

Report

of

Working Group 1 (Cruise planning) Meeting 7

COST Action ES0801

The Ocean Chemistry of Bioactive Trace Elements and Paleoclimate Proxies

Bremerhaven, Germany, April 18-20th 2012

Objective: To prepare a joint proposal for a GEOTRACES expedition on a German ship to Arctic waters in 2015 as a contribution to internationally coordinated GEOTRACES activities in the Arctic in that year.

Location: AWI building E room 5085

Participants:

Hein de Baar, NIOZ, Texel

Micha Rijkenberg, NIOZ, Texel

Martin Frank, GEOMAR, Kiel

Maeve Lohan, Univ of Plymouth

Pere Masqué, UAB, Barcelona

Katharina Pahnke, Univ of Oldenburg

Michiel Rutgers van der Loeff, AWI, Bremerhaven (Local organizer)

Invited (19/4):

Ursula Schauer, AWI, Bremerhaven

Report of the meeting:

Michiel van der Loeff presented the current status of US and Swedish plans for GEOTRACES expeditions in 2015. He also showed a map with cruise scenarios as put together by Roger Francois in preparation for the meeting he is organizing in Vancouver on 2-4 May 2012 with the objective to initiate a Canadian Arctic GEOTRACES contribution and research cruise.

Ursula Schauer presented the rationale of German plans for continuation of the hydrographic work in the Arctic in the coming years. She showed the cruise tracks of Polarstern expeditions of 1996, 2007, and 2011 in the central Arctic. Moreover, in coordination with Norway AWI has annually serviced a series of moorings in the Fram Strait and will continue to do so. AWI envisages to extend this service track with hydrographic sections towards the Greenland coast and to specifically study processes of exchange with the coast and the extent of melting glaciers. Finally she pointed at

Japanese plans to continue their hydrographic work with RV Mirai in ice-free areas of the Chukchi Sea, Canadian basin of the Arctic Ocean.

Maeve Lohan presented the UK plans for a biogeochemical study in the Greenland Sea, extending from Fram Strait to Denmark Strait where it would cross over with the Dutch Pelagia expedition.

The ensuing discussion focused on the GEOTRACES objectives that could realistically be met by the participating institutions, keeping in mind the possibilities for cooperation with other cruise plans.

A full GEOTRACES transect of Fram Strait was considered high priority. This could be done on RV Polarstern in coordination with the yearly servicing of the moorings. Important is the coverage of the full section up to the Greenland coast. This could be achieved by coordination with coastal work planned by Schauer. The objective to include the coastal water requires the use of a strong icebreaker due to the expected thick ice cover and excludes the option to use other German ships, such as RV Maria Merian. In order to cover the complete Atlantic inflow with measurements of compositions of Trace Elements and their Isotopes (TEIs), it was considered imperative to include the Barents Shelf branch by performing a section across the relatively shallow shelf between Svalbard and Norway.

Linkage of the Fram Strait transect and the Atlantic GEOTRACES transects can be achieved by the UK plans for a biogeochemical study with James Clark Ross in the Greenland Sea. This expedition would be process-oriented but would include sections in Denmark Strait and in the accessible part of Fram Strait (i.e., excluding the area closest to the Greenland coast).

It became clear during the meeting that there is continued interest to perform a GEOTRACES section in the central Arctic crossing the major basins, as a repetition of the 2007 IPY expedition GIPY11. This could be achieved by joining the planned proposal for hydrographic work as a repetition in 2015 of sections covered previously in 1996, 2007, 2011. For GEOTRACES, the objective would be the establishment of trends after 8 years (e.g., in reaction to changes in ice cover and in the strength of the Arctic Oscillation, as well as to monitor changes in surface water mass distribution and riverine inputs from the Eurasian and Canadian Basins, as well as in hydrothermal inputs from the Gakkel Ridge), better depth resolution in the upper layer, and inclusion of TEIs that could not be included in 2007, such as stable isotopes of trace metals.

Seeing these opportunities, we considered it impossible to achieve all this in a single year. We opted to join the proposal for the central Arctic in 2015, which would make this section synoptic with planned other studies in this year (plans of Sweden, USA, Canada). The UK study will also be applied for the year 2015. The full Fram Strait section will then follow in 2016. In view of long transit times of the water masses between the central Arctic/ Beaufort Gyre and the passage of Fram Strait of

several years we did not consider it a problem to perform the full, high resolution Fram Strait section a year after the further coordinated program.

We decided to prepare three cruise proposals (see figure):

1. proposal for Polarstern in 2015

We will write a proposal together with hydrography (AWI: Ursula Schauer). This Polarstern proposal and cruise track will be complementary to a section envisioned to be performed by ODEN. The ODEN section is thought to run from the Siberian shelf to the Canada Basin where it will cross over with the US section. If the ODEN section runs on the Greenland side of the central Arctic, the proposed Polarstern cruise track will be well to the Siberian side of the ODEN transect.

Objectives:

Hydrography: changes in the course of 1996 – 2007 – 2011 - 2015
Development of fresh water accumulation, warming of deep water.

GEOTRACES: changes since 2007, higher resolution in surface water complementing 2007 expedition (eg: stable isotopes of trace metals), more measurements of TEIs in particles and in ice.

2. Proposal James Clark Ross 2015

More process oriented biogeochemical study including, however, all GEOTRACES core parameters. Sections perpendicular to east Greenland current from Denmark Strait to Fram Strait. Cross-over with Pelagia St 2 (Denmark Strait). In the northern part this study will be limited to light ice cover.

3. Proposal Polarstern 2016

Fram Strait section and section Svalbard – Norway

In coordination with the AWI Mooring program in Fram Strait (Ursula Schauer). The section will continue onto the Greenland shelf to include shelf currents and consequences of melting glaciers in Greenland.

Objectives. Balance of fluxes of water masses and TEIs at this major gateway, including the Fram Strait and Barents Sea Branch of the Atlantic inflow as well as the outflow in the East Greenland Current. Signals of ice melt by the intrusion of Atlantic water under Greenland ice shelf and potential changes of melting of sea ice transported by the Transpolar Drift into Fram Strait.

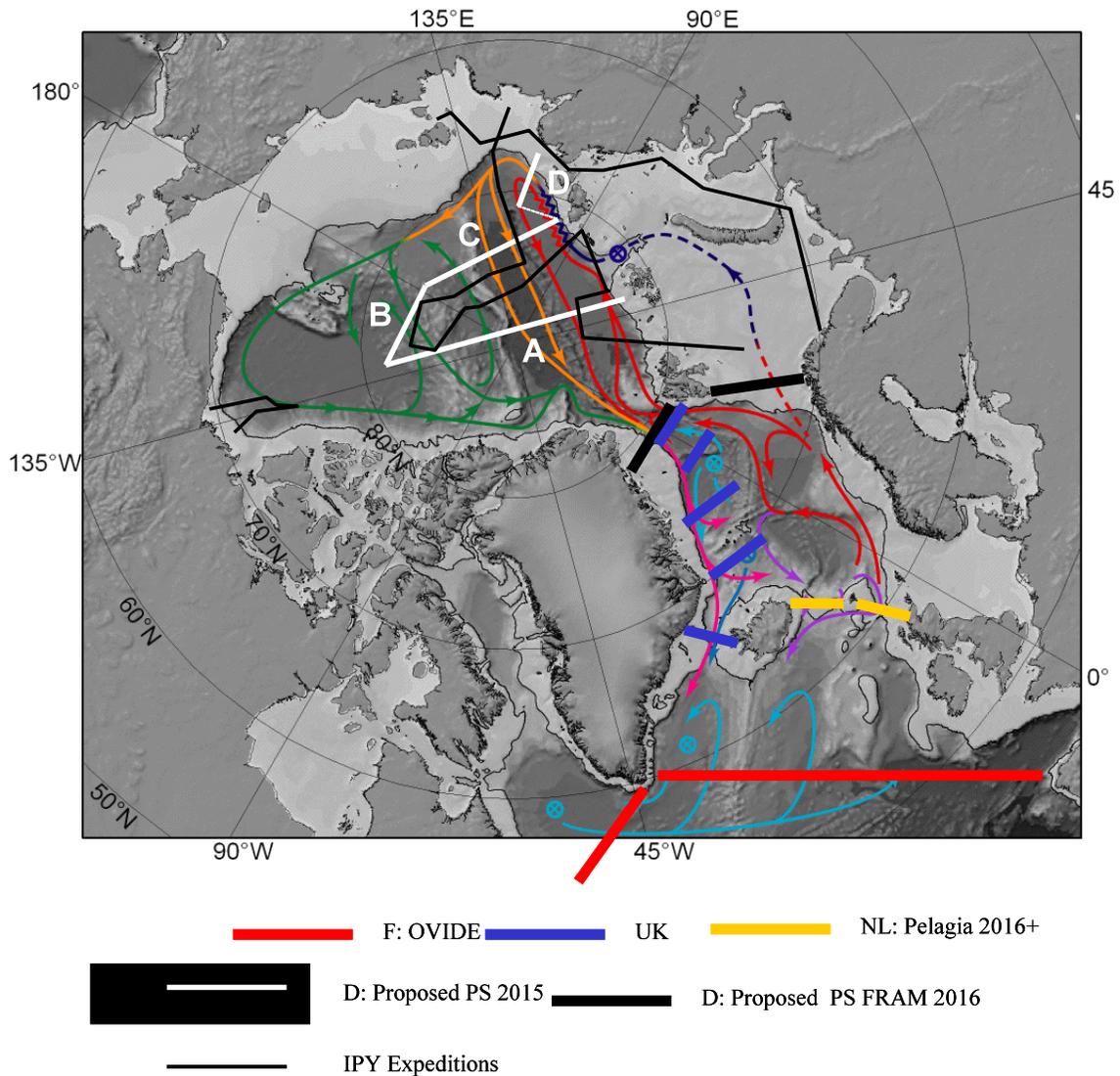


Fig. 1 gives a very rough draft of the expeditions discussed and planned at the meeting in comparison with accomplished and other planned GEOTRACES sections. Rationale of proposed sections for the Polarstern 2015 proposal: A: from Eurasian shelf edge into Canada Basin. Crossing Atlantic Water boundary current upstream confluence and downstream return currents; crossing transpolar ice and fresh water (runoff) drift; capturing front between Atlantic and Pacific waters. Crossing Gakkel, Lomonosov and Mendeleev ridges. B: back into southern Makarov Basin; crossing recirculating Canadian Basin branches. C: back to Eurasian shelf edge. Crossing upstream Atlantic recirculation branches; crossing confluence of Fram Strait and Barents Sea AW branches. D: match to Laptev Sea activities

One of the options for the participation of ODEN in the 2015 study is a transect across the central Arctic joining the US activities N of Bering Strait with the Siberian coast near

Kara Sea. We must be sure that a section A proposed for Polarstern does not duplicate the ODEN section. Section A could be shifted somewhat towards the Siberian side; optimal would be the ODEN section crossing the thicker multi-year ice North of Greenland due to its better ice breaking capabilities.

If this will not be possible and the ODEN will cross the central Arctic, an alternative scenario would be that Polarstern will focus on the western side of the Eurasian Basin between the ODEN section and Fram Strait. This would be particularly interesting for studying the hydrothermal inputs from the Gakkel Ridge.

Tasks:

All participants write text bits (order: half a page) on the TEI group they are experts in, mentioning

- Key questions to be addressed
- Status of the knowledge
- Our own work

We distinguished the following TEI groups and people contributing text:

Trace metals	Hein de Baar Micha Rijkenberg, Maeve Lohan
Stable isotopes of trace metals: Fe, Zn, Hg Nd isotopes, REEs,	Michael Staubwasser; Nadine Mattielli Lars-Eric Heimbürger Martin Frank Katharina Pahnke
Artificial radionuclides U-236 Pu/Cs 129I 99Tc Natural radionuclides ²³⁴ Th, Po/Pb, Th/Pa	Pere Masqué Michiel van der Loeff Pere Masqué
⁷ Be ¹⁸ O, freons, He CO ₂ , nutrients Methane, link with Ra/Rn	Pere Masqué Michiel van der Loeff Michael Schlueter Ellen Damm

Ursula Schauer will be the chief proponent for the two Polarstern expeditions in 2015 and 2016.

Michiel van der Loeff will take the lead for the GEOTRACES part of the proposal for central Arctic in 2015.

Hein de Baar will take the lead for the GEOTRACES part of the proposal for Fram Strait in 2016.

Maeve Lohan discusses with Carol Robinson whether she agrees with the initiatives taken in our workshop.

Michiel van der Loeff will contact Michael Klages to ask for possible exchange/coordination with the Hausgarten program in 2016.

Michiel van der Loeff contacts ART program (Arctic in Rapid Transition) to discuss possible cooperation.

AWI has 7 in situ pumps but they are old and spare parts of the electronics are no longer available. Hein de Baar will contact Martin Laan (NIOZ) to discuss if new electronics can be designed.

Michiel Rutgers van der Loeff
23 April 2012