



Science party of the AR35-04 cruise aboard R/V Neil Armstrong

InterRidge Cruise Bursary Report

Participation on a collaborative research cruise in the frame of the project

Formation and Elimination of Segmentation and Transform Faults on the Reykjanes Ridge

Bursary recipient: Dominik Palgan, Ph.D. (upper row, second left in the above photo), Faculty of Geophysics, University of Gdansk, Poland

Main responsibility: Bathymetry acquisition, processing and supervision of watch-standers

Host Scientist: Fernando Martinez, Ph.D., Chief Scientist, Hawaii Institute of Geophysics and Planetology, School of Ocean and Earth Science and Technology, University of Hawaii at Manoa

Research vessel, cruise location and date: flanks of the Reykjanes Ridge, June-July 2019

The cruise AR35-04 was carried out on board the R/V Neil Armstrong, from 24 June to 29 July (35 science days in total), and started/ended up in the port of Reykjavik, Iceland.

During this expedition we performed systematical and continuous for 35 days geophysical survey of the flanks of the Reykjanes Ridge using the Sea Spy Overhauser-type magnetometer, ship's hull-mounted multibeam echosounder Kongsberg-Simrad EM122, Bell BGM-3 accelerometer-type gravimeter along with 3.5 kHz sediment profiler echosounder Knudsen 3620. A total of 8449 trackline nautical miles (15,648 km) of magnetics, bathymetry, gravity and sub-bottom profiles of surface sediment cover have been collected (Figs. 1 and 2).

The overall goal of our cruise was to survey the flanks of the Reykjanes Ridge – an area that have not been surveyed previously – and determine the timing and geometry of the large-scale tectonic reorganizations that occurred along the ridge in the Paleogene and which reorganization appears to be continuing at present time. The Reykjanes Ridge has been and still is under a strong influence

of the Icelandic hotspot. The modulating mantle gradient had a significant effect on the tectonic reorganizations: from linear to segmented to re-established linear structure. Therefore, the Reykjanes ridge flanks are key areas for investigating mantle controls on ridge segmentation, formation and elimination of transform faults and the mechanisms that control their evolution. Future work will focus on the further processing and modelling of all of the collected geophysical data. The bathymetry, potential field and sediment echosounder profiles will determine the detailed kinematics of the reconfigurations (by identifying magnetic isochrons), tectonic structure (by direct mapping of basement exposures and gravity modeling of buried structures) and assess relative crustal thickness changes.

Scientists from five institutions (University of Hawaii, University of Iceland, ISOR, University of Toronto and University of Gdansk) have participated in this cruise, including many undergraduate and graduate students from the University of Iceland. Thanks to international group of research scientists on this expedition we carried multiple discussions, and ideas and knowledge exchange which has broadened a network of collaboration. Together with already existing on-axis data, the bathymetry results obtained on this expedition will be used to create the first comprehensive geological map of the Reykjanes Ridge led by Dr Dominik Palgan, a work in which all the participants of the AR35-04 cruise will be involved.

The cruise was funded by the US National Science Foundation and organized by University of Hawaii at Manoa and University of Iceland. Dr Dominik Palgan would like to thank the InterRidge Cruise Bursaries Travel Grant which allowed participation in this expedition. The support from Dr. Fernando Martinez is greatly appreciated.



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The Sea Spy Overhauser-type magnetometer towed behind the vessel during the AR35-04 cruise

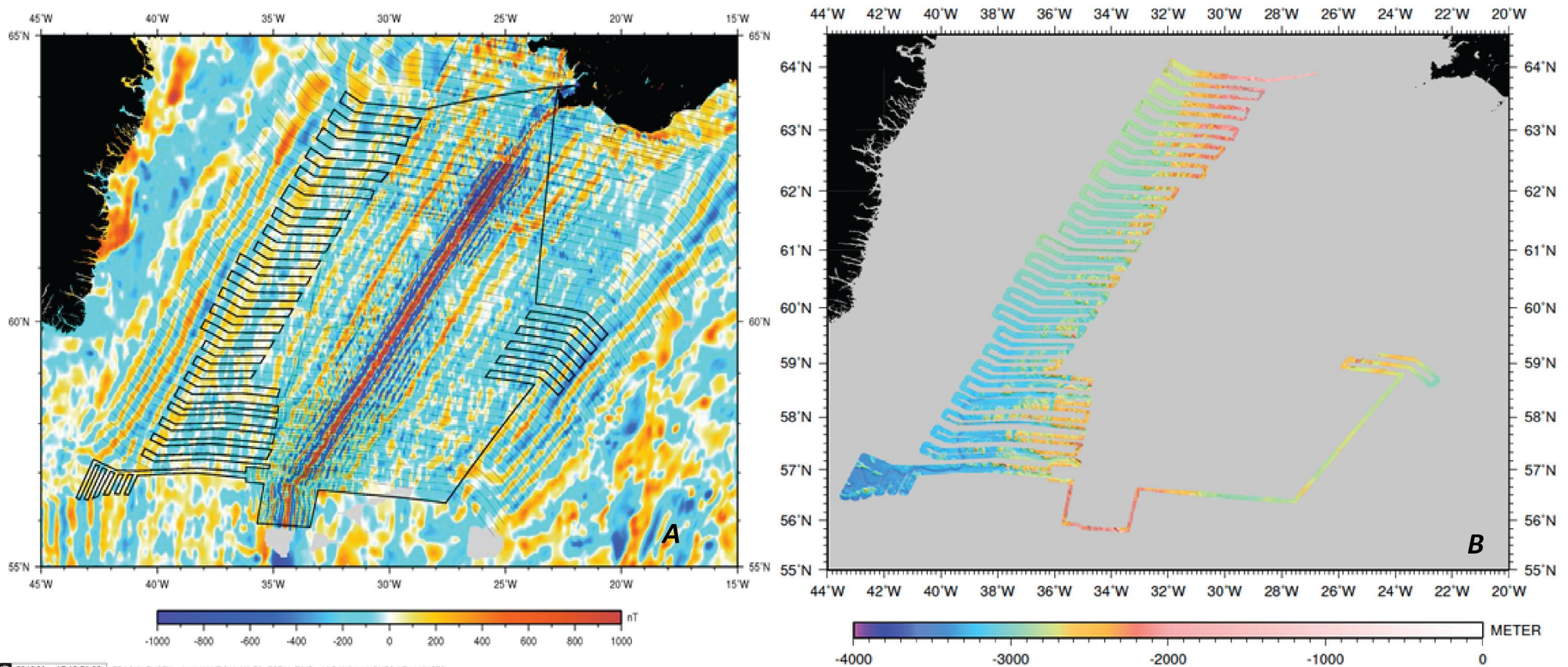


Fig. 1 A trackline of the AR35-04 cruise plotted on a pre-existing, low resolution compiled magnetic anomaly grid (A) and initial results of the bathymetry gridded at 50 m resolution (B).

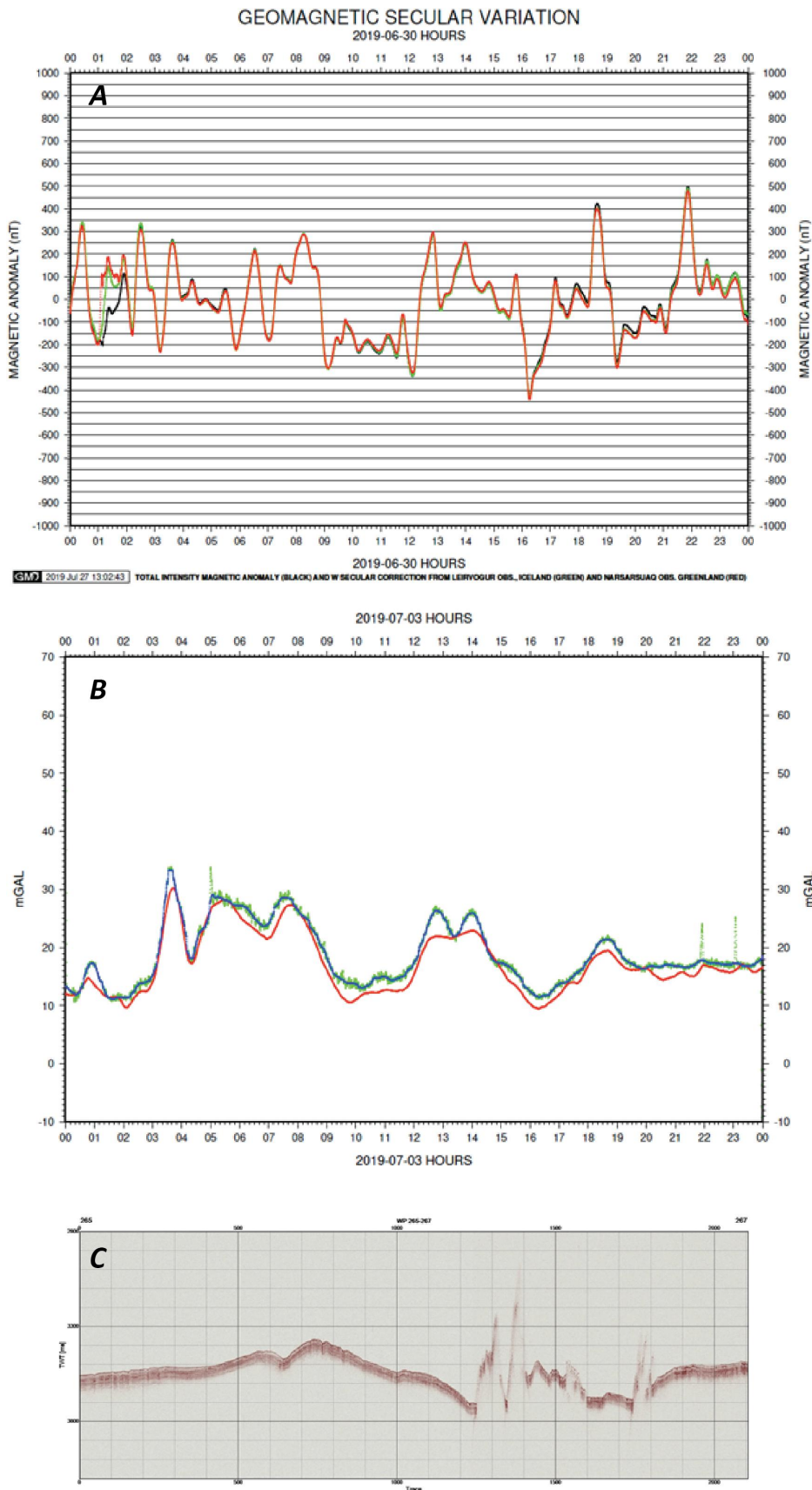


Fig. 2 Examples of the obtained results. (A) Test correction of magnetic anomaly data for secular variation. The curves show the original magnetic anomaly data (black dots) and the values corrected by subtracting the temporal variations observed at the Leirvogur, Iceland (green dots) and the Narsarsuaq, Greenland (red dots) Geomagnetic Observatories; (B) Daily plot of the free air gravity anomaly (blue line) after applying median filter to remove spikes caused by ship's course and/or speed changes; (C) Example of surface sediment profiles imaged using Kogeo Seismic Toolkit 2.7.