Surveys with the Innomar SES-2000 parametric sub-bottom profilers in 2016-2017 in Atlantic and Arctic Oceans

Dr. Oleg Levchenko, et al.
P.P. Shirshov Institute of Oceanology, Russia

Contact

Address P.P. Shirshov Institute of Oceanology,
Russian Academy of Science
Moscow
Russia

Website www.ocean.ru
Email olevses@mail.ru

Surveys with the Innomar SES-2000 parametric sub-bottom profilers in 2016-2017 in Atlantic and Arctic Oceans

O.V. Lrvchenko, R.A. Ananyev, N.N. Dmitrevsky and N.V. Libina
P.P. Shirshov Institute of Oceanology, Russian Academy of Science, Moscow

P.P. Shirshov Institute of Oceanology, Russian Academy of Science collaborates effective and successfully with the company Innomar Technologie GmbH since 2000. Both scientific researches and applied works were carried out during these 17 years with different units from the Innomar SES-2000 parametric sub-bottom profiler family on many seas (Black, White, Baltic, Caspian, Barents, Kara, Laptev, East Siberian, Chukchi and others) and rivers (Volga, Ob, Moscow, Kama and others) of Russia, as well in the Atlantic and Arctic oceans.
P.P. Shirshov Institute of Oceanology, Russian Academy of Science has now two systems: the mobile "SES-2000 standard" using in shallow-water seas and rivers and the installed "SES-2000 deep" on RV Akademik Ioffe using in the deep-water ocean. The first system is used more often for monitoring of underwater pipelines, engineering and environmental surveys by orders of industrial companies, while the second one is used for fundamental researches of the processes of sedimentation and neotectonics in the Atlantic Ocean.
Activity with the mobile "SES-2000 standard" during last two years 2016 and 2017 was applied in the Arctic Ocean. That was mostly the works in the Barents and Kara seas requested by industrial companies (monitoring underwater pipeline and abandoned boreholes). In this time, scientific research with the "SES-2000 standard" in the Arctic Ocean was carried out in the Laptev Sea, East Siberian Sea and Chukchi Sea for the study of ice scoring and escape of gas through seabed into the atmosphere to study the problem of methane crisis resulting from degradation of permafrost. High-frequency channel clearly recorded the distinct gas plumes in the water column, and the low-frequency channel clearly recorded the characteristic pockmarks and domes at the bottom formed in this case. Several fields of active sipping escape of methane through the seabed into the atmosphere were been outlined as a result of completed detailed survey with the "SES-2000 standard".
Scientific studies of contourite sediments in the Atlantic Ocean were continued with the "SES-2000 deep" during cruises of RV Akademik Ioffe in September-October of 2016 and 2017. In particular, detailed survey was carried out over the Ioffe Drift in the South Atlantic off Uruguay. It showed that very complex structure of the upper sedimentary section on the drift is caused by many prominent angular unconformities. Small channels and gullies up to 20 m dip with gently slops oriented parallel to the drift axis and near-bottom currents are widespread here. Typical landslide facies were revealed over slopes of the drift.

Shirshov Institute of Oceanology,
Russian Academy of Science, Moscow, Russia

Surveys with the Innomar SES-2000 parametric sub-bottom profilers in 2016-2017 in Atlantic and Arctic Oceans

Oleg Levchenko, Roman Ananyev, Nikolai Dmitrevsky, Natalia Libina and Alexander Mutovkin

8th Workshop "Seabed Acoustics“ 2017 Rostock

HEARTILY CONGRATULATIONS WITH INNOMAR´S 20TH BIRTHDAY!

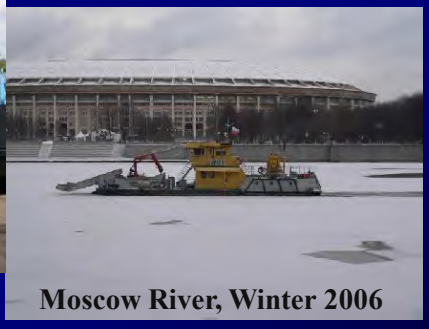
HERZLICH GLÜCKWUNSCH MIT INNOMARS 20TH GEBURTSTAG!

Shirshov Institute of Oceanology, Russian Academy of Science collaborates effective and successfully with the company Innomar Technologie GmbH since 2000. Both scientific researches and applied works were carried out during these 17 years with different units from the Innomar SES-2000 parametric sub-bottom profiler family onboard of various watercraft - from small boats to large vessels in many seas (Black, White, Baltic, Caspian, Barents, Kara, Laptev, East Siberian, Chukchi and others) and rivers (Volga, Ob, Moscow, Neva, Kama and others) of Russia, as well in the Atlantic and Arctic Oceans.

THE BEGINNING OF COOPERATION

August 2000. Jens Lowag and Stefan Erdman have brought SES-96 light in Kaliningrad with car after some traveling adventures and custom troubles. The SES-96 light was installed on lifeboat from our research vessel. The SES-96 light was used for students' practical work in the Pergola River and the Kaliningrad Bay.

SURVEYS WITH PARAMETRIC SUB-BOTTOM PROFILERS SES-2000 LIGHT AND STANDARD ONBOARD SMALL SHIPS

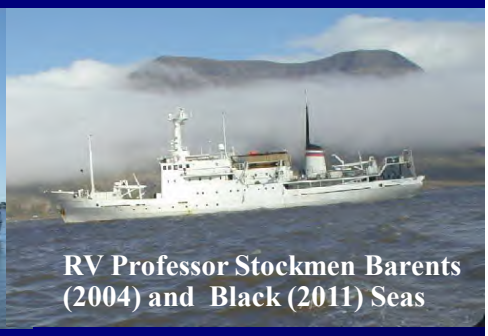


Download: www.innomar.com/seabed-acoustics-2017.php

SURVEYS WITH PARAMETRIC SUB-BOTTOM PROFILERS SES-2000 STANDARD AND MEDIUM ONBOARD MEDIUM SHIPS

RV Victor Buinitsky
Kara Sea 2015, 2016

RV Rift Caspian Sea 2004-2008

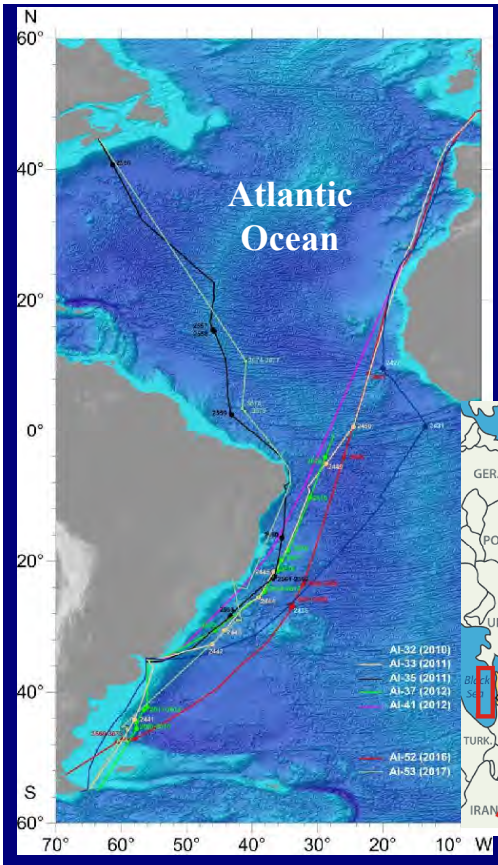


RV Professor Stockmen Barents (2004) and Black (2011) Seas

SURVEYS WITH PARAMETRIC SUB-BOTTOM PROFILER SES-2000 DEEP ONBOARD GIANT SHIPS

RV Akademik Sergey Vavilov
Atlantic Ocean 2009

RV Akademik Ioffe
Atlantic Ocean 2010-2012, 2016, 2017



SES SURVEY AREAS OF SHIRSHOV INSTITUTE OF OCEANOLOGY IN 2000-2017

Scientific researches and applied works with SES-2000 standard and light around Russia

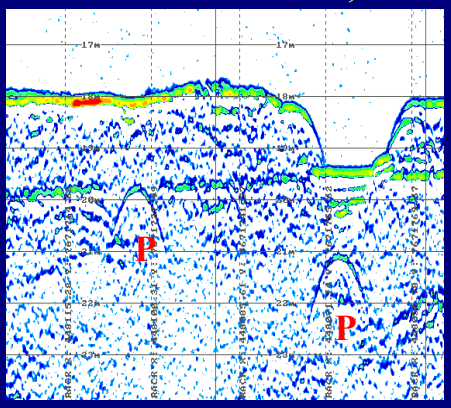
7 regular cruises in the Atlantic Ocean with SES-2000 deep in 2009-2012, 2016 and 2017

SOME RESULTING ARTICLES

ARCTIC OCEAN

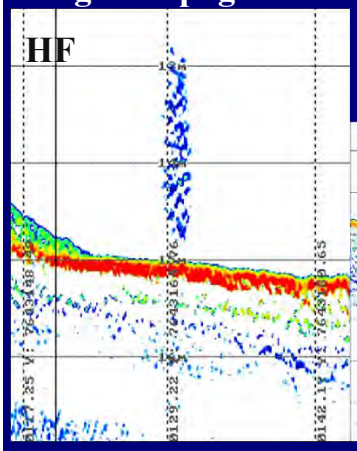
2016 -2017

MONITORING OF THE UNDERWATER GASPIPELINE IN THE BAYDARATSKAYA BAY, THE KARA SEA

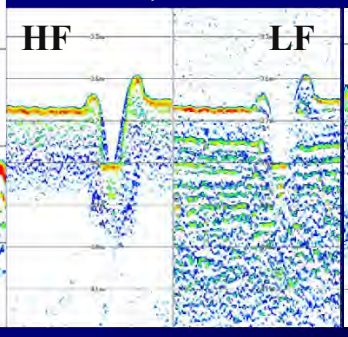


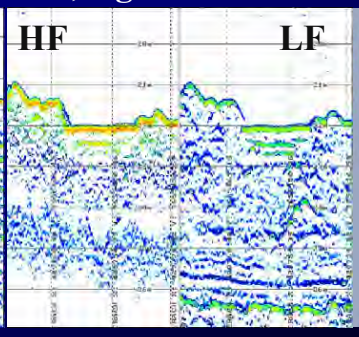
The survey with narrowbeam parametric echosounder SES-2000 standard allow to determine the position and depth of the pipe within sediments with an accuracy of 20-30 cm as well to assess risk of the pipes' destruction by ice scouring

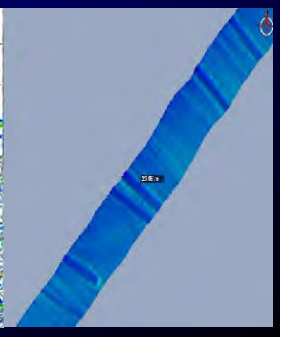
gas seepage



Ice scouring furrows (plougmarks): recent, left and ancient, right

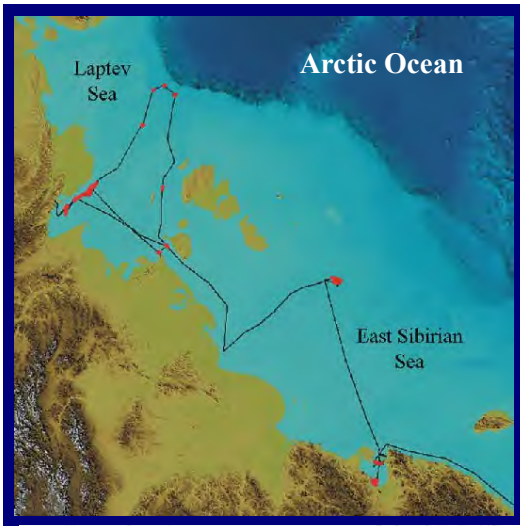






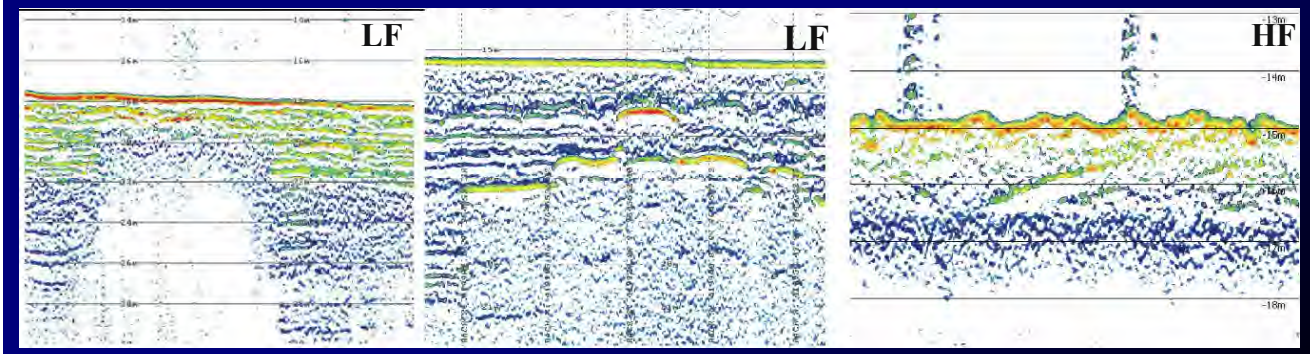
echosounder SES-2000 standard **multibeam**

PERMAFROST DEGRADATION, GAS SEEPAGE AND METHANE CATASTROPHE



The degradation of submarine permafrost and the destruction of hydrates on the shelf of east Arctic Seas could be potential cause of the methane catastrophe. Studies on this problem was continued in 2016 in the East Siberian and Laptev Seas.

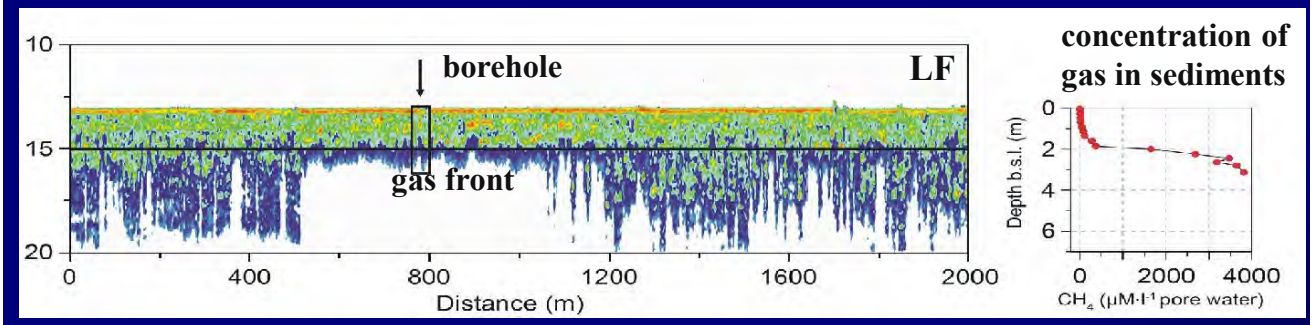
Echosounder SES-2000 standard



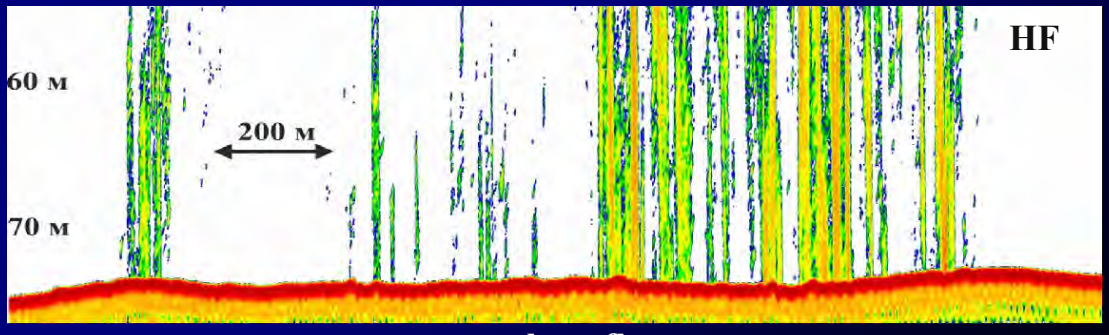
gas-charged or gassy sediments

gas seepage trough seafloor in water column

Subsea permafrost degradation and gas seepage trough seafloor are key factors controlling the East Siberian Arctic Shelf methane (CH4) emissions.

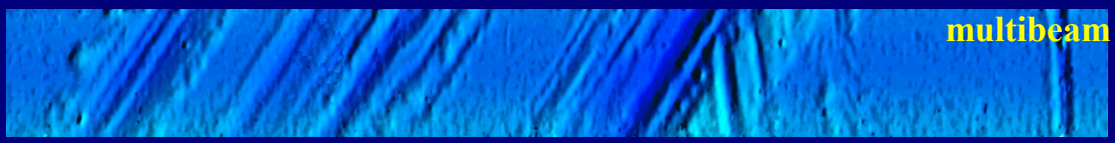


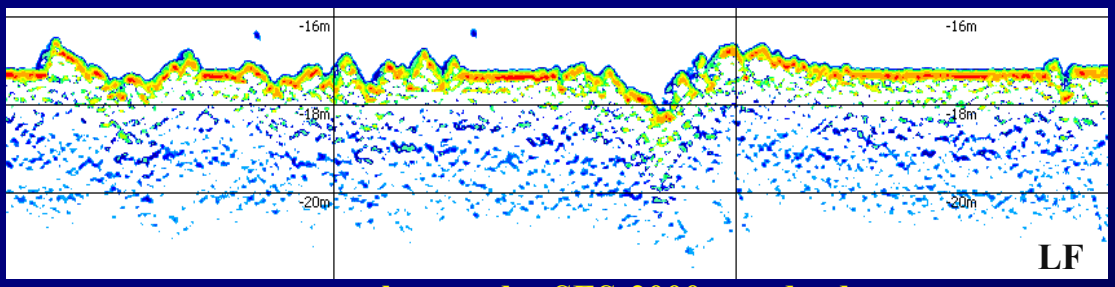
The concentration of gas below the boundary identifying the acoustic anomaly increased by two orders of magnitude, allowing us to interpret the observed acoustic anomaly as being due to the presence of gas in the sediments.



gas seepage trough seafloor

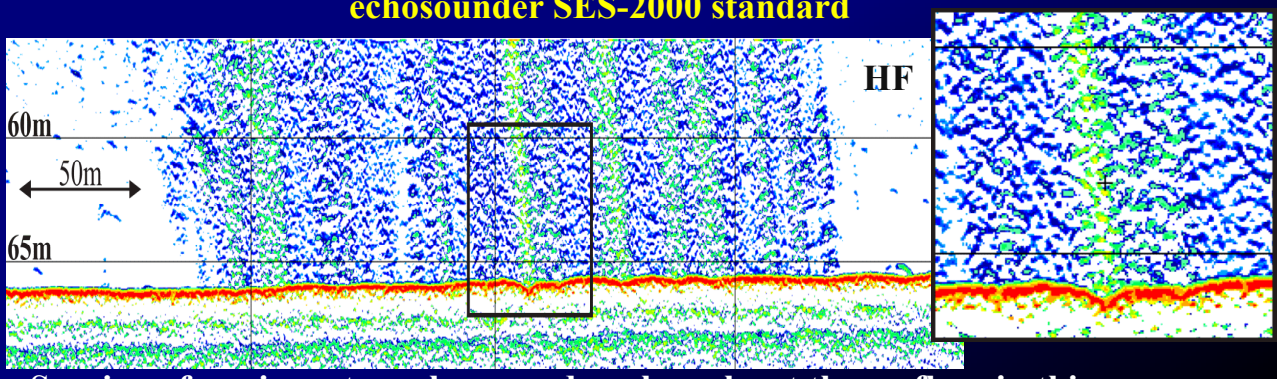
The Laptev Sea





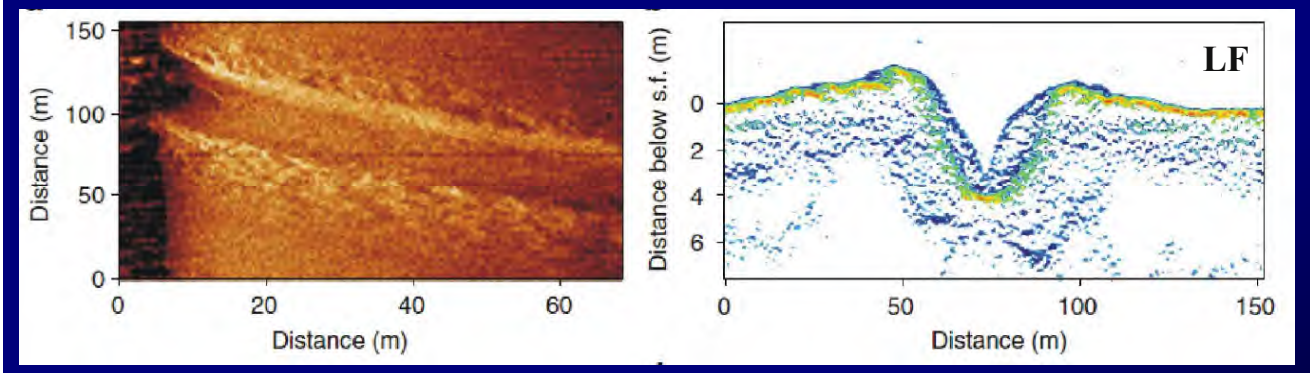
Ice scours

echosounder SES-2000 standard



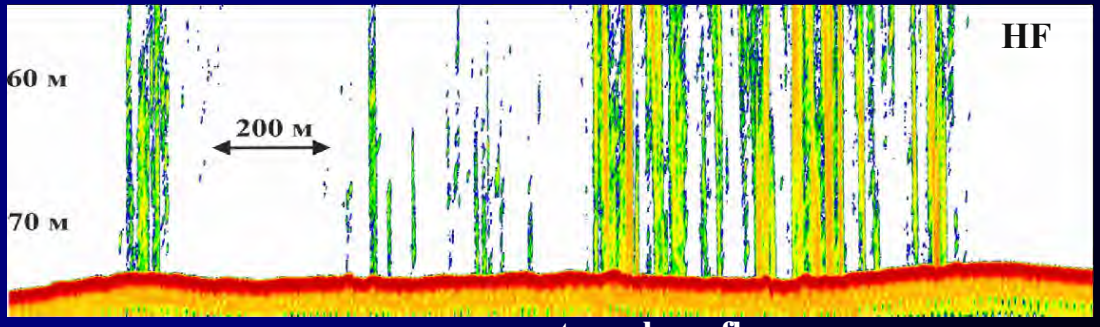
Seeping of gas in water column and pockmarks at the seafloor in this case

The ice scouring could unroof upper sediment layers, opening gas-migration pathways for underlying gas.



High-resolution side-scan sonar image of an ice scour observed in the seafloor

Sub-bottom SES profile image of the ice scour by 4 m deep



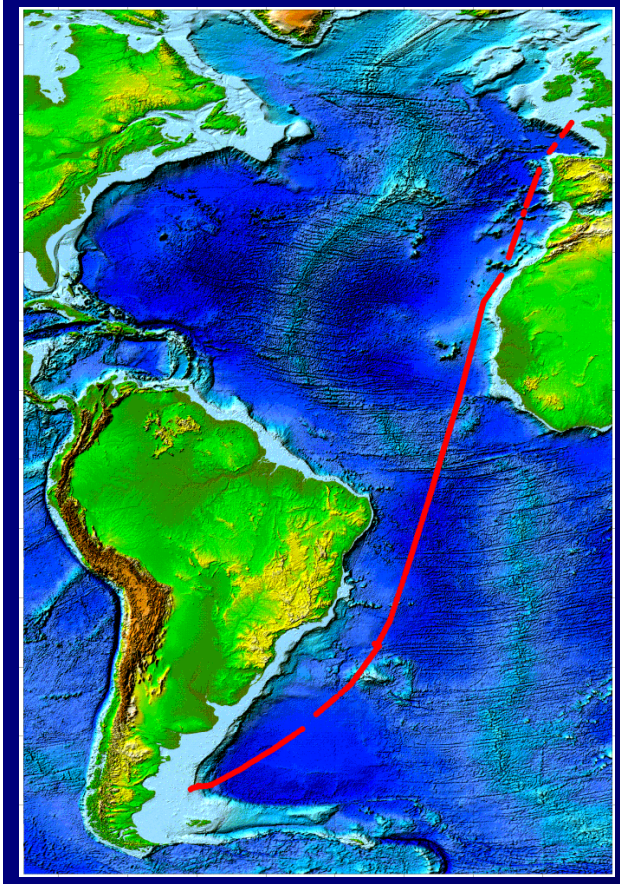
gas seepage trough seafloor

ECOLOGICAL MONITORING OF THE ABANDONED WELLS IN THE BARENTS SEA, 2017

ATLANTIC OCEAN

2016 -2017

Download: www.innomar.com/seabed-acoustics-2017.php

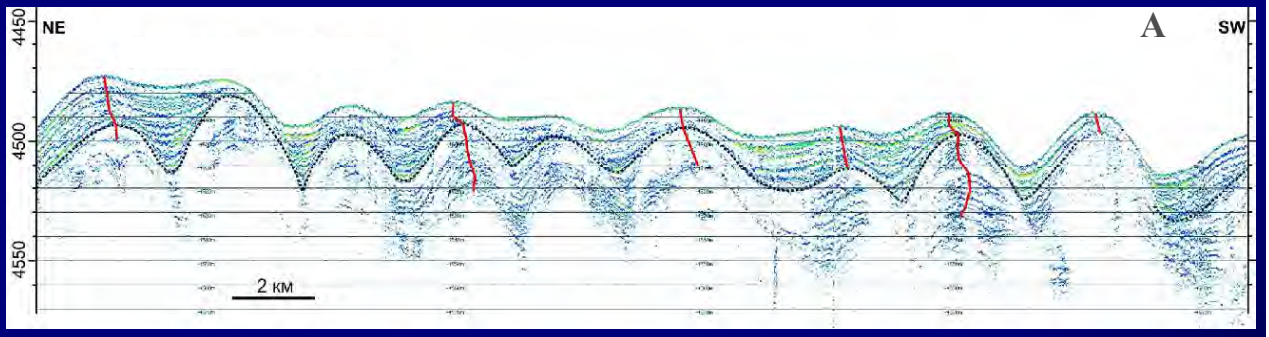


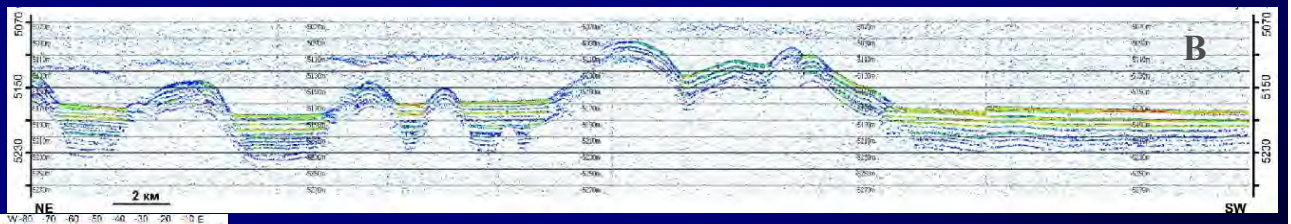
2016

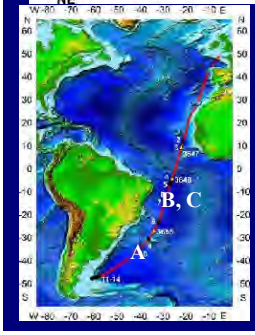
Cruise # 52 *of RV Academik Ioffe*
Gdansk (Poland) –Ushuaya (Argentina)
September 27 – November 8
~5 500 miles (~10 000 km) and 22.5 Gb

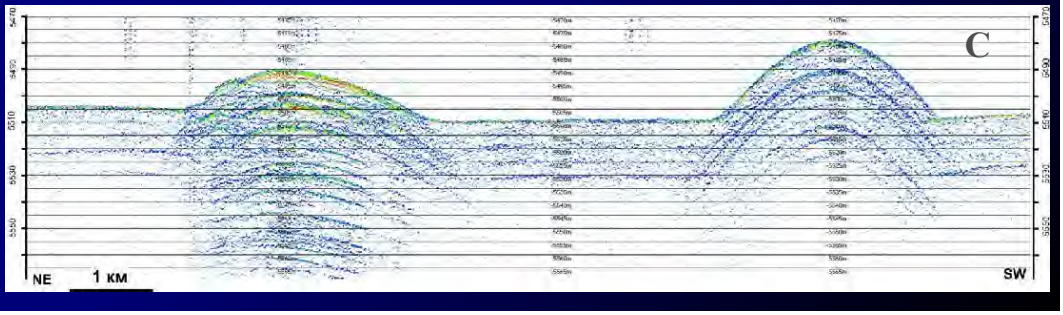
The high-resolution seismic profiling by the SES-2000 deep carried out during the cruise #52 of the *R/V Akademik Ioffe* off exclusive economic zones led to clarify structure of the uppermost Quaternary sediments along the whole route in the Central and South Atlantic. These studies were aimed at studying the influence of circulation of near-bottom water and bottom currents on sedimentation, especially contourite sedimentation.

SEDIMENTARY WAVES IN THE ARGENTINA BASIN (ABOVE) AND DIAPIR-LAKE FEATURES IN THE BRAZIL BASIN PERHAPS FORMED OF CIRCULATION OF THE BOTTOM WATER

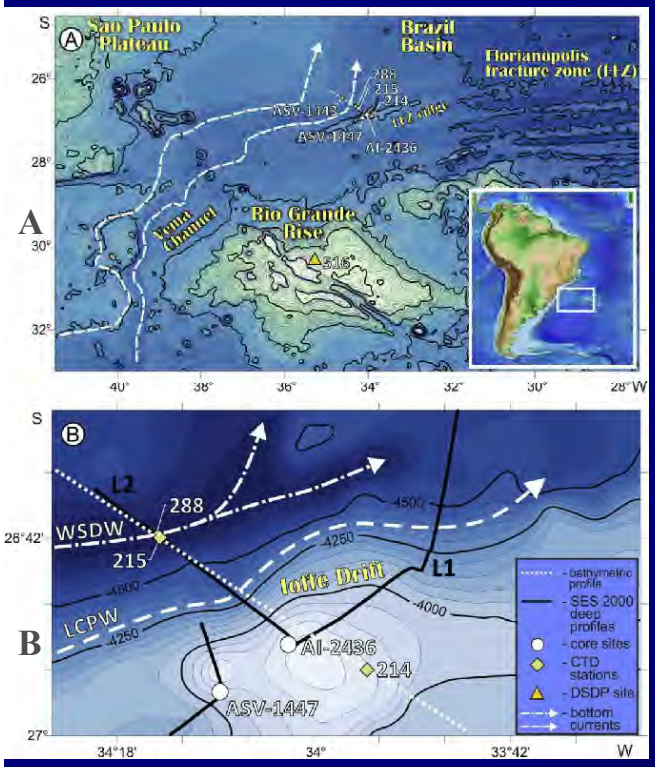








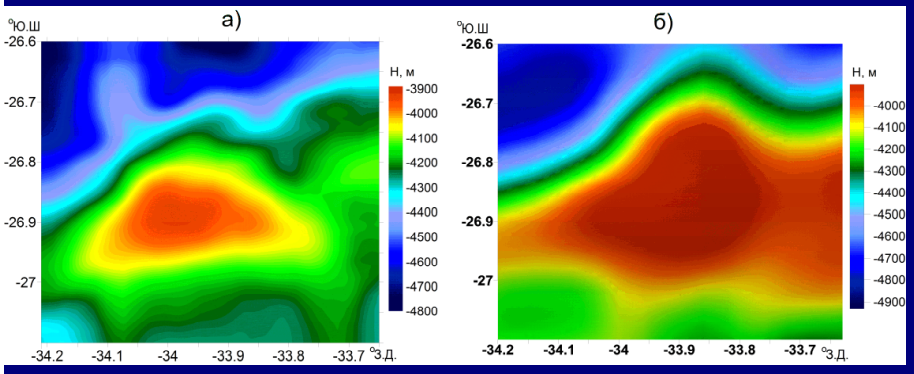
IOFFE CALCAREOUS CONTOURITE DRIFT



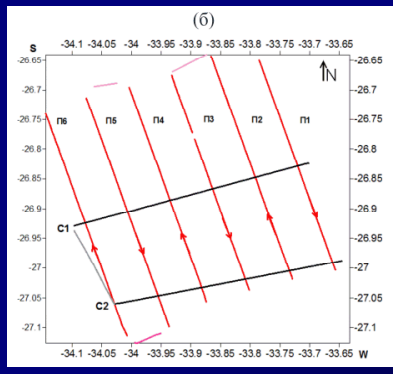
A) Regional map of the Rio Grande Rise area. B) Works over the Ioffe Drift in previous cruises [Ivanova et al., 2016].

High-resolution seismic profiling by SES-2000 deep during cruise #32 of the *R/V Akademik Ioffe* in 2010 led to the discovery of a large contourite drift named Ioffe Drift. It s formed by alternating phases of erosion and accumulation due to the changing intensity of the Antarctic Bottom Water (AABW) outflow from the Vema Channel during the Late Pliocene – Quaternary time. Cores from the drift recovered calcareous nannofossil–foraminiferal ooze contourites with small amounts of fine-grained terrigenous material.

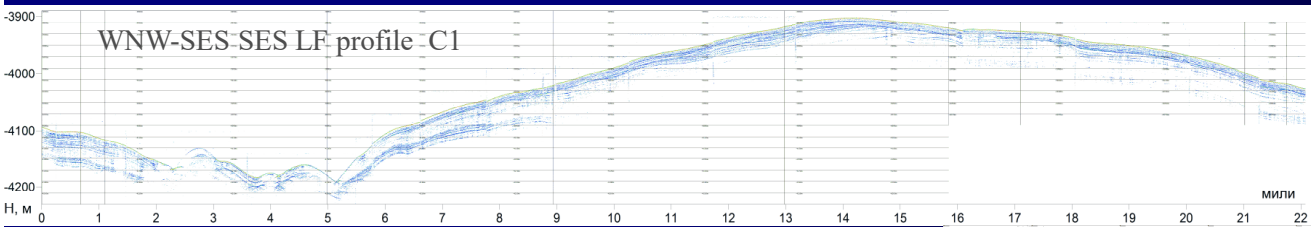
SES SURVEY OVER THE IOFFE DRIFT

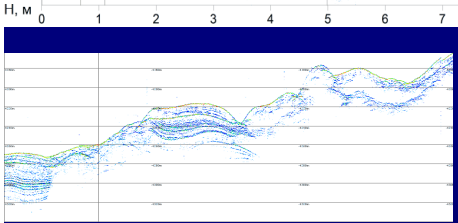


Bathymetry maps of the Ioffe Drift: (a) from the SES survey and (b) a\from MGDS (MARINE GEOSCIENCE DATA SYSTEM).

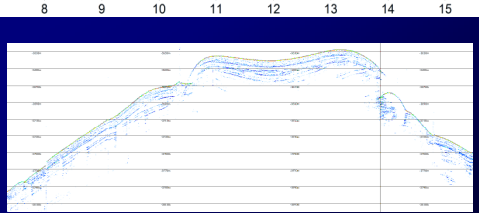


Scheme of SES survey profiles

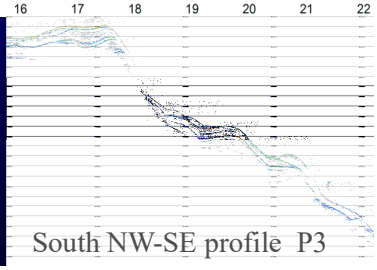




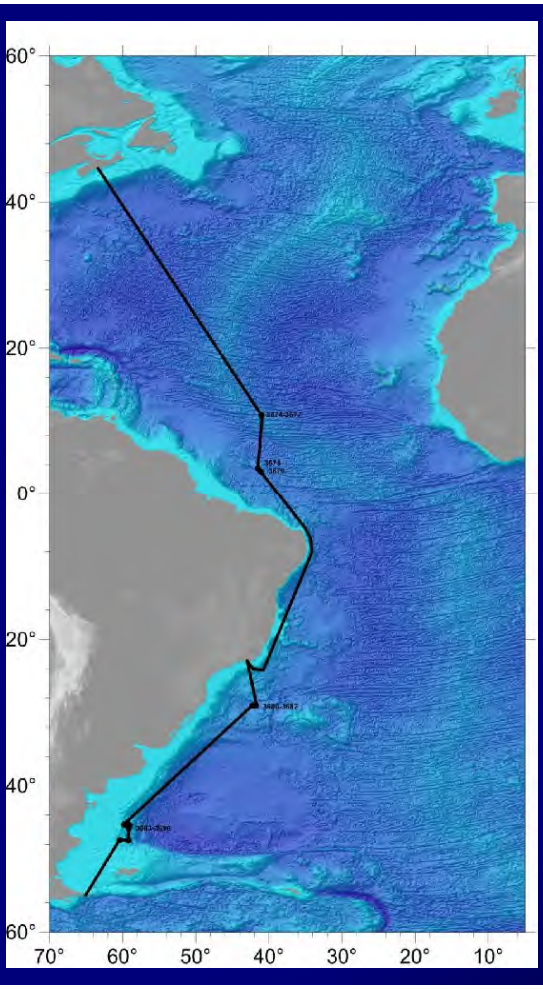
South NW-SE profile P6



Middle NW-SE profile P4



South NW-SE profile P3



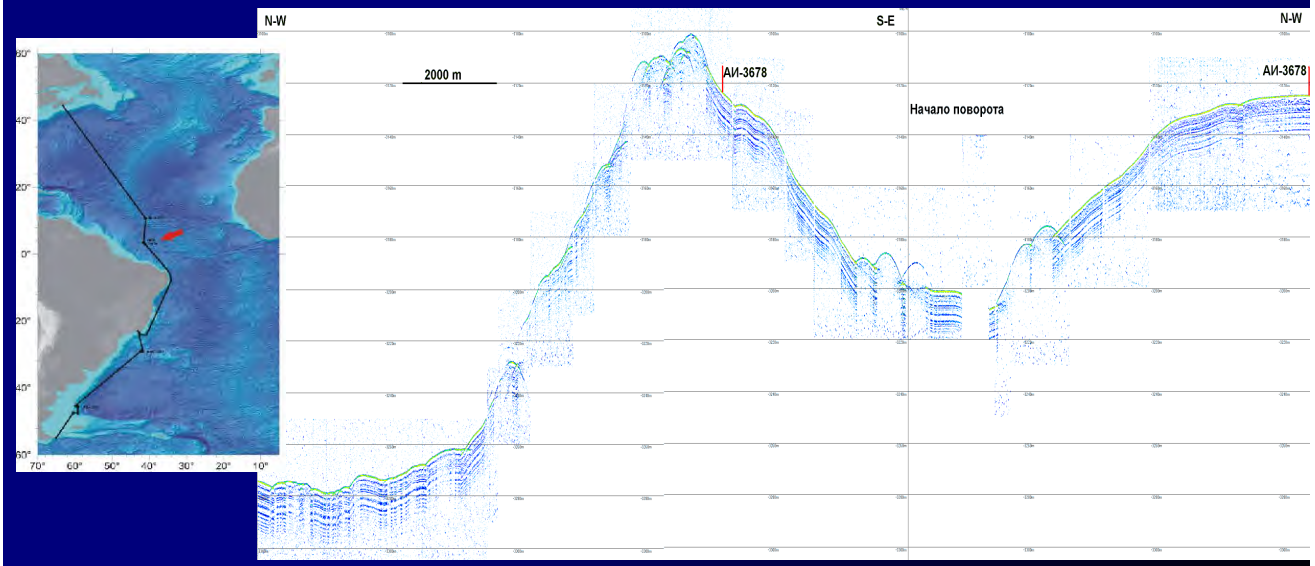
2017

Cruise # 53 *of RV Academik Ioffe*
Halifax (Canada) –Ushuaya (Argentina)
September 19 – October 17
~5 500 miles (~10 000 km)

The high-resolution seismic profiling by the SES-2000 deep in cruise #53 of the *R/V Akademik Ioffe* continued works of previous cruises of 2010-2016 to study contourite and turbidite systems in the Central and South Atlantic formed by bottom currents and gravity flows respectively.

The Seara Rise

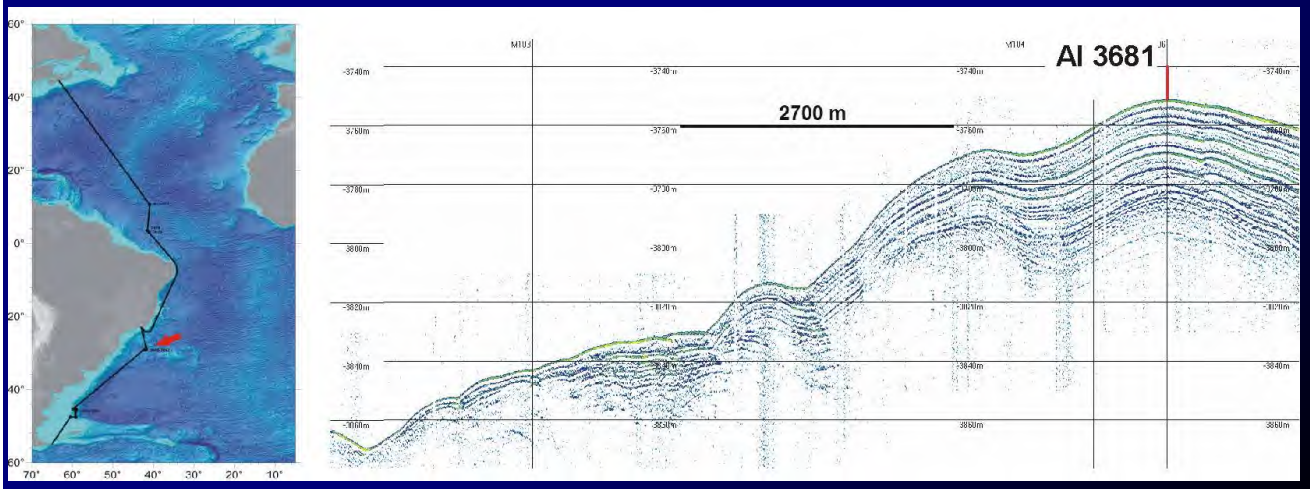
Main aim – to identify lithological and seismic evidences of bottom currents in the southeastern Seara Rise to determine the influence of near-bottom water circulation on sedimentation in this area during the Late Quaternary. The AI-3678 cores imply lateral redeposition of sediments by bottom contour currents.



SES profile over southeastern slope of the Seara Rise

The San Paulo Plateau

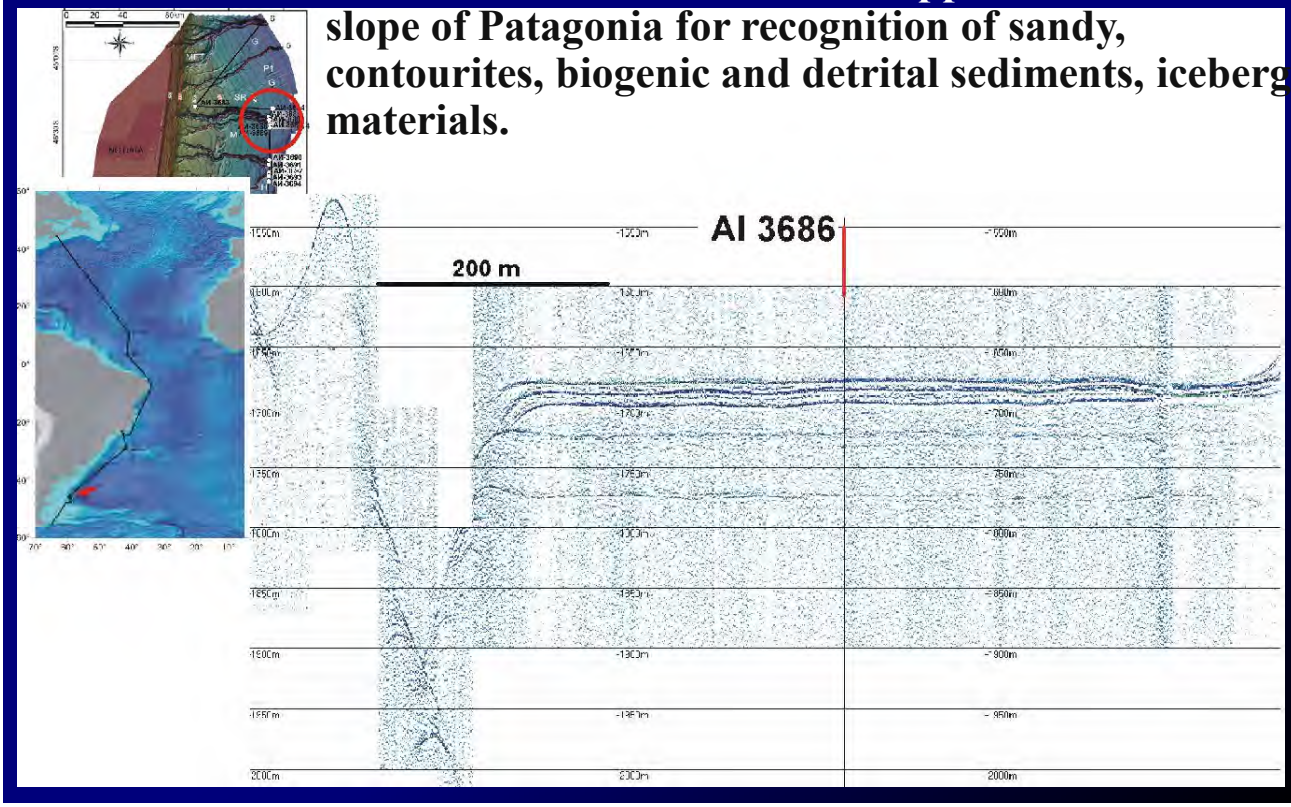
Seismic profiling and sampling on the San Paulo Plateau to validate the contourite drift and contourite-turbidites filling of the channel near the plateau foot. Contourites sampled here confirm that near-bottom currents influenced significantly formation of the sedimentary features near the San Paulo Plateau during the Middle-Late Quaternary



SES profile over top of the hypothetical drift near the foot of the San Paulo Plateau

The Patagonia continental slope

Seismic profiling and sampling on the Nagara and Perito Moreno Terraces in the upper continental slope of Patagonia for recognition of sandy, contourites, biogenic and detrital sediments, iceberg materials.



Download: www.innomar.com/seabed-acoustics-2017.php


AGAIN HEARTY
CONGRATULATIONS
AND
MANY THANKS
FOR LONG USEFUL
AND SUCCESSFUL
COOPERATION !