

## AntArchitecture Meeting, Stanford University, 8 July 2019

In attendance: Robert Bingham (University of Edinburgh; Chair), David Ashmore (University of Liverpool), Don Blankenship (University of Texas at Austin / Montana State University), Julien Bodart (University of Edinburgh), Marie Cavitte (Université Catholique de Louvain), Knut Christianson (University of Washington), Winnie Chu (Stanford University), Riley Culberg (Stanford University), Olaf Eisen (Alfred-Wegener-Institut), Peter Fretwell (British Antarctic Survey), Mark Haynes (NASA-JPL), Nick Holschuh (University of Washington), Daniela Jansen (Alfred-Wegener-Institut), Tom Jordan (Stanford University/ University of Bristol), Nanna Karlsson (GEUS), Edward King (British Antarctic Survey), Michelle Koutnik (University of Washington), Gwendolyn Leysinger Vieli (University of Zürich), Felicity McCormack (University of California Irvine / University of Tasmania), Joe MacGregor (NASA Goddard), Elisa Mantelli (Princeton University), Heinz Miller (Alfred-Wegener-Institut), Francisco Navarro (Universidad Politécnica Madrid), John Paden (University of Kansas), Sergey Popov (St Petersburg University), Wolfgang Rack (University of Canterbury), Martin Siegert (Imperial College London), Matt Siegfried (Colorado School of Mines), Kate Winter (Northumbria University), Duncan Young (University of Texas at Austin).

### 1. Introduction

Members of the room briefly introduced themselves. Rob Bingham provided an introduction and update to the room of the *AntArchitecture* programme so far. For anyone reading these minutes straight from the *AntArchitecture* website:

- *AntArchitecture* was established as a 4-Year SCAR Action Group which aims after 4 years to produce an age-depth model across the Antarctic ice sheet using information from the radar-sounded internal layers cross-calibrated with information from ice cores. The proposal is posted at <https://www.scar.org/science/antarchitecture/resources/>
- A slideshow giving an overview of the programme so far is also posted at <https://www.scar.org/science/antarchitecture/resources/>

### 2. Progress and identification of actions needed with reference to 2017 Edinburgh Report and 2018 establishment as SCAR Action Group

#### a. *Membership – Steering Committee and Wider Group*

The Steering Group to date has consisted of six members, Robert Bingham (Edinburgh), Olaf Eisen (AWI), Joe MacGregor (NASA Goddard), Nanna Karlsson (GEUS), Neil Ross (Newcastle), Duncan Young (UT Austin). This has the advantage of being reasonably small and manageable, but we would also like to expand the reach of *AntArchitecture* to include more input from other dataset-holders, nations and early-career researchers, and also foster greater interaction with the numerical modelling and paleoclimate communities. Part of this may come from new focus groups (see item c below) and part from expanding the steering committee.

Rosemary Nash at SCAR HQ in Cambridge has put together an *AntArchitecture* email list at <https://lists.scar.org/mailman/listinfo/antarchitecture> which can now serve as the group's primary means of communications going forwards.

→ **ACTION (Rob Bingham)** Compose message to cryolist, raising community attention to *AntArchitecture*, encouraging subscriptions to mailing list, and seeking out expressions of interest to join Steering Group and/or focus groups.

#### b. *White paper*

An objective for Year 2 of the SCAR *AntArchitecture* Action Group (i.e. summer 2020) is to publish a white paper in a peer-reviewed journal outlining need for Antarctic internal-reflecting horizons database, potential applications, and methods for achieving it. This can be characterised as a “scoping exercise”. In the meeting we discussed a list of actions needed for progressing this paper:

- i. Compile a table/map of main Antarctic radar datasets containing interpretable englacial layers. Information that would be useful includes: Dataset source (PI / citation); System acquisition parameters; “Quality” of layers. Members of the room noted the following:
    - The exercise has parallels to that conducted for that conducted for the Bedmap programme, so there could be coordination on this aspect of AntArchitecture with Bedmap3.
    - Useful information on system parameters would include: radar bandwidth, frequency, aircraft elevation + information on radar processing, i.e. coherent/incoherent, whether SAR-processed.
    - “Quality” should broadly relate to whether englacial layers are visible in the dataset, and if so over what vertical time range. For a first pass, it may be possible to run the “continuity index”<sup>1</sup> through the data.
    - Ultimately the final map would show both where there is information to analyse, and also where new surveys need to be targeted towards acquiring information on the internal ice-sheet structure.
    - There was debate about whether “shallow layering” should also be considered a component of this initiative. It could be, and there are data processing techniques used in the shallow-layer community that could be very valuable, but the main focus for the 4-year SCAR Action Group will be “deep” (i.e. throughout the ice column) layers.
  
  - ii. Compile a table of main applications/users of englacial layering information (largely a literature review exercise, and will require some engagement with numerical modelling / palaeoclimate communities).
  
  - iii. Compile a list of different approaches used so far to trace or characterise information from englacial layering (largely a literature review exercise).
    - It was noted that both Nick Holschuh/Nanna Karlsson, and Richard Delf with Dustin Schroeder and Robert Bingham have begun this process in *AntArchitecture*-motivated dataset-comparison initiatives. Meanwhile several further presentations in the conference in the week ahead will present some further techniques using e.g. machine learning.
  
  - iv. Upgrade SPRI Folio Map<sup>2</sup> on englacial layering across Antarctica.
- **ACTION (Rob Bingham)** Liaise with Peter Fretwell, Bedmap3, and Mathieu Morlighen (BedMachine) on information gathering per dataset.
- **ACTION (t.b.c.)** Divide above tasks i-iii between Steering Committee members, and organise dedicated 1-week writing workshop to draft paper in spring 2020. This should include some representatives from the early-career community, and the ice-sheet / palaeoclimate modelling communities if they have not already formed part of a widened Steering Committee in response to item 2a.

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<sup>1</sup> Karlsson et al. (2012) EPSL <https://www.sciencedirect.com/science/article/pii/S0012821X12002014>

<sup>2</sup> [https://www.dropbox.com/s/ud8zumtuhw67ovh/SPRI\\_Folio\\_Internal\\_Layers.pdf?dl=0](https://www.dropbox.com/s/ud8zumtuhw67ovh/SPRI_Folio_Internal_Layers.pdf?dl=0)

### c. *Focus Groups*

It was suggested to originate two focus groups representing, respectively, **data types** and **applications**, whose first tasks will be to contribute materials and ideas towards the *AntArchitecture* white paper, but which will form advisory groups as the database builds up.

Nanna Karlsson, Nick Holschuh and Duncan Young registered interest in forming a *data-types focus group*, whose remit will be to identify best formats and practices for lodging and storing data.

- **ACTION (Holschuh/Karlsson/Young)** Assemble community of RES data providers; compile list of available data formats and advantages/disadvantages; host discussion on possible formats/practices for lodging/storing data.

Olaf Eisen, Joe MacGregor, Gwendolyn Leysinger Vieli and Marie Cavitte all registered interest in leading an *applications focus group*, whose remit will be to compile from the ice-sheet and palaeoclimate modelling communities what information (and in what format) is most useful in glacial architecture.

- **ACTION (Eisen/Leysinger Vieli/MacGregor/Cavitte)** Mobilise modellers to request what information is useful from glacial layering? Traced layers? Layer gradients?

## 3. Use of SCAR Action Group funds

Thanks to generous support from the International Glaciological Society and sponsors of the Stanford Radioglaciology meeting, an initial intention to use some of the funds to help early-career researchers attend the Stanford Meeting was rendered moot. The group therefore has USD 4,000 outstanding to devote to *AntArchitecture* activities over the next year. In the meeting it was agreed that these funds should primarily be directed towards a writing workshop to ensure progress of the *AntArchitecture* white paper (the key objective for the end of Year 2), and any surplus could be used to aid key members of the consortium attend the SCAR Congress in Hobart in 2020.

## 4. Publication acknowledgements and posting on *AntArchitecture* website

Some papers of direct relevance to *AntArchitecture*, and perhaps are even motivated by it, are now being published or are close to submission, e.g. Winter et al. (2019) *Earth System Science Data*. The room discussed whether *AntArchitecture* should have some set text for paper acknowledgements. Since the programme is not at this stage funding science, the suggested wording is: "Aspects of this work were inspired/motivated/stimulated by the Scientific Committee for Antarctic Research *AntArchitecture* community."

It was also suggested that upon publication of relevant papers, authors notify Robert Bingham [r.bingham@ed.ac.uk](mailto:r.bingham@ed.ac.uk) so that links to the papers can be posted on the *AntArchitecture* website.

## 5. AOB

### a. *Next meeting(s)*

The next formal assembly of the *AntArchitecture* community will take place at the SCAR Congress in Hobart in 2020. At this meeting we will report back to our SCAR sponsors on progress. Duncan Young

raised whether *AntArchitecture* will try to propose a session at the Hobart Congress. This may be challenging, given that the sessions tend to be more general, but we can coordinate co-convening or targeting particular sessions – perhaps of most use if reaching out to the modelling / palaeoclimate communities.

There is no formal *AntArchitecture* presentation at the SCAR ISAES Congress in Incheon in July 2019, but Dustin Schroeder and Duncan Young will be in attendance and will speak for *AntArchitecture* where relevant.

**b. *Englacial-layer naming conventions***

Prompted by David Ashmore, the room had some discussion over potential naming conventions for traced layers/surfaces as *AntArchitecture* progresses.

There was some thought that a naming convention based on TWTT (two-way travel time) of layers at a key point, say Byrd or WAIS Divide for West Antarctica, could be a worthwhile approach.

An alternative approach might be to name layers, e.g. following the example of “Old Faithful”, essentially to avoid complexities associated with transferring between different sets of data/processing.