Geotraces - RUSSIA
Scientific Report

2014- SSC Meeting

Stellenbosch, Cape Town, South Africa

8-10 October 2014

Short report on the GEOTRACES Russian activity from October 2013 till October 2014

Meetings. In late 2013 – early 2014 Russian scientists participated in 14 conference, where they have done more than 350 presentations.Among the conferences there were the three ones relevant to GEOTRACES:

1) Shirshov Institute of Oceanology in Moscow (18-21 November, 2013) has held the 20-th International Scientific School – Conference on Marine Geology under the leadership of academician Alexander Lisitsin, where about 500 scientists from different institutes have took part. The GEOTRACES related topics were the following ones:

- Biogeochemical processes in seas and oceans;
- Nano- and microparticles in the marine sedimentation processes;
- Geochemical processes in the deep-sea hydrothermal systems,
- Marine geochemistry and geology of the Arctic Ocean;
- Anthropogenic influence on the trace substances' sedimentation processes.

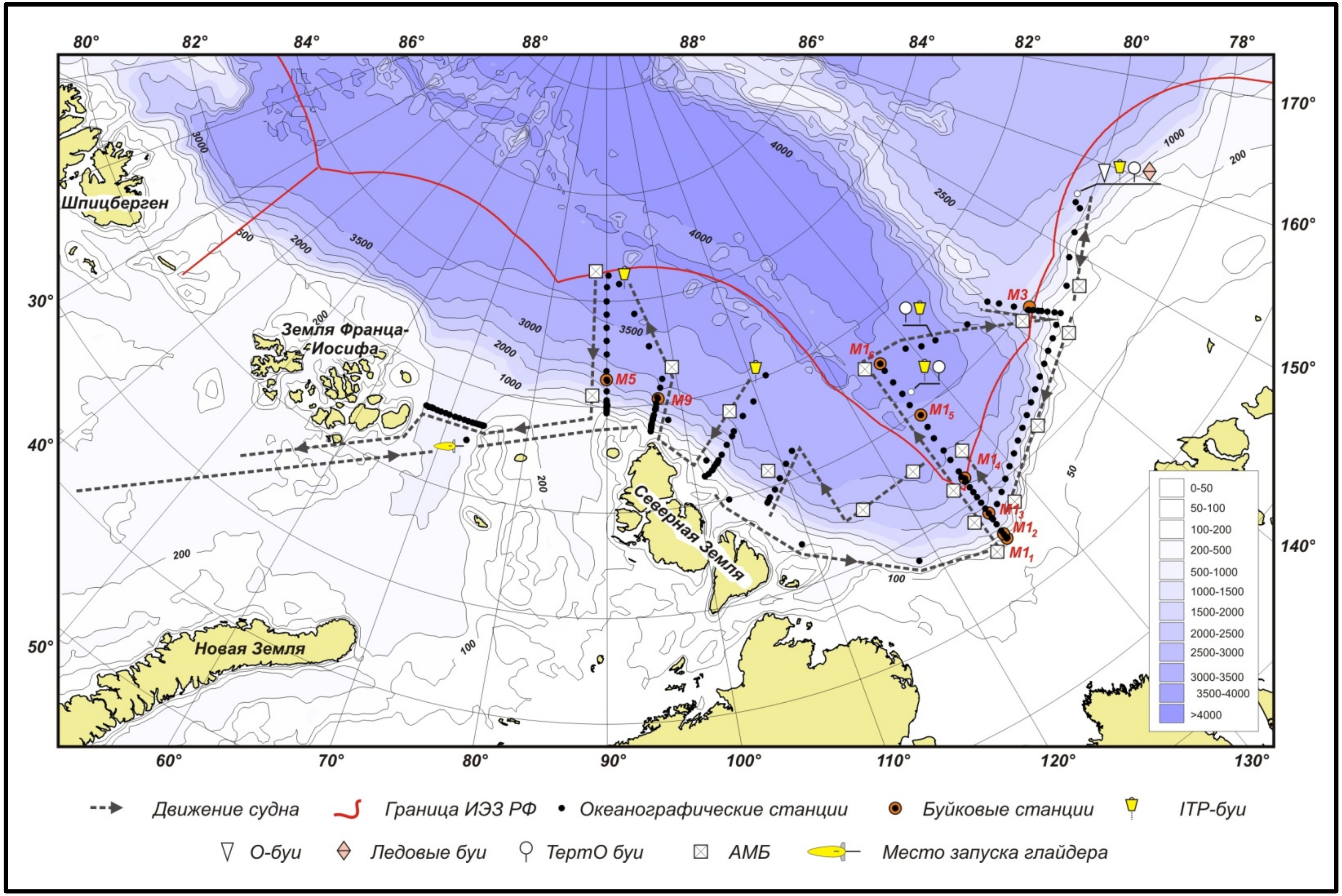
2) Russian Lithology Conference «Sedimentation basins and post-sedimentation processes over the geological history" was held in the Institute of Oil and Gas geology RAS, Novosibirsk (28–31 October, 2013). About 200 scientists have participated, many presentations was aimed to search geochemical, mineralogical and biomolecular indicators of paleoenvironmental sedimentation and ore deposits.

3) Russian Conference "Geochemistry of Lithogenesis" was held in Syktyvkar, March 17-19, 2014 by the Geology Institute of the Ural branch of Russian Academy of Science. There were about 60 participants. Among the themes of presentations related to GEOTRACES one may mention presentations on the methodical geochemical issues as well as mineralogical and geochemical indicators of the sedimentary phases.

The most important cruises in 2013-14

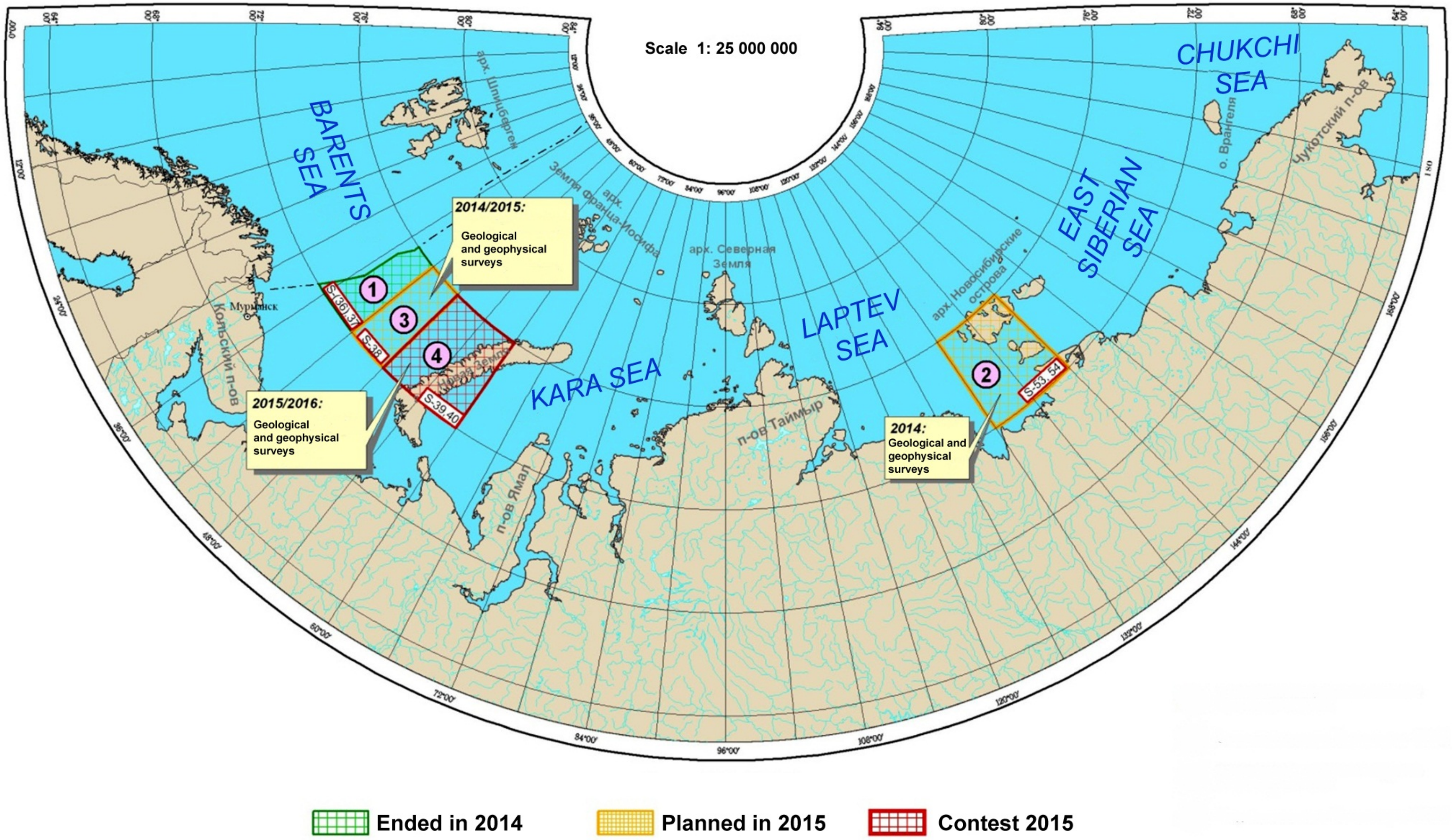
Expedition aim	Time	Area	Research vessel
Multidisciplinary investigations (hydrophysics, chemistry, geochemistry, geology)	August 01-14, 2014	White Sea	“Ecolog”
Arctic Floating University	June 1-29, 2014	White, Barents, Greenland, Kara Seas	«Professor Molchanov»
Russian-German expeditioin “LAPEX/TRANSDRIFT-XXII”	From August 26, 2014	Laptev Sea	“Victor Buinitskiy”
Geochermical indicators of hydrothermal and terrigenous input (CH4, Hg, Br)	July 2014	Japanese Sea	“Acamemik Lavrent’ev”
Swedish-Russian geochemical and geophysical investigations	July- August 2014	Laptev Sea	“Oden”
Comparison of carbonate system of the Eastern Chinese and Japanese Seas	August-September 2104	East Chinese and Japanese Seas	“Professor Gagarinsky”
Multidisciplinary investigations (hydrophysics, biology, chemistry, geochemistry)	08 August – 12 September 2014	Kara Sea	“Professor Shtokman”
Complex Russian- American investigations “AVLAP-NABOS”	17 August – 22 September 2013	North Kara Sea, Laptev and Eastern Siberian Seas	“Academik Fedorov”

Oceanographic stations and transects within the NABOS-2013 expedition held by Arctic and Antarctic Research Institute (AARI) on R/V "Akademic Fedorov"



Expeditions held by MAGE (St.-Petersburg)

Marine Arctic Geological Expedition (MAGE) geological and geophysical surveys in 2014 - 2015



New funding.

We have got financial supporting of the 15 initiative projects, related to the GEOTRACES objectives, from the Russian Foundation on Basic Research (rfbr.ru), aimed to investigate Russian Seas.

In addition we have got 2 initiative projects from the recently organized Russian Scientific Foundation (rscf.ru).

Among the aims of some projects, the Arctic expedition (including the Barents and Kara Seas) is laid out on 2015.

New results Elucidation of behavior of the “truly” dissolved low molecular weight (LMW) <1kDa fraction containing Fe, C org, and a number of insoluble TE

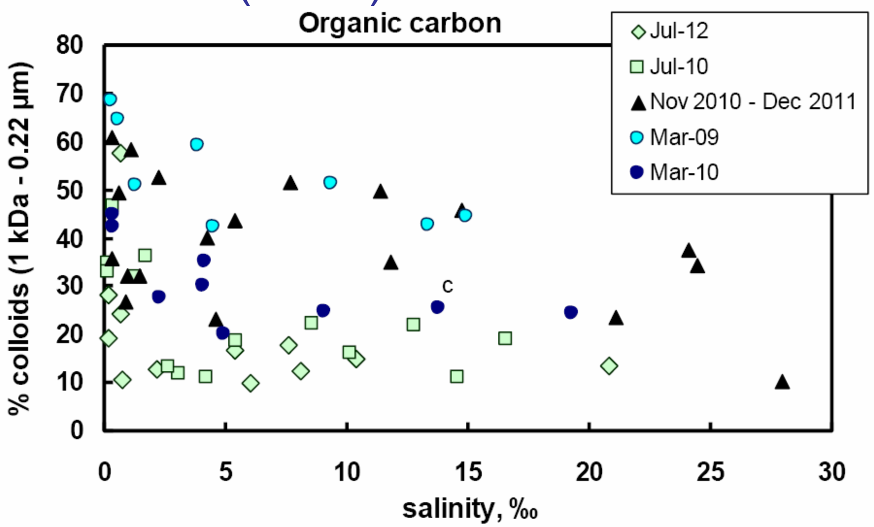
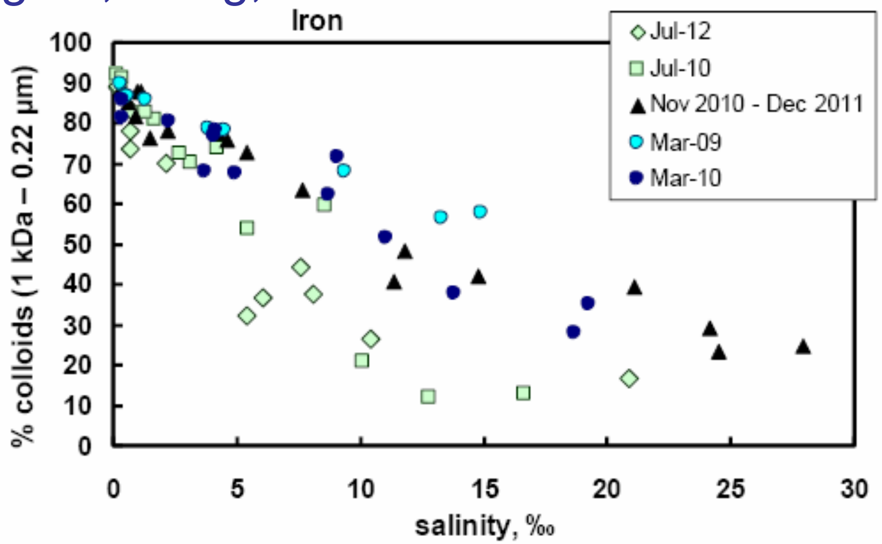


Fig. Colloidal fraction of C org as a function of salinity, the Northern Dvina River mouth (the White Sea) in different seasons.

Concentration of the LMW fraction remains constant or increase in relative contribution to the overall dissolved (<0.22 μm) pool while salinity increases. Similarly, the relative proportion of colloidal (1kDa – 0.22μm) pool for the C and insoluble TE bound to ferric colloids systematically decreased seaward, with the largest decrease occurring at law (< 5‰) salinity. Behavior of this form of elements is of a conservative type as a rule. It means that the trace elements will penetrate into the open sea without any losses in the river-sea mixing zone. The global climate warming might will intensify this process **(Pokrovsky,. Gordeev, Shechenko et al., 2014).**



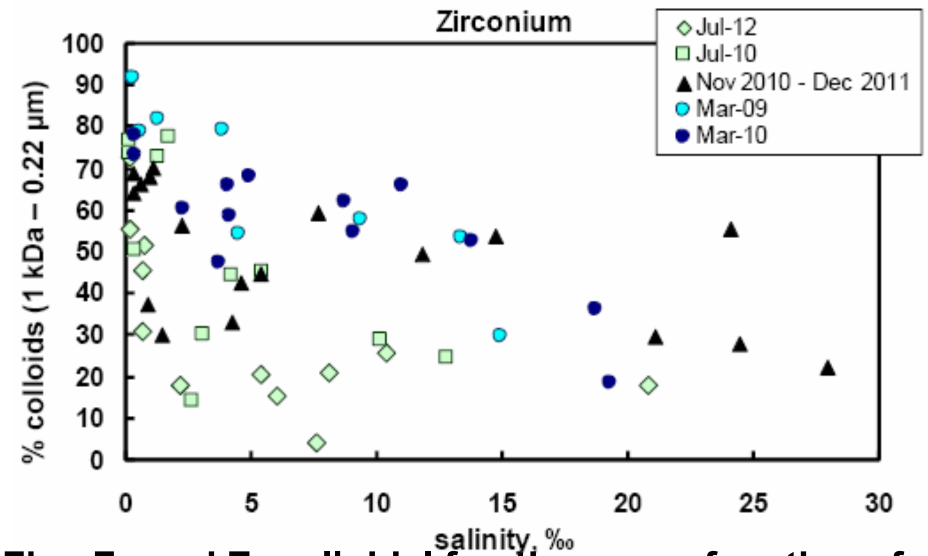


Fig. Fe and Zr colloidal fractions as a function of salinity in the North Dvina Estuary. **(Water samples were filtered through 0.22 μm acetate cellulose filters and later were processed using in situ dialysis (1kDa or 1, 15 and 50 kDa membranes), ICP-MS as an analytical method).**

New results

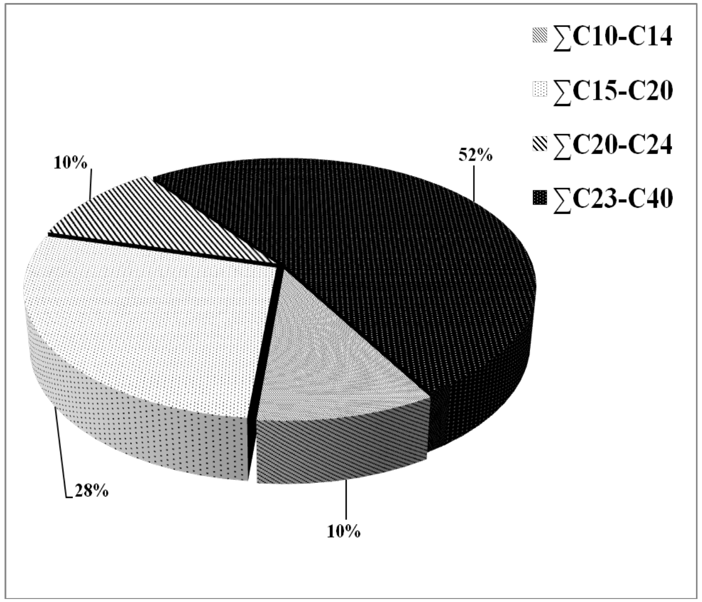
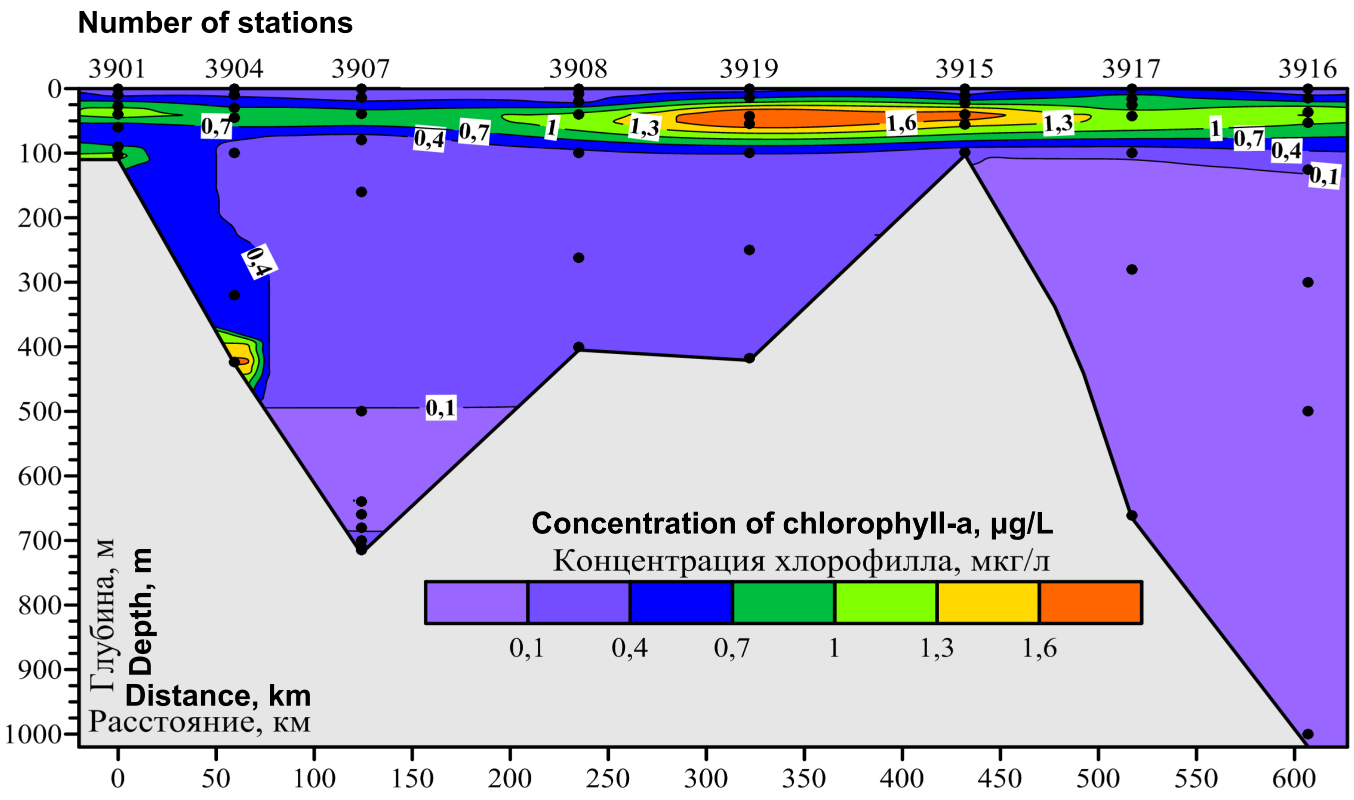


Fig. Average abundance of *n*-alkanes in organic matter of bottom sediments of the Caspian Sea (relative percentage):
(*1*) Σ(C10–C14), migratory;
(*2*) Σ(C15–C20), planktonic;
(*3*) Σ(C20–C24), microbial;
(*4*) Σ(C23–C40), terrigenous.

(Lein et al., 2014)

The decrease in suspended Corg content from the surface to the bottom resulted from the activity of aerobic heterotrophic microorganisms. Autotrophic methanogenesis occurred in anoxic water of dee-sea depressions, where methane concentrations were up to 2.2–3.75 μL CH4 L–1, which was an order of magnitude higher than in the aerobic water column (0.04–0.32 μL CH4 L–1). Methanogenesis was accompanied by a considerable decrease in δ13C of suspended Corg (–26 to –30 ‰).The results of microbiological and biogeochemical investigation demonstrated that, in spite of the absence of connection with the ocean and other specific features, the Caspian Sea has the characteristics of a typical marine basin (Prof. A.Yu. Lein, Shirshov Institute of Oceanology, Moscow).

New results



For the first time the abundance of algae *Pseudo-nitzschia seriata* that are enriched in Chlorophyll-a was detected in the near-bottom water (depth of 295–424 m) in the Caspian Sea. The low boundary of phytoplankton prevalence is the depth of 500 m. In the open Caspian Sea the Chlorophyll-a maximum was found to be deepen to the upper or low boundary of a seasonal thermocline (from 20 to 60 m).

From this it follows that the primary production' estimation based on satellite data may be incorrect in this basin as soon as the light scanners cover only surface water layer that doesn't exceed a few meters (~1–10 m).

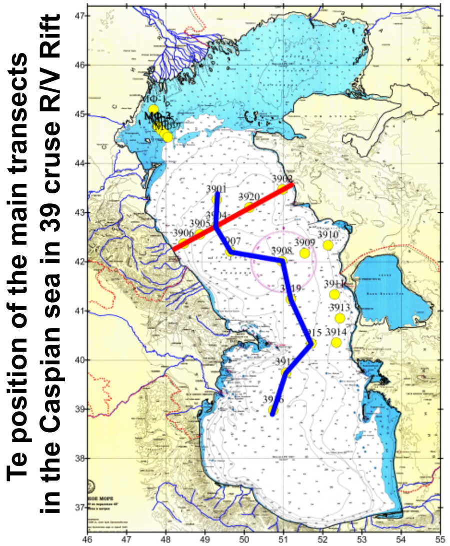
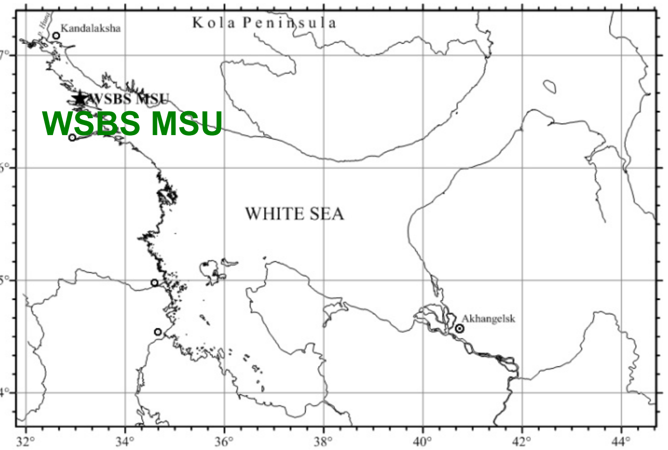


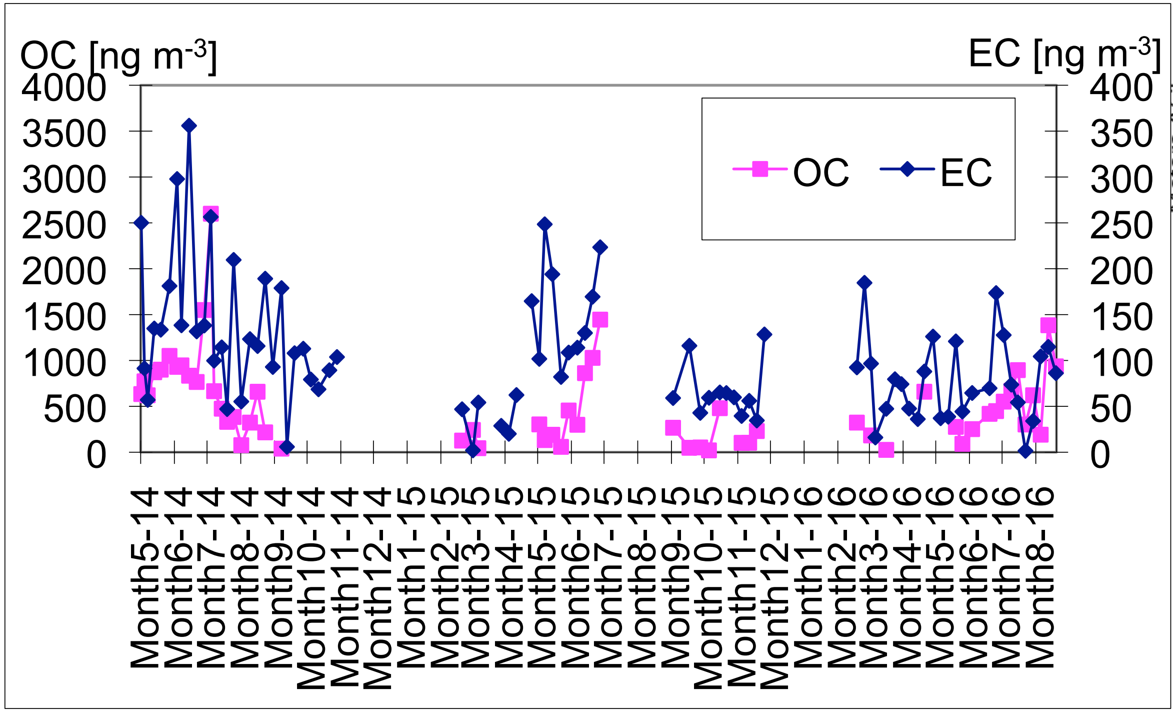
Fig. Chlorophyll-a distribution along the longitudinal transect (blue color) in the Caspian Sea in May-June 2013, cruise 39 of R/V «Rift» (Kravchishina et al., 2014, Shirshov Institute of Oceanology, Moscow).

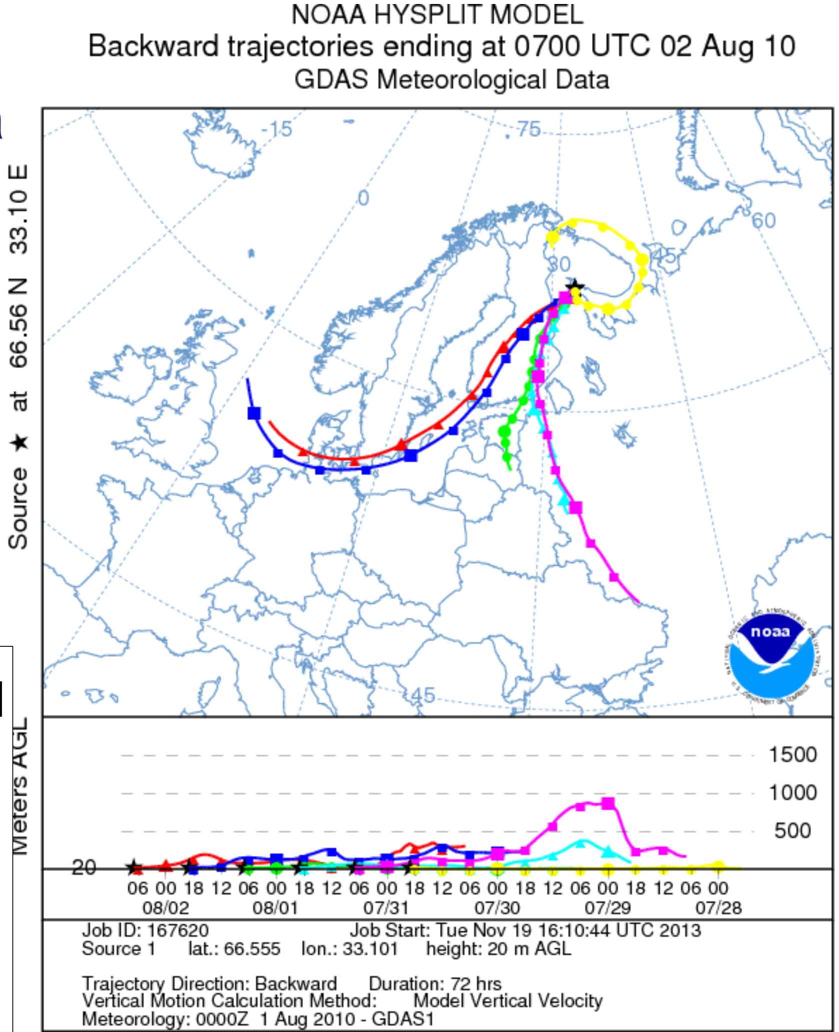
New results

Organic and elemental carbon in aerosols over the White Sea

90 samples of aerosols were collected in 2010–2012 at White Sea Bio-Station of Lomonosov Moscow State University (WSBS MSU) with high-volume aerosol sampler on glass-fiber filters. Elemental and organic carbon (EC and OC, correspondingly) was measured by thermal method.





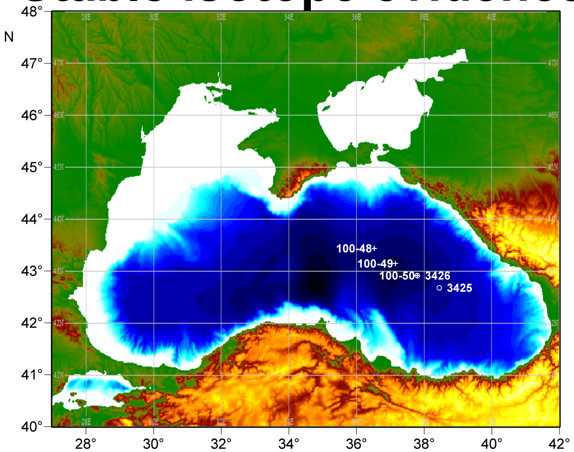


According to backward trajectories analysis, gas flares of the North Sea are one of the sources of elemental carbon.
In 2010 the forest fires were the important source of organic carbon. Here is the map of back trajectories (30.07 – 02.08.2010). We have the highest OC concentration and the second highest EC concentration at the same period (2600 and 256 ng m-3 respectively).

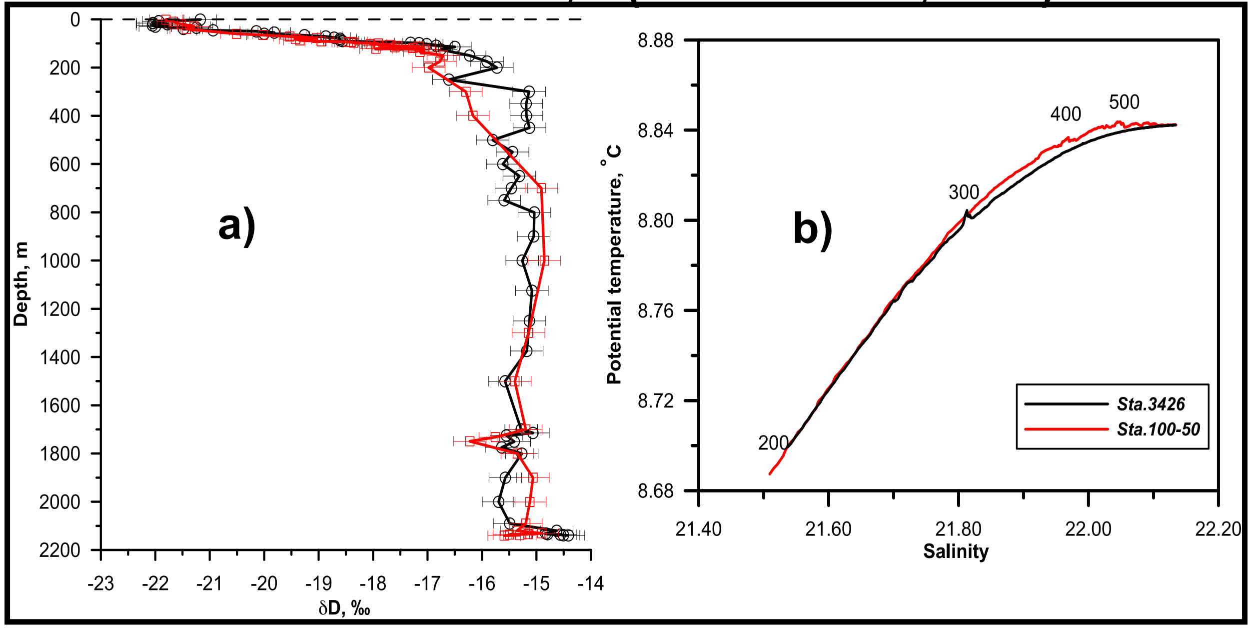
(Shevchenko et al., Doklady Earth Sciences, 2014, in press)

New results

Stable isotope evidence for Bottom Convective Layer homogeneity in the Black Sea

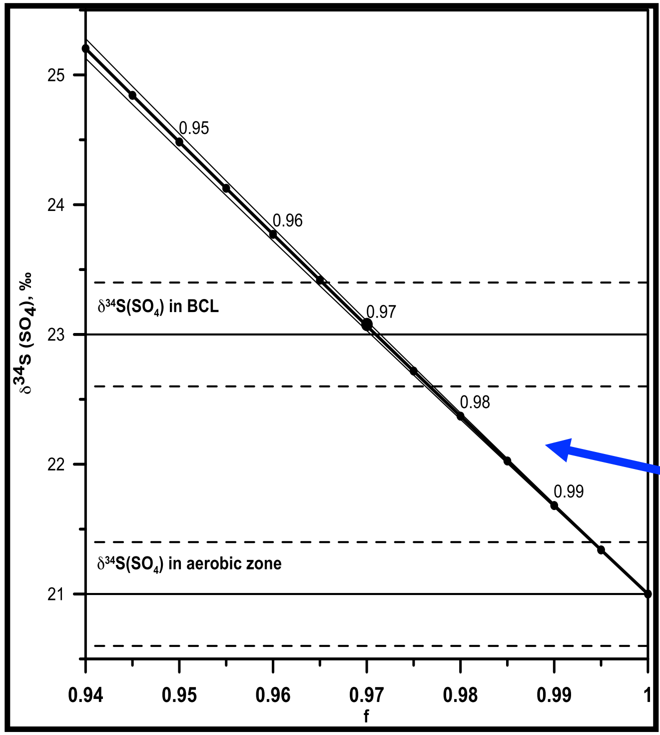


New data on stable isotope composition of S, O and H were obtained to assess homogeneity and possible exchange of matter across the upper and lower boundaries of the Bottom Convective Layer **(Dubinin et al., 2014).**



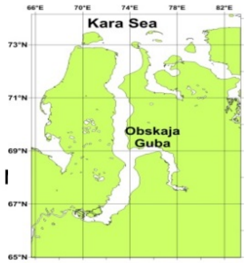
Stations sampled during cruises: R/V "Akvanavt"-2008 (station 3426) and R/V "Professor Shtokman"-2009 (station 100-50).

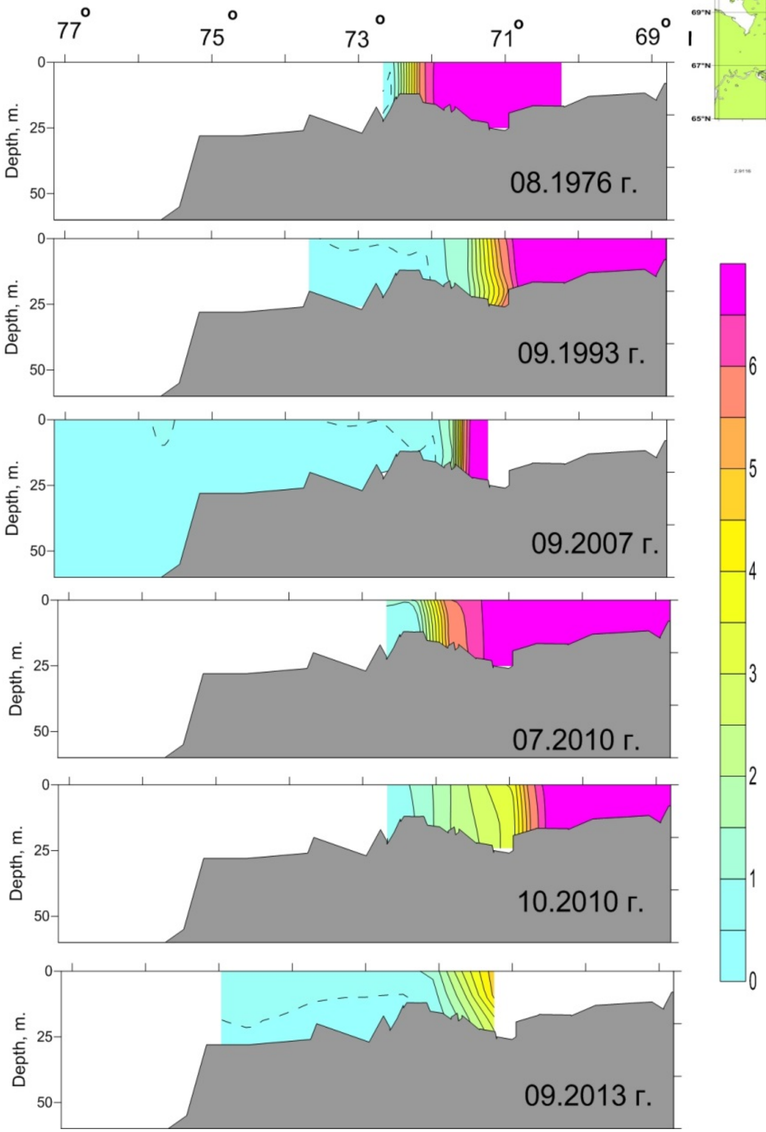
Fig. **(a).** The vertical distribution of δD values versus depth at st. 3426 (black) and st. 100-50 (red) water column. Error bars for δD values correspond to 1σ. Fig. **(b)**Potential temperature–salinity diagram for 200–600 m depth of water column at station 3426 (black) and station 100-50 (red).



Possible residual sulfate fraction in the BCL was calculated by Rayleigh distillation model assuming that the sulfur isotope composition in sulfate changes from +21 ± 0.4 (2σ) ‰ in aerobic zone to +23 ± 0.4 (2σ) ‰ in anaerobic one due to sulfate reduction. Change of sulfate mass fraction loss is shown for enrichment factor ε = 1.0664 ± 0.0012 (2σ) calculated as the average of all samples from BCL. It is also shown 2 σ confidence intervals for the average $\delta^{34}S$ (SO_4) values (dash line) and for the enrichment factor (thin lines).

New results





A new indicator of the fresh and saline water mixing for areas of strong river run-off influence was found: it is the Alkalinity/Salinity ratio. When river waters mix with sea water the Alk/Cl ratio increases, that results from the fact that in river water the Alk/Cl ratio is much higher than that in the sea water. Value of the Alk/Cl ratio > 0.06 – 0.08 appoints to the presence of the river water. In areas under the strong river run-off influence, value of Alk/Cl ratio may reach up to 5 - 7 and even more. From the hydrochemical data base for the Ob River estuary (Obskaja Guba) an evolution of the Alk/Cl ratio over 37 years (1976 - 2013) was examined (fig., unpublished data). A river water - sea water contact zone' location was found to have not only a seasonal change but interannual ones also, that depends on variation in the river-runoff volume.

Fig. Evolution of the Alk/Cl ratio in the Ob River estuary (Obskaja Guba)-the Kara Sea longitudinal transect over 37 years (unpublished data of Makkaveev and Nalbandov, (Shirshov Institute of Oceanology, Moscow)).

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Thanks a lot for your attention!