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»Polarstern« Cruise Ark24-3

An article by *Andreas Prokoph*

In 2009, RV »Polarstern« made marine geological and geophysical investigations in the Arctic Ocean. The cruise started at the 5th of August in Reykjavik and ended at the 25th of September in Bremerhaven. The scientific programme included seismic profiles, geological research and geodetic measurements in North-East Greenland. The main tasks of the working group Bathymetry and Geodesy were to monitor the echo-sounder system and to edit and process the gathered data.

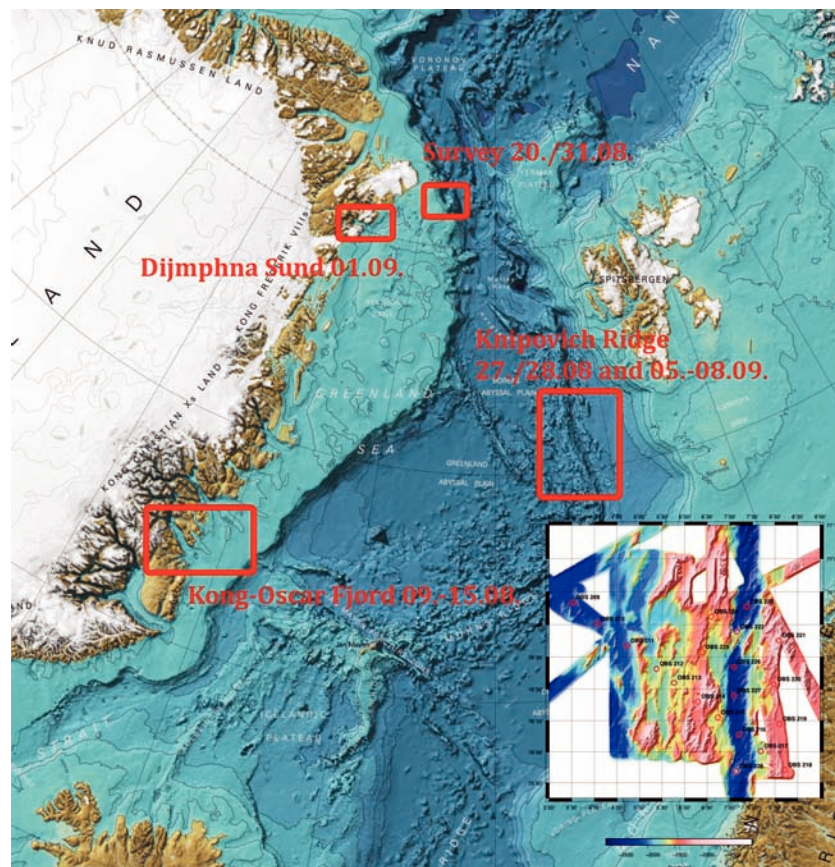
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Reference:

Jakobsson, M. et al. (2008):
An improved bathymetric portrayal of the Arctic Ocean: Implications for ocean modeling and geological, geophysical and oceanographic analyses; *Geophysical Research Letters*, Vol. 35, L07602

Fig. 1: Survey areas and bathymetric map of the Knipovich Ridge (Jakobsson et al. 2008) ▼



»Polarstern« | Arctic Research

After writing my Bachelor Thesis at the Alfred Wegener Institute for Polar and Marine Research, I had the possibility to join the »Polarstern« Cruise Ark24-3 from Reykjavik, Iceland, to Bremerhaven, Germany. For nine weeks, starting at the 5th of August 2009, the research vessel and icebreaker RV »Polarstern« made marine geological and geophysical investigations in the Arctic Ocean (Fig. 1).

The first leg of the cruise led us to the Kong Oscar Fjord, at the south-eastern coast of Greenland. The next weeks we sailed along the coast northwards, until we reached the Dijnphna Sund at 80° 10' N and 19° 30' W. Our last destination was the Knipovich mid ocean ridge, approximately 150 nautical miles west of the southern tip of Spitsbergen. After a short return to the Kong Oscar Fjord, the cruise ended at the 25th of September in Bremerhaven.

The scientific programme included seismic profiles, geological research and geodetic measurements, like installing GPS stations at ice-free loca-

tions in the coastal area of North-East Greenland. These long-term observations deliver a valuable contribution to the validation and improvement of models of the glacial-isostatic adjustment and of the recent mass balance in North-East Greenland.

Jointly with three other students I was part of the working group Bathymetry and Geodesy. Our main tasks were to monitor the echo-sounder system and to edit and process the gathered data. Besides, we were also responsible for providing bathymetric maps to the other scientists on board. The acquired bathymetry was used to select coring-stations and supply bathymetric data to assist geological and geophysical interpretation.

During previous expeditions in this area bathymetric data was collected as well. In order to avoid a repeated survey of the ocean floor, our group was also responsible for a reasonable track planning.

The echo-sounder system installed on RV »Polarstern« is the Hydrosweep DS-2, made by Atlas Hydrographic. The transducer is sending out a signal with a frequency of 15.5 kHz, which is low enough to achieve the desired depth range, reaching the maximum ocean depths. Furthermore this frequency is high enough to secure good vertical resolution, and the signal is reflected from the true bottom, rather than penetrating the sediment layers to the sub-bottom surfaces. The sea floor is covered by a fan of 59 preformed beams and the swath angle used during the expedition has an aperture of 90°. This means that at equal depths the swath coverage is two times the water depth. The accuracy is better than 1 % near the centre beam and about 1.5 % at the outer beams.

The most time-consuming task was the elimination of coarse errors in the acquired datasets. Heavy ice conditions caused air bubbles and ice underneath the transducers. Thus, data post-processing, like the removal of outliers and systematic errors, was indispensable to achieve bathymetric mapping with high accuracy. The cleaned data was daily converted into ASCII format for plotting maps using the Generic Mapping Tools (GMT). Bathymetric maps were prepared by combining existing »Polarstern« surveys with newly acquired data, and submitted for scientific planning to other working groups. □