

Russian national report 2003

The Russian IMAGES scientists include researchers from the following institutions:

- Shirshov Institute of Oceanology RAS (SIO RAS)
- Pacific Oceanographic Institute, FEB RAS (POI FEB RAS)
- Vernadsky Institute of Geochemistry RAS (GEOKHI RAS)
- Institute of the Lithosphere RAS (IL RAS)
- Moscow State University (MSU)
- Far-East Geological Institute FEB RAS (FEGI FEB RAS)

The membership is operated from Shirshov Institute of Oceanology in Moscow since 1998.

This year the IMAGES-related researches are concentrated in the Western Arctic seas, North-Western Pacific seas, Norwegian Sea, and Eastern Equatorial Pacific. Several MD giant cores are under study in cooperation with foreign partners. Several new sediment cores have been retrieved in Russian scientific cruises organized by SIO (with participation of GEOKHI) in the Norwegian and Barents seas (cruise 16 of the RV *Akademik Sergei Vavilov*), and by POI (with participation of SIO) in the Japan Sea and the Sea of Okhotsk (cruises 32 and 29 of the RV *Akademik Lavrentjev*, the latter one in cooperation with GEOMAR, Germany within the KOMEX Project). During cruise 17 of the RV *Akademik Sergei Vavilov*, (2003), within the Meridian program, V. Sivkov (Atlantic Branch of SIO) carried out high-resolution seismic profiling, and obtained three gravity cores from the Brasil Basin and Vema channel, South Atlantic.

The teams from GEOKHI (headed by M. Levitan), POI (headed by S. Gorbarenko), and A. Matul (SIO) in cooperation with GEOMAR, Kiel University and AWI (Germany) analyzed several micropaleontological and sedimentological proxies in the giant cores from IMAGES VII WEPAMA cruise. (The whole study of Cores MD01-2416 and MD01-2417 from the NW Pacific and of Core MD01-2415 from the Sea of Okhotsk is coordinated by M. Samthein, and by D. Numberg and R. Tidemann respectively).

Studies of IMAGES cores by M.A. Levitan with his team (GEOKHI) are mainly focused at the history of terrigenous sedimentation, changes in sediment supply from different provenances, in sediment transport (e.g. ice rafting) and deposition mechanisms. In 2003 the laboratory dealt with the processing of two giant cores, MD01-2413 and MD01-2415, obtained from the Sea of Okhotsk in 2001 during WEPAMA cruise MD122/IMAGES VII. Grain-size analyses were completed for the Core 2413, and by 75% for the Core 2415. Neutron activation analyses in both cores will be finished in this year. The study of clay minerals in Core 2413 started.

A. Matul (SIO) carried out the radiolarian analysis of the sediment core MD01-2415 from the Sea of Okhotsk, that spans the interval of MIS 31-1 or the last 1 Ma. The study revealed: (a) a cyclic glacial/interglacial radiolarian variations, and (b) irreversible changes in the radiolarian fauna correlated with major shifts in the Quaternary paleoclimate (the Mid-Pleistocene Revolution, Transition at the Bruhnes/Matuyama boundary, the Mid-Bruhnes Transition, the Transition to the last glaciation, the Holocene Transition).

Diatoms are studied by the POI team in the upper 240 cm of Core MD01-2417 retrieved from the Emperor Seamount Chain, with the sampling interval of 5 cm. The preliminary results show that their abundance strongly increases upward, from the late glacial to the Holocene. This is consistent with the previous Russian data. The stratigraphic boundary between stages 1 and 2 can be identified by the common species relationship.

S.Korsun (SIO) and L.Khomenko (St.Petersburg University) in collaboration with the University of Tromsø, Norway, analyze foraminiferal assemblages and stable isotopes in core MD99-2305, retrieved by RV Marion Dufresne in Van Mijen Fjord (a glaciated fjord of Svalbard) during an IMAGES cruise in 1999. The core contains a 16-m-thick uninterrupted Holocene sequence. The age model is constrained by 23 radiocarbon dates. The advection of Atlantic Water to the area was maximal in the Early Holocene. After 8,000 cal. yr BP, when the exchange with the ocean became restricted due to postglacial rebound of the sill, the fjord basin began accumulating brine-injected bottom waters.

E. Ivanova (SIO) studied foraminiferal assemblages and their preservation in the Termination I to Holocene part of the core MD02-2529 obtained from Cocos Ridge in IMAGES VIII MONA cruise. Together with French colleagues from CEREGE we applied the modern analog technique to reconstruct paleotemperature variations at the site MD02-2529. This preliminary attempt demonstrates rather small and consistent temporal variations of seasonal and mean annual temperature, generally within 2 °C during the Holocene. Lower winter and summer values are found in Termination I. The joint multi-proxy study of the core will be continued next year.

Multiproxy study of the 6-m-long gravity core ASV-987 from Russkaya Gavan' Fjord, NW Novaya Zemlya, carried out by I.O. Murdmaa, E.V. Ivanova (SIO) and L. Polyak (USA) provides the first subcentury-scale sedimentary record from the eastern Barents Sea. for the last ca 800 years. This uniquely detailed high-Arctic data set, combined with high-resolution Holocene sedimentary archives of a glaciomarine fjord, makes Russkaya Gavan' a key site for studies of recent paleoclimatologic and paleoceanographic changes in the eastern Barents Sea. The study results reveal paleoenvironmental responses to the global-scale climatic events of the last millennium: the Medieval Warm Period, the Little Ice Age, and the recent warming. Results of multiproxy studies of 25 sediment cores collected from the eastern Barents Sea during SIO expeditions, and summarized by

I.O. Murdmaa, with co-authors, characterize evolution of the Barents Sea facies system since the last glaciation to the Holocene.

The Laboratory of Ocean Chemistry, SIO, headed by E.A. Romankevich recently studied the distribution and molecular composition of n-alkanes, aromatic hydrocarbons, lignin, and phenols in the ocean in order to reconstruct changes in productivity, climatic and oceanographic conditions, and to reveal genesis and fluxes of organic matter. Chromatographic methods are used for research of 15 cores, 2–6 m long, collected in 12 cruises of R/V. *Academic Sergei Vavilov*, *Mstislav Keldysh*, and *Professor Shtokman* in the White, Barents and Pechora seas and in the Atlantic Ocean (Voring Plateau, Bismark Polygon, Blake-Bagama abyssal plain). Two monographs have been published in 2001-2003.

The mineral composition of sediments from the Yenisei transect (R/V "Akademik Boris Petrov", 2000) have been studied by M.V. Bourtman (SIO). First results reveal a number of indicators of the terrigenous matter supplied from various sources and deposited in the hydrodynamic barrier area on the south of the Kara Sea. This work is a part of SIRRO project - joint Russian-German program.

O. Naidina (IL) carried out palynological studies on Holocene shelf deposits from the Laptev Sea and from the Franz-Victoria Trough, Barents Sea. Pollen analysis with morphological investigation of pollen indicators was performed on radiocarbon-dated sediment core samples, collected by Russian and German research vessels during previous years, using optical microscope and scanning electron microscope. The good chronological framework of sediment cores provides first record of the transfer of pollen grains onto the shelf. Because of the close land-shelf linkage due to riverine connections, the trends observed in the shelf data seem to be in a good agreement with the Holocene vegetational evolution of the coastal hinterland. The interpretation of pollen stratigraphy in terms of climate based on empirical facts and use of the climatic model would be helpful in detailed climatic reconstruction over the Laptev Sea area.

The research group from MSU (E. Taubenkova, A. Stepanova, S. Dem'yankov) in cooperation with German colleagues, has studied temporal and spatial variations in the species composition of modern and Holocene assemblages of molluscs, ostracods and foraminifera from the Laptev and Kara seas shelf in order to reconstruct palaeoenvironmental changes. Based on analysis of core-top sediment samples, four modern assemblages were established reflecting changes in water depth and bottom water salinity. Modern analogue data were used for reconstructing Holocene palaeoenvironments. Fossil assemblages from two AMS¹⁴C-dated sediment cores from the eastern middle shelf provide clear evidence for a gradual transformation of the shelf environment due to the southward transgressing sea from a nearshore brackish-water environment of the initial stage of inundation to a shallow inner-shelf, fluvial-affected environment, and to a modern marine environment which eventually became established since 10.8 and 8.2 cal. Ka.

Several research teams from POI (S.A. Gorbarenko), IL (I.A. Basov), and SIO (T.A.Khusid, M.P. Chekhovskaya), in cooperation with German colleagues carried out high-resolution studies on paleoceanography of the last glacial cycle in the Japan Sea, Sea of Okhotsk, and Bering Sea. Main evolution stages of the basins are revealed and related to regional and global climatic changes, as well as to sea level oscillations. Short-term paleoceanographic events are also fixed. Variations in paleoproductivity and circulation patterns are reconstructed based on multiproxy studies of numerous sediment cores.

N.V.Bubenshchikova (SIO) in cooperation with Dr.D.Nuernberg (GEOMAR, Germany) investigated the evolution of the Sea of Okhotsk paleoenvironment in cores from the Sakhalin and Kamchatka slopes. The results concern changes in productivity, sea ice cover, production of Sea of Okhotsk Intermediate Water (SOIW), and oxygen minimum zone (OMZ). It is suggested that the difference in OMZ behavior between two regions is associated with sea level raise and poor SOIW ventilation around Sakhalin slope during the Holocene unlike the Kamchatka slope.

The study of diatom assemblages by V.Pushkar and M.Cherepanova (FEGI RAS) resulted in detailed stratigraphy of the Postglacial sediments of the Japan Sea. Distinguished zones are consistent with European Prae-Dryas, Older, Middle and Younger Dryas, Bolling and Allerod, and then with the Holocene subdivisions: Prae-Boreal, Boreal, Atlantic, Sub-Boreal, and Sub-Atlantic. Finally, paleocirculation pattern was reconstructed based on variations in diatom assemblages.

Report submitted by Elena Ivanova
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