MEMBER COUNTRY: **Ukraine**

National Report to SCAR for year: **2009 - 2010**

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Activity	Contact Name	Address	Telephone	Fax	Email	web site
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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:

Geological research

"Atlas of the Antarctic Deep Structure with the Gravimetric Tomography (Version 1)"/Greku R.Kh., Gozhik P.F., Litvinov V.A., Usenko V.P., Greku T.R.; - Kiev, 2009.-67 p.- ISBN 978-966-02-4937-0 is published. Atlas includes 61 maps and vertical cross-sections, some explanations and interpretation of images. The Version 1 contains images without isostatic reduction of density anomalies in isostatically compensated regions. The following topics are in the the atlas: **I** Gravimetric Tomography Method and Initial data; **II** Interaction of Antarctica with Other Regions; **III** Transformation of the Earth's Structure in the Different Depths; **IV** Antarctic Lithospheric Boundary; **V** Trans Antarctic Vertical Sections; **VI** Sections crossing the West Antarctic; **VII** Detailed Structural Maps of the West Antarctic; **VIII** Regional Structural Features of the Scotia Plate. Bathymetric surveys of the West Antarctic shallow water archipelagos were carried out: Argentine Islands (detailed), Anargam Islands (detailed), Cruls Islands (reconnaissance), Roca Islands (reconnaissance).

Meteorological research

Quasi-two-monthly periodicity (70 days approx.) in the atmospheric circulation was detected near the surface and in the mid-tropospheric (500hPa) level. This periodicity is confirmed by analogs in atmospheric pressure fields as well as by the data of air temperature of Vernadsky (ex-Faraday) station. The periodicity is better identified between autumn and winter seasons. The forecast regression scheme for the anomaly of the average monthly air temperature with monthly lead for the Academic Vernadsky station is developed.

Written and published a monograph Martazinova V.F., Timofeev V.E., Ivanova E.K. "The atmospheric circulation in the South polar region and climate of the Antarctic Peninsula". In this monograph the current state of atmospheric circulation in the Southern Hemisphere and in the Antarctic Peninsula region is presented and weather conditions in the Ukrainian Antarctic station Akademik Vernadsky in winter and summer seasons are described. In the monograph objective classification of synoptic processes in the extratropical zones of the Souther Hemisphere was firstly made. Classificationof synoptic processes helps to study the transformation of large-scale atmospheric circulation from decade to the next in the second half of the twentieth century, in winter and summer season and to describe the modern atmospheric circulation over the extratropical zone in the Southern Hemisphere. Positions of permanent centres of action are specified with predominant shifts between decades. On the other hand, interdecadal changes of the atmospheric circulation in the Southern Polar region can explain reasons of climate warming in the Antarctic Peninsula region. Detailed classification of near-surface atmospheric circulation by classes of probability has been carried out in 1990s, the warmest decade in the Antarctic Peninsula. Typical positions of synoptic weather systems near Antarctic Peninsula are indentified; catalogue of classes of synoptic processes is created. The results of research in the Southern Hemisphere provide a complete understanding of the modern nature of atmospheric circulation and weather conditions in the Antarctic Peninsula and Vernadsky station.

Geophysical research

1. There have been collected sets of the rock sample (120 specimens) exposed on the Argentine Islands and neighboring part of the Antarctic Peninsula (AP) for the petrophysical study. These data are used for geological, petrophysical, geochemical, geochronological and paleomagnetic studies. In addition measurements of magnetic properties and densities help to constrain initial model parameters in joint 2D gravity and magnetic modeling for the AP continental margin.

2. Marine magnetic survey was carried out within the polygon of 20´km size covering the part the Argentine Islands in the region of the Ukrainian station of Academic Vernadsky. Automated systems were developed for geophysical data processing and interpretation including that derived from marine geophysical surveys. This robust approach permits to model a number of components of gravity and magnetic fields and also to fit model parameters regarding the geoid height undulations (alterations).

3. A synthesis was made of existing geophysical data, both potential fields (gravity and magnetic) and seismic refraction for the northern AP between Anvers Island and the north-east end of Bransfield Strait. In addition new measurements of magnetic properties and densities are present in order to help to constrain apparent susceptibilities and densities in joint 2D gravity and magnetic models for the region. Developed 2D joint geophysical models shows continental margin of the AP of two styles. Joint model, extending to the north from the Hero fracture zone and crossing the AP margin through the South Shetland Trench/Islands system and Bransfield Strait, indicates continental margin here of active style. It relates with recent subduction and ongoing continental rifting in the Brandsfield Strait. The model crossing the AP margin near the Anvers Island (to the south from the Hero fracture zone) shows features of the passive continental margin.

4. Automated interpretation systems were developed for interpretation of potential fields in 3D and setting up of 3D density models which utilizes the “back-stripping” techniques. This makes it possible to reveal density heterogeneities in the lithosphere when they are covered by seawater and thick sediments.

5. A seismic tomography method has been developed to study velocity structure of the lithosphere and upper mantle of the large segment of West Antarctica that includes the major part of the Scotia Sea, Drake Passage and the AP. In order to do this we continue to collect the seismological data from different sources. Initial model, that is based on limited data, has been constructed for the study area.

6. The complex palaeomagnetic research of a representative collection of Andean Intrusive Suite from the western part of Antarctic Peninsula (near Ukrainian Antarctic base Academik Vernadsky) was carried out. The collection of samples is various on a chemical compound and includes gabbrous, diorites and quartz diorites, tonalities, granodiorites and granites. The age of igneous complex varies from 58 to 106 Ma. New paleomagnetic poles have been calculated for Antarctic Peninsula terrain in Late Cretaceous time

7. The monitoring measurements of geomagnetic field module T on the tectonomagnetic polygon near Ukrainian Antarctic base Akademik Vernadsky were carried out. The data since 1998 confirmed tectonomagnetic effects about -2nT/y and extensional latitudinal horizontal forces nearly 5 bars per year.

Biotechnologies

Complex structure and function researches have shown that microbal communities of Antarctic Region possess a high adaptation degree which is possible to consider as a homeostasis, i.e. preservation of viability and ability to grow in a wide range of concentration of extreme factors. The collection of Antarctic microorganisms resistant to extreme factors is developed. The collection includes cryoprotector-producing bacteria, microorganisms resistant to high UV radiation level (up to 500-1500 J/m²), isolates resistant to a wide spectrum of the most toxic metals (Hg^{2+}, Cu^{2+}, Cr(VI), Co^{2+}, Cd^{2+} and Ni^{2+}) in concentrations of $5x10^{2}$-$6x10^{4}$ mg/l, isolates that are producers of biologically active substances (melanin, carotene, antibiotics, etc.). Producers of melanin (coal-black yeast) are found out on crustose and bushy lichens on vertical rocks, less often in a soil, their quantity formed $1x10^{2}$ - $6x10^{3}$/g of a sample. Coal-black pigments are selected from two Antarctic strains of yest. According to complex of specific chemical tests, these pigments ere indentical to melanin that is proved by the character of UV-spectra (220-230 nm) and by absorbtion spectra in the visible area (400-800 nm). Melanin yield of strain № 36 made more than 10% from the biomass amount. In whole, in ground Antarctic biotopes the yeast intensively synthesizing melanin is revealed.

Biotechnologies based on microbial mobilization of insoluble metal compounds are effective for increase of their extraction in the mining industry and in bioremidiation. Immobilization abilities can be applied in metal-containing sewage tretment. Antarctic microorganisms can be used for new antibiotics production, antibiotic-resistant strains as test cultures for studying efficiency of new antimicrobal preparations. Methylotrophic bacteria are perspective producers of cryoprotector, pigmented microorganisms - as biologically-active substances producers (melanin, carotene). The unique yeast isolate *Exophiala nigra* (a melanin producer) can simultaneously be used for sewage treatment (for example, Ni^{2+} and Co^{2+}), UV-protective preparations, creation of medicines with preventive and curative properties in relation to ulcer-erosive lesions of the stomach and its precancerous states.

Comprehensive Study of Antarctic Biota

Physiological studies: UV-B radiation changes in the content of pigments such as chrolophylls and carotenoids (except violoksantyn). The composition of lipids was characterized by accumulation of tryglycerydes, sulfohinovadyldiacylglycerol, phosphatidylholine and monogalactozyldiatsylglycerol content destruction. H^2O^2 caused accumulation of chlorophyll content in both types of plants and carotenoids in *D.antarctica*plants. Research of glycolipids content has established the lowering of monogalactozyldiacylglycerol content in *D.caespitosa*leaves and slight accumulation of sulfohinovadyldiacylglycerols in *D. antarctica* plants. Virology studies: Detection of viruses in *D.antarctica*and *C.quitensis*plants samples from Argentine Islands is shown. Using serological detection the presence of viryses of different taxonomic groups - CMV (Cucumovirus), TSWV (Tospovirus), CGMV (Tobamovirus) - was shown. In samples of *C. quitensis* viral antigens CGMV were detected. Methods of plant-indicators confirmed the nature and infective viruses, identified in *D. antarctica.* Biological testing demonstrated that the plants from typical Ukrainian ecological cenosis *D. caespitosa, C. epigejos, A. gigante* may serve as reservoir (asymptomatic hosts) of CGMMV. Biochemical studies: Lipid content and flow of oxidative processes in the liver of *N. coriiceps; C. aceratus, P. charcoti and T. bernacchii* received over the period of the 13 th Antarctic expedition were studied. It is established that the investigated fish species are characterized by differences of tryglycerides, phospholipids and cholesterol content in liver . The lowest content of lipids, in comparison with other species, is found for *N. coriiceps* that may be a particular condition for the peculiarities of their metabolism. Zoological studies: Within Petermann Island there were found three species of *Collembola* and five species of mites : *Cryptopygus antarctica, Friesea grisea and Isotoma octooculata; Alaskozetes antarcticus, Gamasellus racovitzai, Halozetes belgicae, Protereunetes minutus, Stereotydus villosus*. Some species, except mites *P.minutus S. villosus* were marked on the Big Yalury Island. On both the investigated islands representatives of *Cryptopygus antarctica and Alaskozetes antarcticus* were strongly pronounced dominants according to their quality (occurrence) and quantity (density). Botanical studies: For the first time 22 taxons of diatoms are described for bryophyte groups of the Big Yalury Island and Antarctic Peninsula (Tuxen Cape). Observation results revealed that multinucleated cells of *Xanthonema* genus representatives are found as frequent as mononuclear cells. For the first time the example of Antarctic isolate *Xanthonema* genus representative has shown that a characteristic feature for representatives of *Xanthophyta* is a semi-closed type of mitosis but not only a closed one as it is for representatives of the *Vaucheriales* order. The study of genetic diversity of the *Tribonemataceae* (*Xanthophyta*) family representatives has not found endemic species or phylogenetic clades corresponding to the representatives of this geographic region. But *Tribonemataceae* family representatives may have Antarctic populations that differ from those of other regions.