



Geosciences Group (GSG)

National representative: Synnøve Elvevold (NPI)
Ane Engvik (NGU)

2 Research programs (PAIS, SERCE)

7 Expert groups (ADMAP, ANTOS, ANTPAS, ANTVolc, **GIANT**, GRAPE, IBCSO)

4 Action groups (AntArchitecture, **CGG**, Geoconservation, **GeoMap**)

- *Connecting Geophysics with Geology (CGG)*
- *GeoMap (Geological Mapping Update)*

Connection Geophysics with Geology (CGG)

Chair: Joachim Jacobs (since 2012) (together with F. Ferraccioli and A. Läufer)

- Identify highest priority areas where lineaments and/or apparent tectonic block boundaries intersect with outcrops
- Coordinate and develop multinational capabilities in geophysics and geology
- Plan and initiate international expeditions to key areas
- Provide improved geological maps, specifically in logistically demanding areas
- Identify worthy drill sites for basement recovery and connect to other Antarctic drilling communities

Connecting Geophysics with Geology (CGG) – activities 2018-2002

Meetings:

- Session “*Structure, evolution and heterogeneity of Antarctica’s lithosphere*” at the XIII International Symposium on Antarctic Earth Science (ISAES), 22.-26.07.19, Incheon, South Korea; largest session at the conference with 54 contributions
- *CGG Action Group meeting* at the XIII International Symposium on Antarctic Earth Science (ISAES), 22.-26.07.19, Incheon, South Korea
- Session “*Geological History of Victoria Land; Reviews and New Findings*” at the XIII International Symposium on Antarctic Earth Sciences (ISAES), 22-26.07.19, Incheon, South Korea; second largest session at the conference with 33 contributions
- 36 presentations in several Potential Field & Tectonophysics sessions at the IUGG 2019, AGU 2019 Fall Meeting and EGU 2020, including an *Invited Plenary Talk* at the XIII International Symposium on Antarctic Earth Science (ISAES), 22.-26.07.19, Incheon, South Korea

Planned activities in 2020 to 2022

Planned activity
High-resolution aeromagnetic survey and geological field work in northern Victoria Land during the planned BGR expedition GANOVEX XIV (2021-22)
New aerogeophysical surveys of the Princess Elizabeth Land frontier, as part of a proposed international project- GEOEAIS- led by India & UK (earliest target field seasons 2021-22 & 2022-23)
4D Antarctica modelling efforts to help constrain crustal and lithosphere structure and its influence on Antarctic geothermal heat flux heterogeneity (2020-2022)
Contributions to new International Lithosphere Programme on East Antarctica (2020-2025).
Sampling/analyses of ice-rafted debris/moraine material off/in Dronning Maud Land
EGU/AGU, conference sessions
SRP planning meeting in Bergen, Norway, in early 2021

Field activities, other activities:

Isotopic profiling along the Dronning Maud Land Mts. to gain insights into the crustal evolution across a major accretionary plate margin in Neoproterozoic/early Paleozoic times, several papers in preparation (Jacobs, J., et al.)

Comprehensive Ar/Ar dataset of eastern DML to delineate the protracted Neoproterozoic/early Paleozoic deformation and cooling history of this part of East Antarctica (Läufer, A., et al.)

High-resolution aeromagnetic survey over the western margin of the Mariner Glacier, combined with extensive geological field work in Victoria Land, Transantarctic Mountains during BGR expeditions GANOVEX XIII (2018-19) and GANOVEX XIII/2 (2019-20)

Pre-site survey “Sub-EIS-Obs III” jointly organized by AWI and BGR with core sampling under the Eckstrom Shelf Ice at Neumayer III station in the 2018-19 Antarctic season following extensive vibroseismic surveys in the two previous seasons

Comprehensive seismic bathymetry data set beneath Eckstrom Shelf Ice collected during joint AWI/BGR project Sub-EIS-Obs (Smith, Läufer et al.)
High resolution aerogeophysical surveys of Thwaites Glacier (2018-19 & 2019-20) flown by BAS in collaboration with LDEO as part of the International Thwaites Glacier Collaboration led by NSF & NERC (Jordan, Tinto et al.)

Four European Space Agency funded research projects (PolarGAP, GOCE+Antarctica, ADMAP 2.0+ & 4D Antarctica) with BAS leading and/or contributing to airborne and satellite geophysical data analyses and modelling to investigate subglacial geology, crustal and lithospheric architecture, global supercontinent linkages and geothermal heat flux heterogeneity (Ferraccioli, Ebbing, Forsberg, et al.). Several papers published & in preparation.

Geological and geophysical contributions to new SCAR-SERCE international and interdisciplinary Geothermal Heat Flow Sub-Group, including the 2020 White Paper (Alex Burton-Johnson et al.) and contributions to the new SCAR INSANT SRP proposal development.

Application of remote sensing techniques combined with geological field and lab and geophysical data to identify bedrock and structures in northern Victoria Land, one paper published, one in preparation (Läufer, Crispini, et al.)

Full waveform ambient noise tomography to investigate the structure of East Antarctica, work in progress (Hansen, S. et al.)

Regional-scale interpretation of magnetic anomaly field for the Mac. Robertson Land – Princess Elizabeth Land region, integrated with surface geology (Mikhalsky & Leitchenkov, 2018)

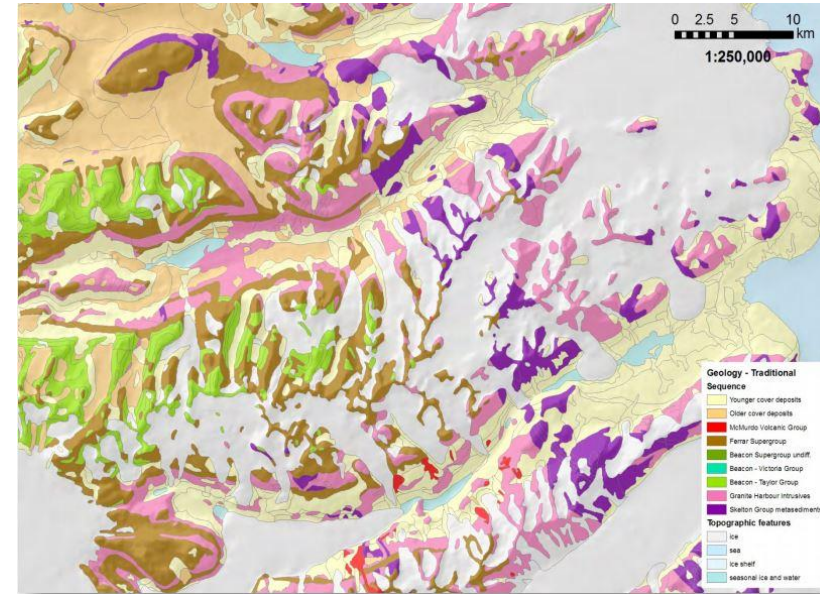
Tectonic map of Antarctica, 2nd edition. (Grikurov & Leitchenkov 2019)

Geological Mapping Update (GeoMap)

Chair: Simon Cox (NZ) og Paul Morin (USA)



Simon Cox discovers there are numerous, hard-copy, regional-scale geological maps of Antarctica that were developed last century but it can be somewhat daunting to obtain a good regional overview.



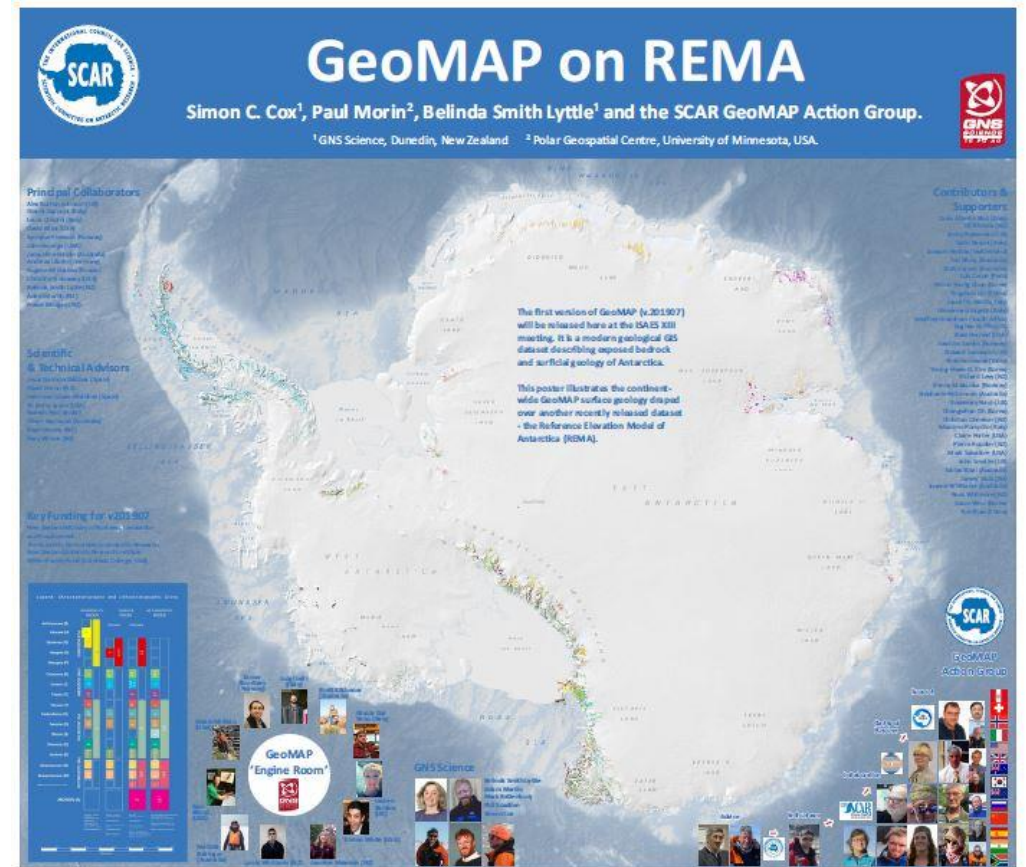
Aim:

- update geological geospatial information of Antarctica by gathering both rock and surficial deposits information and compiling it into a modern digital GIS framework

“Top down” construction starting from a continent-scale, low density, attribute-poor dataset that is added to and improved through multiple iterations

GeoMap (Geological Mapping Update)

- Principal collaborators: Norway, USA, Italy, UK, Australia, ny, Russia and New Zealand
- «Engine room» workers: 11 student volunteers
- First version of Antarctic continent-wide geological map released 2019 at XIII ISAES (International Symposium on Antarctic Earth Sciences)
- Next stage: reviewing and finalising GeoMap for publication
- And after, the datasets will continue to evolve and improve over time



Project Background

The SCAR GeoMap (Geological Mapping Update of Antarctica) action group has been an international effort to gather both rock and surficial deposit information and compile it into a modern GIS framework. Construction from 2015-2019 has involved principal collaborators from USA, Norway, Italy, UK, Australia, Russia and New Zealand, but includes contributions from at least 14 nations. Much of the manual work has been completed by an 'engine room' of 11 student volunteers. Many others have provided advice, data and support.

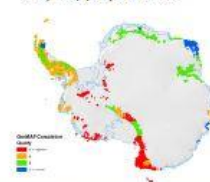
The aim has been to capture existing geological map data, update its spatial reliability, and improve representation of glacial sequences and geomorphology. The new GIS dataset comprises over 95,000 polygons describing 'known geology' of rock exposures, rather than 'interpreted' sub-ice features, using a mixed chronostratigraphic- and lithostratigraphic-based classification.

GeoMAP construction involved a 'top-down' work-stream, starting from a continent-scale, low density, attribute-poor dataset that has been added to and improved through multiple iterations. It involved capturing existing geological map data, refining its spatial reliability, then improving representation of glacial sequences and geomorphology. Feature classification and digitisation of rock and moraine polygons employ international GeoSINM data protocols to provide attribute-rich and queryable data, including bibliographic links to source maps and literature.

Bibliography of Map Sources



Completion, Quality & Work to Do



The Data behind this Poster

The map displayed above renders GeoMAP geological unit polygons with colours reflecting rock or deposit age, many of which will be difficult to see at a continent scale. But you can zoom in on the computer and a rich attribute table enables these data to be displayed or queried in a wide variety of ways. Other data captured for GeoMAP includes a source bibliography of 502 polygons outlining maps and previous work (shown left), 1476 fault lines and 3160 structural data points.

GeoMAP has been displayed over a shaded grey-scale image of REMA (Howat et al. 2019) refile, downsampled to 200 m resolution with data gaps filled by a 300 m DEM to provide visual continuity. REMA was constructed using the Blue Waters supercomputer and the open source photogrammetry software SETSM. A series of individual DSMs were developed from DigitalGlobe optical stereoscopic satellite images acquired from 2009-2017, then registered vertically to satellite altimetry measurements from CryoSat-2 and ICESat. REMA has absolute uncertainties of less than 2m over most of its area and relative uncertainties of decimetres. Version 1 has been developed into a high resolution (8 m) terrain map covering ~98% of the Antarctic continental landmass.

GeoMAP has potential to provide fresh perspectives, for example, through combined geological legends and interpretation of continent-wide time-space plots. It is also ideal for continent-wide perspectives and cross-discipline science. Visit <https://www.scar.org/science/geomap/geomap/> for further information and links to download data.

Invitation to contribute

One of the hardest tasks for GeoMAP has been, and still is, building consistency and capturing the local nuances of different interpretations available. There will undoubtedly be debate as to how well this has been achieved for v201907, but there is full expectation that it will continue to evolve and improve over time. There is a quality layer shown to the left providing information on the attention various areas have received, relative quality of the information provided (Scale lowest=1 to highest=5), and work still needed.

The next stage of work will involve reviewing and finalising GeoMAP for publication. It is expected GeoMAP v.201907 will undergo peer scrutiny, QA/QC and editing for full publication around mid-2020. The Action Group are looking for people to contribute their local knowledge, so please contact Simon Cox (s.cox@scs.csi.csi.au) if you would like to be involved.