MEMBER COUNTRY: RUSSIA

National Report to SCAR for 2016 - 2017

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A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS

PHYSICAL SCIENCES

Physical oceanography

In January – February 2016 nine CTD/O_2 transects (106 stations) were made from r/v Akademik Fedorov in the Prydz Bay area. Oceanographic stations were performed by "Sea Bird 911+" probe with water sampling to determine the nutrients on the particular horizons. Two additional sections with 23 stations were made in April in the northern part of Bransfield Strait and on the continental slope of the South Shetland Islands in the southern Drake Passage.

In the period 15 – 31 January 2017 three CTD/O_2 transects (112 stations) were made from r/v Akademik Fedorov in the Davies Sea. Oceanographic stations were performed by "Sea Bird 911+" probe with water sampling to determine the nutrients on the particular horizons. Two sections were made along the Shakleton Ice Shelf front. Two sections (26 stations) were made in 9 – 11 April 2017 in the northern part of Bransfield Strait and on the continental slope of the South Shetland Islands in the southern Drake Passage.

Joint Swiss-Russian Antarctic Circumnavigation Expedition (ACE) was undertaken from December 2016 to March 2017 on board r/v Akademik Tryoshnikov. It was a unique attempt to address a range of globally significant questions in the Southern Ocean and Antarctica in a single cruise, for the first time attempting to link the islands with the wider oceanographic context. Undertaken by an international group of 150 scientists working on 22 projects a principal objective is to foster cross-disciplinary working and data sharing.

Deep drilling at Vostok and glaciological studies

In the 2016-2017 austral season, during the 62nd Russian Antarctic Expedition, the drilling of deep hole 5G-3 at Vostok Station was resumed and the hole was deepened by 36 m to a depth of 3720 m.

An investigation of the new ice core, which represents the lake water frozen in the borehole, has confirmed that the core has been heavily contaminated with the organic components of the drilling fluid, and is not suitable for a study of the real chemical and biological properties of the lake water (Alekhina et al., 2017). In addition, the intensive mixing of the subglacial water and the drilling fluid resulted in the formation of a solid plug that filled the volume of the borehole and blocked access to the lake. It has been demonstrated that this solid plug consisted of kerosene, ice, and clathrate hydrate of HCFC-141b used as a densifier of the drilling fluid (Manakov et al., 2017). Collectively, all the evidence and lessons learned at Vostok to date suggest that the drilling technology used to unseal Lake Vostok is not suitable for direct investigations of the subglacial lake body. The drilling fluid presently used at Vostok should be replaced, at least in the bottom section of the hole, by another fluid which does not react with subglacial water, in order to allow further investigation of Lake Vostok.

A new shallow hole was drilled in the vicinity of Vostok to a depth of about 26 m. The isotopic and chemical analyses of the obtained snow core are now in progress in the Arctic and Antarctic Institute (St Petersburg) and in the Limnological Institute (Irkutsk). The data anticipated from these studies will provide a high-resolution record of climate and atmospheric chemistry in this region of Antarctica covering at least the last 600 years. The drilling of this hole will be continued in the 2017-2018 austral season.

References:

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Manakov A.Yu., Ildyakov A.V., Lipenkov V.Ya, Ekaykin A.A., Khodzher T.V, Formation of clathrate hydrates of hydrochlorofluorocarbon 141b in the deep borehole at Vostok Station (Antarctica) in the course of the unsealing of subglacial Lake Vostok. Earth's Cryosphere, 2017, vol. XXI, № 3, 32-40.

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GEOSCIENCES

ORGANIZATIONS INVOLVED:
Federal Research Institute for Geology and Mineral Resources of the World Ocean, VNIIOkeangeologia (Ministry of Natural Resources and Environment of Russian Federation, Federal Agency for Mineral Resources).
Polar Marine Geosurvey Expedition, PMGE.

FIELD ACTIVITY
Marine geophysics (PMGE, VNIIOkeangeologia).
Region: Prydz Bay/Cooperation Sea (area between 65E and 81E; 62.5S and 68.5S).
Data: 3220 km of MCS, magnetic and gravity data; Refraction data from 6 Ocean Bottom Seismometers (OBS).
Technology: MCS data were recorded with a 560-channel, 7-km-long digital streamer and airgun array of 40 liters in total volume.

Airborne geophysics (PMGE)
Region: Princess Elizabeth Land (area between 88E and 92E; 66.5S and 67,35S).
Data: c. 6350 km of airborne survey including magnetic and radio-echo sounding observations.
Technology: Short-range airplane AN-2 was used for data acquisition. The RES studies were carried out using a 130-MHz radio-echo sounder. Flight lines were generally oriented north-south and spaced 5 km apart.

Geological studies (PMGE)
Region: Central part of Banger Hills, East Antarctica. Geological mapping and study of tectonic, igneous and metamorphic events.

INTERNATIONAL PROJECTS (VNIIOkeangeologia)

Commission for Geological Map of the World (CGMW). Subcommission for Antarctica.
http://www.ccgm.org
The second edition of the "Tectonic map of Antarctica" is in Progress. The map and explanatory notes are expected to be ready in 2020.

Antarctic Digital Magnetic Anomaly Map (ADMAP). SCAR SSG GS Expert Group.
http://www.scar.org/admap
New ADMAP version was compiled in VNIIOkeangeologia and published at the end of 2017.

Past Antarctic Ice Sheets (PAIS). SCAR Scientific Research Program
Digital data sets with thicknesses of syn-glacial (post-34 Ma) sediments from eastern Weddell Sea, Cosmonaut Sea and Mawson Sea were created within the PAIS Project "Paleobathymetry and Paleotopography of Antarctica".

NATIONAL PROJECTS (VNIIOkeangeologia)

Geological map of Mac.Robertson Land and Princess Elizabeth Land (East Antarctica) at scale 1:1000 000.

The main goal of this project is to summarize and integrate available geological and isotopic age data obtained in the Mac.Robertson Land and Princess Elizabeth Land. Three major tectonic provinces have been subdivided into seven individual zones (each with a specific geological history) defined by a specific legend block. About 60 map units have been totally distinguished.

Russian Foundation for Basic Research (RFBR) projects (2015-2017): 1) Neoproterozoic-Cambrian tectonism and metamorphism in East Antarctica: geodynamic implications for Gondwana formation; 2) Environment and geology of subglacial Lake Vostok in Central Antarctica.

Russian Science Foundation (RSF) Project (2016-2018): Deep structure, thermal evolution and magmatism of the East Antarctic transitional zones and adjacent oceans.

SELECTED PUBLICATIONS OF 2016-2017

Gulbin Yu.,L., Egorova K.V., Mikhalsky E.V., Tkacheva D.A., Galankiba O.L. 2016. New data on metamorphism of the Neoproterozoic Sodruzhestvo Serries in the southern Prince Charles Mountains, East Antarctica. Zapiski RMO (Proceedings of the Russian Mineralogical Society), Part CXLIV, No5, pp. 15-32.

Leitchenkov G., Antonov A., Luneov P., Lipenkov V. 2016. Geology and environments of subglacial Lake Vostok. Phil. Trans. R. Soc. A. 2016. Vol. 374, 20140303. (doi: 10.1098/rsta.2014.0303).

Leitchenkov G.L., Guseva Yu.B., Gandyukhin V.V. 2016. Crustal structure and tectonic evolution of the eastern Weddell Sea and Lazarev Sea. Prospecting and Protection of Depths. No 2, pp.43-47 (In Russian, with Abstract in English).

Mikhalsky E., Krylov D., Rodionov N., Presnyakov S., Skublov S., Myasnikov O. 2017.Refined geological history of polyphase plutono-metamorphic complex in the Thala Hills area (Enderby Land, East Antarctica) from zircon SHRIMP dating and implications for Neoproterozoic amalgamation of the Gondwanaland // In: Pant, N.C., & Dasgupta, S. (eds.) Crustal evolution of India and Antarctica: The supercontinent connection. Geological Society, London, Special Publications. Vol. 457, pp.7-36.

Scheinert M., Ferraccioli F., Schwabe J., Bell R., Studinger M., Damaske D., Jokat W., Aleshkova N., Jordan T., Leitchenkov G., Blankenship D. D., Damiani T. M., Young D., Cochran J. R., Richter TD. 2016. New Antarctic Gravity Anomaly Grid for Enhanced Geodetic and Geophysical Studies in Antarctica. Geoph. Res. Let. Vol. 43. doi:10.1002/2015GL067439.

Vasilyev N.I., Leychenkov G.L., Zagrivny E.A. 2017. Prospects of obtaining samples of bottom sediments from Subglacial Lake Vostok. Journal of Mining Institute. Vol. 224. pp. 199-208. DOI: 10.18454/PMI.2017.2.199

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