Towards a digital dataset of the Antarctic geosphere

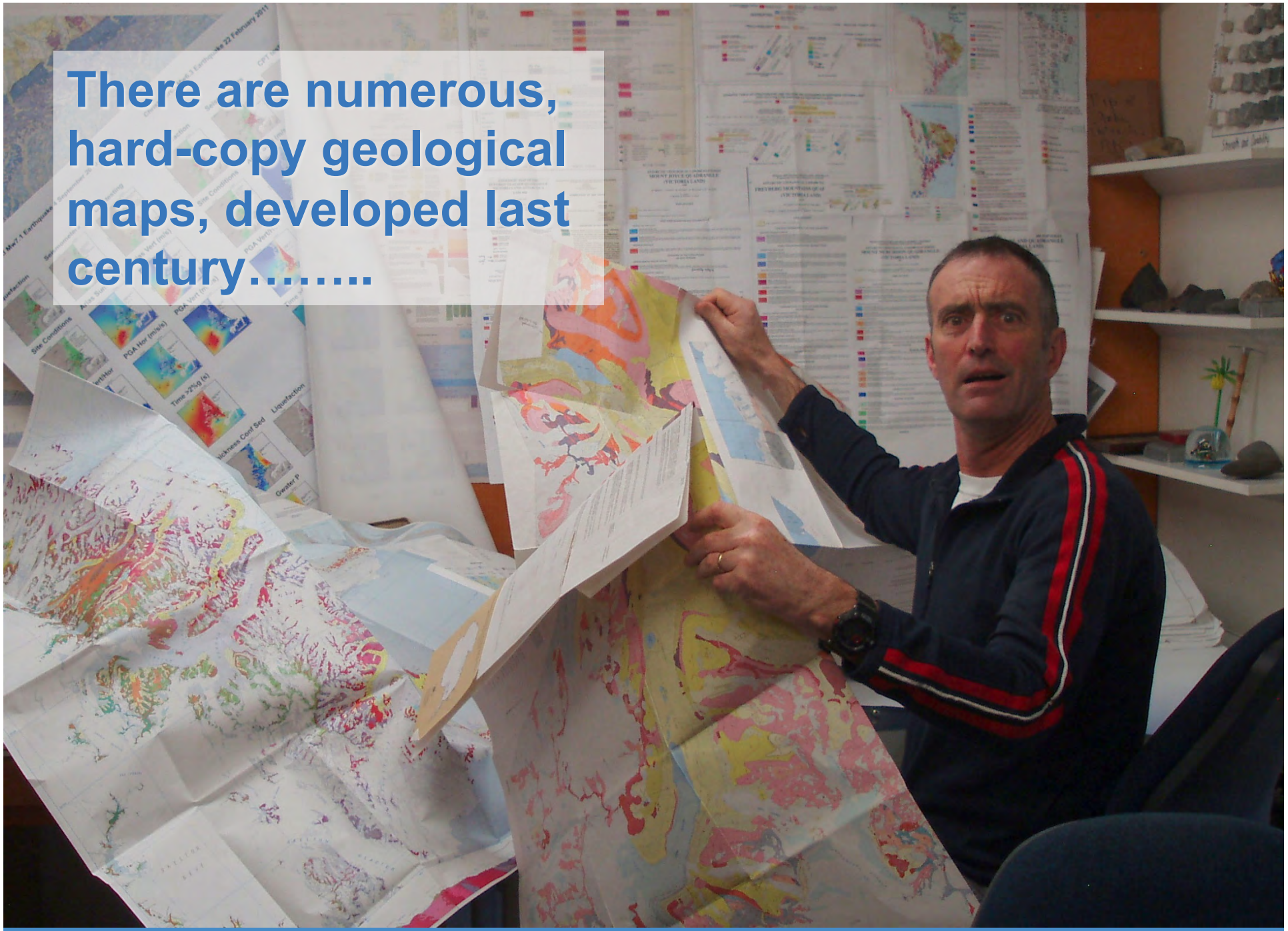
SCAR GeoMap project and progress

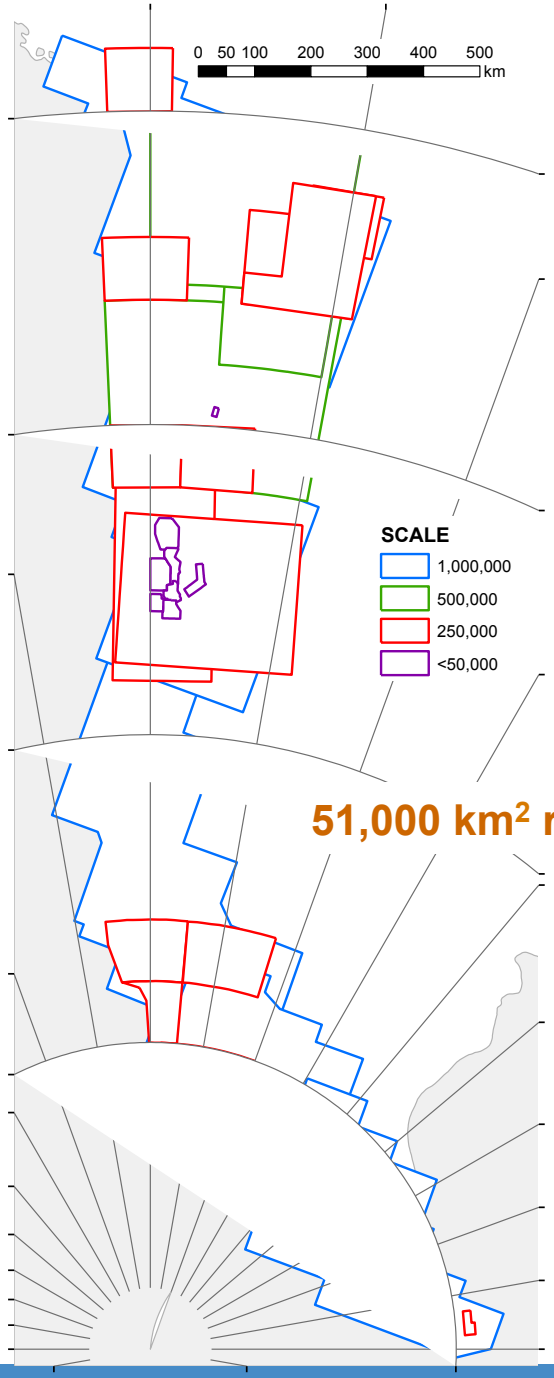
S.C. Cox[1], P. Morin[2]

[1] GNS Science, New Zealand s.cox@gns.cri.nz

[2] PGC, University of Minnesota, USA

GeoMAP Action Group


There are numerous, hard-copy geological maps, developed last century……..



HAVE

Lots of old, hard-copy geological maps, developed last century, mostly representing 'deep time'.

Poor spatial reliability.

Large areas of rock and cover deposits containing a geological/glaciological history.

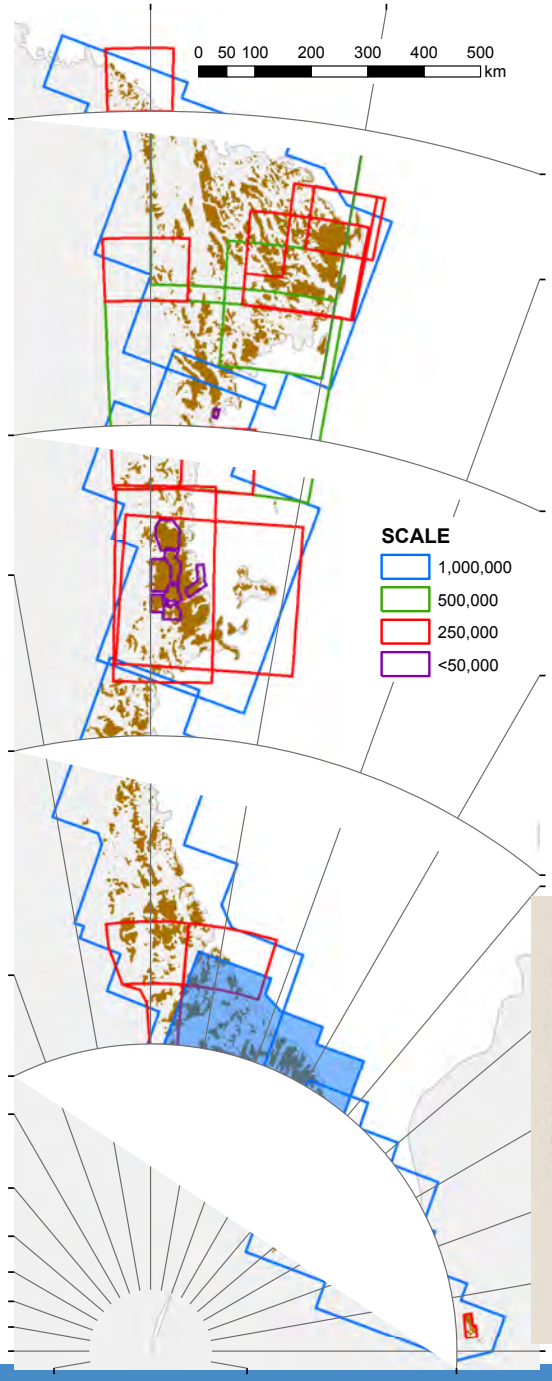
Some very detailed localised maps.

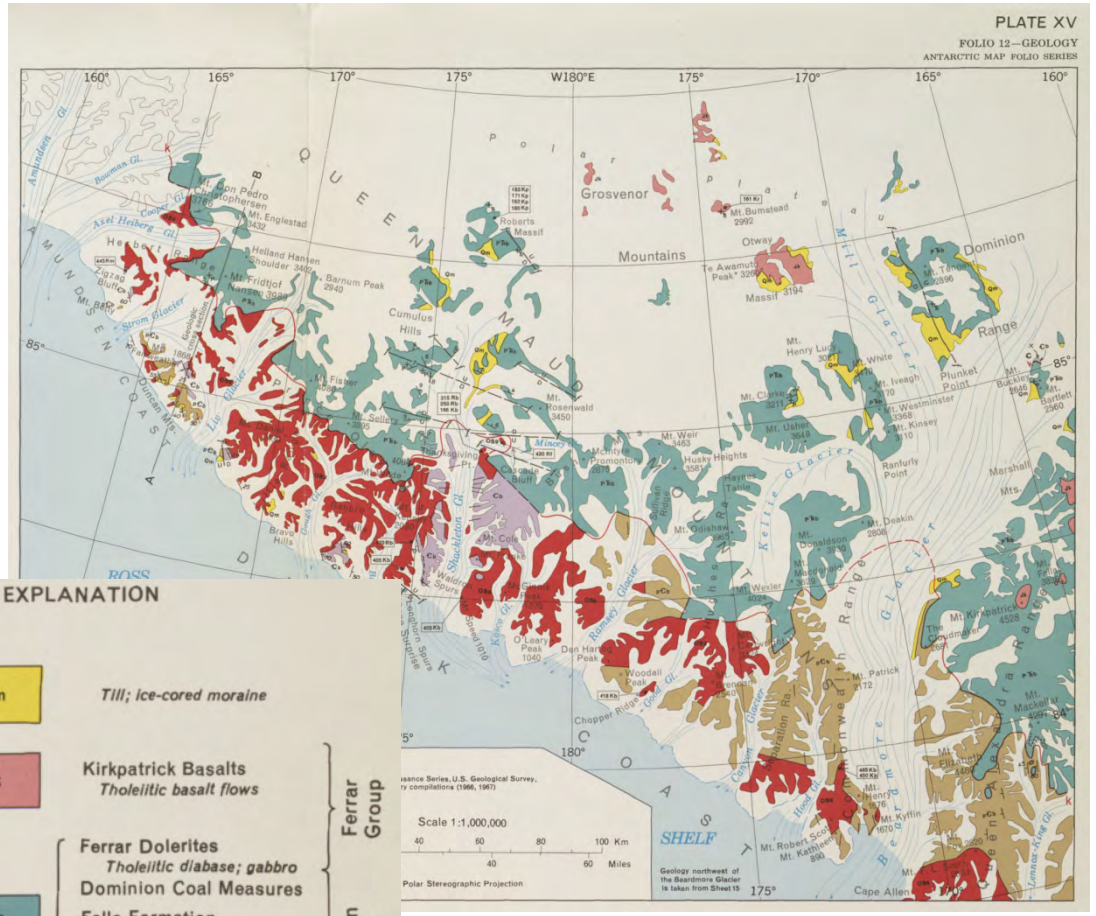
Paleoclimate records based on few, spatially limited, ?representative? sites

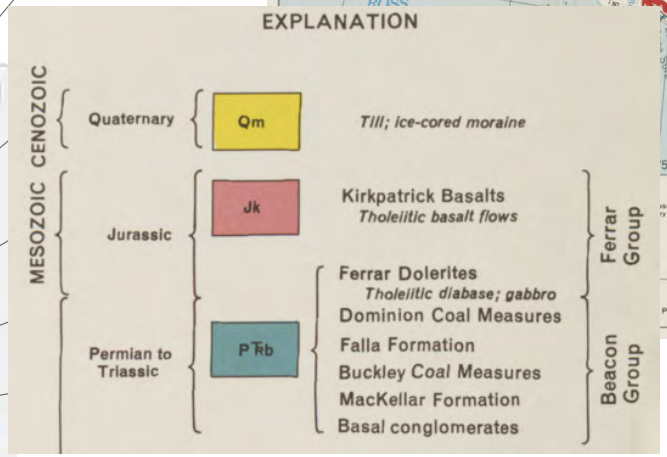
Large quantities of NEW satellite data.

Example: McGregor & Wade (1969) Queen Maud Mountains

1:1 million Folio Series

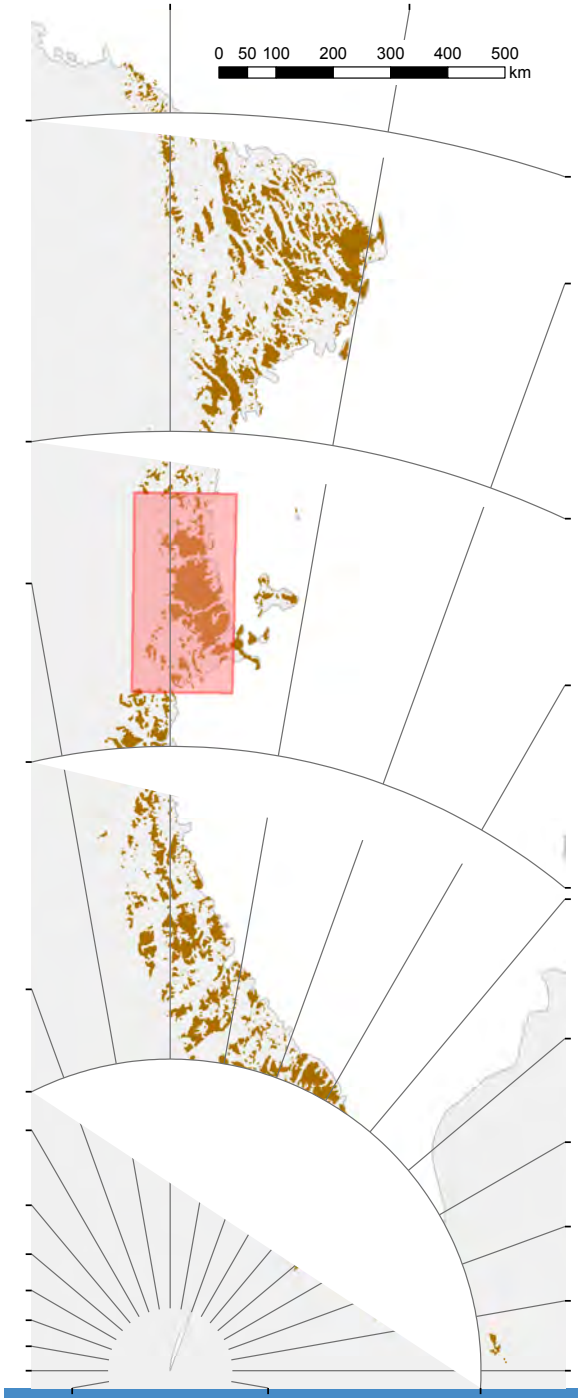






Commonwealth Trans-Antarctic Expedition

IGY Gunn & Warren (1962)



Morainic deposits.
Scree, stream deposits, dunes, etc.

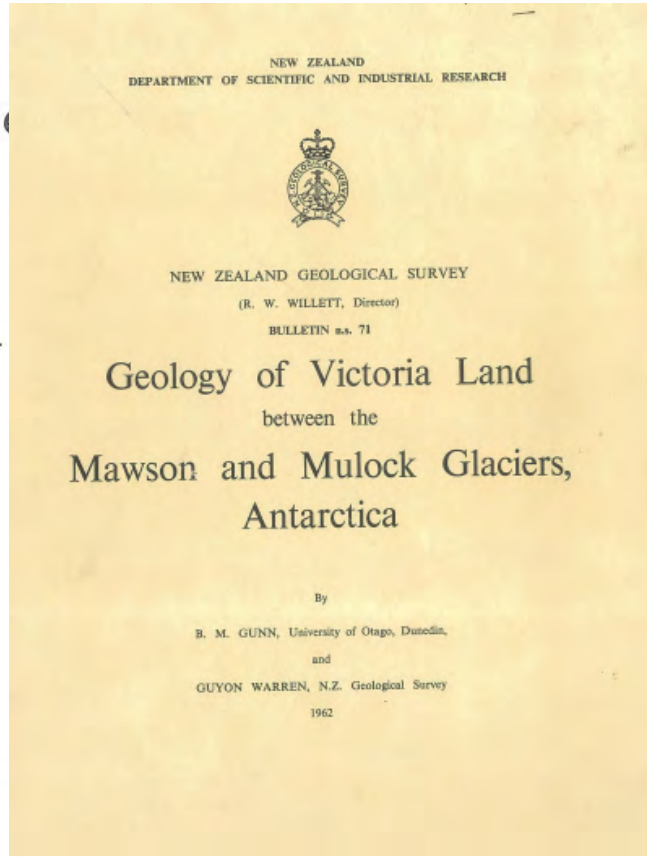
mv — Olivine basalt, kenyte.

fd / fdl — Dolerite sills, dikes.
Basaltic lavas.

mt — Tillite.

bs — Sandstone, siltstone, conglomerate, carbonaceous beds.

BEACON SANDSTONE



NEW ZEALAND
DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH

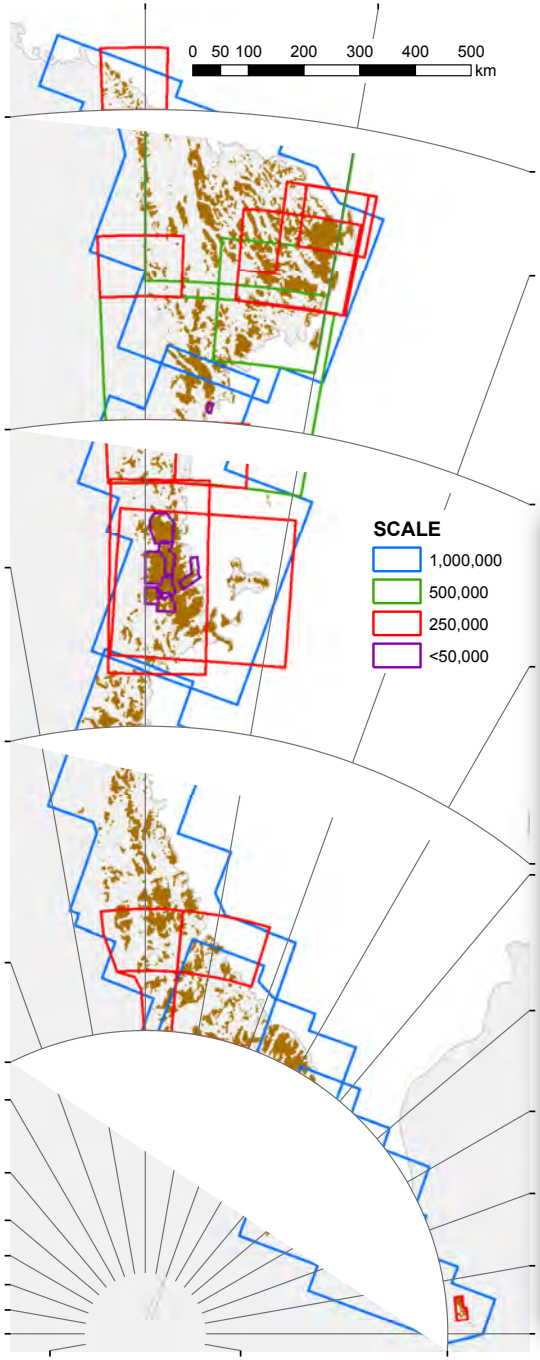
NEW ZEALAND GEOLOGICAL SURVEY
(R. W. WILLETT, Director)
BULLETIN n.s. 71

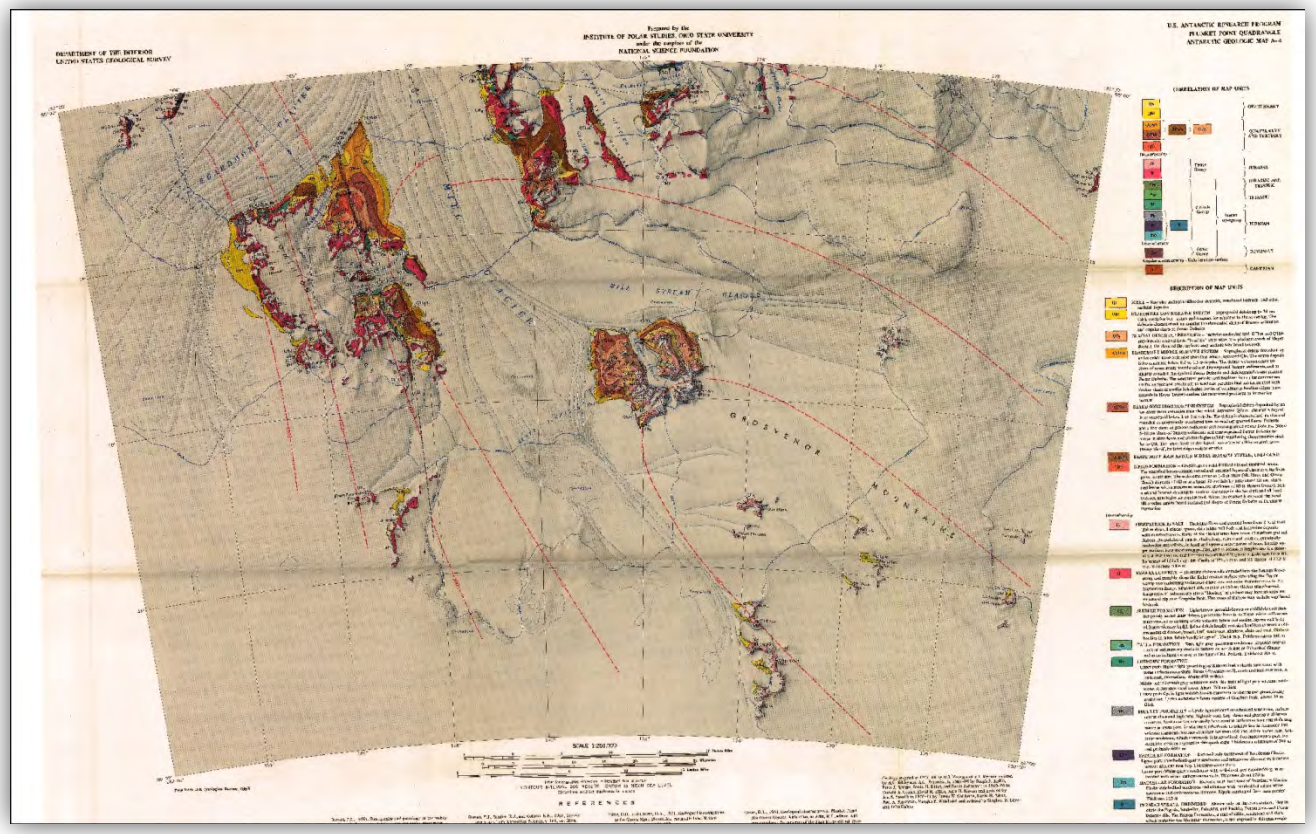
Geology of Victoria Land
between the
Mawson and Mulock Glaciers,
Antarctica

By
B. M. GUNN, University of Otago, Dunedin,
and
GUYON WARREN, N.Z. Geological Survey
1962

Example: Elliot et al. (1974) Plunket Point

Reconnaissance 1:250 k Geology





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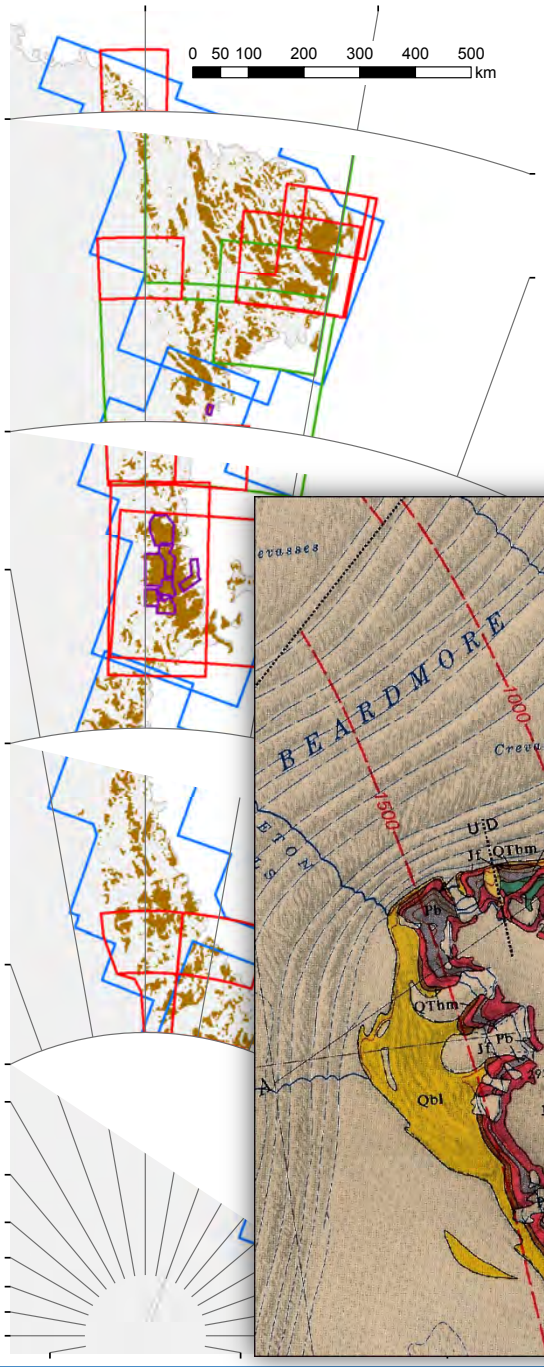
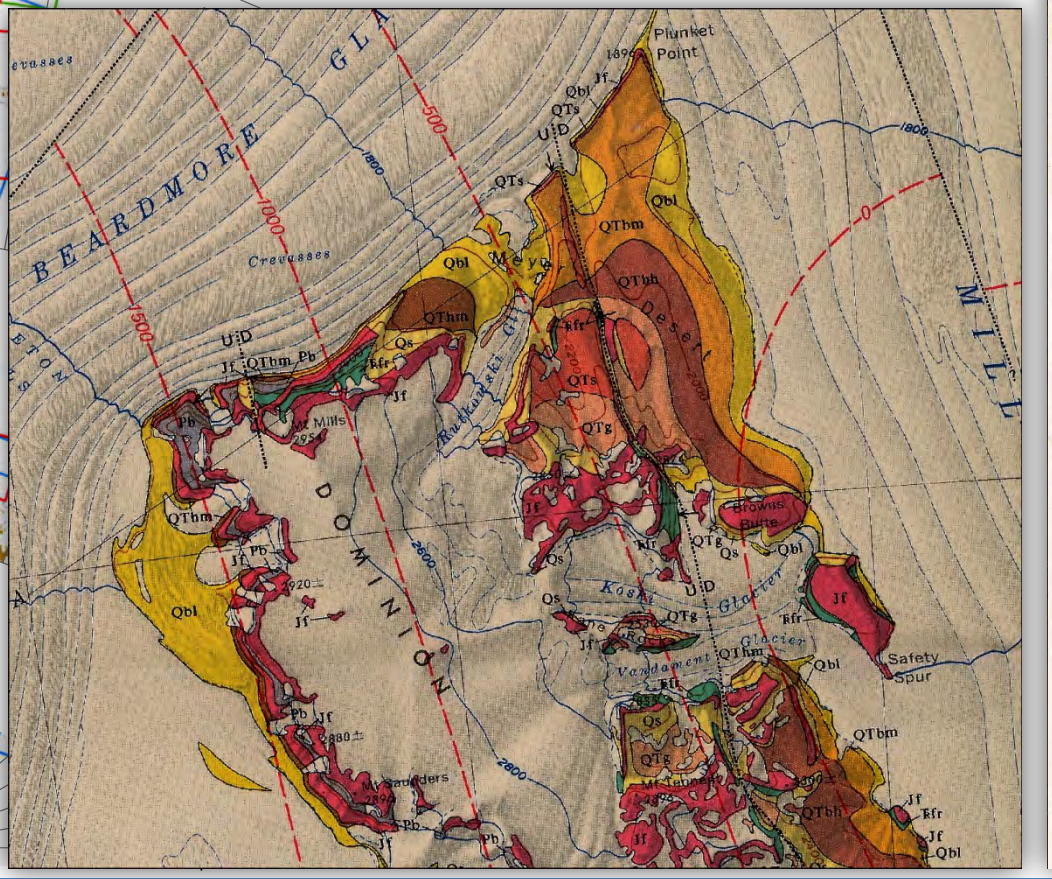
Reconnaissance 1:250 k Geology





DESCRIPTION OF MAP UNITS

Qs SCREE – May also include solifluction deposits, weathered bedrock surficial deposits

Qbl BEARDMORE LOW MORAINE SYSTEM – Supraglacial debris up thick overlying bot active and stagnant ice adjacent to the activ debris is characterized by angular to subrounded clasts of Beacon and angular clasts of Ferrar Dolerite

QTg GLACIAL DEPOSITS, UNDIVIDED – Includes undivided Qbl, QT and deposits derived from "local ice" expansion (the platform s Desert). On elevated flat surfaces may include weathered bedroc

QTbm BEARDMORE MIDDLE MORAINE SYSTEM – Supraglacial debri an ice cover more extensive than that which deposited Qbl. The is ice-cemented below 0.5 to 1.5 m depths. The debris is charact clasts of cavernously weathered and disintegrated Beacon sedim slightly rounded fine-grained Ferrar Dolerite and disintegrated c Ferrar Dolerite. The weathered pebbles and boulders form a lag on the surface and overlie silt to sand size particles that are inte fresher clasts of similar lithologies. Series of continuous boulder notable in Meyer Desert) outline the recessional positions of for termini

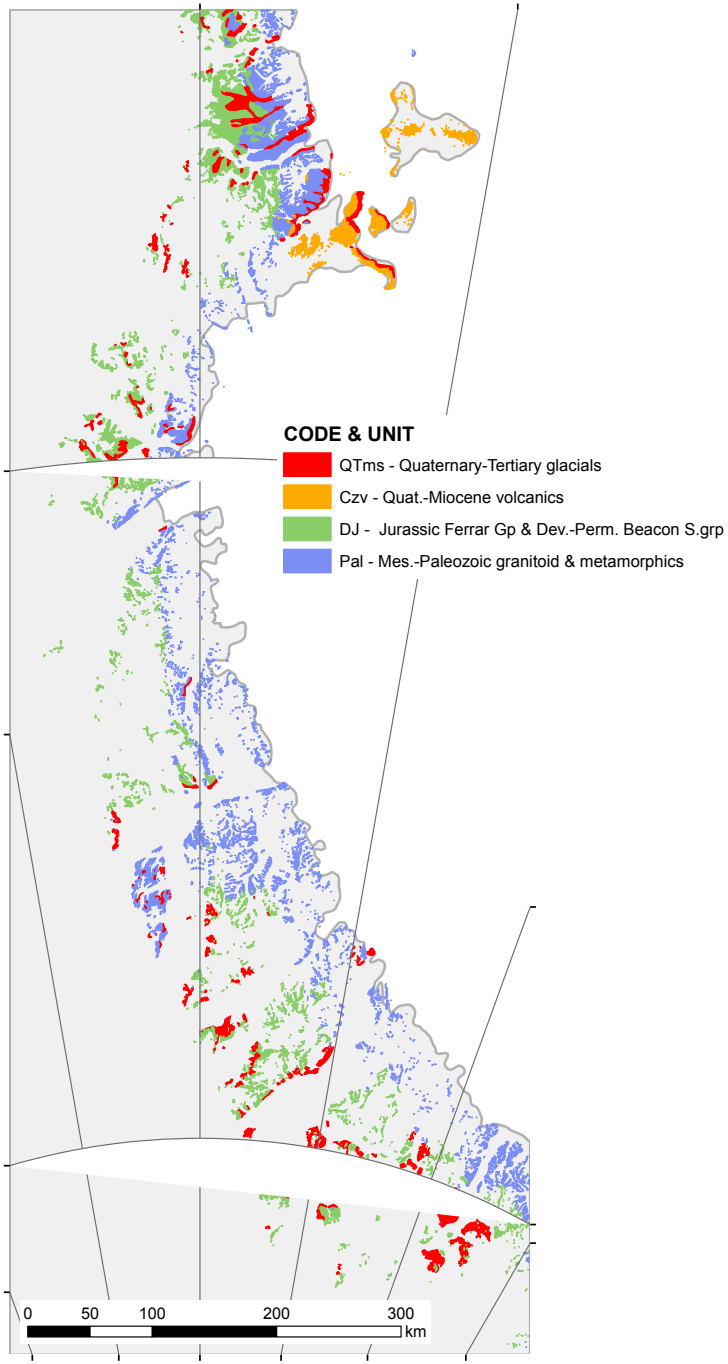
QTbh BEARDMORE HIGH MORAINE SYSTEM – Supraglacial debris d ice cover more extensive than that which deposited QTbm. The is ice-cemented below 1 to 2 m depths. The debris is characteri rounded to cavernously weathered fine- to medium-grained Fer and a few clasts of Beacon sediments and coarse-grained Ferrar 5–10 cm clasts of Beacon sediments and coarse-grained Ferrar I crease in abundance and all lithologies exhibit weathering chara lar to Qbl. The upper limit of the deposit can often be different Otway Massif, by faint ridges and/or erratics

QThm BEARDMORE HIGH AND/OR MIDDLE MORAINE SYSTEM, U

QTs SIRIUS FORMATION – Grayish-green semi-lithified till and strati The stratified lenses contain sorted and unsorted layers of clast gravel to silt size. The sediments occur as 1–2 m thick (Mt. Bla Massif) deposits of till or as a basal till overlain by intermixed t fied lenses with a maximum measured thickness of 85 m (Meye ated and faceted clasts up to boulder size occur in the basal till bedrock lithologies are represented. Where the contact is expos till overlies unweathered surfaces and slopes of Ferrar Dolerite Formation

Disconformity

Jk KIRKPATRICK BASALT – Tholeiitic flows and ponded lavas fro 200 m thick. Includes sparse, thin acidic tuff beds and lacustri



WANT

Spatially accurate, holistic overview of deposits and landforms formed by the waxing and waning of Antarctica's ice masses.

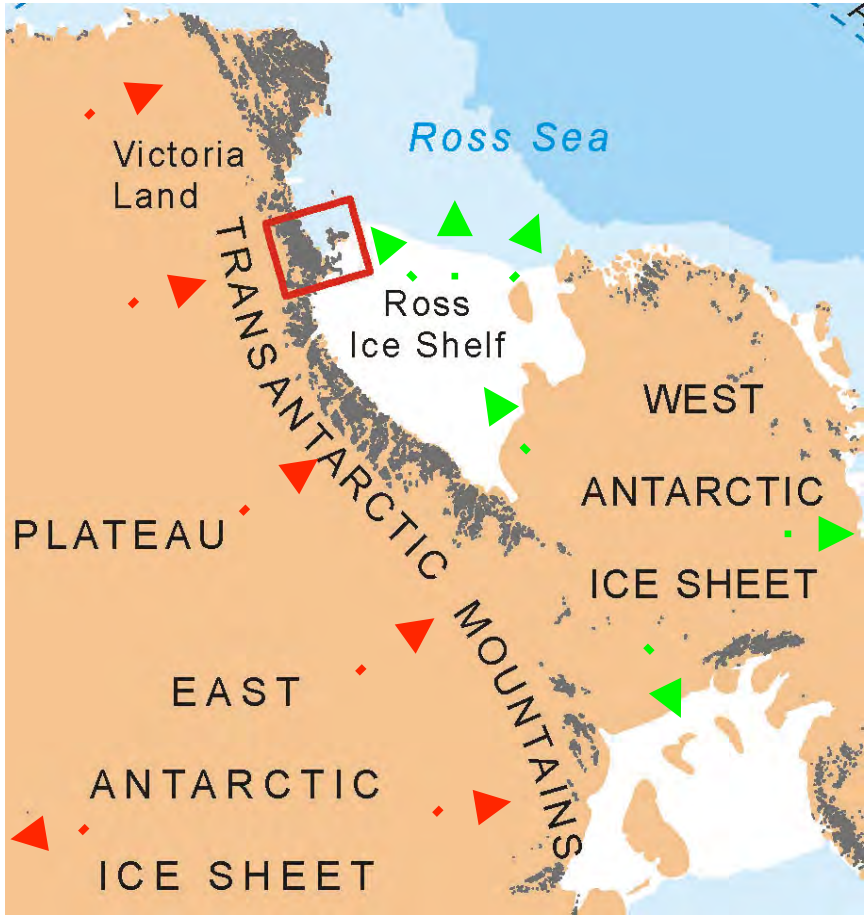
Dataset pinpointing the locations of deposits and indicating their mode of formation, age, and likely source.

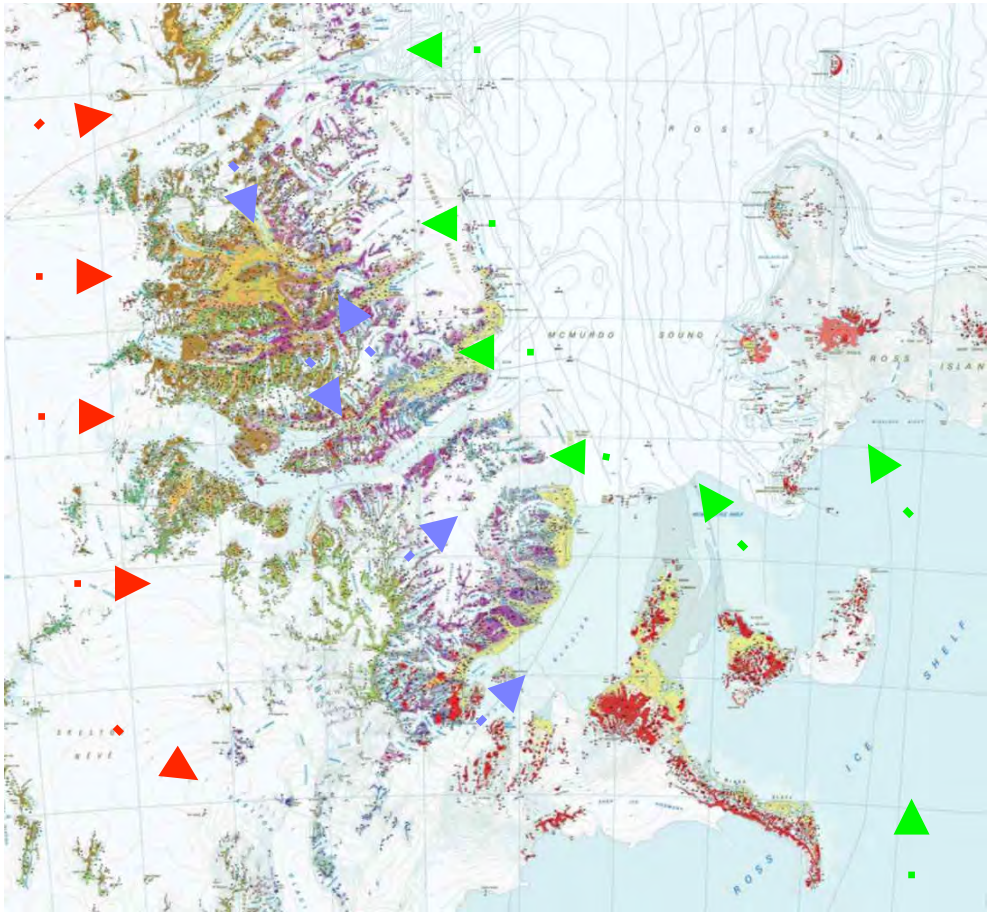
Dataset to provide key underpinning information on the Antarctic geosphere and its history!

For constraining biological and ecological research, identify geoindicators of climate change, improved understanding of Antarctica's climate role.

TAM Record of Three Glacial Systems

- EAIS
- WAIS
- Local





Legends

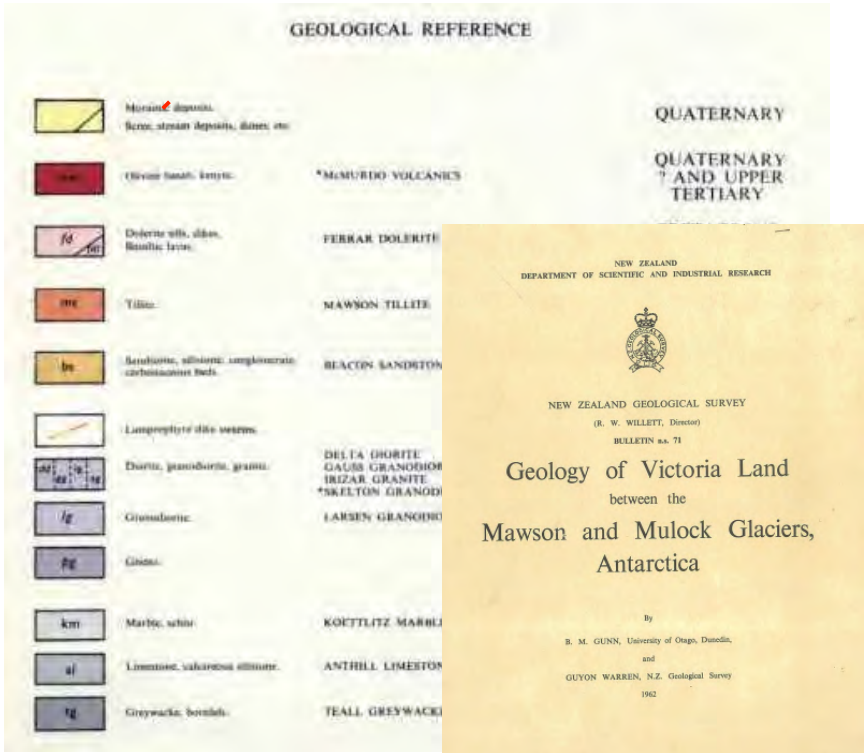
QMAP 2012

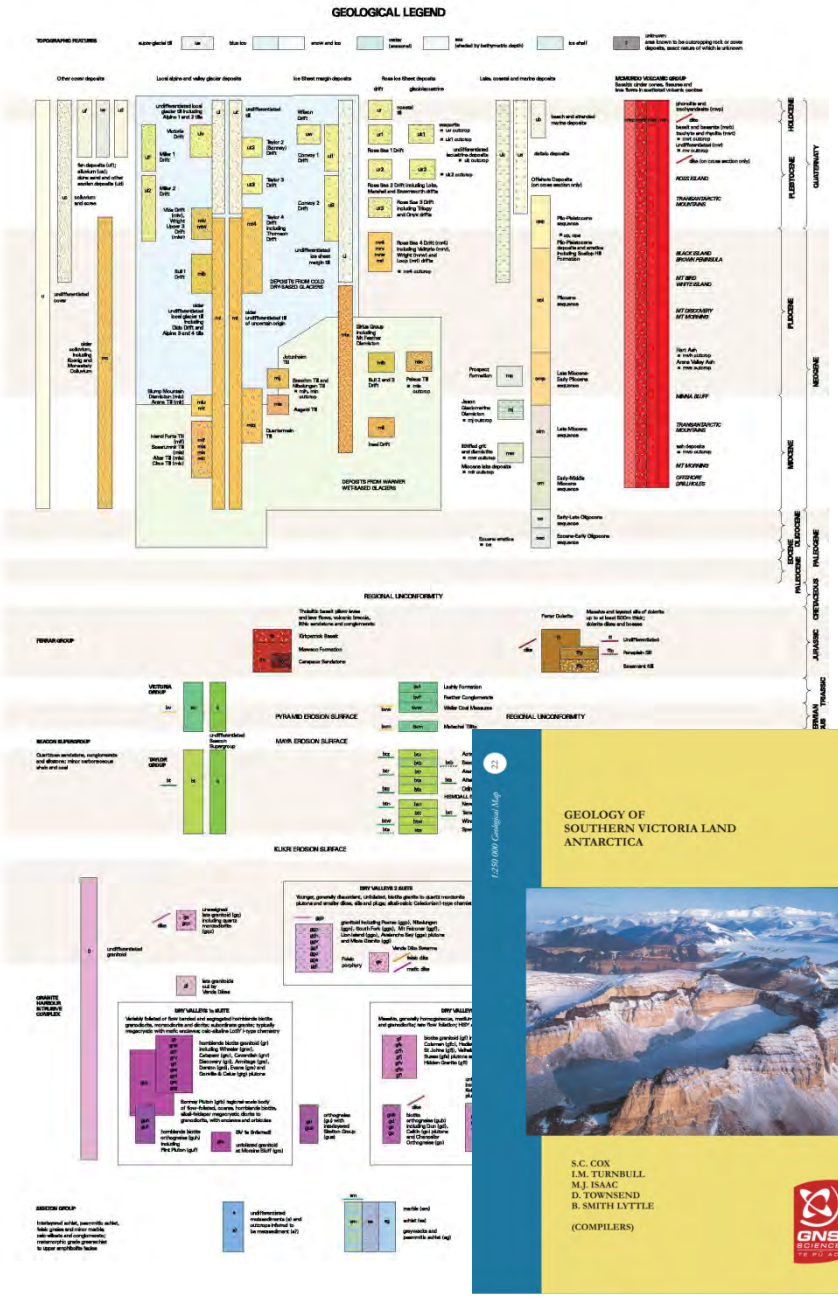
> 70 units

South Victoria Land

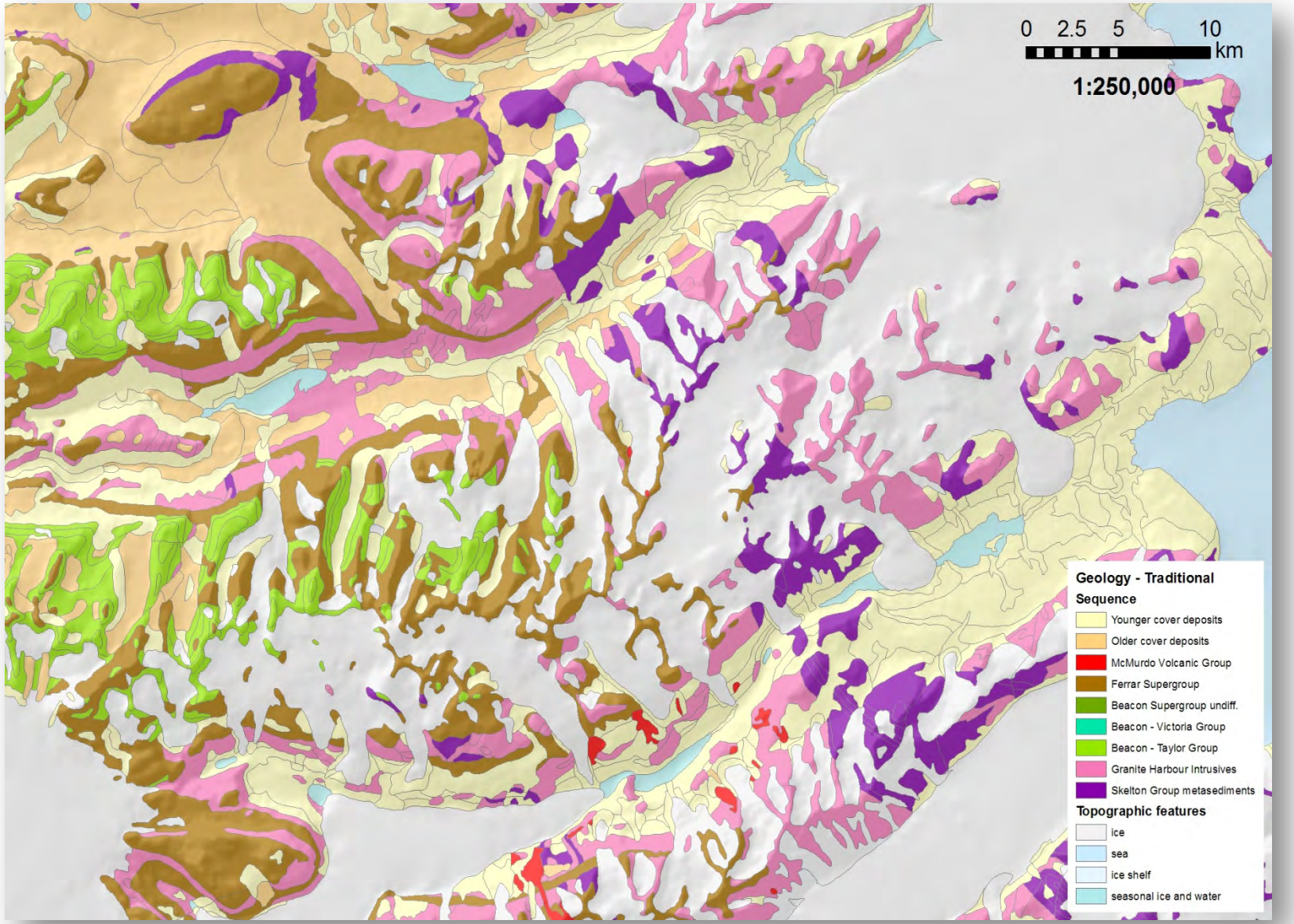
2 surficial units

Gunn & Warren 1962

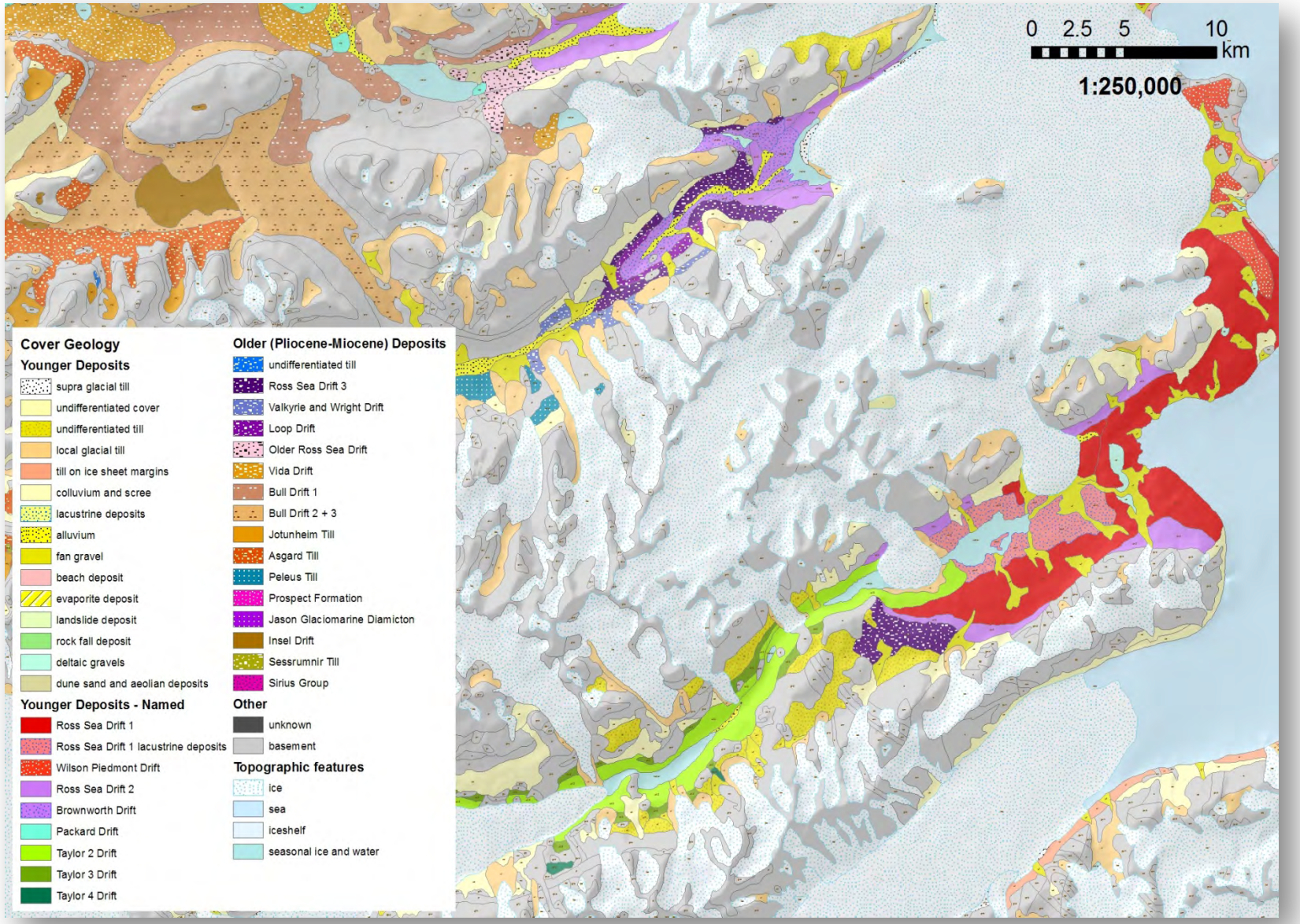




Example: Simplified Traditional Display



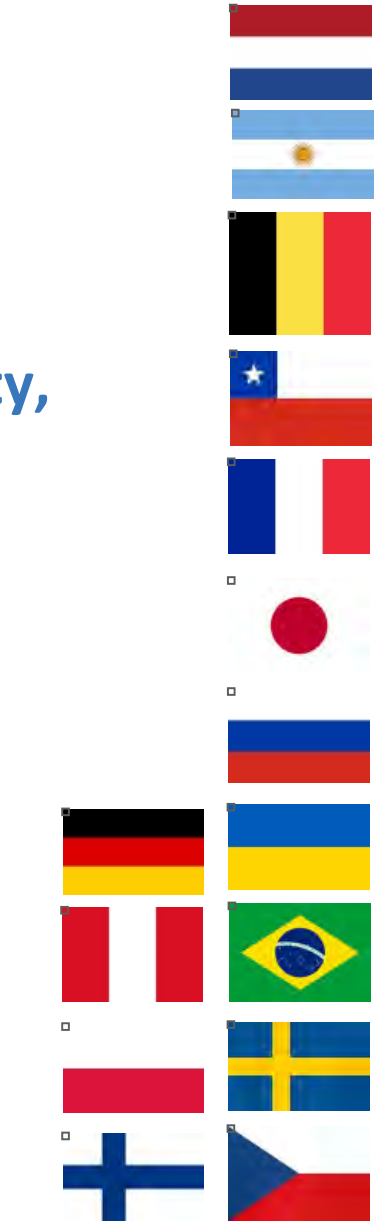
Example: Non-traditional display utilising GIS



Now Involved

GeoMAP Action Group

Yet to welcome



Integrated programme to capture existing geological map data, update its spatial reliability, improve representation of glacial & cover sequences, and deliver data via web-feature services.

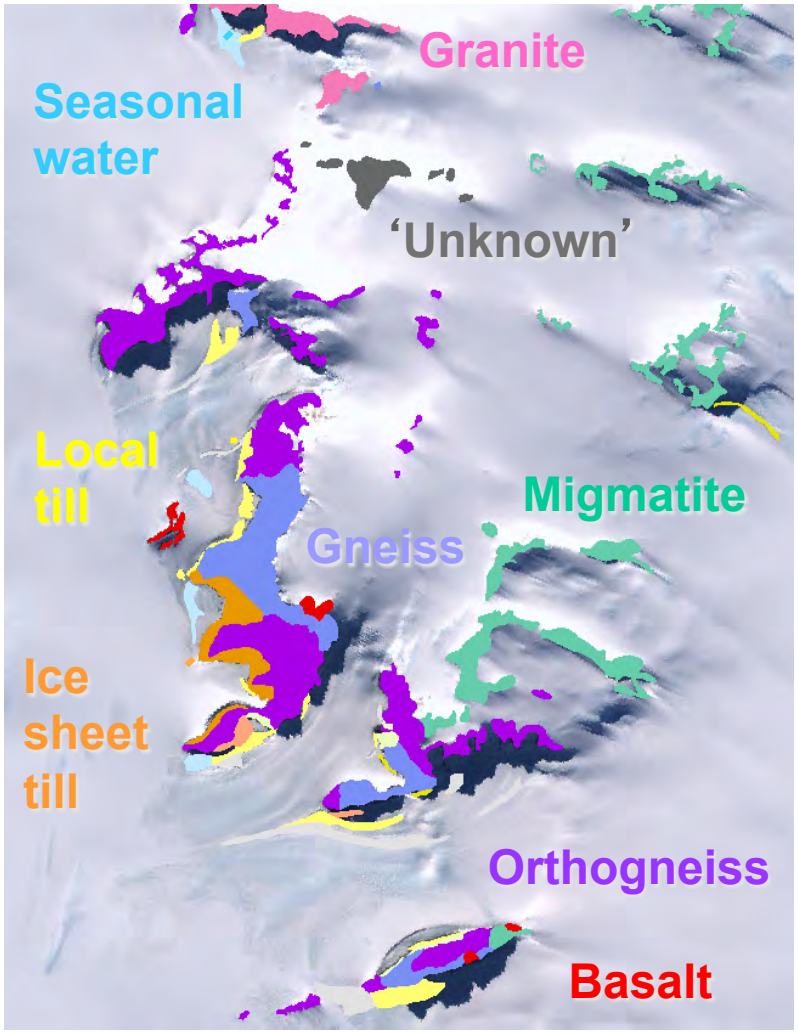
Proposed and accepted at SCAR 2014.

International representation solicited.

First workshop to held in Goa at ISAES XII meeting, 12 July 2015.

More people/countries welcome!

GeoMAP



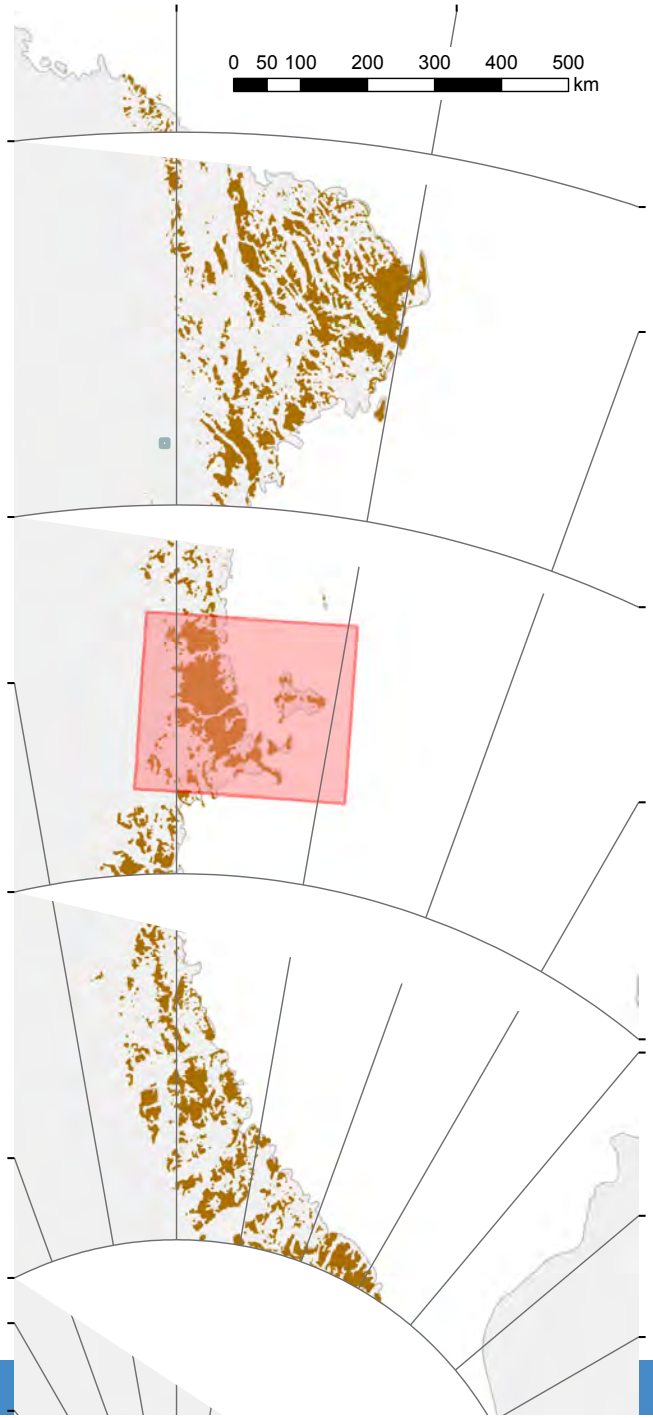
GOAL

Provide a dataset aimed at **cross-discipline** use, or for **continent-wide perspectives**, using a mixed chronostratigraphic- and lithostratigraphic-based classification.

CHALLENGE

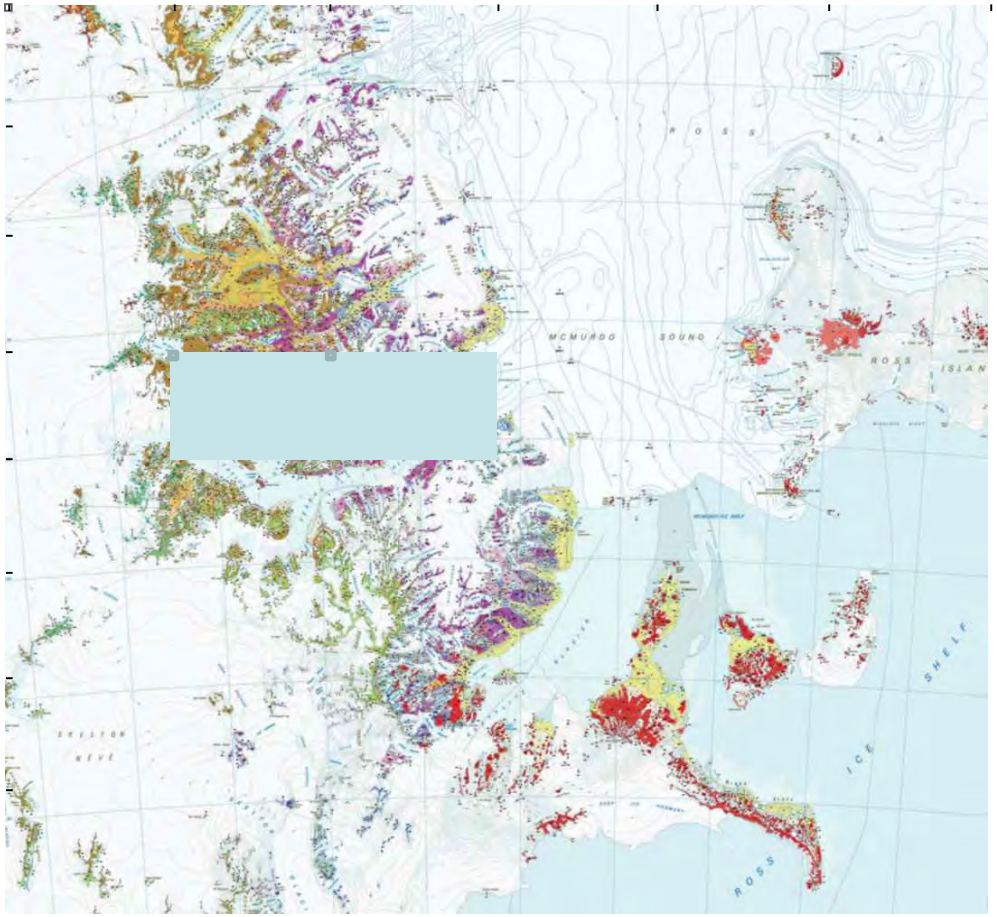
Collaboratively build the first modern geological dataset to classify and describe Antarctica's exposed bedrock and surficial geology.

Classify and describe around 72,000 distinct polygons that cover 51,000 km^2. Luckily its <0.5% of continent!



Philosophical Change

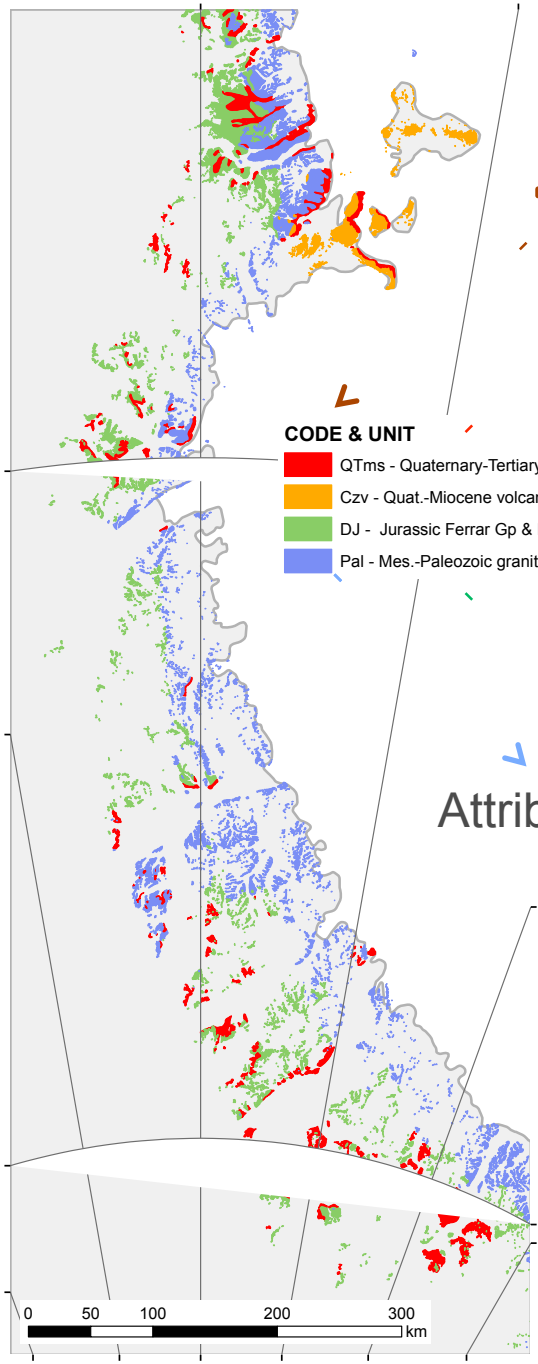
Conventional "bottom up" construction



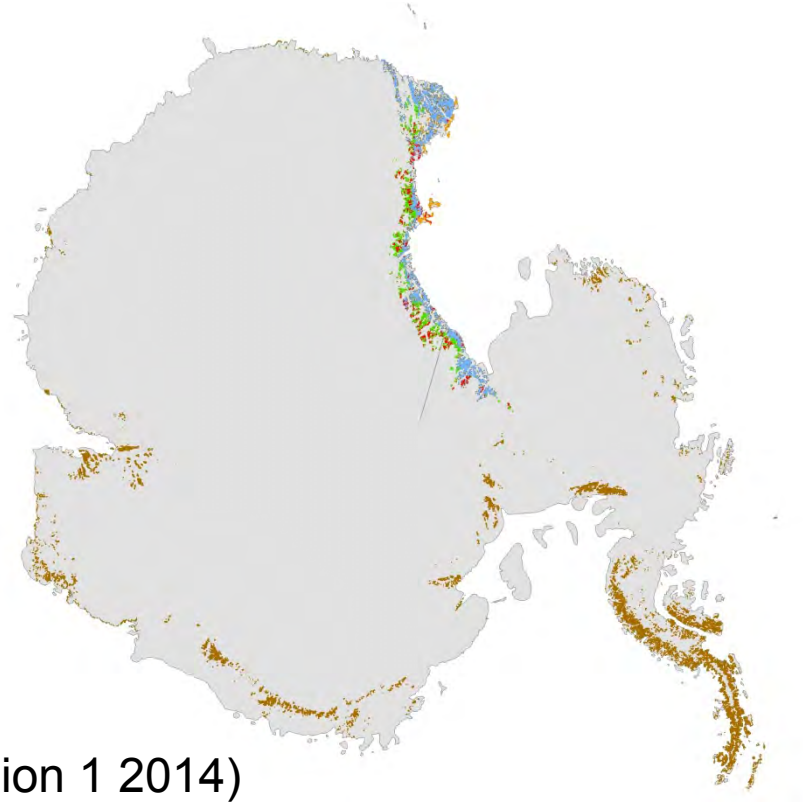
QMAP SVL built from 72 sheets @1:50,000

Philosophy

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

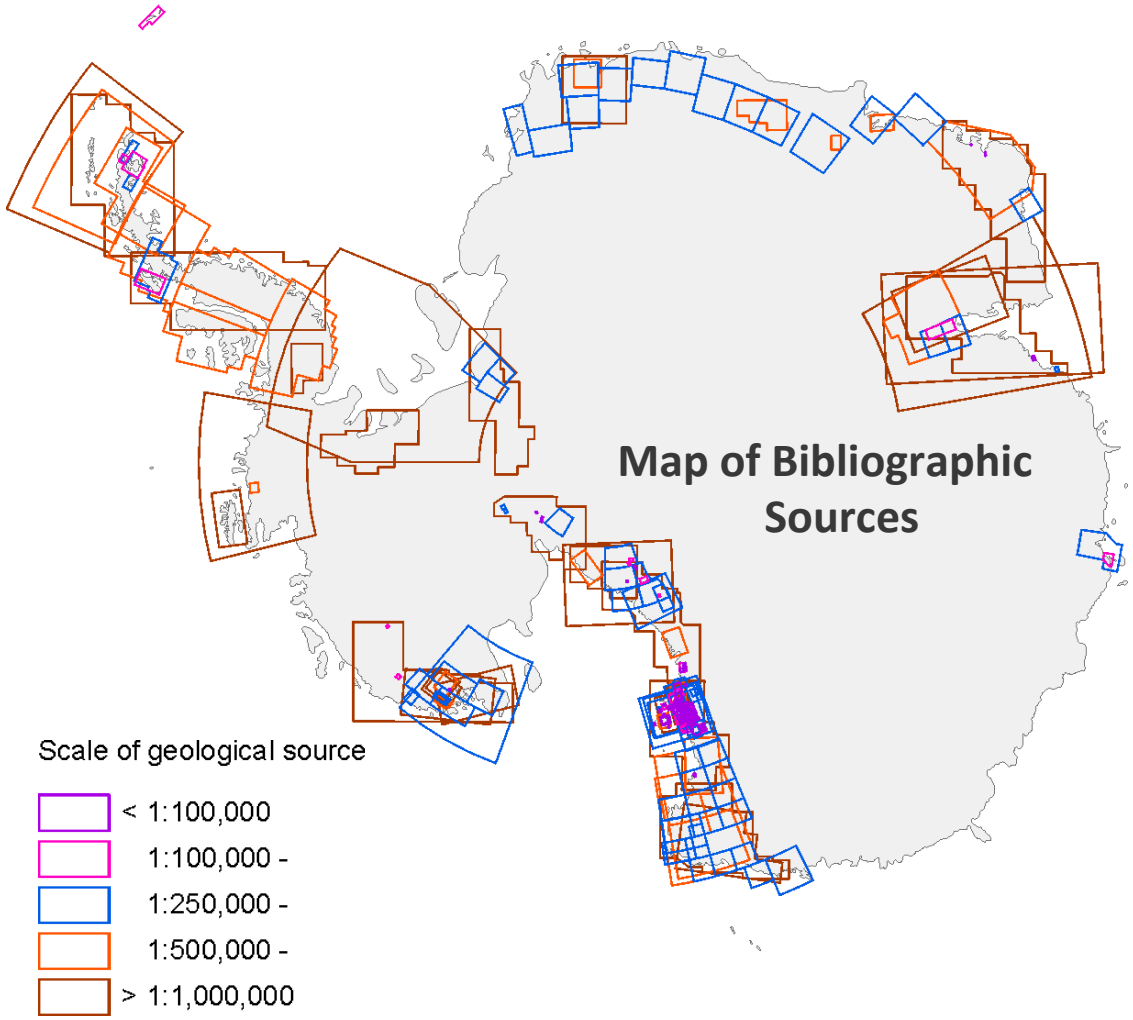


Attributes increasingly complex



geo01 dataset (Version 1 2014)
based on ADD (Version 6) rck01 polygon

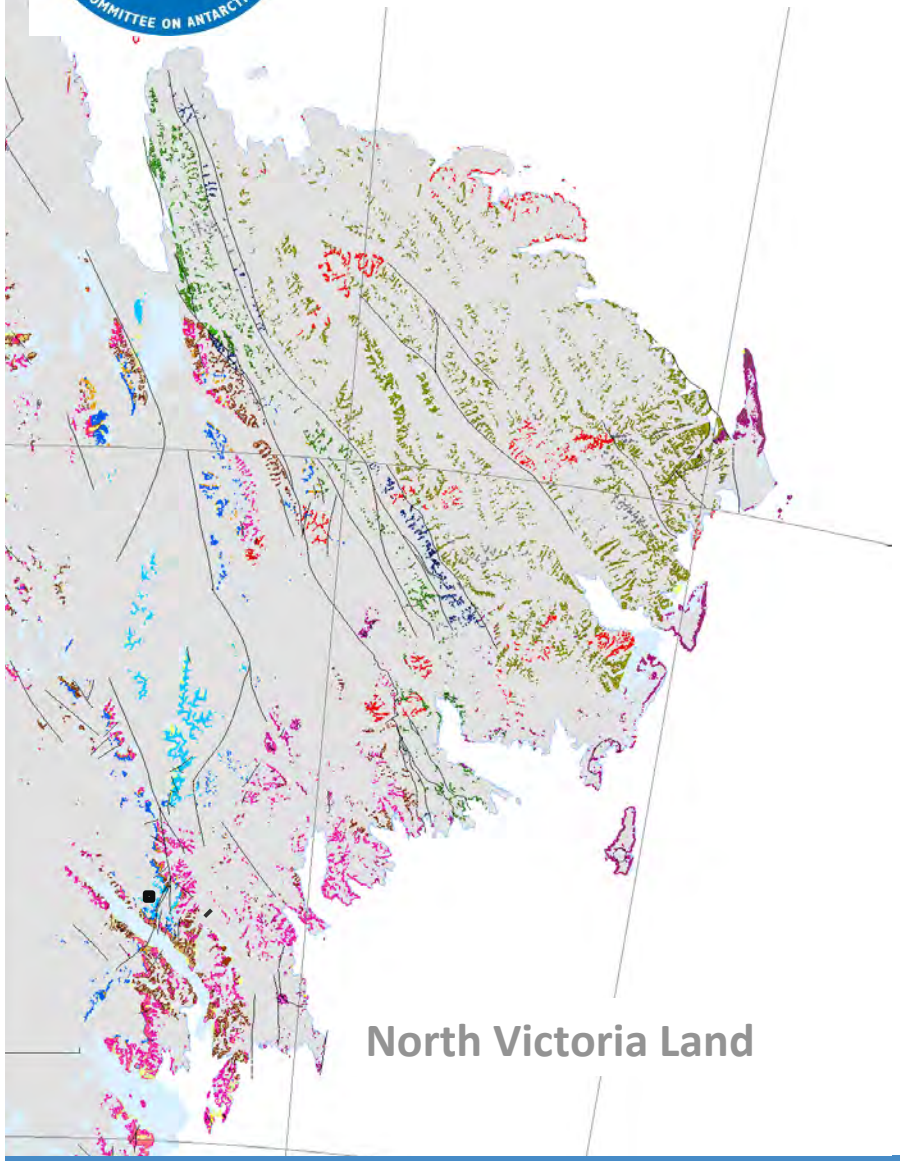
GeoMAP Process Stages 1,2



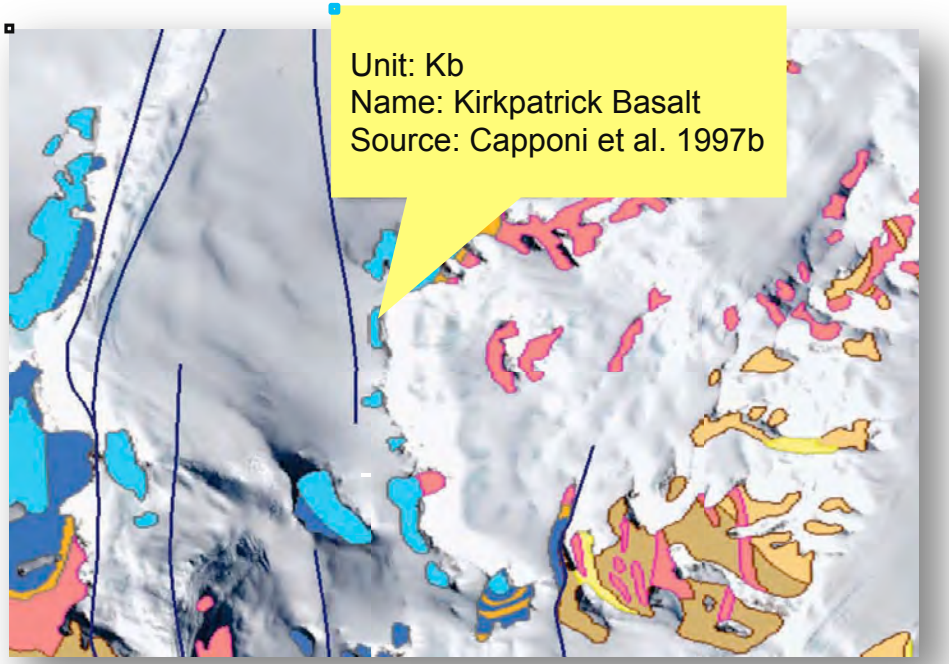
(1)Adjust rock & moraine polygons (ADD00 -> LIMA)

(2)Scan and georegister maps, build source bibliography

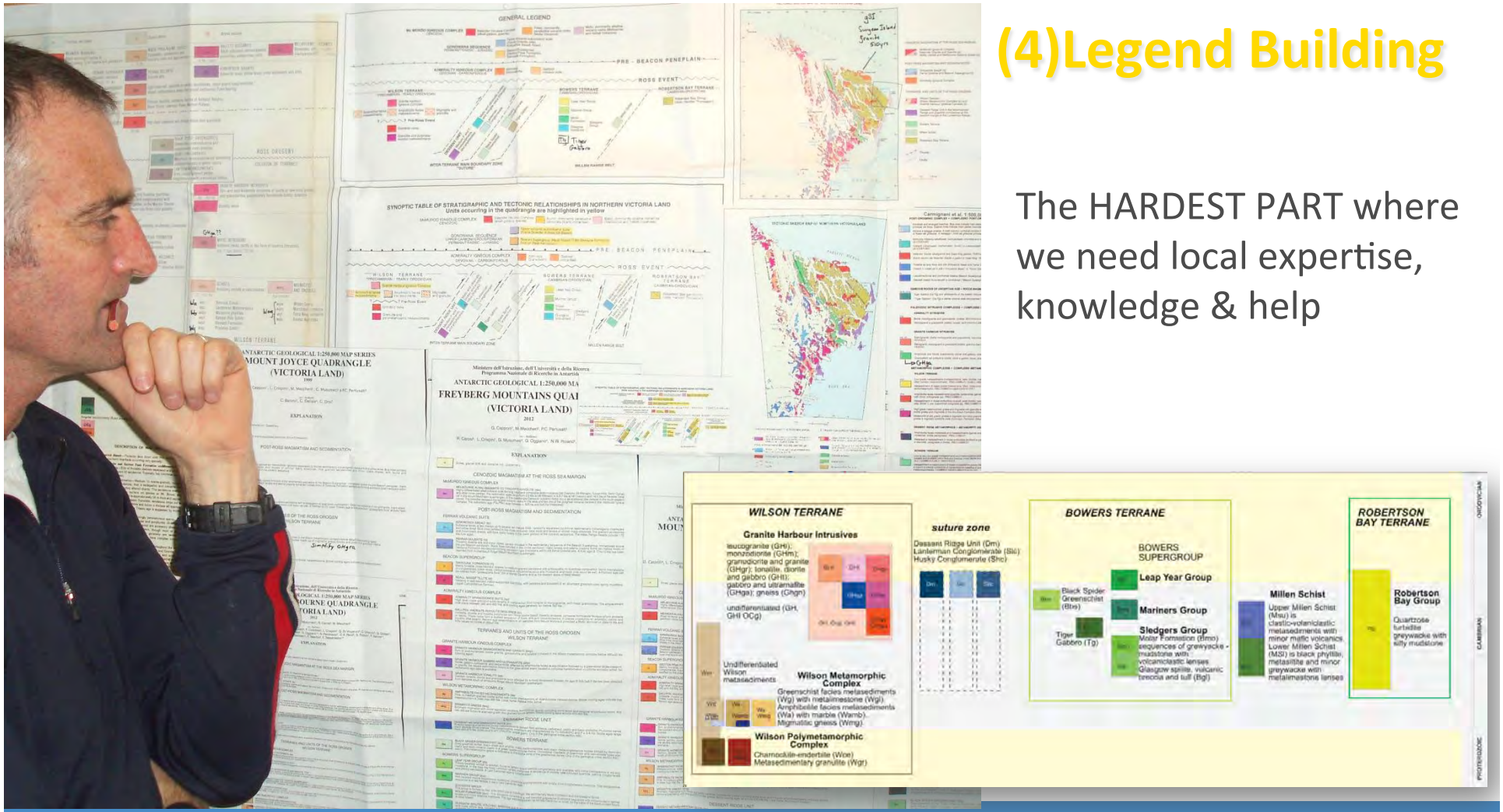
GeoMAP Process Stage 3



(3) Assign each polygon with map classification and source info



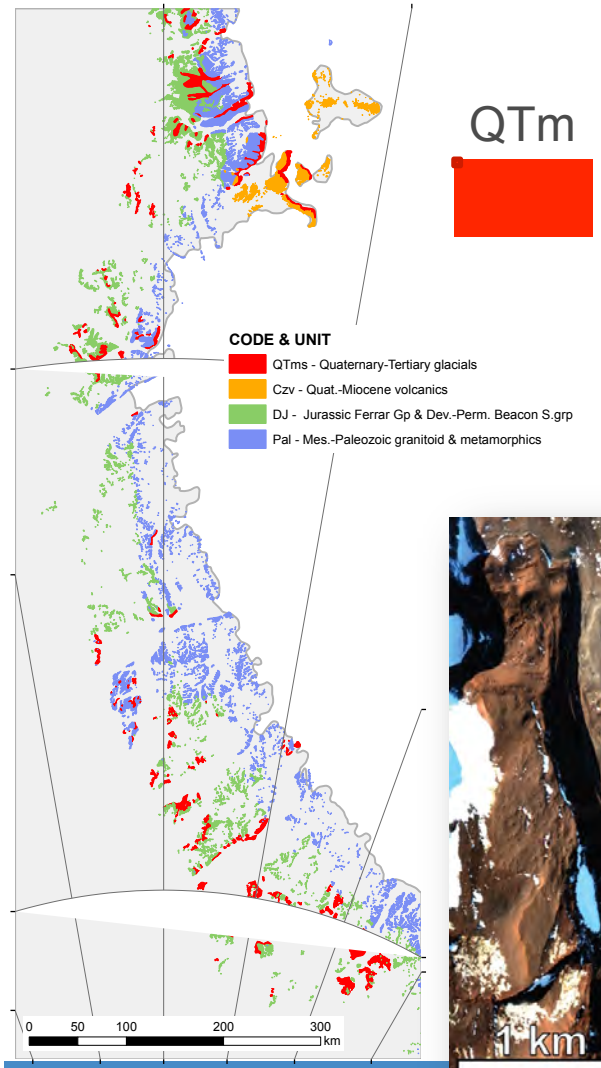
GeoMAP Process Stage 4

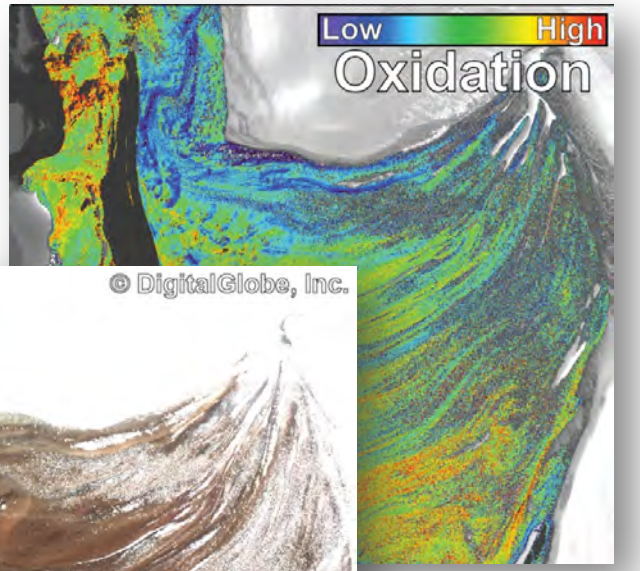


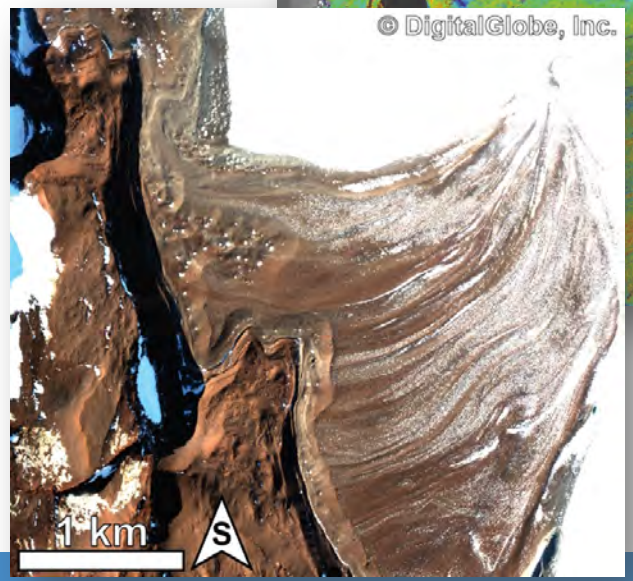
(4)Legend Building

The HARDEST PART where we need local expertise, knowledge & help

GeoMAP Process Stage 5





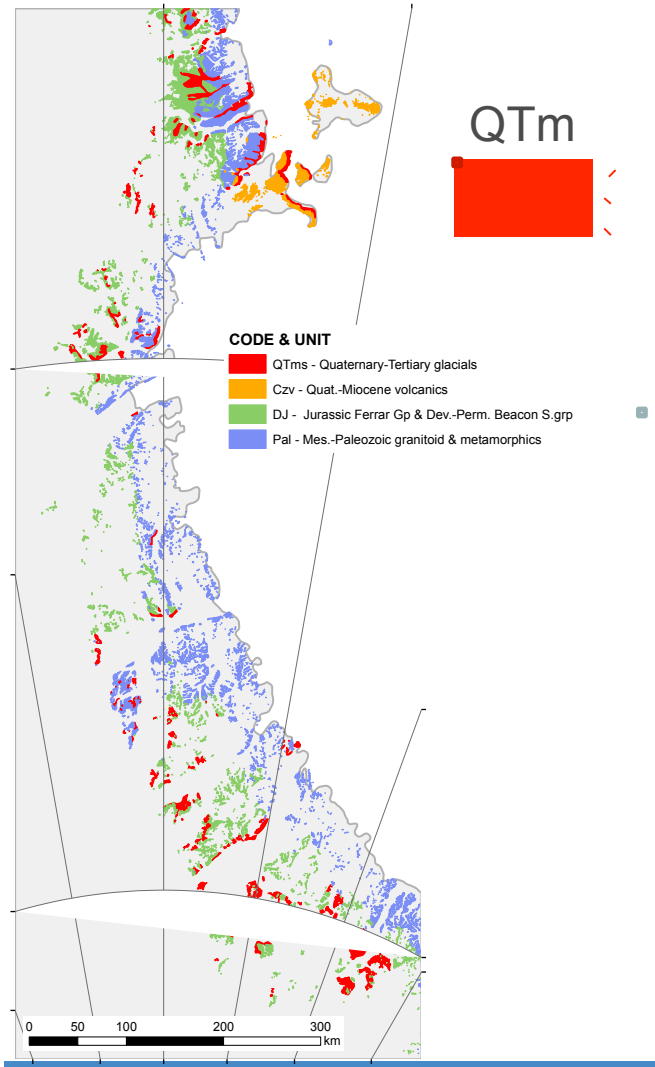


(5)Review Glacial Geology & Cover Sequences

Integrate remote sensing, aerial photos, detailed local studies, to improve precision of regional geology and improve depiction of glacial sequences.

Improve classification of age, composition and source of tills and other surficial deposits.

GeoMAP Process Stage 5



QTm

By Source

Local glacier

EAIS

WAIS

(5)Review Glacial Geology & Cover Sequences

Colluvium Scree

Local alpine & valley glacier tills

Ice sheet margin tills

Ross Ice sheet tills

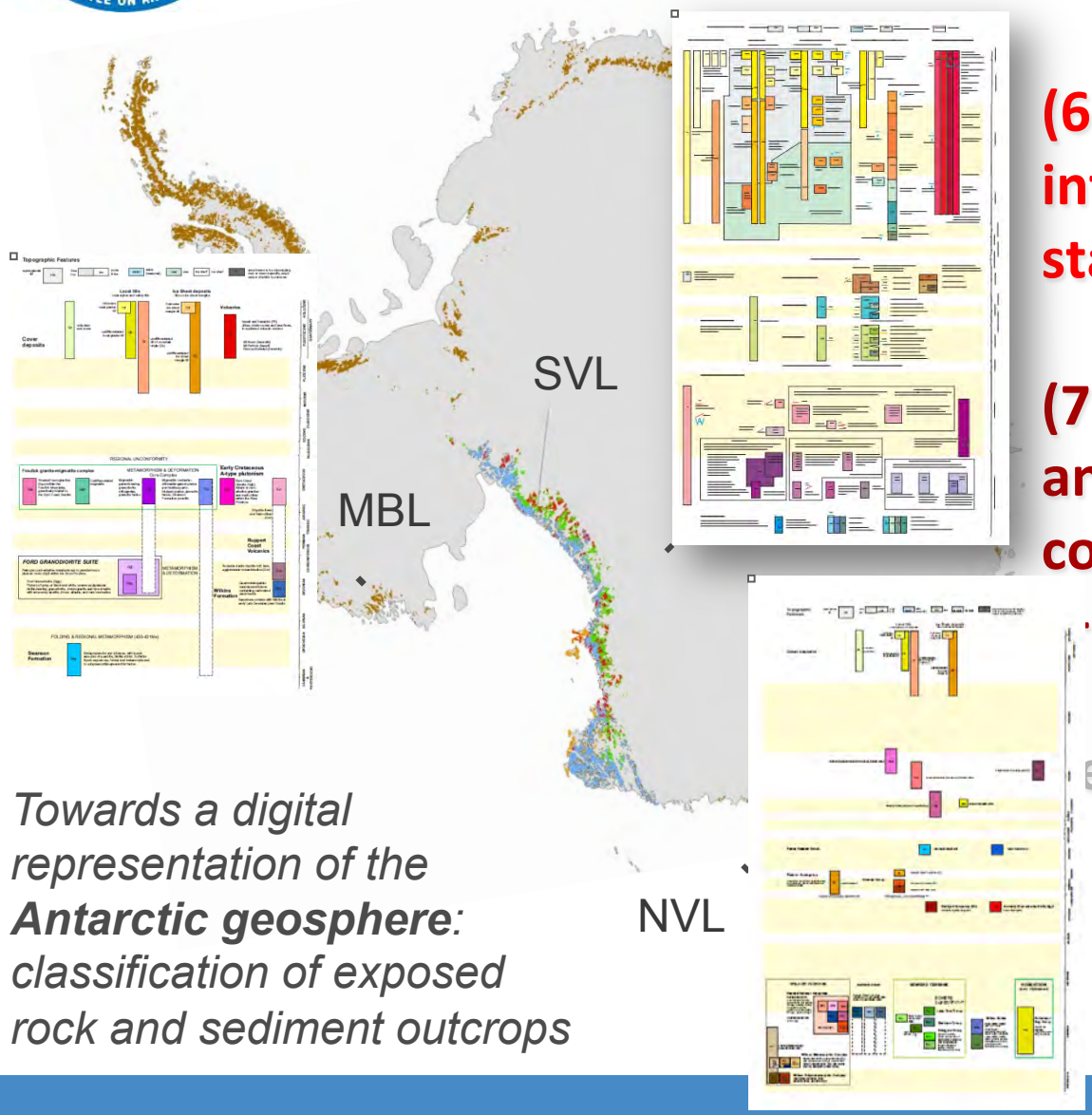
Lake, coastal and marine deposits

AGE

COLDER DRY-BASED GLACIERS

WARMER WET-BASED GLACIERS

GeoMAP Process Stages 6,7



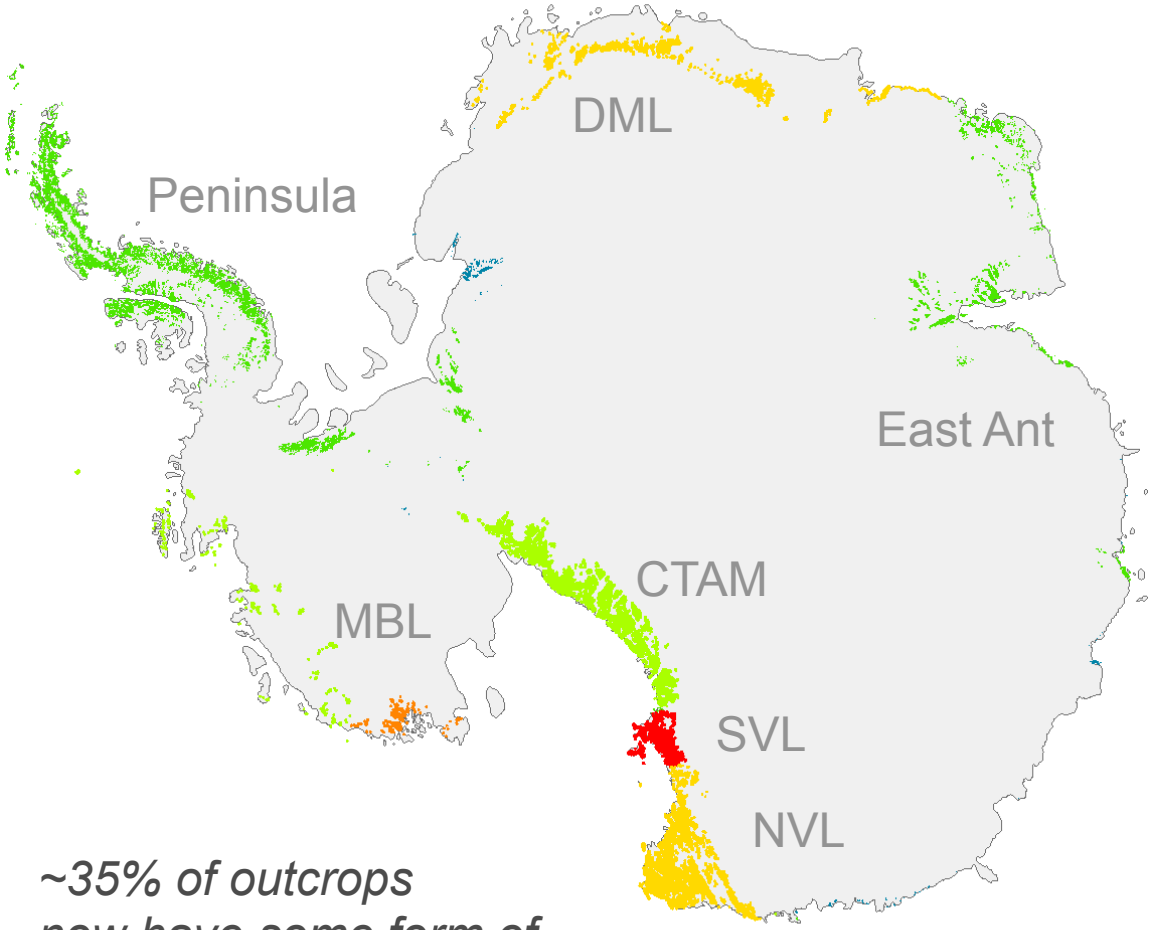
(6)Assign polygons with information using GeoSciML standard

(7) Develop unified legend and coding into seamless continent-wide dataset, peer review, checking)

ersion 1.1 in 2019?

Towards a digital representation of the ***Antarctic geosphere****: classification of exposed rock and sediment outcrops*

GeoMAP Achievements 2014-16



1 Rock and ice polygons

2 Data sources compiled, maps georegistered

3 Rock polygons adjusted, geol. unit codes transferred

4 Legend built

5 Cover geology finalised

6 Attributes assigned, GeoSciML compliant

7 GeoMAP seamless

~35% of outcrops now have some form of digital representation ≥Stage 4 suitable for use at 1:250,000 scale

GeoMAP: Like a spatial Wikipedia of the exposed Antarctic geosphere

Uses: interpretation of sub-ice geology, source characterisation of tills, ice modelling, exploration for geoindicators of climate change, biological and ecological studies, ?????? (and maybe even geology!)

Help Us! The GeoMap team welcomes anyone interested in capturing their geological or geomorphological data, or historical data, from a particular region.

Visit the S20 posters in Ballroom 2 @ 14:00

Contact: s.cox@gns.cri.nz