11.3.04, 16.7.-29.8.04 Jnr. 04/3904
License No.: 412/2004

Polarstern Expedition

ARK XX/2

16.07.2004 – 29.08.2004

Longyearbyen - Tromsø

Fahrtleiter / Chief Scientist

Peter Lemke

KOORDINATOR /COORDINATOR

Eberhard Fahrbach

11.3.04, 16.7.-29.8.04 Jnr. 04/3904
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Summary and itinerary

Polarstern left port in Longyearbyen on 16 July, 2004 to perform oceanographic, petrologic, bathymetric, sea ice and air chemistry studies in and north of Fram Strait (Figs.1 and 2).

The oceanographic work was dedicated to investigate the water mass and heat exchange between the Arctic and the North Atlantic with special emphasis on the circulation in and north of Fram Strait. A hydrographic section along 79N was taken, and water samples for tracer determination were collected. Fourteen oceanographic moorings, which have been deployed along this section last year, were recovered, and twelve were re-deployed with new instruments to enlarge the existing time-series for the investigation of long-term variability. In addition the complex structure of the West Spitzbergen Current north of Fram Strait has been investigated through three hydrographic sections (Figs. 3 and 4).

The goal of the petrological work was to conduct a detailed sampling and mapping campaign on the effectively slowest-spreading mid-ocean ridge on Earth: Western Gakkel Ridge and Lena Trough (Fig. 5). This allowed the petrologic (i.e. volcanologic) study of immature volcanoes at the earliest stages of their formation and evolution, and will help to understand why and how volcanoes form. At these mid-ocean ridges, the natural cooling of the ocean crust by seawater results in a depression of the process of partial melting, which produces basalt. These investigations offer new and valuable insights into the processes of crustal accretion at mid-ocean ridges, and the generation and evolution of basalts in general.

The bathymetric activities expanded the area in Fram Strait already surveyed by R/V Polarstern during former expeditions further to the north, with special emphasis to register the geologically and oceanographically important transition from the Spitzbergen Deep over Lena Trough to the Gakkel Ridge. Investigations were carried out by means of systematic surveys with the Hydrosweep DS-2 multi-beam echo sounder. Results will be combined with existing R/V Polarstern multi-beam data and with data from other sources. Besides depth information, Hydrosweep collects pseudo-sidescan and backscatter data. The sidescan images can resolve even smaller topographic features not detected by the multi-beam. Backscatter strength yields information on the physical properties of the sediments.

The sea ice work was undertaken as a preparatory activity for the international calibration and validation initiative for CryoSat measurements. Imaging radar data were scheduled for acquisition in near-real-time onboard Polarstern in addition to the reception of data from NOAA-AVHRR. A diverse program including helicopter flights carrying various measurement instruments (EM-Bird, laser altimeter, video camera) and direct measurements on the ice surface was performed in the region north of Fram Strait. These measurements added to a series of observations from 1991, 1996, 1998 and 2001, which so far indicate a trend toward decreasing sea ice thicknesses.

During the entire cruise an extensive air chemistry programme was performed. The main interest was the detection of trace organic contaminants and mercury species in remote environments of the Northern Hemisphere, to investigate the environmental cycling and fate of key global pollutants, with special emphasis on the exchange between air, ice/snow and water and the role of the long-range transport and hence the delivery of organic pollutants to the Arctic region.

After the conclusion of the work programme R.V. Polarstern steamed towards Tromsø and reached port on 29 August, 2004.

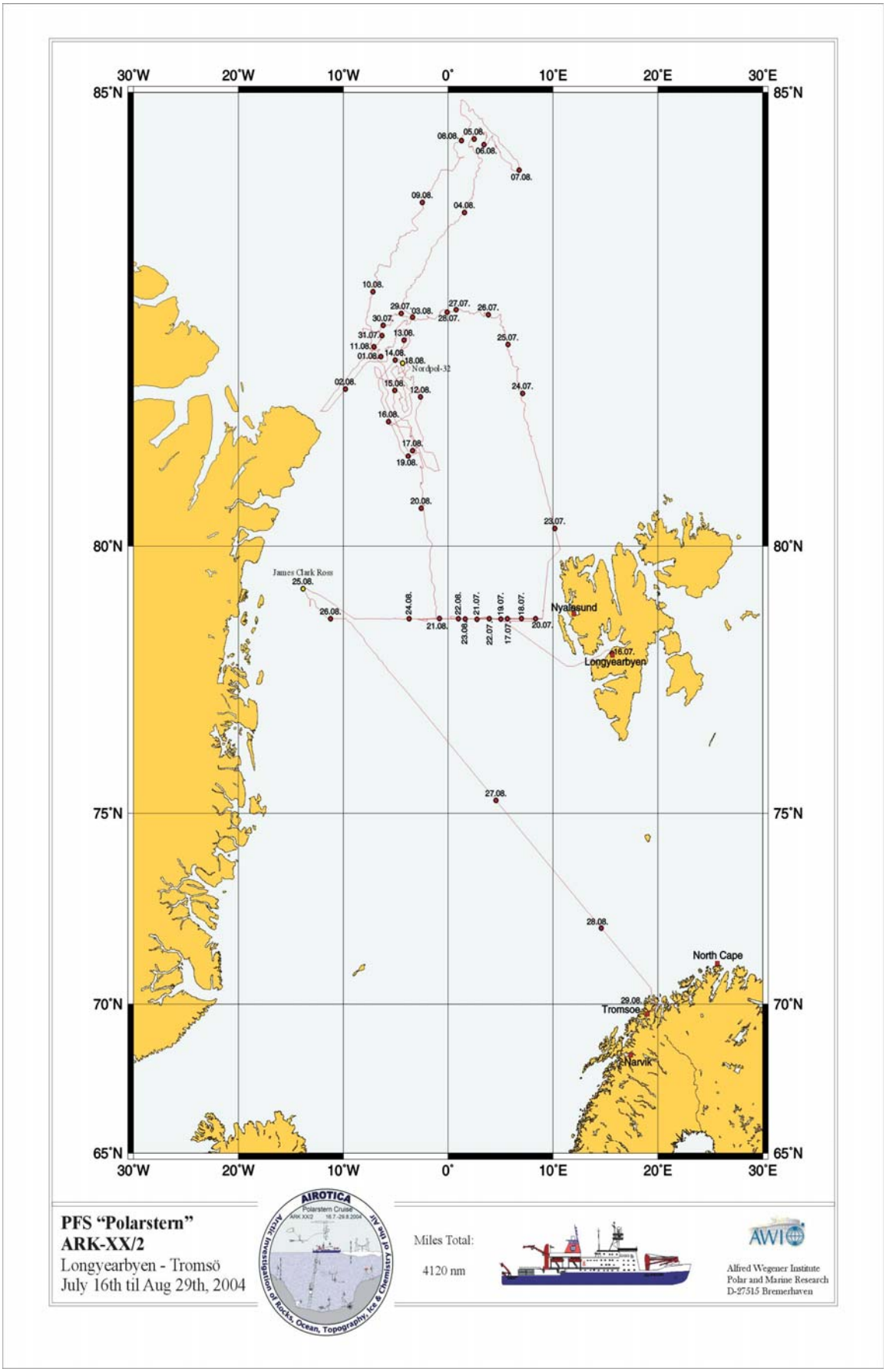

Fig.1: Cruise track.

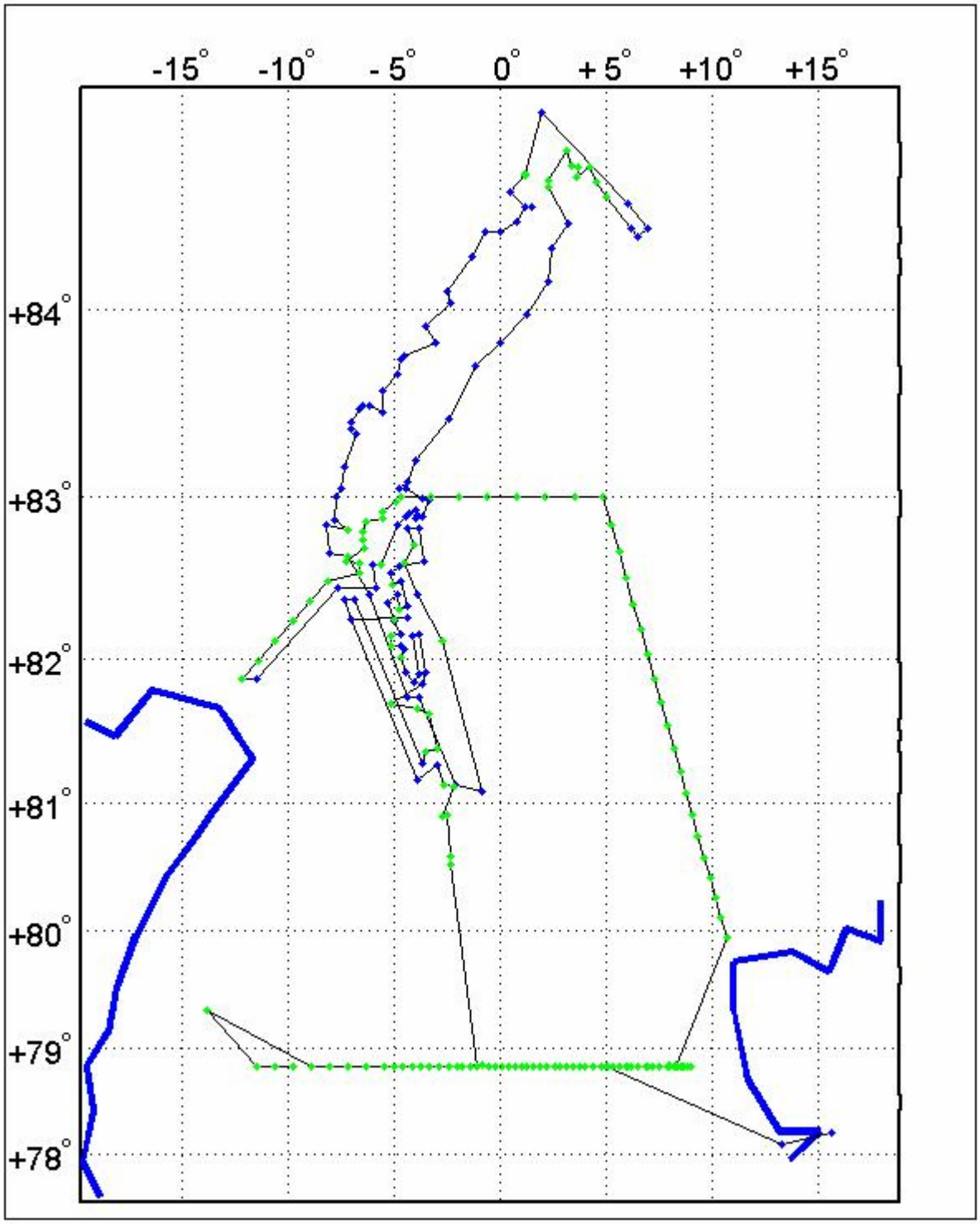

Fig 2: Station map of ARK XX/2. Green dots indicate station work. Blue squares denote bathymetry way points.

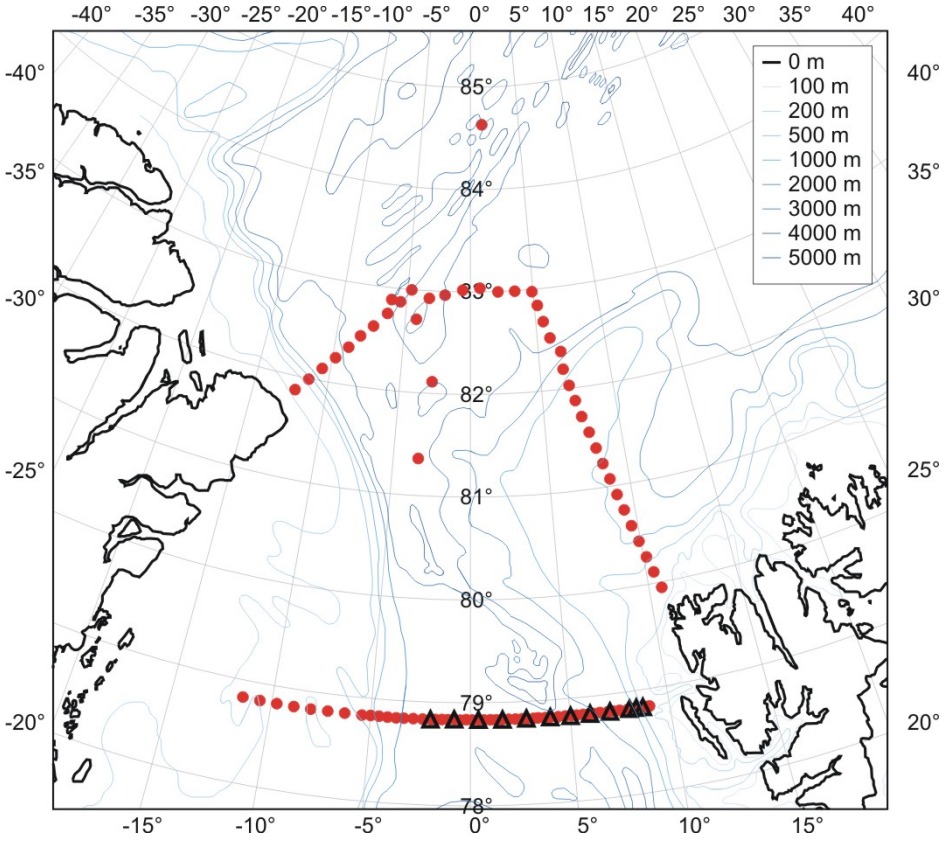

Fig. 3: Map with the position of moorings (triangles) and CTD stations (dots) taken during ARKXX/2.

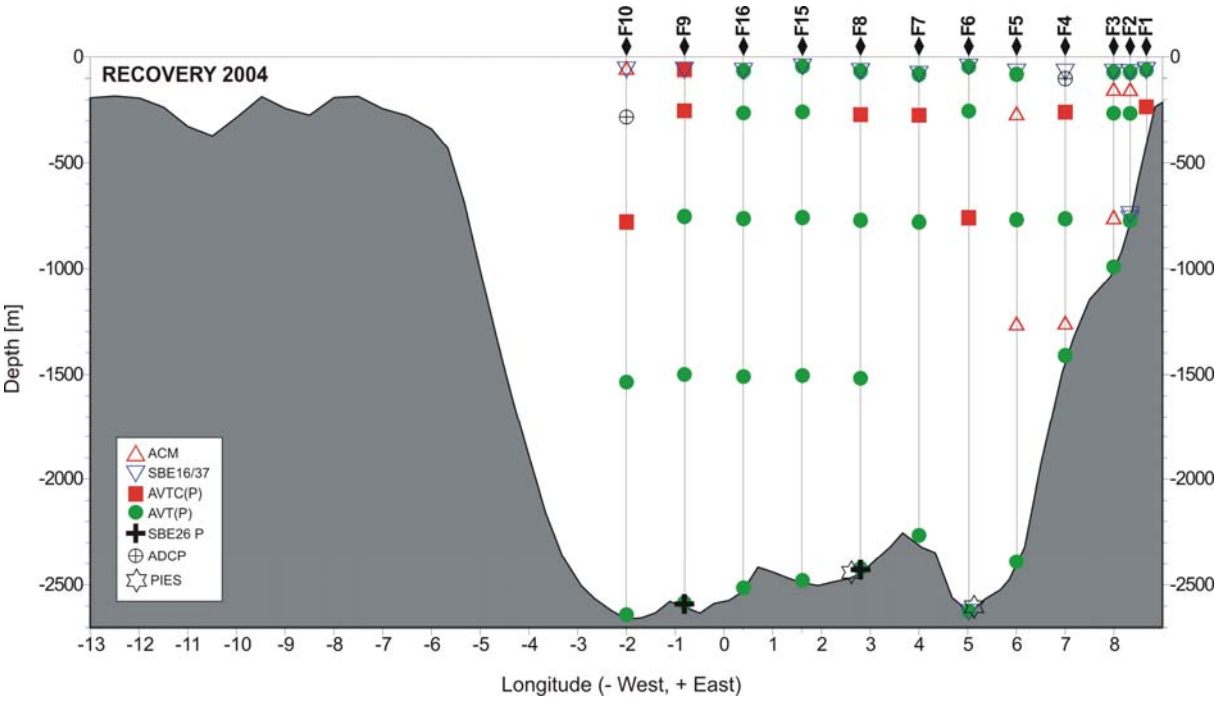

Fig. 4: Transect across Fram Strait with the moored instruments recovered during ARXX/2.

Table 1: List of recovered and deployed moorings

RV "Polarstern"
Reederei F. Laeisz GmbH
- master - On board, August 24, 2003

Research Cruise ARK XX /2 - RV "Polarstern"
16. July – 29. August 2004

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moorings recovered:

Recover	Description	Depth	Latitude	Longitude
17.07.2004	F6-7	2631 m	78°49,8’ N	005°01,2 E
18.07.2004	F4-6	1422 m	78°50’ N	007°00’ E
18.07.2004	F5-6	2402 m	78°50’ N	006°00,1’ E
19.07.2004	F3-6	1011 m	78°50,1’ N	007°59,7’ E
19.07.2004	F2-7	778 m	78°50,1’ N	008°19,9’ E
19.07.2004	F1-6	244 m	78°49,9‘ N	008°39,9’ E
21.07.2004	F7-5	2276 m	78°50’ N	004°00,1’ E
21.07.2004	F8-6	2429 m	78°50’ N	002°48,1’ E
21.07.2004	PIES W	2505 m	78°49,9’ N	002°47,6’ E
22.07.2004	PIES C	2712 m	78°49,9’ N	005°00,9’ E
21.08.2004	F9-5	2591 m	78°50,3’ N	000°48,7’ W
21.08.2004	F10-6	2652 m	78°49,9’ N	002°00,0’ W
22.08.2004	F16-2	2531 m	78°50,1’ N	000°24,0’ E
23.08.2004	F15-2	2557 m	78°50’ N	001°36,6’ E

Moorings and Landers deployed:

Deployed	Description	Water depth	Latitude	Longitude	Top of unit below surface
18.07.2004	F4-7	1458 m	78°50,17’ N	007°00,01’ E	50 m
19.07.2004	F5-7	2467 m	78°49,94’ N	006°00,08’ E	50 m
19.07.2004	F6-8	2693 m	78°49,80’ N	005°01,33’ E	50 m
20.07.2004	F1-7	248 m	78°49,94’ N	008°39,84’ E	50 m
20.07.2004	F2-8	795 m	78°50,14’ N	008°19,64’ E	50 m
20.07.2004	F3-7	1036 m	78°50,30’ N	007°59,55’ E	50 m
22.07.2004	F7-6	2339 m	78°49,99’ N	004°00,03’ E	50 m
22.07.2004	F8-7	2491 m	78°50,05’ N	002°48,09’ E	50 m
21.08.2004	F9-6	2662 m	78°50,33’ N	000°48,74’ W	50 m
22.08.2004	F16-3	2581 m	78°50,05’ N	000°23,81’ E	50 m
23.08.2004	F15-3	2546 m	78°50,00’ N	001°36,59’ E	50 m
24.08.2004	F10-7	2717 m	78°49,88’ N	002°00,06’ W	50 m

Following Lander/Mooring was not recovered

	PIES E	793 m	78°50,3’ N	008°19,8’ E

Expected recovery for above: June 2005

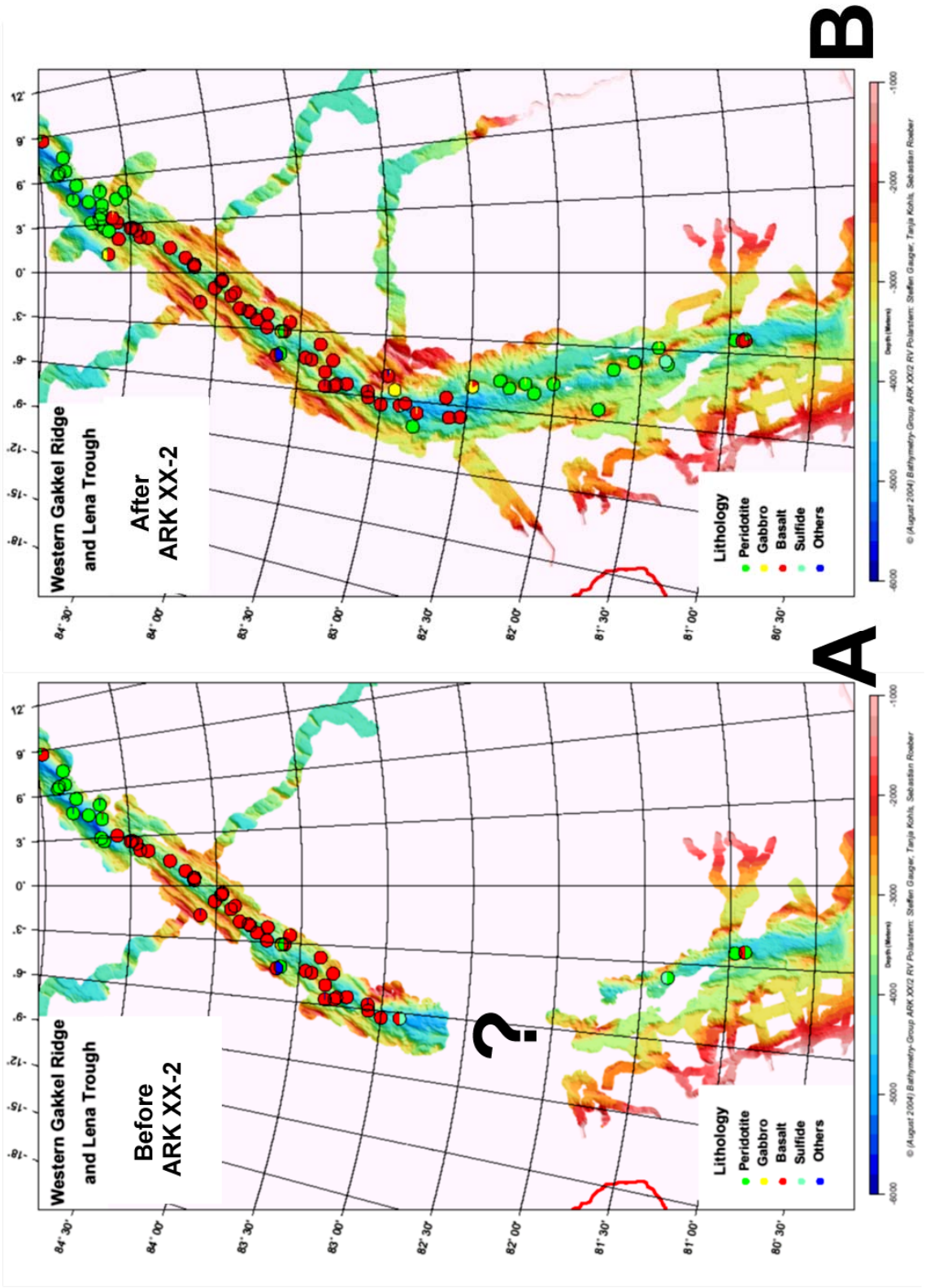

Figure 5: Overview of mapping and rock sampling in Lena Trough and Gakkel Ridge.