

Geological and Geophysical Investigation of Contourite Systems from the Central and Southern Atlantic during Cruise 52 of the R/V *Akademik Ioffe*¹

E. V. Ivanova^{a, *}, I. O. Murdmaa^a, D. G. Borisov^a, N. V. Simagin^{a, b}, E. A. Ovsepyan^a, N. V. Libina^a,
J. I. Isola^c, E. V. Bulycheva^d, N. A. Shulga^a, A. V. Krek^d, N. V. Lobus^a, and L. V. Lapidus^d

^a*Shirshov Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia*

^b*Department of Geology, Moscow State University, Moscow, Russia*

^c*University of Buenos Aires, Argentina*

^d*Atlantic Department, Shirshov Institute of Oceanology, Russian Academy of Sciences, Kaliningrad, Russia*

*e-mail: e_v_ivanova@ocean.ru

Received December 29, 2016

DOI: 10.1134/S0001437018020054

INTRODUCTION

The geological and geophysical expedition during cruise 52 of the R/V *Akademik Ioffe* was organized by the Shirshov Institute of Oceanology, Russian Academy of Sciences, according to the expeditionary program of FASO Russia; it was combined with transit of the vessel after the end of the Arctic tourist season, from September 29 to November 8, 2016 (port of exit: Gdansk, Poland; port of entry: Ushuaia, Argentina).

The objectives of the expedition were formulated by scientific supervisor I.O. Murdmaa. The scientific party included 12 persons. The expedition was led by E.V. Ivanova and her deputy D.G. Borisov. The tasks of the expedition were carried out by the geological team (head E.A. Ovsepyan) and seismic profiling and meteorology team (head N.V. Libina).

The expedition was aimed at high-resolution seismic profiling along the ship's track and in the central part of the Ioffe Drift, with collection of sediment cores and grab samples in order to investigate the impact of bottom circulation on sedimentation.

Geological works included sediment sampling to study contourites (sediments formed by contour currents) and other lateral sedimentation products (turbidites, gravities). The studies were carried out in transform valleys of the Mid-Atlantic Ridge (MAR), on the Ioffe contourite drift in the southern Brazil Basin, and on contourite terraces of the southern Argentine continental slope. The stations of sediment sampling by gravity corers (127 mm in diameter) and an Okean 0.25 grab sampler were selected on seismic profiles with a high-resolution SES-2000 deep sub-bottom echo sounder (4–7 kHz). Positioning of the

vessel at the scheduled sites was assisted by GPS. The methods of preliminary onboard analyses during the expedition, including 5487 NM of seismic profiling, were performed along the vessel track starting from the exit to the Atlantic, except for the economic zones of European countries and Argentina, and including 194 miles in a survey area in the central Ioffe Drift. Twenty-seven geological sampling stations were made (Fig. 1) with the collection of 3 sediment cores and 17 grab samples or minicores.

PRELIMINARY SCIENTIFIC RESULTS

As a result of seismic profiling, records of the upper sedimentary cover structure were obtained along the vessel track, notably in MAR transform valleys, the Columbia Channel, the Ioffe Drift, and on terraces of the Patagonian continental slope. A detailed bathymetric map has been compiled for the central part of the Ioffe Drift.

Cores AI-3647 (water depth 4584 m) and AI-3648 (w.d. 5502 m) characterize sedimentary infilling of **MAR transform fault valleys** between 8° and 4° S. The cores recovered sections of Middle to Upper Quaternary contourites and miopelagic clays, respectively.

Core AI-3655 was retrieved at a depth of 3941 m near the summit of the **Ioffe Drift**. It consists of Quaternary calcareous nannofossil–foraminiferal ooze. Preliminary identification of foraminiferal stratigraphic zones suggests several hiatuses, which were found earlier in core AI-2436 [4]. Active erosion by bottom currents is inferred from a preliminary study of grab samples collected along the transverse profile across the channel at the base of the drift's northern slope.

¹ The article was translated by the authors.

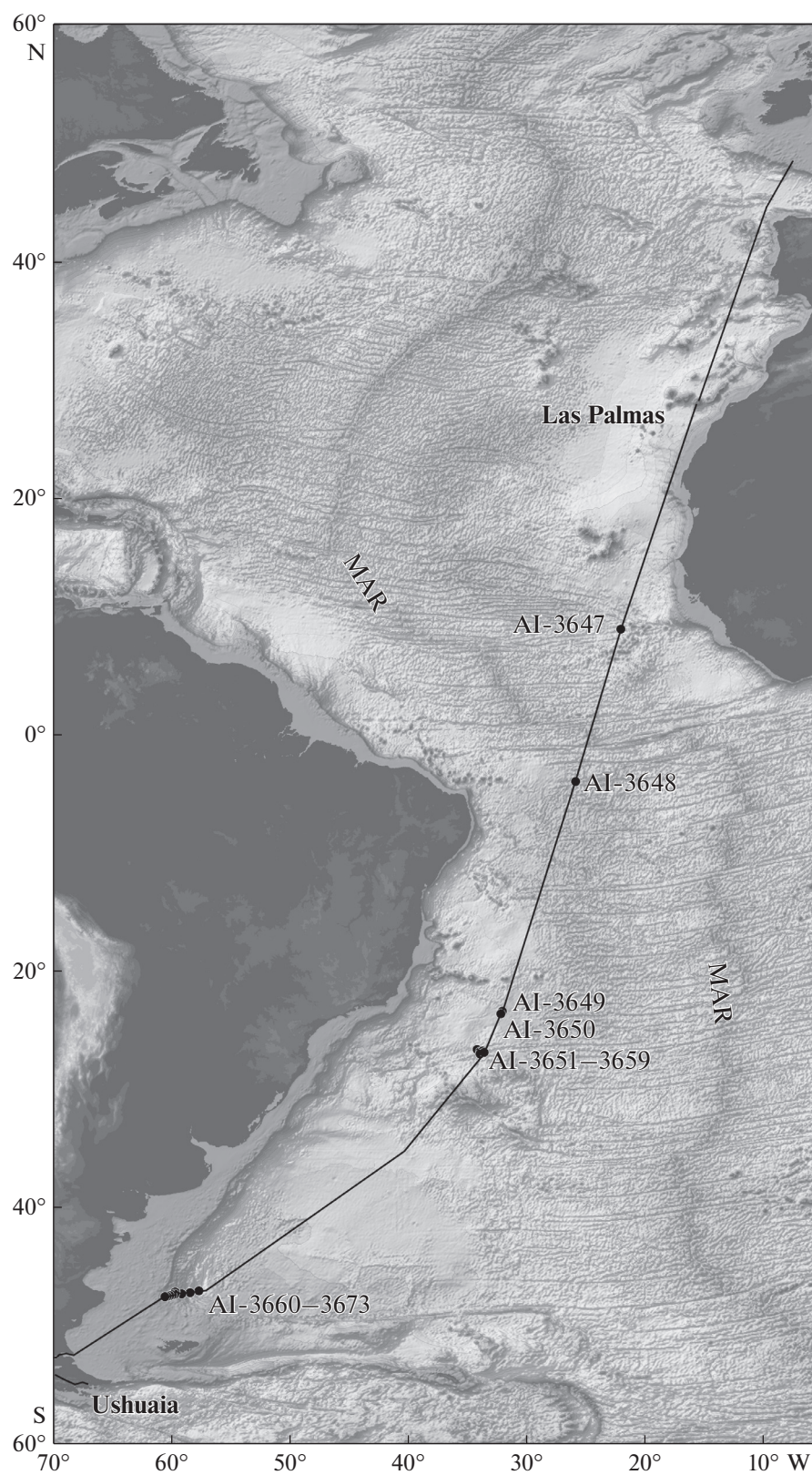


Fig. 1. Route of cruise 52 of R/V *Akademik Ioffe* and location of sediment sampling stations.

In the southern Argentine Basin, a series of grab samples were obtained along the transverse profile of the continental slope of Patagonia, from the Feilberg terrace to the upper part of the Nagera terrace. The conceivably contourite origin of the terraces [3, 5] was confirmed by our studies during cruises 46 and 50 of the R/V *Akademik Ioffe* [1, 2]. Coarsening of sediments from silt and clay at a depth of about 3800 m to medium and coarse sand at depths less than 700 m was ascertained during cruise 52. Almost all grab samples contain Quaternary planktonic foraminifers. Fine-grained sediments of the lower slope contain abundant coarse iceberg rafted debris (IRD). At the deepest station AI-3660, IRD is represented by angular rock fragments up to 3–4 cm in size, whereas at the shallower station AI-3661, it contains rather well rounded rock fragments with more variable petrography. This likely indicates calmer hydrodynamics on the deeper terrace. Preliminary facies analysis of the series of six grab samples across the canyon on the Nagera terrace suggests sediment transport along the canyon bed to the deeper Perito Moreno terrace.

The major scientific achievements of the expedition include: (1) the obtaining of new seismoacoustic data on the morphology of bottom landforms and internal structure of the sedimentary cover of the Atlantic, from the Cape Verde Basin to the upper part of the Argentine continental slope; (2) refining of the bathymetry and internal structure of the uppermost sedimentary cover in the central part of the Ioffe contourite drift; (3) the obtaining of a recent facies profile across the middle part of the continental slope of Argentina from the Feilberg to Nagera terraces, including a transverse microprofile across one of the canyons; (4) collection of new IRD evidence from the southern Argentine continental slope.

ACKNOWLEDGMENTS

We are grateful to Captain A.V. Zybin and the crew of the R/V *Akademik Ioffe* for their assistance in

accomplishing the scientific tasks of the expedition. The expedition was conducted in the framework of the following: state assignment of FASO Russia (topic no. 0149-2018-0016), Russian Science Foundation (project no. 14-50-00095), the project “Deep-Sea Contourite Systems of the Atlantic Ocean” of Program I3P by the Presidium of Russian Academy of Sciences, Russian Foundation for Basic Research (project no. 14-05-00744a), IGCP 619, INQUA 1204. The expedition was partly funded by FASO Russia.

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