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ADMAP-2: The second generation Antarctic crustal magnetic anomaly map

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Since the publication of the first magnetic anomaly map of the Antarctic in 2001 (Golynsky et al., 2001), the international geomagnetic community has acquired more than 2.0 million line-km of new airborne and marine magnetic anomaly data. The newly acquired data were corrected for the international geomagnetic reference field and diurnal effects, edited for high-frequency errors, and levelled to minimize line-correlated noise. However, they could not be simply stitched together with the previous ADMAP-1 survey data without extensive reprocessing that included mutually levelling the data to accommodate overlaps in the surveys.
The ADMAP-2 compilation provides the most complete and coherent view to date of the magnetic properties of the Antarctic crust. The map reveals a wide variation of magnetic anomalies reflecting crustal terranes of different lithologies, ages, degrees of tectonic reworking, and thermal attributes.
The magnetic anomaly patterns of the East Antarctic continental margin, for example, have been enhanced considerably by the 430,000 line-km of new airborne and marine survey data in the ADMAP-2 compilation. The compilation also helps to map out Proterozoic-Archaean cratons, Proterozoic-Palaeozoic mobile belts, Palaeozoic-Cenozoic magmatic arc systems and the boundary between East and West Antarctica, continent-ocean transitions, and other regional Antarctic crustal features. It further helps to resolve basement terrane variations and related suture zones, intra-continental and continental margin rifts, and regional distributions of plutons and volcanics including the Ferrar dolerites and Kirkpatrick basalts, respectively. When combined with ice-probing radar, gravity and other geophysical and geological information, the ADMAP-2 compilation greatly facilitates developing new insights on fundamental large-scale Antarctic geological processes such as continental rifting, intraplate mountain building, subduction and terrane accretion processes, intraplate basin formation, and the evolution of the Gondwana and Rodinia supercontinents and the Antarctic seafloor.
However, care is required in interpreting the anomaly variations in the compilation as some of them may also reflect variations in survey specifications. In addition, crustal magnetic studies of some areas offshore of West Antarctica and in East Antarctica are limited by spotty or incomplete data coverage. To help mitigate these limitations, localized spherical harmonic Slepian basis functions are being developed to jointly model the south polar cap's crustal magnetic anomalies from ADMAP-2 and the Swarm satellite mission. Honoring both the near-surface and satellite input data in the least-squares sense, the localized Slepian model will provide improved perspectives on how the crustal magnetic anomalies vary over the intervening altitudes, which simply cannot be obtained from standard downward or upward continuations of the individual input data sets. The Slepian coefficients also can be used to update global spherical harmonic coefficients, and thus ADMAP-2 is poised to substantially upgrade the Antarctic components of the World Digital Magnetic Anomaly Map.
The ADMAP-2 project is a testament to the success of international collaborations to produce and update a coherent digital magnetic anomaly database and map of the Antarctic. The synthesis of the individual magnetic surveys into the ADMAP-2 compilation greatly enhances their utility for geological studies of the Antarctic region south of 60°S.