Preliminary Results of Heat Flow Measurements across the Eastern Flank of the Adare Trough, Antarctica

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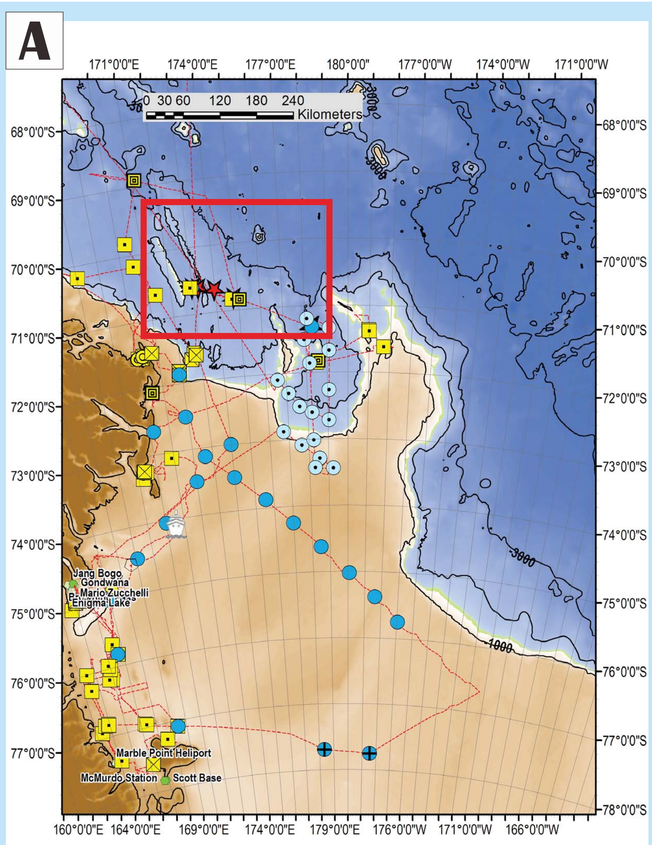
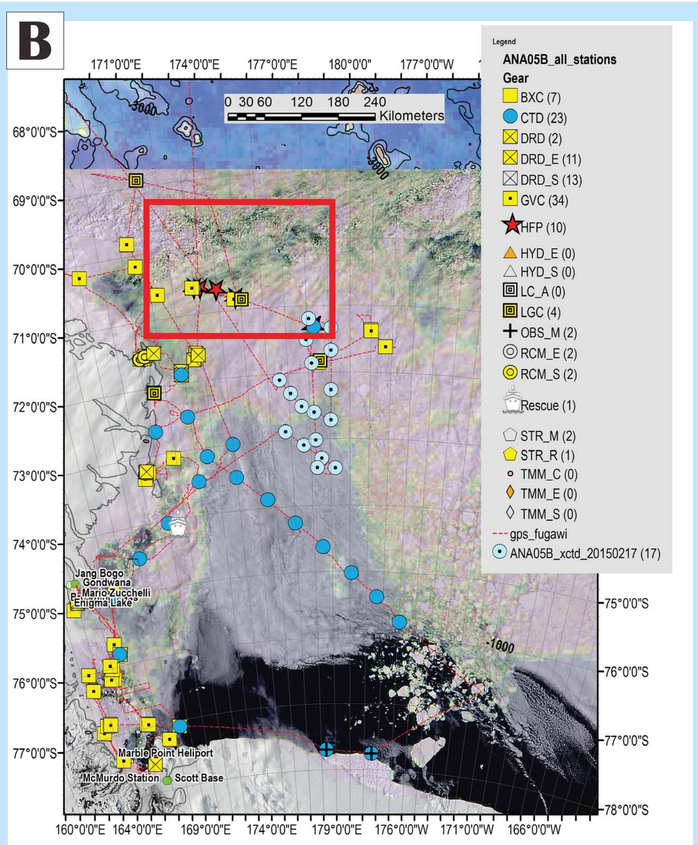
Abstract

Marine heat flow measurement on the ridge is a direct and useful approach to know the current state of thermal regime below the lithosphere. Measurements in ridges located in the Antarctica are practically challenged by harsh conditions such as extensive and moving sea ice cover and stiff seafloor composed of diatomaceous sediments. We planned heat flow measurements across the Adare Trough, north of the Ross Sea, during the recent Korean icebreaker R/V Araon's Antarctic expedition (ANA05B; Dec 12th 2014-Feb 25th 2015) to get thermal information which is a missing piece in terms of geophysical data in this region to describe its asymmetric activity in spreading rate. Finally, we collected information only at three stations across the eastern flank of the Adare Trough over 70 km along with NBP9702 seismic line because of various limitations above. It is a preliminary result that observed heat flow seems significantly higher than estimated one from known magnetic anomaly age using a global age-heat flow curve. In order to conclude some suggestion, we need further studies regarding identification of 'real' heat flow from lithosphere, and increase of the number of data. More heat flow measurements will be carried out again on the eastern flank in the next Araon's Antarctic expedition (tentatively ANA06C; Feb-March 2016) to supplement the small number of data.





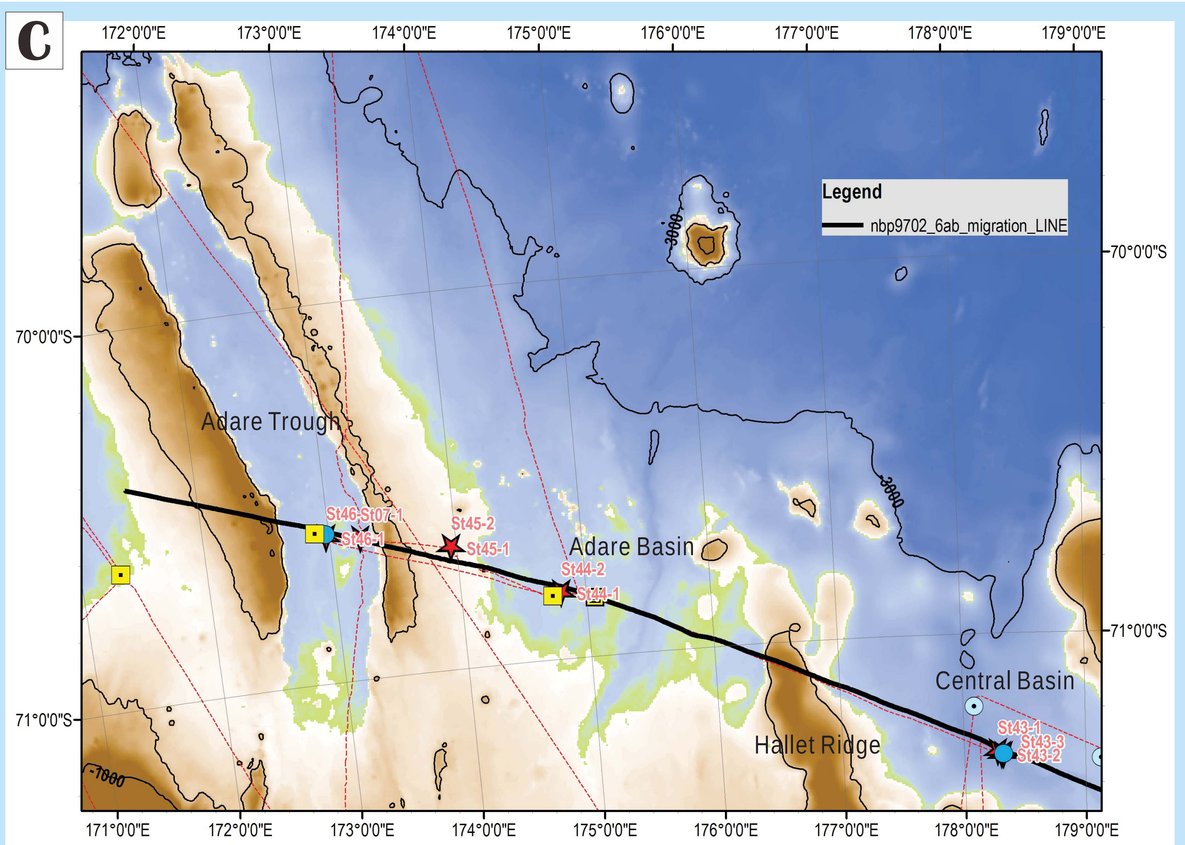
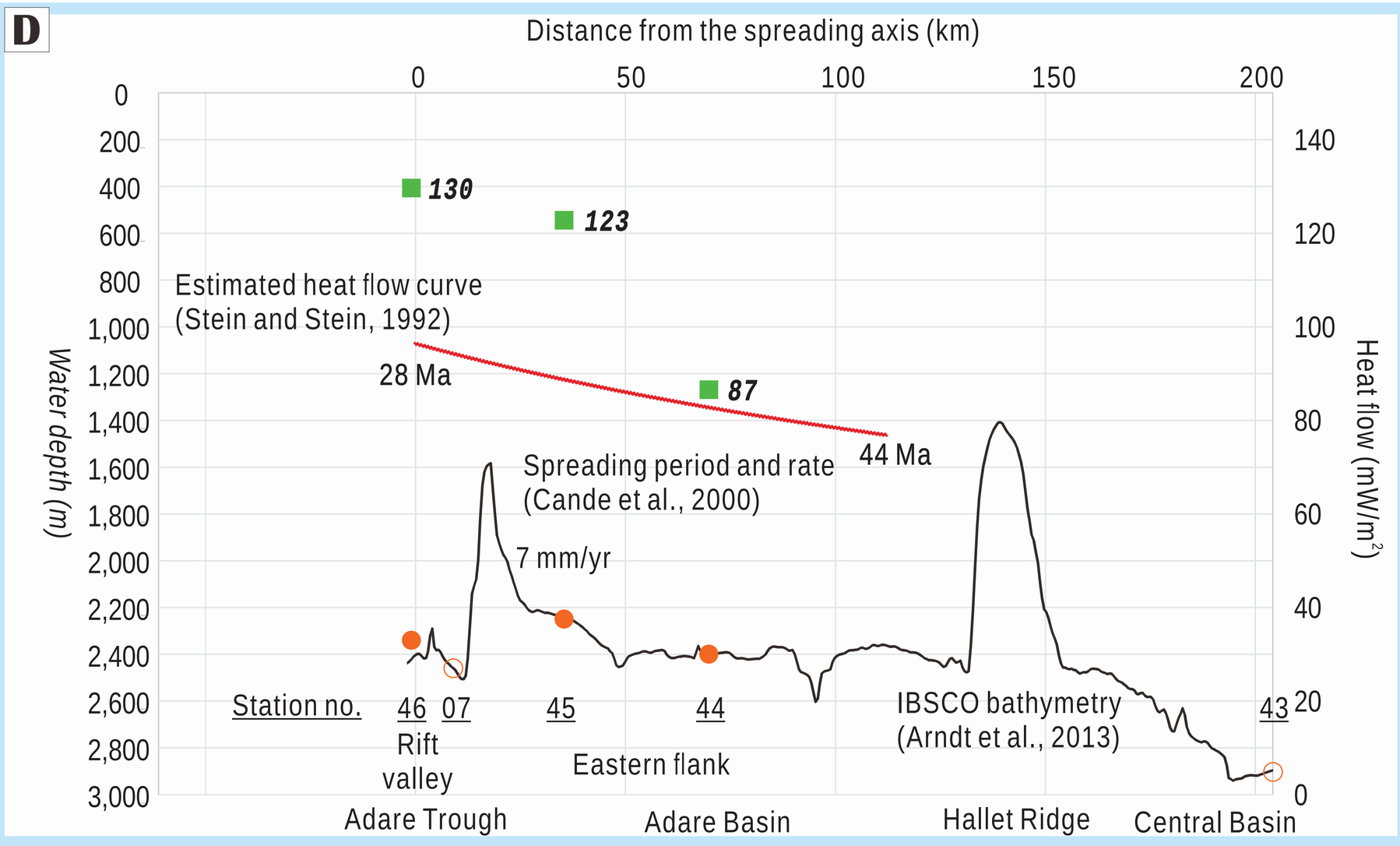


Fig. A. Station map of the ANA05B Expedition (Dec 12 2014 - Feb 25 2015)
Fig. B. Sea ice maps on 9th Jan, 2015 on the occasion of heat flow measurements. Sea ice maps are from satellites: concentration by AMSR2, and image from AQUA.
Fig. C. Stations for heat flow measurements (stars). Black line for NBP9702 line of which rift vally and flank areas were interpreted by Müller et al. (2005).



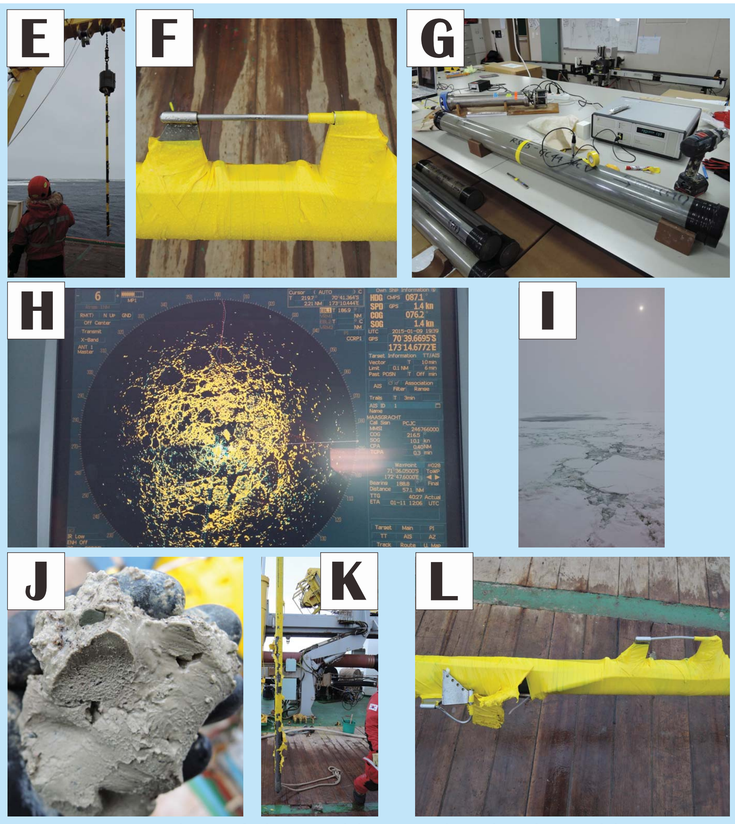


Fig. D. Comparison of observed (squares) and estimated (orange lines) heat flows in the eastern flank of the Adare Trough. Black lines for bathymetry. Closed/open circles for heat flow stations with/without suceesful measurement.
Fig. E-F. 5-m long Ewing-type heat probe having 8 theristors.
Fig. G. TeKa TK04 thermal conductivity meter with a needle probe.
Fig. H-I. No observation at St. 07 due to extensive ice cover.
Fig. J-L. No observation at St. 43 due to stiff seafloor sediment (diatomaceous granule siltstone) causing damage to the heat probe.

Possible reasons for the higher observed heat flows than estimated ones

- Secondary heat sources (advective vertical fluid, volcanic intrusion)
- High temperature of the asthenosphere
- Measuring errors

Future plan

- More measurements in the upcoming ANA06C Expedition (Feb - Mar 2016).
- Further literature survey

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Note

- Most of this material was previously presented in 2nd InterRidge International Workshop held in Korea Polar Research Institute for October 12-15, 2015.