechora province will make it possible to study its deep structure, the further development of oil and gas prospecting and also to carefully analyze lower deposits. It is very important that the borehole will be drilled in the region of the Vuktyl gas deposit which is now in use and the recently discovered West Soples gas deposit. Subsequently several ultra-deep boreholes will be drilled in Tyumen Region and in Timan-Pechora province. For the first time in northern areas of Timan-Pechora province ultra-deep boreholes will be drilled by the F-320 drilling rig designed and manufactured in Romania. We continue to expand our close production contacts with Romania in the field of prospecting for and use of oil and gas deposits. This is another example of the efficiency of long-term businesslike cooperation among socialist countries within the CMEA framework.

On the whole, the considerable expansion of the scale of super-deep drilling in the USSR will make it possible to specify and study the different types of the structure of the geological section earlier inaccessible to exploration, to create effective means for its study and to work out scientific criteria for the use of mineral deposits. In addition, it is very important to set up teams of geophysicists, geologists, and drillers capable of solving these problems unique in complexity, practical and scientific significance.

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## GUBIN'S SEISMOTECTONICS LAW TO AID EARTHQUAKE PREDICTION

Moscow APN DAILY REVIEW in English 5 Aug 85

[Article by Ella Nikolskaya: "An Earthquake: Where Will It Occur?"]

[Text] A new major scientific achievement has been entered into the USSR State Register of Discoveries. A hitherto unknown regularity, found out by Igor Gubin, corresponding member, USSR Academy of Sciences, and called "Gubin's law of seismotectonics", helps with a large degree of probability to predict the place of a future earthquake, its size, the force of tremors and their recurrence.

Predicting earthquakes is one of the key problems in modern science. Regions where occasional shiftings of the earth's crust take place are inhabited by about one-third of the world's population. As in non-seismic areas, builders there are erecting higher and higher [structures in] cities, high-speed highways, industrial giants and power stations. A timely and precise forecast would enable prompt measures to be taken, preventing loss of human life, fires, and other disastrous consequences. In perspective this problem is to be of great relevance for builders.

Buildings erected in seismic areas in recent years are particularly sturdy, their supporting frames capable of withstanding even strong tremors. But such construction, naturally, involves considerable additional expenses. So every time starting to build, say, a hydropower station, construction engineers try to obtain a special map of the region showing not only zones of possible earthquakes, but also their nature: force of tremors, width of paths along which they spread, and recurrence. With these data in hand, engineers determine the kind of construction they will undertake.

Maps of seismic regions, on which geographic zones are divided into districts corresponding to the degree of a potential seismic hazard, have been in use for a fairly long time now. But in seismology there is a number of scientific schools and, accordingly, different approaches to map making. On the whole, all is done on the basis of a comprehensive analysis of seismological, geological and statistical data, historical and literature materials, etc. But whatever the methods used, maps compiled this way suffer from inaccuracies: they indicate too wide (several hundred square kilometers) zones of possible earthquakes and, besides, more often than not, underestimate or overestimate their potential energy.

Having studied for several decades the earthquakes in Central Asia, one of the most seismic regions in the world, Igor Gubin, corresponding member, USSR Academy of Sciences, established and formulated in figure terms a hitherto unknown regularity: active geological structures of one and the same type and size are the site of similar earthquakes--their foci, energy, tremor force and recurrence are analogous. This discovery has helped to delineate more precisely the size and outlines of danger zones and more accurately to predict the force of tremors and other parameters of a possible disaster.

Twenty-three big earthquakes that have taken place in recent years were predicted by Gubin and his followers with a high degree of accuracy, including in places where no such cataclysms had been observed before. Thus, Nature itself confirmed the scientist's conjecture first made in the 1940s, when he was exploring in Turkmenian and Kirghiz mountains the fissures of the earth's crust caused by previous earthquakes, the structure of component rocks and when he was collecting in remote mountain villages data on old earthquakes, looking for their traces and reading their past from the exposed hillsides and river banks.

There are already many examples on record demonstrating the operation of Gubin's law of seismotectonics. When India, for example, planned to build a hydropower station not far from Bombay, Gubin was invited as a consultant: the question was whether construction at the chosen site was to be carried out by usual or by anti-seismic methods. After a thorough inspection of the site and its environs, the scientist said that a strong earthquake was to be expected in the area (although none had occurred previously). The Soviet geophysicist's opinion was taken into consideration. The prediction was confirmed unexpectedly soon: in a few years' time. In geology, where processes take millennia, that was a truly "lightning answer" to a forecast. The earthquake did take place, but, owing to the measures taken in advance, failed to cause the damage it might have caused under other circumstances.

The scientific significance of Gubin's discovery lies in the fact that it has radically altered seismological thinking and launched a new trend in this science, mapping out reliable approaches to the solution of the key problem: prediction of earthquakes.

Equally great is its practical value: seismic maps compiled according to "Gubin's law of seismotectonics", make it possible to choose most suitable sites for housing, enterprises and power stations, to determine the type of building to be conducted in a particular locality and to lay railways and highways, erect dams and cut tunnels in conformity with a possible risk.

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SOLUTION OF DIRECT GRAVIMETRY PROBLEMS FOR VERTICAL CYLINDRICAL BODIES

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 10, Oct 85  
(manuscript received 11 Apr 84) pp 94-100

[Article by A. V. Kudrya (deceased), Tbilisi State University, Tbilisi]

[Abstract] A new method is suggested for calculating the  $\Delta g$  field generated by a regular rectangular prism, the density of which changes exponentially with the vertical coordinate. Analytic and approximate solutions of the direct problem in gravimetry are presented. Figures 1; references 8: 7 Russian, 1 Western.

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TRANSIENT PROCESSES IN ELECTROMAGNETIC SOUNDINGS IN ELECTROCHEMICALLY ACTIVE HALF-SPACE

Novosibirsk GEOLOGIYA I GEOFIZIKA in Russian No 10, Oct 85  
(manuscript received 3 Apr 84) pp 100-109

[Article by A. A. Ryzhov, All-Union Scientific Research Institute of Hydrogeology and Engineering Geology]

[Abstract] Typical forms of transient processes excited by a grounded electric dipole are presented. If the half-space is polarizable, typical forms of the magnetic component in the loop differ from those observed in a nonpolarizable half-space. The influence of polarizability is found to differ from that of the time parameter. Electrochemical activity of the medium creates different types of EMF in the loop of a grounded electric dipole or equivalent circuit. Neglecting this factor may result in errors concerning the type of geoelectric cross-section suggested by interpretation of the results of soundings. Figures 4; references: 8 Russian.

6508/5915  
CSO: 1865/206

## USE OF ACOUSTICAL TELEVISION TO SOLVE HYDROGEOLOGICAL PROBLEMS

Moscow RAZVEDKA I OKHRANA NEDR in Russian No 10; Oct 85 pp 55-56

[Article by V. I. Morozov and I. K. Onofriychuk, "Krymgeologiya" Geological Production Association, and V. I. Pasnik and B. S. Voznesenskiy, Special Design Bureau, "Ukrgeofizika" Geological Production Association]

[Abstract] A study was made of the effectiveness of acoustical video logging of boreholes in studying hydrogeological cross-sections of carbonaceous jointed karst collector strata in the Baydar Intermontaine Valley in the Crimea. The borehole instrument radiated pulses with a frequency of 1 MHz, reducing the influence of the drilling solution in the boreholes on the results of logging. Acoustical video logging was found to be effective for location of jointed zones and karsting. In combination with other methods it can be used to find water-bearing zones, areas of influx or absorption of water. The method can be used to locate vertical fractures of 1 mm thickness, allowing it to be recommended for a number of practical purposes. Figures 2; references: 4 Russian.

6508/5915  
CSO: 1865/205

UDC 55:553.98(477.5)

## NEW DATA ON GEOLOGICAL STRUCTURE AND PREDICTION OF OIL- AND GAS-BEARING TRAPS IN DNEPR-DONETS DEPRESSION

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 1, Jan 86 pp 15-22

[Article by V. K. Gavrish and A. I. Nedoshovenko, Geological Sciences Institute, Ukrainian Academy of Sciences, M. A. Demidova and L. V. Kalamkarov, Moscow Institute of the Petrochemical and Gas Industry]

[Abstract] Recent literature is reviewed to outline the stratigraphy of the Dnepr-Donets depression based on recent studies. It is concluded that suggestions by proponents of the inorganic synthesis of petroleum that deep faults directly influence the location of accumulations of oil and gas are not supported by the geology of this region. Computations of the full normalized gradient of the force of gravity along one profile reveal a number of new deep salt blocks and new structural objects of interest for oil and gas prospecting. Predictions of local oil and gas traps made by the full force of gravity gradient method and by interpretation of air and space photographs are in good agreement. The Lyutenkovskiy and Western Zenkovskiy sectors are considered most promising. Figures 3; references: 11 Russian.

6508/5915  
CSO: 1865/214

## FOUR-DIMENSIONAL SEISMIC PROBLEMS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZIKA ZEMLI in Russian No 12  
Dec 85 pp 101-103

[Article by S. P. Starodubrovskaya and A. I. Ravich]

[Abstract] A scientific seminar on problems of 4-dimensional seismic studies was held in May 1985, in the Department of Physical Principles of Prospecting Geophysics, Earth Physics Institute, USSR Academy of Sciences. Some 73 participants from 17 scientific research organizations took part in the seminar, discussing the experience of seismologic observations and new tasks. Regular seismic studies should be repeated in order to localize and certify heterogeneities in the seismic characteristics of the earth occurring over time. Continuous reporting and monitoring of the seismic noise situation, deformations in the earth's surface, the groundwater level and the influence of physical effects such as mining and extraction of oil and gas on natural processes are suggested. The problems currently before 4-dimensional seismic studies include an increase in the quality of seismic observations, a study of the tensosensitivity of rock in the field and in the laboratory and the study of the influence of seismic noise on the physical properties of rocks. The earth's crust and its sedimentary layers have been found to undergo clear changes with time. More unity is required in observation methods and equipment used to trace these changes.

6508/5915  
CSO: 1865/204

UDC 550.34

## STATUS AND PROSPECTS FOR DEVELOPMENT OF SCIENTIFIC RESEARCH IN EARTHQUAKE PREDICTION

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, Oct 85 pp 26-38

[Article by M. A. Sadovskiy, academician]

[Abstract] The current status of work on earthquake prediction is summarized with emphasis on such aspects of the problem as seismic cycles, possibility of more precise determination of the time of an earthquake, long- and short-range precursors. The author stresses the need for organizing an earthquake prediction service similar to the weather service. However, the main task of seismology continues to be formulation of a physical model of earthquake preparation. There has been improvement in seismic zoning at different scales. A new map of seismic zoning of the USSR has been compiled and incorporated in Construction Norms and Specifications; this map shows the sites of possible foci of strong earthquakes and their mean frequency of recurrence. Seismic engineering methods are developing vigorously as a basis for improving seismic-resistant structures. Studies of structure of the medium in which earthquakes

occur are broadening. Laboratory and in situ studies are being made of the deformation of large blocks of rock and artificial materials in research on the nature and characteristics of a number of precursors of rupturing. The methods for long-range prediction of earthquakes which are developing are characterized by an error of 10-20%. An expert group has been formed to evaluate predictions. Publications in the field are increasing in number and quality. Intermediate- (months) and short-range (days, hours) predictions are being developed on the basis of geological, physical, geophysical, geochemical and biological indices and also with application of mathematical statistics. Volcanic eruptions on Kamchatka are being made successfully and intermediate-range methods for predicting strong oceanic earthquakes have been developed. Computer software has been developed for an automated system for the collection and processing of seismological and geophysical data. However, significant shortcomings also exist. There is poor communication between observation stations and data processing centers, making a timely prediction impossible even when a sufficient number of precursors has been registered. Instrumentation and equipment is in short supply for both station and field operations. Some instrumentation is outdated. There are virtually no automated stations for seismological and geophysical observations. Computer equipment is different in different areas and at different stations, making it difficult to organize unified systems for processing prediction data. Studies of deep structure in seismically active regions are far from adequate. There is no theory of seismic processes which takes into account the nonlinearity and block structure of real media. Figures 6.

5303/5915  
CSO: 1865/96

UDC 550.831.23(26)

#### DEVELOPMENT OF NEW AVIATION TECHNOLOGY FOR GRAVIMETRIC SURVEYING

Moscow EKSPRESS INFORMATSIYA: MORSKAYA GEOLOGIYA I GEOFIZIKA in Russian No 11, 1985 (signed to press 21 Oct 85) pp 1-5

[Article by K. Ye. Besylov, P. D. Bagdatlishvili and V. O. Bagramyants, All-Union Scientific Research Institute of Geophysics; "Kaspneftegazgeofizrazvedka" Association]

[Abstract] In a standard cardan mounting, a gravimetric instrument requires 4-6 minutes to settle before measurements can be performed. This makes gravimetric surveying from helicopters quite difficult and reduces the accuracy of the surveys. A restraining device has been suggested for use with the new technology of airborne gravimetric surveying to fix the instrument in position and protect it from contact with the walls and to allow readings to be made 15 to 20 seconds after the restraining system is released. Tests have shown the success of this instrument when used in combination with a winch, which is necessary to create safer conditions for application of the new technology. When the winch is used, the time required to place the gravimetric instrument on the ground is reduced, the amplitude of rocking of the instrument as the observation point is approached through the air is greatly reduced and the quality of observations is improved, since they can be made at heights greater than 30 meters. When observations are made over the shelf, a float on a 2- to

3-meter cable some 15 to 17 meters from the gravimeter can be used as a reference point and the helicopter can be placed in a position such that the float is within view of the pilot, making it easier to maintain the helicopter hovering above the observation point.

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CSO: 1865/208

UDC 550.8:622.24(24:181).061.3

RESULTS OF FIELD SESSION OF INTERDEPARTMENTAL SCIENTIFIC COUNCIL OF STATE COMMITTEE FOR SCIENCE AND TECHNOLOGY ON PROBLEM 'STUDY OF EARTH'S INTERIOR AND SUPERDEEP DRILLING'

Moscow SOVETSKAYA GEOLOGIYA in Russian No 12, Dec 85 pp 3-9

[Article by N. V. Mezhelovskiy, USSR Ministry of Geology, D. I. Musatov, Institute of Mineralogy, Geochemistry and Crystal Chemistry of Rare Elements]

[Abstract] The session was held in Minsk and discussed problems of future development of geodynamic analysis, increasing the effectiveness of its utilization for determination of the laws of formation of mineral deposits. The Chairman of the Interdepartmental Scientific Council, Minister of Geology Ye. A. Kozlovskiy, as well as the chairmen of scientific research and production organizations of the Soviet Union and the Belorussian SSSR and other ministries and departments, took part in the session, hearing and discussing 29 reports. The reports revealed increasing utilization of a systems approach to the study of prospective areas with broad utilization of both traditional and nontraditional methods of geological research, including paleomagnetic analysis, isotope measurements, precision geochemistry, deep magnetotelluric soundings using MHD generators, various seismic and seismologic methods including vertical reflected wave soundings, reconstruction of ancient stress fields, electrogeochemical and fluid geodynamic studies, physical and mathematical modeling, dialogue-mode computer interpretation and many others. Seven areas are to be opened during the Twelfth Five-Year Plan; Kola, Krivoy Rog, Kirgiz, Kyzyl-Kum, Timan-Pechora, Norilsk-Igarsk and Vitimo-Baykal-Patoma. The theoretical basis of geodynamic analysis is to be further improved and methods for its application to existing geological survey operations are to be developed. The geodynamic program can be effective only if closely correlated to superdeep drilling programs, which will require the creation of individual specialized scientific and production subdivisions, interdepartmental working groups and a coordinating council. The necessary hardware, some of which will be imported, must also be acquired and such steps as the publication of handbooks and training of personnel must be undertaken. Individual reports heard at the session are briefly discussed. A resolution adopted at the session called for an increase in the applied nature of work in the field to achieve practical results, approved the basic points of the geodynamic program of the USSR Ministry of Geology through 1990 and beyond, and suggested that the materials of the conference be published.

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CSO: 1865/210

# PREMISES FOR DETECTING PROMISING PETROLEUM AND GAS STRUCTURES IN DEVONIAN DEPOSITS TO NORTH OF ORENBURG ARCH

Moscow EKSPRESS-INFORMATSIYA, SERIYA: GEOLOGIYA, METODY POISKOV I RAZVEDKI MESTOROZHDENIY NEFTI I GAZA in Russian No 8, 1985 pp 1-5

[Article by A. Sh. Nazhmetdinov, Sh. Z. Khusainov and O. A. Khomentovskaya, Southern Urals Division, All-Union Geological Prospecting for Petroleum Scientific Research Institute]

[Abstract] Commercial yields of petroleum have been obtained from different subdivisions of the Devonian system within the Vostochno-Orenburg structural arch. For example, in the northwestern part of the Kolgan area Pashiyskiye sandstones with a thickness up to 30 m have proven their productivity. A detailed examination of the wave pattern made it possible to define a series of characteristics corresponding to petroleum-saturated strata. Pertinent data are presented in a structural map and a geological-seismic profile. The characteristics or parameters defined for the promising Kolgan area are in general similar to those noted for 19 deposits in the Ukraine. The defined parameters carry information on the possibility of discriminating individual extensive strata differing in their physical properties from surrounding strata. These formations are typical for build-up of sedimentary bodies under conditions of shallow waters of a delta zone. Sandy collector strata alternate with clayey covering rocks. Three zones of development of sandy strata in Pashiyskiye deposits were defined. Productivity has been confirmed by test drilling. The northern boundary of this region has been defined. Several formations to the south of the Kolgan area are also promising. Further work is required on improving methods for pinpointing nonanticlinal hydrocarbon traps. Figures 1.

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CSO: 1865/202

UDC 551.263:546.711

# MANGANESE CONTENT IN FORMATIONS DETERMINED IN ACCORDANCE WITH CONCEPTS FORMULATED BY N. S. SHATSKIY

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEOLOGIYA I RAZVEDKA in Russian No 10, Oct 85 pp 90-95

[Article by Ye. A. Sokólova, Geology Institute, USSR Academy of Sciences]

[Abstract] The entire contents of this issue of the journal are dedicated to the geological work of N. S. Shatskiy. This particular article summarizes Shatskiy's theory of geological formations as applicable to exploration for manganese, which he applied successfully himself and which has proven highly productive in subsequent reconnaissance and exploration for such deposits. Formation analysis as developed by Shatskiy was intended to yield practical results, to serve as a basis for scientific prediction of mineral deposits.

Shatskiy devoted much attention to the metallogeny of manganese and manganese content of formations of volcanic and sedimentary origin. Particular attention was given to greenstone-siliceous and porphyritic-siliceous groups of volcanic-siliceous formations and manganese deposits associated with them. Shatskiy made important tectonic and metallogenetic generalizations which revealed the tectonic patterns of distribution of volcanic-siliceous formations containing manganese. In this article the author, in the example of specific manganese deposits or provinces, shows how the development of Shatskiy's ideas changed concepts concerning the genesis and patterns of localization of ore concentrations. In Southern Siberia, in the Altay-Sayan region, and in the Far East formation analysis is the fundamental method for exploring for manganese deposits. Shatskiy's concepts have proven valid everywhere where they have been applied. The article emphasizes the use of formation analysis for manganese exploration, but it can be used successfully in studying iron ore formations and in clarifying the patterns of localization of stratiform polymetallic deposits.

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CSO: 1865/102

UDC 553.98:[551.4:551.8.022.4]

PALEOMORPHOLOGICAL ANALYSIS OF UPPER VISEAN-SERPUKHOVO DEPOSITS IN CENTRAL PART OF DNEPR-DONETS DEPRESSION FOR DETECTING ADDITIONAL FORMATIONS FOR PETROLEUM AND GAS EXPLORATION WORK

Moscow EKSPRESS-INFORMATSIYA. SERIYA: GEOLOGIYA, METODY POISKOV I RAZVEDKI MESTOROZHDENIY NEFTI I GAZA in Russian No 9, 1985 pp 1-9

[Article by B. D. Goncharenko, L. P. Zhestkova, M. V. Pronicheva, N. N. Ryabinkina and G. N. Savvinova, All-Union Geological Prospecting for Petroleum Scientific Research Institute]

[Abstract] Additional formations suited for petroleum and gas exploration work were sought in an area of about 12,000 km<sup>2</sup> in the Dnepr graben region. The data used in the assessment included information from 108 deep boreholes in 30 work areas, supplemented by seismic reconnaissance records. Emphasis was on study of the Upper Visean-Serpukhovo complex of deposits. An isopachyte map was constructed for this complex at a scale of 1:200,000, as well as a paleogeomorphological profile. These graphic materials reveal a regional slope of the territory from west to east, toward the Donbass, with thickness of strata ranging from 900-1,000 m in the west to 1,500 m in the east. The area which appeared most likely to warrant exploration efforts is described in detail. A graph accompanying the text details the paleogeographic characteristics of this complex. The thickness of the productive horizons in the most promising structures varies in the range 40-80 m. The collected materials made it possible to define sectors favorable for formation of nonanticlinal petroleum and gas traps associated with different morphogenetic types of Visean-Serpukhovo relief. Figures 2.

5303/5915  
CSO: 1865/203

SPECIFICS OF FORMATION OF LASER BEAMS BY OPTICAL SYSTEMS

Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 5, Sep-Oct 85 (manuscript received 5 Oct 84) pp 102-106

[Article by Yu. M. Klimkov, docent, candidate of technical sciences, and T. I. Kuzmina, candidate of technical sciences, Moscow Order of Lenin Institute of Geodesy, Aerial Photographic Surveying and Cartography, and T. I. Kuzmina, candidate of technical sciences, House of Optics]

[Abstract] Laser radiation is usually shaped by changing the curvature of the leading edge of a wave on the surfaces of optical elements in the laser system. If the optical system does not limit the transverse dimensions of the beam and has no aberrations, the parameters of the beam passing through the optical system can be calculated using the conjugate planes method in the paraxial approximation. If aberrations are slight, beam parameters can be calculated without using diffraction theory. If the beam is significantly limited and aberrations are comparatively great, calculations must be made using diffraction theory. A method related to this theory is described in this article. Information is required on the amplitude-phase distribution upon emanating from the laser and the distance between the laser and the first optical surface. The sequence of computations is outlined. Figures 1; references: 4 Russian.

6508/5915  
CSO: 1865/159

MODELING OF NONLINEAR EFFECTS OF PLASMA WAVE BEAMS ON IONOSPHERIC PLASMA

Leningrad PISMA V ZHURNAL TEKHNIЧЕСКОY FIZIKI in Russian Vol 11, No 23, Dec 85 (manuscript received 28 Jul 85) pp 1465-1469

[Article by G. A. Markov, L. L. Popova and Yu. V. Chugnov]

[Abstract] Results are presented from laboratory modeling of the effect of a field of intensive plasma waves excited by dipole sources on the local parameters of the lower ionosphere. The purpose of the modeling was to determine the effectiveness of this method of action which is related to excitation in the lower layers of the ionosphere of an HF discharge in the form of a self-similar plasma-wave channel extending from the source along the geomagnetic field. The experimental data and theoretical estimates demonstrate the possibility of excitation of columns of hot, dense plasma in the lower ionosphere,

which can be used to study nonlinear ionospheric phenomena. The local changes in plasma density are several orders of magnitude greater than the corresponding disturbances in ionospheric parameters observable with traditional methods of acting on the ionosphere using terrestrial radiation sources. Figures 2; references 4: 3 Russian, 1 Western.

6508/5915  
CSO: 1865/165

UDC 551.510.42

INFLUENCE OF THERMAL AND DIFFUSION PHORETIC FORCES ON AEROSOL PARTICLE  
CAPTURE BY MOVING EVAPORATING DROPLETS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 20 Apr 83; after revision 3 Jan 84)  
pp 1072-1077

[Article by Yu. I. Yalamov, M. G. Markov and Ye. R. Shchukin, Moscow  
Pedagogic Institute imeni N. K. Krupskaya]

[Abstract] A study is presented of the precipitation of aerosol particles onto the surface of evaporating, moving droplets of a solution. The droplets are in a binary gas mixture, the first component of which forms volatile molecules. Calculations are made using a quasi-steady approximation assuming that thermal and diffusion Péclet and Reynolds numbers are small. Dimensionless quantities are calculated which describe the effectiveness of capture of aerosol particles by droplets of various sizes. The calculations show that even at relative humidity of 99.9% the influence of thermal diffusion phoretic forces on the process of moist washing exceeds the influence of meshing. Thermal diffusion phoretic effects can thus significantly influence the capture of aerosol particles by water droplets even at slight concentration differences characteristic for the evaporation or growth of cloud droplets. Figures 3; references 13: 11 Russian, 2 Western.

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CSO: 1865/103

UDC 551.510.534:551.510.42

POSSIBILITY OF CHANGING OZONE CONTENT WITH INTENSIVE DISTURBANCE OF AEROSOL  
COMPONENT

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 16 Feb 84) pp 1056-1063

[Article by S. G. Zvenigorodskiy and S. P. Smyshlyayev, Leningrad Institute of  
Hydrometeorology]

[Abstract] The article discusses problems in the interaction of ozone with aerosol particles such as those produced by volcanic activity or a nuclear explosion. The mechanism of breakdown of ozone on aerosol particles containing

metal oxides, particularly aluminum oxide, forms the basis of this article. The kinetics of such heterogeneous reactions in the atmosphere is discussed. Numerical investigation of the possible effect of a decrease in ozone in aerosol clouds was carried out using a 1-dimensional, unsteady photochemical model of the atmosphere for the 0-50 km altitude zone. Analysis of the results indicates that in the case of disturbed aerosol profiles, the loss of ozone on aerosol particles could become an important component in the ozone balance in the troposphere and lower stratosphere. Figures 5; references 20: 7 Russian, 13 Western.

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CSO: 1865/103

UDC 551.521.3:551.510.42

#### GROUND HAZE UNDER QUASI-STEADY ANTICYCLONE CONDITIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 23 Mar 84) pp 1050-1055

[Article by V. N. Sidorov, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] Dense haze covered the Moscow region in February 1984. The haze was extremely stable during an anticyclone over the European USSR which produced cold, sunny weather, with dry air and almost no wind. Optical measurements showed that this haze was different from haze described in the literature. The measurements provided a rather complete optical model of this interesting haze, which occurred with an average relative humidity of about 60%. The concentration of particles was about  $10^5$  per cubic centimeter, the optically active aerosol concentration about  $180 \mu\text{g}/\text{m}^3$ . After the analysis it was clear that hazes similar to this one had been observed previously, as in January 1977, and also in other seasons, for example July 1981. This type of haze is apparently more frequent in winter, when it can last for longer periods of time. Figures 2; references 12: 10 Russian, 2 Western.

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UDC 551.510.53

#### STUDY OF SEASONAL CHANGES OF GRAVITY WAVE PARAMETERS IN THE METEOR ZONE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 5 Apr 84; after revision 11 Sep 84)  
pp 1036-1042

[Article by Ye. D. Kalov, N. M. Gavrilov, Leningrad State University]

[Abstract] Results are presented from processing of regular radiometric measurements in 1979-80 at Obninsk ( $55.1^\circ\text{N}$ ,  $36.6^\circ\text{E}$ ) using an algorithm for isolation of internal gravity wave parameters described in a previous work.

The processing algorithm allowed determination of the horizontal wavelength and phase velocities of internal gravity waves propagating to the north, west, south and east. The meteor station yields a number of values of horizontal wind speed at random moments in time in each of the four directions for a mean altitude of the meteor zone 93 km. The area viewed by the station is divided into horizontal subareas in the direction of the antenna beam. High-frequency filtration is performed by averaging in 10-minute intervals for each group of meteors registered in each horizontal subarea; low-frequency filtering is performed, followed by amplitude and phase spectral analysis of data over moving 12-hour time intervals. Subsequent statistical analysis of the spectra allows discrimination of the internal gravity wave spectra from the noise background and determination of the projections of horizontal wave numbers and phase velocities. The frequency distribution of the waves is found to be nearly constant, though there are maxima in time diagrams of the phase velocities, amplitudes and wave numbers. The predominant direction of internal gravity waves is southeastward in spring and summer, northwestward in winter. Figures 2; references: 11 Russian

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#### MODELING OF GLOBAL PROPAGATION OF POLLUTANTS IN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 10, Oct 85 (manuscript received 6 Dec 83) pp 1026-1035

[Article by S. G. Chefranov, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] A global circulation cell model is developed in which the variation in lifetime of a pollutant is considered as a function of latitude. The basis of the construction of the model of pollutant transfer is the method of randomization of integrable problems, avoiding the hypothesis of closure and the use of adjustment parameters such as turbulent diffusion coefficients to describe the statistically averaged distributions of impurity concentrations in the atmosphere. The model indicates the possibility of existence of intensive sources of carbon monoxide of nonhuman origin in the equatorial zone. Figure 1; references 17: 10 Russian, 7 Western.

6508/5915  
CSO: 1865/103

## RELATIVE CHANGE IN COLLECTION EFFICIENCY IN CASE OF GRAVITATIONAL AND GRAVITATIONAL-TURBULENT COALESCENCE OF CLOUD DROPLETS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 10 Apr 84) pp 1274-1282

[Article by A. I. Neizvestnyy, A. G. Kobzunenko and G. B. Kotov, Central Aerological Observatory]

[Abstract] Published data on the influence of turbulence on the rate of coalescence of cloud droplets are highly contradictory and required experimental clarification. An experiment was formulated for obtaining data on the collection efficiency of collector droplets with radii 15 and 20  $\mu\text{m}$  and fog droplets with a radius 10  $\mu\text{m}$  during interaction in laminar and turbulent air flows. The apparatus used was a channel of rectangular section 290 cm in length and 6 x 9 cm in section. A turbulent flow was formed by placement of a honeycomb in the channel. Particles were collected on glass plates measuring 6 x 9 cm, introduced in holders inserted through the side walls. (The two types of droplets, introduced into the channel by separate spray jets, after being entrained in the air flow, interact with one another and are precipitated out by gravity and turbulent pulsations.) Both laminar and turbulent flows were generated by this apparatus, with controllable vertical flow velocity shears and rates of dissipation of turbulent kinetic energy  $\epsilon$ . It was found that in the case of turbulent pulsations with  $\epsilon \approx 1 \text{ cm}^2 \cdot \text{s}^{-3}$  the collection efficiency of such droplets is greater by almost an order of magnitude than in the case of strictly gravitational coalescence, all other parameters being assumed equal. Figures 3; references 14: 8 Russian, 6 Western.

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CSO: 1865/152

UDC 551.521.31:551.591

## VERTICAL PROFILES OF ATMOSPHERIC SPECTRAL EXTINCTION DETERMINED FROM BALLOON MEASUREMENTS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 16 May 84, after revision 25 Oct 84)  
pp 1260-1267

[Article by M. S. Kiseleva and I. N. Reshetnikova]

[Abstract] Balloons were used in studying the dependence of the atmospheric extinction index on altitude. The so-called "setting sun" method was used. Data for the Central European USSR and Central Asia were collected. The measurements, with a three-channel spectrometer, were in summer in the first region and in autumn in the second. Balloons, released 90 minutes before sunset, made observations for 30-40 minutes at maximum drift altitude. Two

optical channels were used in registry of solar spectra in the range 0.4-1.0  $\mu\text{m}$ ; solar radiation intensity was measured in a third channel using interference light filters. Spectra of a standard source were periodically registered on all flights. The sought-for dependence was determined in 10 parts of the spectrum. All the analyzed data were plotted on graphs representing total and aerosol extinction in the visible and IR spectral ranges at altitudes up to 25 km. It was found that there are two distinct optical states of the stratosphere: a transparent and a turbid stratosphere. The reasons for these two different situations are discussed. Evidence of such macroscale horizontal inhomogeneity of stratospheric aerosol was first obtained in space observations from the "Salyut-6". Figures 5; references 12: 9 Russian, 3 Western.

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CSO: 1865/152

UDC 551.501.8:551.55

JOINT INFLUENCE OF TURBULENCE AND WIND ON SIGNAL POWER IN RADIOACOUSTIC  
SOUNDING OF ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 12, Dec 85 (manuscript received 15 Mar 84) pp 1242-1251

[Article by A. I. Kon, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The joint effect of atmospheric turbulence and wind drift on radioacoustic sounding signals was studied in an effort to improve sounding method accuracy. A bistatic sounding system was used with the spaced radar transmitting and receiving antennas symmetrically arranged relative to the acoustic source and with the axes of all three antennas parallel; the emitted radio wave is scattered by the structure of permittivity induced in the atmosphere by an acoustic beam. The frequency of the scattered field carrying information on local temperature was investigated. A formula for the strength of the radioacoustic signal in the absence of turbulence, but in the presence of wind drift, was derived first, followed by a similar derivation for the joint effect of these two factors. This provided basis for an expression describing mean signal strength in a turbulent moving medium. This expression is applicable for virtually any type of radioacoustic apparatus and any sounding ranges. Allowance for these two key factors cannot be made separately because atmospheric turbulence lessens the wind drift influence. The maximum effect on sounding range is governed by turbulence, provided that the transverse wind is not too strong, which can cause the signal-to-noise ratio to drop off sharply even at low altitudes. This impediment can be overcome using adequately high radar potentials. Figures 3; references 18: 12 Russian, 6 Western.

5303/5915  
CSO: 1865/152

## ARCTIC AND ANTARCTIC RESEARCH

### DYNAMICS OF CONTINENTAL GLACIATIONS

Moscow PRIRODA in Russian No 12, Dec 85 pp 11-19

[Article by Ya. -M. K. Punning, doctor of geographical sciences, Geology Institute, Estonian Academy of Sciences]

[Abstract] Studies of the oxygen isotope concentration of glacial ice specimens and fossils have been used to trace the history of continental glaciation over the past 1.5 million years. Mathematical processing of paleoclimatic data based on such isotope profiles can indicate the extent of northern European glaciation during the last ice age, 18-20,000 years ago, and deviations of temperatures around the world at that time from present temperatures. This quantitative approach to the study of the dynamics of ice sheets has greatly expanded man's knowledge of the development of natural conditions in the late Quaternary. The introduction of isotope-geochemical methods has played a leading role in this work. By studying the isotopic composition of the ice and ancient marine organisms, specialists have learned that they represent unique paleothermometers capable of indicating the course of temperatures over thousands or even millions of years. Figures 10; references 7: 3 Russian, 4 Western.

6508/5915

CSO: 1865/153

# TRIALS OF GIANT MI-26 HELICOPTER IN FAR NORTH

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian, 16 Feb 86 No 40(5031),  
p 2, col 8

[Article by A. Mokrousov, (Tyumen)]

[Text] The world's largest helicopter, the MI-26, has arrived in Tyumen for performance trials.

"We had our reasons for selecting this region," said S. Popov, a senior project test-pilot of the State Scientific Research Institute of Civil Aviation. "The MI-26 has a large cargo capacity, up to 20 tons, a large share of its automation and electronic equipment is of the most modern type, and its engines have a record low fuel consumption. These features make the helicopter really indispensable in Siberia's conditions. It is the first representative of third-generation helicopters, which Aeroflot is beginning to receive. In addition to possessing splendid operating qualities, it is genuinely comfortable. The unusually spacious cockpit, practically total absence of vibration, and other merits of the MI-26 have already earned it renown among pilots of Aeroflot. An auxiliary power plant will help to heat the helicopter or to cool its cockpit in hot weather, and it will supply electric power while the helicopter is standing. A special television camera will make it easy to watch loads on the external sling."

Two such aircraft have already spent 900 hours in the air over Tyumen Oblast this year. These new helicopters will deliver priority cargo for geologists and oil field workers in the course of trials.

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AN-74 AIRPLANE TESTED ON ICE RUNWAYS IN YAKUTIA

Moscow PRAVDA in Russian 8 Feb 86, No 39 (24661), p 6, col 1

[Article by V. Tarutin, correspondent]

[Text] Yakutsk, Feb 7--A crew of testers of the AN-74 airplane has made the first flights in the skies of Yakutia.

This winter has presented ideal conditions for the comprehensive testing of this airplane, which is intended for work in the most severe conditions. From the airport located near the town of Mirnyy, this newcomer is taking off not only on flights which are typical ones for AN-24 airplanes, which it is supposed to replace in the future, but also on flights that are more difficult. New navigational apparatus is being tested in conditions of landings on ice fields in the Arctic.

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## ADAPTATION STUDIES PLANNED FOR HIKE BETWEEN ARCTIC STATIONS

Moscow MEDITSINSKAYA GAZETA in Russian, 29 Jan 86, No 9 (4558), p 4, cols. 1-7

[Article by S. Digantsev]

[Excerpt] The participants of a high-latitude expedition of the Institute of Clinical and Experimental Medicine of the USSR Academy of Medical Sciences' Siberian Branch and of the newspaper KOMSOMOLSKAYA PRAVDA were being examined at the Moscow Medical Physical-Culture Dispensary No 11 on the day before their departure. This expedition is headed by Dmitriy Shparo. Seven years ago a group of skiers led by him made a passage to the North Pole that was without precedent.

Engineer Anatoliy Fedyakov, one of the participants in the expedition, was obviously exerting himself while pedaling an ergometer bike.

I asked G. T. Kobyakova, a therapist: "What information do you receive as a result of this testing?"

"The complete name of the test is 'Therapeutic Examination with Tests Using an Ergometer Bike'. An apparatus called 'Spirolit' provides characteristics of the body's aerobic and anaerobic efficiency. The condition of respiratory organs and the cardiovascular system is particularly important in high latitudes."

My next questions were addressed to Mikhail Malakhov, the expedition's physician.

"The route of the expedition is approximately 520 kilometers long. This is the distance between the two drifting stations 'SP-27' and 'SP-26'. Moreover, our route runs via the pole of relative inaccessibility. This point has been reached only by airplane in the past.

"This expedition differs from all the rest in that there will be broad and active participation of medical personnel. There will be two of us in the group: Aleksandr Rozumenko, a junior science associate of the Institute of Clinical and Experimental Medicine, and myself. Two other associates of the medical institute, A. Kolpakov and P. Vloshchinskiy, will be waiting at the drifting station for the hiking group. All of us together will study biochemical aspects of the condition of humans in the extreme conditions of the Far

North. . More and more people live and work in the Arctic with every passing year. It is therefore very important to know all that is possible about this region's effects on human health.

"In addition to this, there are other programs which have been drafted by the Central Scientific Research Institute of Stomatology and the State Scientific Research Institute for Standardization and Control of Drugs."

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# FINNISH FIRM TO BUILD RESEARCH ICEBREAKER FOR ANTARCTIC

Moscow VODNYY TRANSPORT in Russian 8 Feb 86, No 17 (8980) p 3, cols 4-6

[Article by S. Levin]

[Excerpt] Transport equipment on which successful research in Antarctica largely depends is becoming more and more sophisticated.

The foreign-trade association "Sudoimport" and the Finnish company "Rauma-Repola" have concluded a contract for the building of a new scientific research vessel for Soviet Antarctic expeditions.

Our correspondent met with Esa Seppanen, head of foreign relations of "Rauma-Repola", and asked him a number of questions.

"What kind of a vessel will the new one be, and what will distinguish it from others that are now operating in the Antarctic region?"

"This will be an icebreaker which is conceived as a kind of floating scientific-research base, equipped with the latest instruments for comprehensive study of the ocean and the atmosphere. It must be powerful enough to operate effectively and safely in ice the year around, at a minimum temperature of minus 40 degrees. One mandatory requirement is that it provide maximum comfort for the scientists who will be working on board it, and also for helicopter crewmen and the crew of the vessel itself. In addition to these 90 people, it will be capable of transporting 160 passengers--replacements for contingents at scientific stations on the continent. But this is not all. It will be a multipurpose cargo ship capable of transporting and offloading the most diverse cargoes: all kinds of transport equipment, including airplanes and helicopters; various mechanisms and equipment for Antarctic stations; stocks of fuel and lubricants; food products; bulk cargo; and other cargo items.

"The vessel's large-capacity crane equipment will allow cargo-handling operations to be performed on shores without port facilities, and on the coastal ice of the mainland and islands.

"The vessel will have the following specifications: length--140 meters, width--23 meters, a draft of 8.5 meters, and a speed of 16 knots. The vessel's ice class will meet the requirements of the USSR Register of Shipping."

"When is it planned to complete the vessel's construction?"

"Under the terms of the contract, this vessel for the Antarctic is to be delivered in the summer of 1987, and it will set out on its first expedition to Antarctica in the fall of the same year.

"Our firm has been cooperating successfully with Soviet foreign-trade organizations for many years, and the 850th vessel to be built for the USSR will be launched from our shipyards this year. Scientists and designers of 'Rauma-Repola' have always had close contacts with the Central Scientific Research Institute of the USSR Ministry of the Merchant Fleet in their research."

"Will the new vessel carry mechanisms and equipment produced at industrial enterprises of the USSR?"

"A large percentage of its equipment will be shipped from the Soviet Union."

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NUCLEAR-POWERED LIGHTER-CARRYING ICEBREAKER 'SEVMORPUT' LAUNCHED

Leningrad LENINGRADSKAYA PRAVDA in Russian 21 Feb 86, No 44 (21586), p 2,  
cols 1-2

[Article by Yu Stvolinskiy]

[Excerpt] The world's first nuclear-powered lighter- and container-carrying transport icebreaker, the "Sevmorput", was launched yesterday at the "Zaliv" Plant imeni Butoma in Kerch.

This vessel was designed in Leningrad, at one of the industry's oldest design organizations--the central design bureau "Baltsudoproyekt". The designers were assisted by personnel of the Central Scientific Research Institute imeni Krylov, the "Ritm" Research-and-Production Association, and the Leningrad Shipbuilding Institute. Designed and built in our city were the main geared-turbine unit of the nuclear-powered vessel, with a capacity of 40,000 horsepower (at the Kirov Plant); generators (at "Elektrosila"); and a controllable-pitch screw propeller with a diameter of 6.7 meters (at the Proletarskiy Plant). Representatives of these and other enterprises worked actively in Kerch on the installation of various mechanisms and systems.

The nuclear propulsion plant of the vessel, which has a displacement of more than 61,000 tons, will ensure it a substantial cruising capacity.

The vessel's designers encountered many 'unknowns.' There were no counterparts in world shipbuilding practice. The problem of combining qualities that are mutually exclusive into a single vessel had never before been solved. Lighter carriers and icebreakers have completely different hull lines. The finding of a successful solution testifies to the creative maturity and high caliber of the central design bureau's personnel.

LENINGRADSKAYA PRAVDA made telephone call to Kerch. Ye. K. Zhukov, secretary of the "Zaliv" plant's Communist Party committee, said:

"With the development of the 'Sevmorput', Soviet shipbuilding has reached a new height from the technical and creative standpoints. This vessel is very complex. Technology had to be developed which is radically different from what we were used to. All of these problems were solved by a large group of our technologists, team leaders and welders. Substantial assistance was rendered by a group of "Baltsudoproyekt" representatives at the plant, and N. N. Rodionov, chief project designer of the 'Sevmorput', in particular."

So the fifth Soviet nuclear-powered vessel, which is the world's first nuclear-powered transport vessel, is on the water. Outfitting, running trials, and the vessel's baptism by the ocean and Arctic ice lie ahead.

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## SUCCESSFUL TESTS OF AN-74 AIRPLANE IN EXTREME ARCTIC COLD

Moscow IZVESTIYA in Russian 16 Feb 86, No 47 (21489), p 1, cols 3-6

[Article by O. Borodin]

[Excerpt] The AN-74 airplane currently is in the final phase of plant trials, and at the same time it is undergoing state testing. [See also the Daily SNAP, February 21, 1986, p 1, col 1] Representatives of Aeroflot will give the last word on this aircraft's suitability for work in the extreme conditions for which it was developed.

The AN-74 is intended for transport work in the central Arctic basin and in Antarctica, and also for visual ice-reconnaissance flights. In its cabin, designers have provided room for a small galley, 12 passenger seats, and a place for a hydrologist. Right now, its cargo compartment is packed full with heavy monitoring and recording apparatus.

[On a test flight], the altimeter needle was pointing at the 11,000 meter mark when a red warning signal flashed on the instrument panel--"Left engine failure". A slight vibration was felt as the aircraft began a drop in altitude. Beneath us were the sharp peaks of the Verkhoyanskiy Mountain Range...

This 'failure' was a programmed one, having been included with other assignments for this day's flight. The cut-off engine would be started again before long, but in the meantime S. Nikulin, senior project engineer for testing of the engines, was watching instrument readings carefully and writing on a clipboard.

The AN-74 is equipped with two D-36 turbofan engines. Developed by the design and experimental bureau of V. Lotarev, they develop a thrust of up to 6.5 tons.

This aircraft has shown itself excellently also in flights in the high temperatures of Ashkhabad, in which engine thrust drops considerably. A. Romanyuk, director of the tests, keeps a simple geographic map showing points where the AN-74 has been. From Central Asia its route heads to the North. It is here, in Yakutia, where its further reliability tests are taking place. The testers are happy--they were lucky enough to 'catch' a temperature of minus 58 degrees in Verkhoyansk. They already consider cold of minus 40-55 degrees to be an ordinary, working temperature for the AN-74. Test pilot Yuriy Vladimirovich Kurlin dreams of landing the airplane on drifting ice.

Kurlin has tested nearly all of the Antonov design bureau's airplanes. He has flown the "Antey", and he made 200 flights in the "Ruslan" airplane in various climatic conditions. In the AN-24 and AN-26 airplanes, he has made 13 landings with engines totally cut off; the last one was in conditions where he had to pass through a storm front.

The day before, Ye. Pankevich, a pilot of the State Scientific Research Institute of Civil Aviation, had taken the AN-74 up with an engine that 'failed' on take-off. Several days before that, he made a landing with the same type of 'failure.' Once on a single flight, the right and left engines were cut off alternately 19 times in various conditions.

...Our flight was continuing. The altimeter needle stopped at the 8,000 meter mark. Flight engineer S. Zhovnir started the left engine. The warning light went out, and the aircraft began to gain altitude again.

(A photograph is given showing the airplane on the ground.)

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## ARCTIC OPERATIONS OF KA-32 HELICOPTER DESCRIBED

Moscow MOSKOVSKIY KOMSOMOLETS in Russian 2 Feb 86, No 28 (14498), p 4, cols 6-8

[Article by O. Milyukhov, correspondent]

[Excerpt] At the last International Aerospace Show in Le Bourget (France), one of the most interesting Soviet exhibits was the KA-32 helicopter, which was developed at the Design Bureau imeni Kamov under the direction of chief designer, Doctor of Technical Sciences Sergey Mikheyev. The new aircraft was designed for ice reconnaissance operations, servicing drilling platforms, and work in mountains.

The famous aviator Mark Shevelev, who is one of the pioneers of exploration of the Arctic, was the first person to introduce me to the KA-32.

"For a long time," he said, "Polar explorers have been dreaming of such a reliable, all-weather, maneuverable and small-sized aircraft capable of conducting ice reconnaissance, transporting cargo and performing rescue operations."

Under the direction of Sergey Mikheyev, the design bureau succeeded in developing an ideal helicopter for operation in the most extreme conditions. I had the opportunity to see the new aircraft a number of times. Before being put into series production, the helicopter was tested in dozens of operations, including ones in the Arctic.

In one trip the helicopter can carry 5 tons of cargo on an outside sling. Over a 24-hour period, the aircraft is capable of transporting up to 360 tons. Naturally, it can do this work in places other than the Arctic.

Vadim Provalov is a pilot of the State Scientific Research Institute of Civil Aviation who commanded the helicopter last year when it accompanied the icebreaker "Sibir" on a cruise over the Northern Sea Route with a ship convoy. He reported on the work of the KA-32 as an ice scout.

"The main thing I want to stress," said the pilot, "is that this is truly an all-weather aircraft. While guiding the 'Sibir', we made 73 flights with a total duration of 124 hours. We flew during the polar night at temperatures of 0 to minus 32 degrees Celsius, in blizzards and snowstorms. We operated at distances of 250-300 kilometers from the icebreaker, confidently finding it afterwards at a visibility of only 40 by 400 meters. We landed on the deck of the icebreaker, which was towing other ships."

"We have equipped the new helicopter with a complete piloting and navigation set," reported Sergey Mikheyev. "For increased reliability, the helicopter's main systems have been backed-up. The aircraft's high thrust-weight ratio and the presence of two independent engines ensure a high safety level even if one engine should fail."

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# ACCOUNT OF FLIGHT TO ANTARCTICA BY IL-76TD AIRPLANE

Moscow VOZDUSHNYY TRANSPORT in Russian 27 Feb 86, No 25 (1273), p 4, cols 1-3

[Article by V. Karpskiy, correspondent]

[Excerpt] On February 23, after traveling more than 11,000 kilometers in 14 and one-half hours, an IL-76TD airplane landed in Maputo early in the morning at an airport from which this airplane was to make a flight to Antarctica. [See also the Daily SNAP, February 10, 1986, p. 3., col 2]

"Our task on route to Larnaca was to test all of the airplane's systems one more time," said Yu. Golovchenko, commander of the first crew. "After all, the most strenuous part of the work lies ahead for Yu. Yakovlev's crew."

The airplane passed over Africa at night, when fewer storms rage over this continent. The flight, which was made over a route where there are relatively few radio navigation systems, demanded keen attention and precise work on the part of the aviators.

On February 25, the IL-76TD took off for Antarctica.

Moscow--We met with G. Kashkov, navigator on duty at the Central Operations Traffic Control Administration of Civil Aviation. With him, we followed the flight of the IL-76TD to Antarctica.

We tore the first telegram from the teletype machine: "7:32 a.m., heading for Molodezhnaya Station." A little behind the schedule that had been planned earlier. Could there be bad flying weather in Maputo? No, the forecast was completely in order.

Another telegram: "On board 76479. Passed over Durban at 8:13 a.m."

Only at the end of a telegram received at 8:58 a.m. was it reported: "Flight delayed by late opening of airport," meaning the airport at Molodezhnaya.

"What could be happening there?" I asked Kashkov.

"They were probably testing the strength of the runway's surface one more time," replied Genrikh Aleksandrovich.

Yes, two days before there had been a radiogram: "The strength of the surface has been checked with a test unit, and radio navigation equipment is ready."

From a telegram received at 12:27 p.m.: "Calculated time of arrival at Molodezhnaya--1:55 p.m. Weather at Molodezhnaya excellent."

"What's meant by excellent weather?" I inquired.

"Wind of 2-3 meters, visibility unlimited, temperature of minus 7 degrees."

Molodezhnaya Station--Workers of civil aviation marked a great labor victory on the opening day of the 27th Congress of the Communist Party of the Soviet Union. The first landing in Antarctica by an IL-76TD heavy transport airplane of Aeroflot was made following a trip of more than 16,000 kilometers. New possibilities have been opened up for the exploration and study of the Antarctic continent.

This flight represents a great achievement for aviators and winter research teams in Antarctica. I. Kosterin, secretary of Molodezhnaya's Communist Party bureau; R. Galkin, head of the 30th Soviet Antarctic Expedition (SAE); N. Kornilov, head of the aerial expedition of the 31st SAE; and V. Kiselev, chief navigator of the Ministry of Civil Aviation and the flight's director, talked about this at a rally which took place directly at the airfield.

(A photograph is given showing the IL-76TD in flight.)

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## PORTABLE EQUIPMENT FOR BLOOD TESTS ON ARCTIC EXPEDITION

Moscow MEDITSINSKAYA GAZETA in Russian 28 Feb 86, No 18 (4567), p 4, cols 1-5

[Article by M. Malakhov, correspondent, physician of the [cross-ice ski] expedition (Arctic Ocean)]

[Excerpt] On the eve of our first day of rest, radio operators of the expedition established contact with support and escort aircraft. [See the Daily SNAP, February 20, 1986, p 3, col 2] "Wait for an airplane at the point with these coordinates," radioed the aviators.

An IL-14 airplane went into a turn over the expedition's campsite. Minutes later, the canopies of cargo parachutes opened in the lead-grey sky. Everything needed in order to continue the hike was delivered: foodstuffs, fuel, and two packages which were especially needed by the expedition's medical group. Written in large letters on each package was "Medicine, First Drop". It was our field laboratory.

Our program of medical research calls for taking venous blood from all 11 participants of the hiking group. After the necessary equipment and reagents had been dropped from the skies, Aleksandr Rozumenko, junior science associate of the Institute of Clinical and Experimental Medicine of the USSR Academy of Sciences' Siberian Branch, and I began doing this task, which was no simple one.

We laid out test tubes filled with blood on a soft sleeping bag. A. Rozumenko prepared a special field centrifuge. It is a remarkable instrument; although it weighs only about a kilogram, it accelerates to a speed of 3,000 revolutions per minute. It runs on batteries. This excellent instrument was developed at the Volgograd Medical Equipment Plant.

Aleksandr and I drew off and sealed plasma, serum and erythrocytes from the samples. The work of A. Rozumenko, a professional biochemist, was a joy to behold; everything was done quickly and efficiently. After being bundled and properly packed, the test tubes were stowed in backpacks. We are taking these biomaterials with us to the SP-27 station, from where we will deliver them, in isothermal containers, to Moscow and Novosibirsk. The expedition's medical program was drafted by the Institute of Clinical and Experimental Medicine. The greater part of the biomaterials will be sent to scientists of this institute. In addition to this, we are conducting research in line with programs of the Central Scientific Research Institute of Stomatology and the State Scientific Research Institute for Standardization and Control of Drugs.

## WORK ON MAKING AVIATION TECHNOLOGY WITHSTAND EXTREME COLD

Moscow VOZDUSHNYY TRANSPORT in Russian 25 Feb 86, No 24 (1272), p 2, cols 6-8

[Article by I. Cherskiy, Doctor of Technical Sciences, Professor, deputy director of the Institute of Physical-Technical Problems of the North (Yakutsk)]

[Excerpt] Fog which forms at air temperatures lower than [minus] 40 degrees Celsius has a structure whose nature is completely different from that of fogs consisting of droplets of liquid and of supercooled fogs. When attempts were made to get rid of such ice fog by the conventional method of scattering dry ice from an airplane, the fog became still thicker. Careful studies were made, and it was found that this fog consists basically not of droplets of moisture but of a suspension of tiny ice crystals frozen to the surface of solid particles. These particles are, as a rule, products of the combustion of coal, gas or wood in boilers or furnaces, of gasoline in internal-combustion engines, etc.

Weaknesses of ice fog were also found, and methods of combating it are now being developed in laboratories of our institute. This is only one of the directions in which the Institute of Physical-Technical Problems of the North is doing work on topics relevant to aviation. We have good contacts with the Design and Experimental Bureau imeni Antonov, for example. When specialists of our institute theoretically substantiated and experimentally confirmed the unquestionable advantages of fluorocarbon polymers over rubber ones in sealing devices, these materials were thoroughly tested at the design bureau and employed in the latest types of airplanes.

The institute has done interesting work on introducing self-lubricating materials in units and mechanisms for ground maintenance, in collaboration with the Yakutsk Aviation Enterprise's aviation-technical base. In a number of these maintenance units, all of the grease-lubricated anti-friction bearings were replaced with plain bearings made of self-lubricating materials. Prolonged tests demonstrated that these bearings ensure free start in motion and movement of units in the severest cold. Unfortunately, this work has not been followed through to the introduction stage at manufacturer-plants.

In connection with this same problem, we have brought to light a whole series of defects of ground equipment supplied to northern airports. This equipment includes belt transmissions which lose their elasticity and do not operate at temperatures below minus 40 degrees; storage batteries which have to be warmed up periodically inside heated buildings; components which require constant lubrication, etc.

Many years of practice have shown that a number of specific defects occur also in airplanes operated on the territory of Yakutia at temperatures of minus 40 to minus 60 degrees Celsius. This evidently is explained by the fact that airplanes are designed chiefly with conditions of the country's middle latitudes taken into account, where temperature fluctuations are substantially less, and the actual temperature is seldom lower than minus 40 degrees.

Unfortunately, the scope of the research which the small staff of our academy institute is doing does not take in every problem of the operation of aviation technology in the Far North, and results of this research do not always find broad introduction into practice, owing to our limited material and technical resources. It appears to us that comprehensive solution of timely tasks is possible only through the creation, on the territory of Yakutia, of a scientific experimental facility for studying the behavior of aviation technology in extremely low temperatures, and for conducting comprehensive tests of new types of airplanes, helicopters and ground equipment, in collaboration with design bureaus and institutes of civil aviation.

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AN-74 AIRPLANE TESTS CONTINUE, IL-86 TRIALS BEGIN IN FAR NORTH

Moscow VOZDUSHNYY TRANSPORT in Russian 4 Mar 86, No 27 (1275), p 3, cols. 1-2

[Article by O. Borodin, correspondent, Yakutsk]

[Excerpt] The 12th 5-Year Plan calls for ensuring that civil aviation will be equipped with aircraft that can fly in conditions of the Arctic and Antarctic.

The AN-74, a new aircraft from the Design Bureau imeni Antonov, was specially designed and built for operation in severe climatic conditions. It has passed tests in mountainous areas of Tajikistan, in the polar region, and in the hot climate of Turkmenia. [See the Daily SNAP, March 3, 1986, p 3, col 1; and March 13, 1986, p 1, col 1]

The testers of this airplane are currently working in Yakutia.

"Flights are being made at temperatures of minus 45-55 degrees, and in Verkhoyansk we even flew at a temperature of minus 58," related Yu. Kurlin, a meritorious test-pilot of the USSR. "In the course of the tests, specialists have made a number of observations which will be taken into account in the series production of the AN-74."

In collaboration with representatives of the design bureau, specialists of the State Scientific Research Institute of Civil Aviation are completing a cycle of plant and state trials. Among these specialists are test-pilot Ye. Pankevich, and Yu. Sheremetyev, senior project engineer for the airplane tests.

An IL-86 passenger liner landed in Yakutsk recently. This giant airplane's flight area is expanding substantially.

"Additional trials in low-temperature conditions have become necessary for this reason," related A. Manokhin, senior project engineer for IL-86 flight tests of the Design and Experimental Bureau imeni Ilyushin.

"This airplane is currently limited to operation within the temperature range plus 45 to minus 40 degrees."

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PACIFIC ANTARCTIC STUDIES

Moscow MOSCOW DOMESTIC SERVICE in Russian 21 Feb 86 2200 GMT

[Abstract] The scientific research ships "Professor Vize" and "Professor Zubov" have completed the most important stage of their voyages in the South Pacific. They have been collecting data on natural processes and phenomena between Russkaya and Leningradskaya meridional stations in the Pacific Ocean sector of Antarctica. Their oceanographic, hydrobiological, aerometric, ice, and other research findings will make a considerable contribution to the further developments of scientific operational back-ups for ships operating in that little-studied area of the Pacific. The two ships are now involved in transport operations at some of the Soviet stations on the coast of Antarctica.

CSO: 173-E

## PLANS FOR INTRODUCING NEW AIRCRAFT INTO FAR NORTH SERVICE

Moscow KOMSOMOLSKAYA PRAVDA in Russian 9 Feb 86, No 34 (18537), p 1, cols 1-4

[Article by V. Yunisov]

[Abstract] In an interview, Vladimir Yakovlevich Potemkin, head of the flight service administration of the Ministry of Civil Aviation and a former polar aviator, comments on the difficult work of pilots in the Arctic region and mentions some of the present-day activities of aviation enterprises serving this area, including operations in support of Arctic drifting stations.

Potemkin also comments on progress in modernizing the fleet of aircraft at the disposal of Far North aviation. The IL-18 long-range airplane, for example, recently was put to work in reconnaissance of ocean fish resources. Aerial measurements of the thickness of Arctic ice will be made from a new reconnaissance airplane, the AN-74. [See the Daily SNAP, February 21, 1986, p 1, col 1] Potemkin also mentions plans for putting polar versions of the AN-24 and AN-28 airplanes into production, and for putting the world's most powerful helicopter, the MI-26, and the multipurpose KA-32 helicopter into service in the Arctic at an early date. The KA-32, which can be carried on board seagoing ships, is intended for use in ice reconnaissance, and for cargo handling work in places without port facilities.

A photograph is given showing an IL-76 cargo plane parked at the airport in UST-Kut.

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# AN-74 AIRPLANE TAKES PART IN ARCTIC EXPEDITION SUPPORT WORK

Moscow KOMSOMOLSKAYA PRAVDA in Russian 25 Feb 86, No 47 (18550), p 4, cols. 2-6

[Article by V. Yunisov, correspondent]

[Abstract] The article gives an account of a recent flight of an AN-74 airplane from Cherskiy to Zhokhova Island. It was the first operational flight in the Arctic by this new aircraft. The flight was made as part of support operations for an Arctic cross-ice ski expedition sponsored by the newspaper KOMSOMOLSKAYA PRAVDA. [See the Daily SNAP, February 20, 1986, p 3, col 2.] The AN-74 had recently completed test flights in the Yakut ASSR. [See the Daily SNAP, March 3, 1986, p 3, col 1.] The airplane's crew included Anatoliy Trofimovich Romanyuk, senior test project engineer, and Yuriy Vladimirovich Kurlin, test-pilot of the Design and Experimental Bureau imeni Antonov.

On the flight to Zhokhova Island, the AN-74 carried 13 drums of fuel for another airplane which was to drop supplies to the expedition. Romanyuk noted that the AN-74 was carrying more than three tons of test gear in addition to the cargo of fuel. This equipment included instruments for recording flight parameters from different points of the airplane. It is noted that whereas it takes IL-14 and AN-26 airplanes four hours to make the trip from Cherskiy to Zhokhova Island, the AN-74 flew this distance in a little over an hour. The reason for this is that the AN-74's ceiling is far higher than that of the IL-14 and AN-26, explained navigator Sergey Nechayev. On Zhokhova Island, the AN-74 landed on an ice runway about one meter thick. The fuel drums were unloaded manually. Although the airplane ordinarily is equipped with an automatic cargo handling device, during the test flights, computer and other electronic gear occupied the space reserved for this device in the cargo bay. The device is said to be capable of moving loads as heavy as 2.5 tons through the airplane's fuselage.

Commenting on the AN-74's capabilities for operation in the polar regions, Kurlin related that it can perform ice reconnaissance, and it can transport cargo to areas that are difficult to reach. It can land on unpaved airfields, and also on ones that are covered with heavy snow. The AN-74's navigational and piloting instrumentation enables it to make flights at any time of the day or year. Kurlin mentioned in conclusion that plans call for completing tests of the AN-74 this year, and putting it into series production next year at a plant in Kharkov.

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