S10 – 402: The Structure and Evolution of the Antarctic Continent in Light of Recent Geophysical and Geological Investigations

ADMAP-2: A New International Magnetic Anomaly Compilation Project to Aid Antarctic Geosciences

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The Antarctic Digital Magnetic Anomaly Project completed the first international magnetic anomaly compilation of the Antarctic region south of 60°S (ADMAP-1) some six years after its launch (Golynsky et al., 2001). This magnetic anomaly compilation provided tantalizing new insights into the structure and evolution of Antarctica, including its Proterozoic-Archaean cratons, Proterozoic-Palaeozoic orogens, Palaeozoic-Cenozoic magmatic arc systems, continental rift systems and rifted margins, large igneous provinces and the surrounding oceanic gateways. The ADMAP-1 database was produced from air, ship borne and satellite magnetic observations by the international ADMAP working group. More than 1.5 million line-kilometres of near surface magnetic recordings were used in the construction of the map. The compilation merged available magnetic survey data collected by the international community from the IGY 1957-58 to 1999.

Since the production of this first Antarctic magnetic anomaly map, the international geomagnetic community has been extremely active, and acquired more than 1.9 million line-km of new air- and shipborne data. This implies that the amount of magnetic anomaly data over the Antarctic continent has more than doubled. In particular, the increased international dimension of magnetic surveying has enabled several major largely unexplored Antarctic frontiers to be investigated, such as the enigmatic Gamburtsev Sub-glacial Mountains (Ferraccioli et al., 2011), Wilkes Land (Aitken et al., 2014), which is one of the least understood geological regions on Earth, largely unexplored sectors of the Wilkes Sub-glacial Basin (Ferraccioli et al., 2009) and Dronning Maud Land (Mieth & Jokat, 2014) and many others. The more than 350,000 line-km of new airborne and marine magnetic observations for the East Antarctic continental margin lead to essential improvements in definition of magnetic anomaly patterns compared to the first ADMAP compilation (Golynsky et al., 2013).

To initiate the production of the next generation magnetic anomaly map and database for the Antarctic south of 60°S, an international ADMAP-2 steering committee was formed, which met at the Korean Polar Research Institute (KOPRI) in August 2013. Here, we review the status of the new ADMAP-2 project compilation with the broader community involved in Antarctic geomagnetic studies. Specific issues that will be considered include: identifying high-priority regional compilations for which datasets are currently available; engaging with international stakeholders and data owners who have yet to release their data; re-assessing the roadmap, milestones, timelines and products to be delivered by ADMAP-2; reviewing planned data processing techniques; expanding the geological utility of Antarctic magnetic

surveys; interfacing with the next generation World Digital Magnetic Anomaly Map; promoting new international magnetic anomaly surveys; and strengthening interdisciplinary links with other Antarctic geosciences communities.

In general, the creditability of any magnetic anomaly compilation depends on characterizing the input data and procedures used for their processing. The processing of recently acquired data was achieved in several consistent steps and all new surveys data were re-examined and their quality assessed by careful statistical analysis of the crossover errors. Most magnetic data used in the present compilation were delivered as profiles, although several of them in raw form, even though the data holders had already cleaned, corrected and leveled the data for other uses. Some datasets come decimated or upward continued form to altitudes of 4 km or higher, thus smoothing out high frequency signals that are however important for subsequent geological interpretation. Accordingly, sets of line data used for ADMAP-1 compilation must be reprocessed for a number of obviously erroneous values and residual corrugations. The new near-surface magnetic data were corrected for the international geomagnetic reference field and diurnal effects, edited for high-frequency errors and leveled to minimize line-correlated noise.

It was obvious that magnetic anomaly data collected mainly in the 21-st century cannot be simply stitched together with previous surveys. Overlapping surveys required mutual levelling adjustments and these procedures were treated individually. The final compilation merged all the available aeromagnetic and marine grids to create the new composite grid of Antarctica with minimal mismatch between the datasets along their boundaries. The adjusted magnetic data were interpolated onto a 5 km grid using a minimum curvature algorithm. Regional coverage gaps in the composite grid will be filled with anomaly estimates constrained by both the near-surface data and satellite magnetic observations taken mainly from the CHAMP and Swarm missions.

The preliminary version of the ADMAP-2 map provides a new geophysical foundation to develop a better understanding of the geological structure and tectonic history of the Antarctic continent. In particular, it will enable improved interpretation and modeling efforts of the geodynamic evolution of the Antarctic lithosphere that was a key component in the assembly and break-up of both the Rodinia and Gondwana supercontinents. Improved views of the nature of the transition from the Antarctic continental lithosphere to its oceanic basins will also derive from the ADMAP-2 compilation. Our current aim is to release the final version of this map and digital databases by the SCAR meeting in 2016.

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