

ISAES: XII International Symposium on Antarctic Earth Sciences
Pre-symposium Workshop, 12 July 2015
1-5pm Salon 3, Goa Marriott



Towards improved geological maps of Antarctic rocks and surficial deposits

Underpinning datasets for studies of glacial dynamics and climate change

Overview: Meeting at a Glance

The GeoMAP Action Group was launched at the SCAR 2014 conference in Auckland. It aims to facilitate an integrated programme to promote the capture of existing geological map data, update its spatial reliability, improve representation of glacial sequences and geomorphology, and enable data delivery via web-feature services.

GeoMAP held its first formal meeting on 12 July 2015 at the ISAES XII conference Goa. Over 35 people, representing 11 different nations, participated at a pre-symposium workshop.

Topics introduced and discussed included: Background rationale of the idea and need; A review of the state of knowledge in available maps and datasets; Options for database models and delivery; The need to conform to international standards; A proposed top-down philosophy of approach; Issues of classification and available base datasets; Mapping activity to the Antarctic Roadmap Challenges.

GeoMAP direction was formulated through collective ideas and informal consensus. A working team and action plan has been established, with ~10 people shoulder tapped for tasks in year 1, supported more generally by the wider GeoMAP group and email list. A formal gathering is being planned for the SCAR August 2016 conference in Kuala Lumpur, Malaysia, although informal meetings will be held at AGU San Francisco 2015 Fall Meeting and in New Zealand by individuals en-route to/from Antarctica. Further representation and participants are welcome!

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Workshop Points of Discussion

- There is strong polarity between onshore and offshore geological records of the Neogene in Antarctica. Continuous records of climate exist offshore and have been a focus for 2-3 decades, but are expensive to collect and are spatially limited (drilling to date $\sim 5 \text{ m}^2$). Onshore records are discontinuous, but visible and accessible and have 10 orders of magnitude greater spatial extent (outcrops = $5 \times 10^{10} \text{ m}^2$) than drilling and seem under-utilised.
- Glacial deposits and landforms contain a record of the waxing and waning of Antarctic ice, and help constrain the scale of Antarctica's influence on global climate and its potential contribution to future sea level rise. Studies to date have been mostly localised. There is a lack of continent-wide digital geological data. Regional-scale maps have very limited depiction of post-Miocene surficial geology and geomorphology. Spatial reliability is also highly variable and a holistic overview is difficult to obtain.
- There is room to improve map datasets – which are a fundamental description of the geosphere – to provide underpinning information to constrain biological and ecological research, and help locate geosignals of climate change. Example maps (both hard-copy and digital products) from various nations highlighted a wealth of information to mine. The New Zealand 1:250,000 2nd edition geological map of southern Victoria Land, for example, turned two units (till and scree) into c. 70 units pinpointing the locations of deposits and indicating their mode of formation, age, and likely source. Available base datasets of rock outcrop locations are okay for regional work, but will not match the decimetre- resolution satellite data starting to become available.
- Traditionally national programs and geological surveys have mapped using a 'bottom up' approach. GeoMAP will instead adopt a 'top down' construction starting from a continent-scale, low density, attribute-poor dataset that is added to and improved through multiple iterations. A lithostratigraphic-based classification is most applicable at top-levels. The creation of a top down approach may be more attractive to funders as it asks big questions. In the first instance the focus is to provide a geosphere dataset for other scientists (cf. geologists) aimed at cross-discipline use, in a similar way that 'wikipedia' provides a non-academic source of non-specialist information that complements specialist academic manuscripts.
- SCAR promotes international collaboration, and participating nations are already committed to data sharing. Pragmatism is likely to favour a centralised rather than distributed database model. As long as source bibliographic metadata are provided with links to publications, there are unlikely to be issues around academic/custodial/sovereign rights.
- Capability development, either from one nation to another, or through training of next generation scientists, is seen as a priority. GeoMAP should investigate workshops and exchanges for training in GIS methods, remote sensing, GeoSciML and geoscience information storage and delivery – being a useful way to promote collaboration, spread labour and enhance progress.
- GeoMAP underpins many of the "Priorities for Antarctic Research" identified by the Antarctic Roadmap Challenges Project (Mahlon et al. 2014 Nature 512, 23–25). From the catalogue of 80 questions, the action group maps to: Q3, 5, 8, 21, **25**, 26, **29**, **32**, **38**, **39**, **40**, 43, 45, 74, 75, 79 (bold= stronger relationship).

Participants

The following is a list of participants that had either indicated they wanted to be present, or those we thought were present. A number of others attended (great!) whose names were not recorded.

ATTENDED

Chris Carson	Geoscience Australia	Australia	chris.carson@ga.gov.au
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Alex Burton-Johnson	British Antarctic Survey	UK	alerto@bas.ac.uk
David Elliot	Ohio State University	USA	elliott.1@osu.edu

UNABLE TO ATTEND (but interested in outcomes or being involved)

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Action Plan

- Years 1-2:** Capture a continent-wide digital geological dataset of existing bedrock and surficial geology, 'wikipedia-style' appropriate for use at 1:1M – 1:250,000. Add attributes to the ADDv6 rck01 polygon and build a spatial bibliography of sources. Adopt international GeoSciML data format and find an appropriate data delivery mechanism. The team will meet again at the SCAR 2016 Conference, Kuala Lumpur, Malaysia where teams can address specific GeoMAP problems and issues.
- Years 2-4:** Peer review v1. Improve the spatial resolution and reliability of the base dataset utilising satellite image processing. Develop methodology to integrate more-detailed geomorphological data, including the absence of deposits (erosive unconformities) and other databases (chronology, sub-ice geomorphology), appropriate at scales ($\leq 1:100,000$). Compile examples for key areas, constrained by high-resolution (m-scale) satellite data. Develop 1st dataset outlining glacial deposits and landforms.
- Subsequently:** Use in source characterisation, ice modelling, exploration for geo-indicators of climate change, biological and ecological studies.

Team and meetings

A core working team has been established. Individuals with contributions planned in Year 1 include: S. Cox, A. Martin, M. Rattenbury (New Zealand); C. Siddoway-Smith, P. Morin (USA); A. Burton-Johnson (UK); T. Abu-Alam (Norway); L. Crispini (Italy); C. Carson (Australia); J. Lopez-Martinez, M. Montes (Spain); E. Mikhalsky (Russia). Others will remain active on the mailing list, helping to source maps and datasets, provide reviews and advice.

Specifically for late 2015:

- GNS Science to develop a description, data structure and XML files. Translate QMAP SVL into a GeosciML dataset for GeoMap, then begin compilation of central Transantarctic Mountains (complete 2016);
- Christine Smith-Siddoway to send student to GNS Science (Dunedin) to compile geology of Marie Byrd Land and translate into GeoMap format (Sept 2016);
- Giovanni Capponni and Laura Crispini to visit GNS Science and oversee compilation of North Victoria Land (Nov 2016);
- Alex Burton Johnston to complete processing of LIMA dataset, and try first pass classification of geology of Antarctic Peninsula.
- Tamar Abu-Alam to continue compiling and preparing Dronning Maud Land geology.

A formal gathering is planned at the SCAR August 2016 conference in Kuala Lumpur, Malaysia, although informal meetings will be held at AGU Fall Meeting and in New Zealand en-route to and from Antarctica. Further international representation and participants are welcome!

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