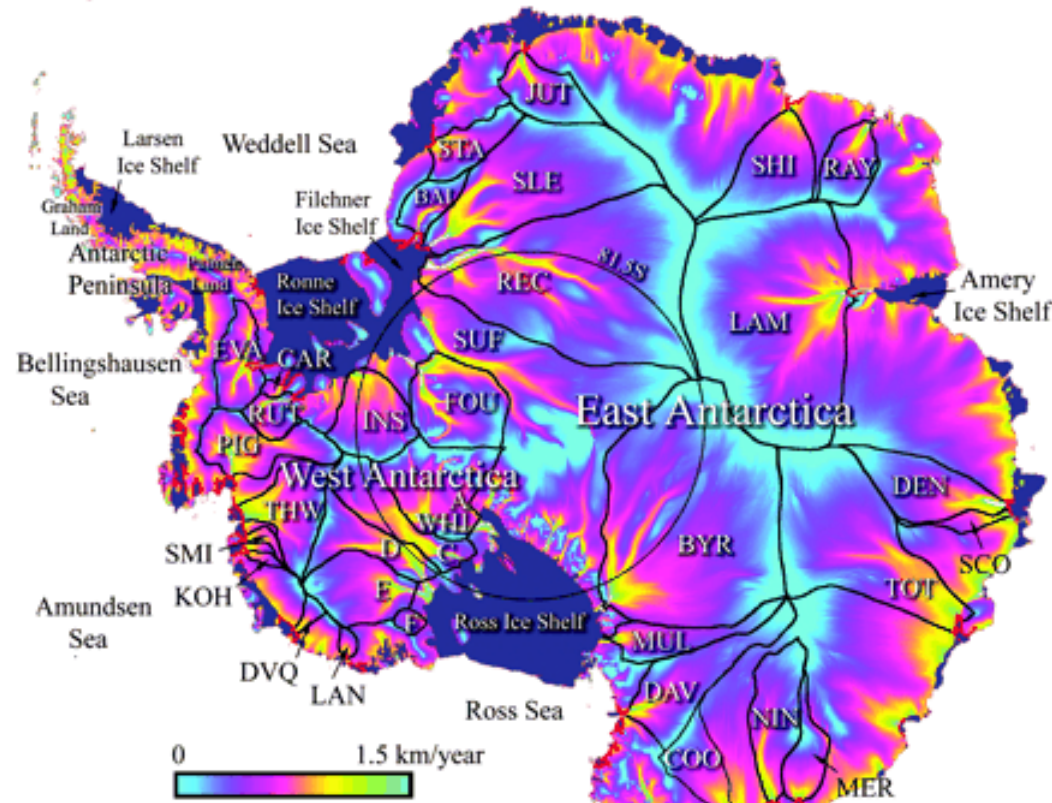
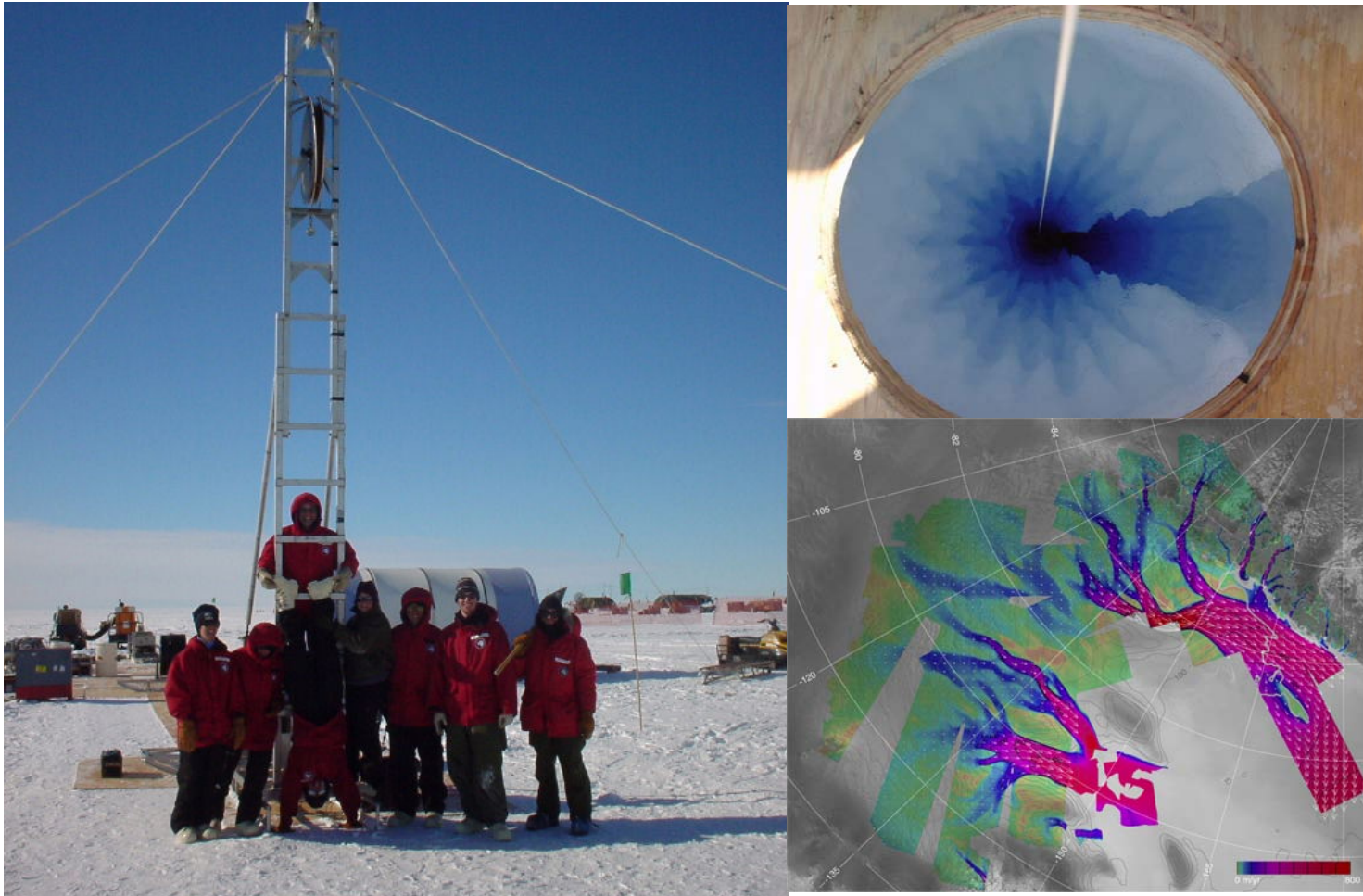


Drilling for ice dynamics and glacial history



Rignot and Thomas [2002]

- fast-flowing outlet glaciers and ice streams exert strong control on mass balance;
- slow-moving ice contains records of past flow (as well as climate).
- drilling in regions of both fast- and slow-moving ice is needed to understand and predict dynamic responses to future possible environmental forcing

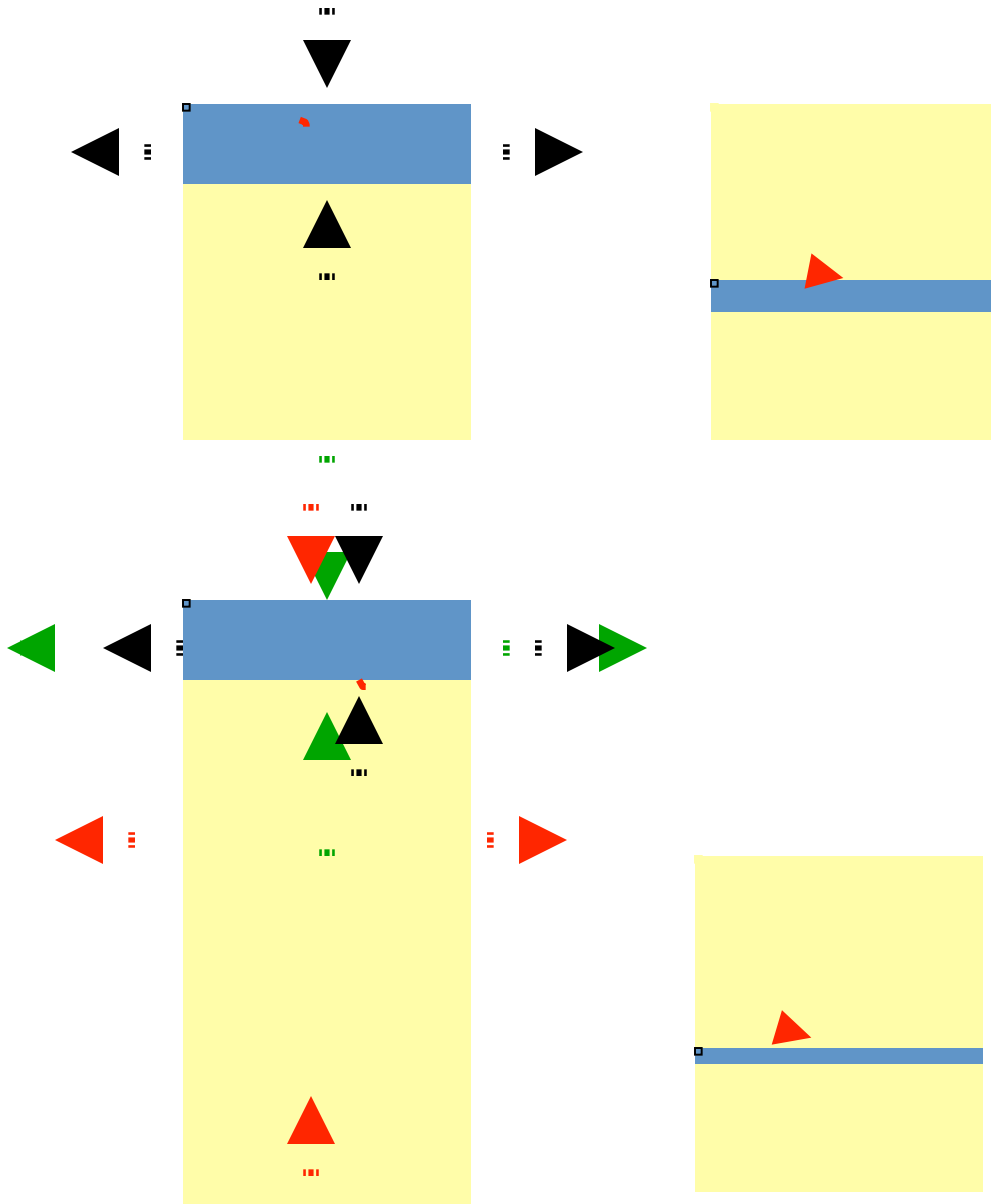


Urgent need for drilling of targeted locations to understand the dynamics of fast-flowing outlet glaciers and ice streams

The technology is not new:

- Swiss hot water drill used to probe Jacobshavn Isbrae
- Caltech hot water drill used to probe the beds of the Ross Ice Streams
- UAF hot water drill used to probe Black Rapids Glacier, Pine Island Glacier

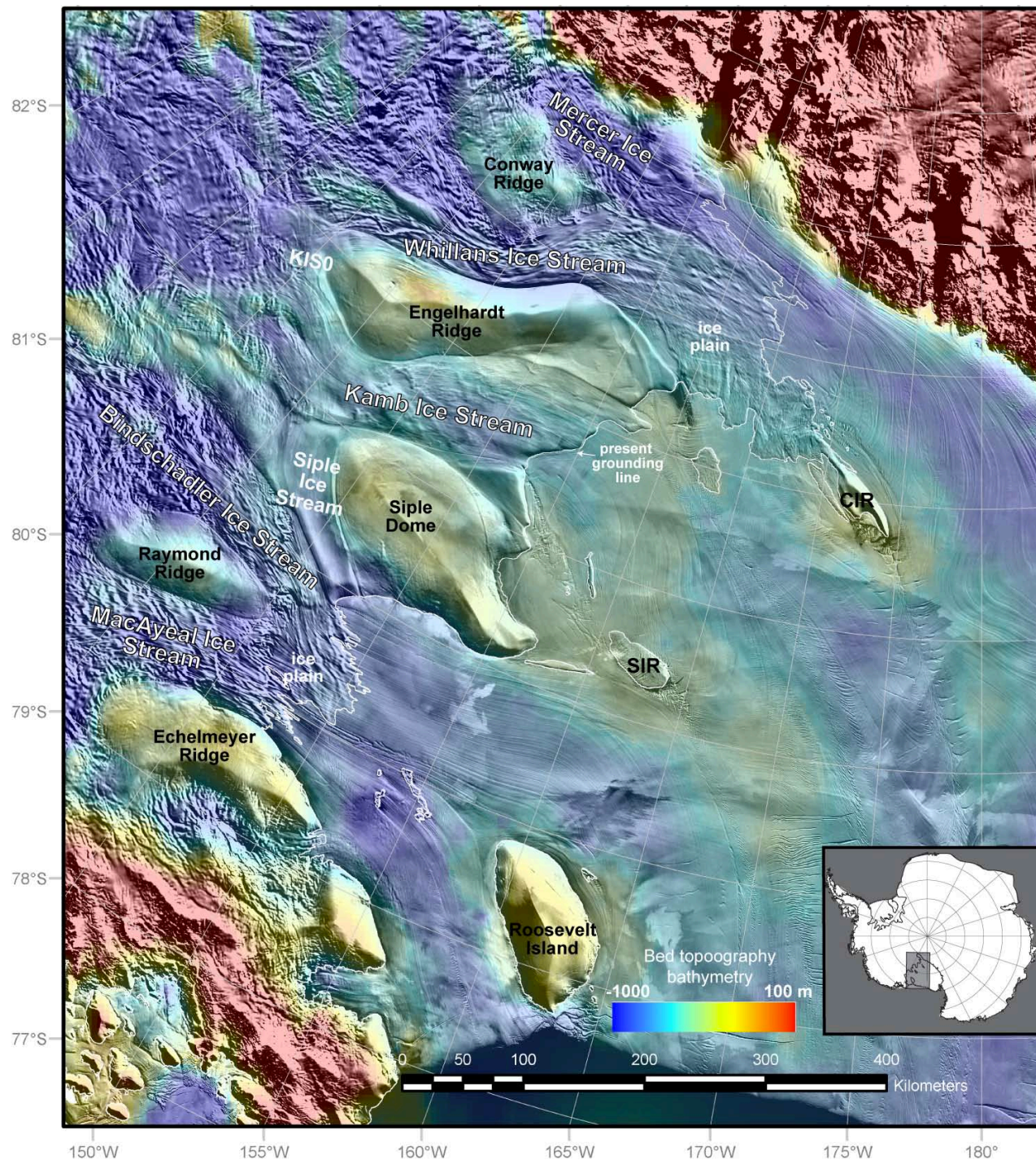
Histories of ice dynamics contained in slow-flowing ice (records are swept away in regions of fast flow)



- Layers get thinner in steady flow

- Layers get thinner even faster when entire ice sheet is also stretched and thinned

- i.e. the depth-age relationship contains a record of ice sheet thinning



Histories from depth-age data from coastal domes:

Siple Dome

– drilled by USAP; results show it thinned 300m ~14kys ago (Waddington et al., 2005; Price et al., 2007)

Berkner Island

- drilled by BAS

James Ross Island

- drilled by BAS

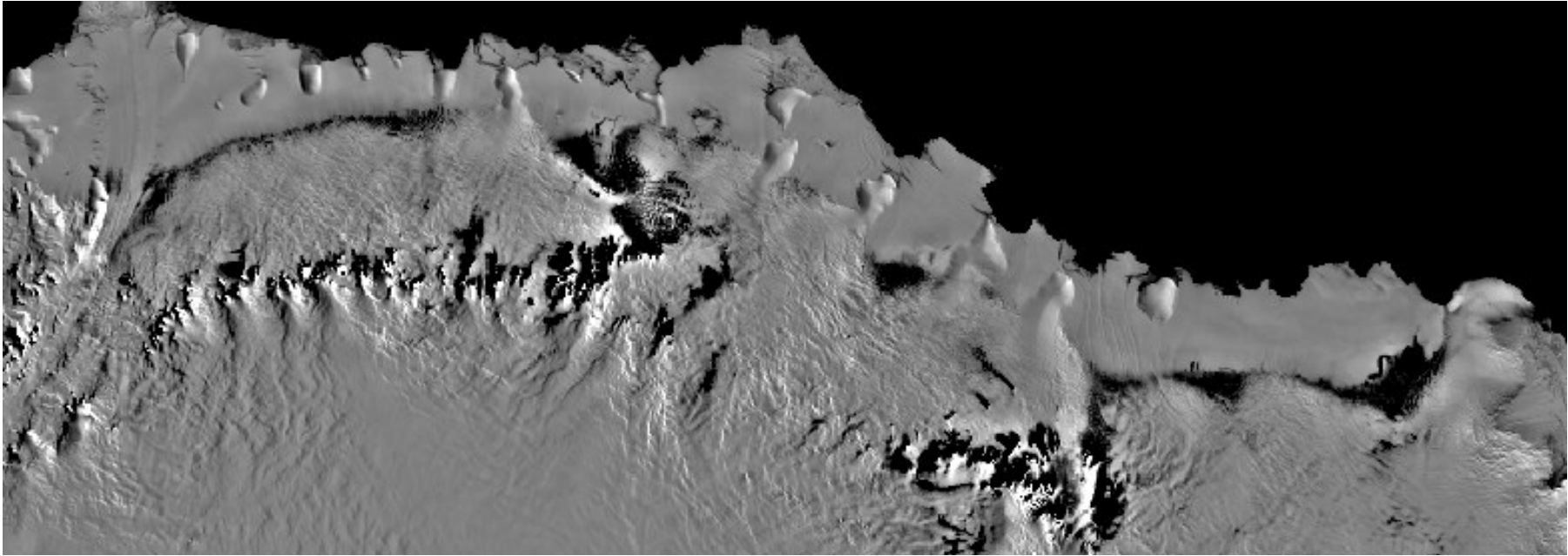
Law Dome

- drilled by Australian Ant Program

Roosevelt Island

- drilling by AntNZ starting this year

Many possibilities that could provide “dipsticks” to constrain deglaciation since the LGM



- Dronning Maud Land
- Sulzberger Bay
- Amundsen Sea Embayment
- Antarctic Peninsula

An urgent need for versatile, light-weight intermediate-depth drills for coastal domes

Cosmogenic dating of rock exposures

- rock “dipsticks” that constrain ice extents that were greater than present
- a need to access and sample the bed beneath the present ice in order to constrain past minimum extents.

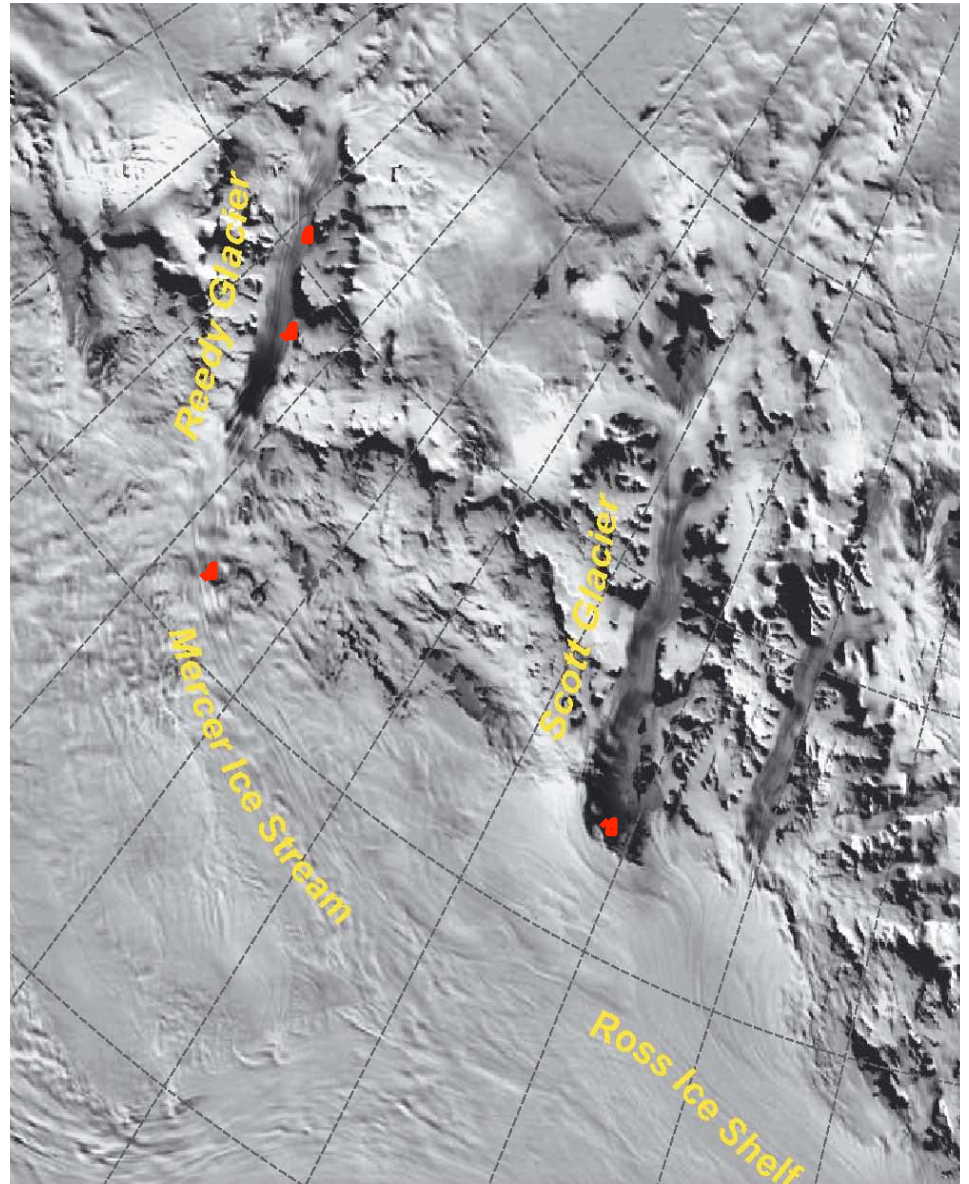
Caloplaca and
Quartz Hills

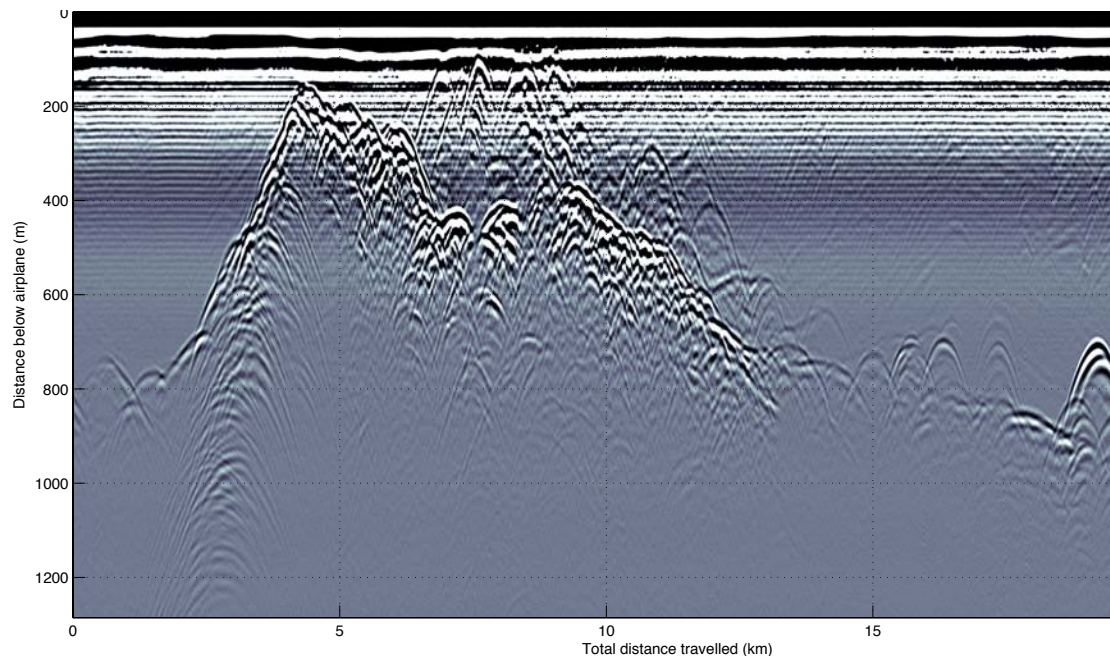


Lower Reedy
Nunataks



Lower Scott
Karo Hills

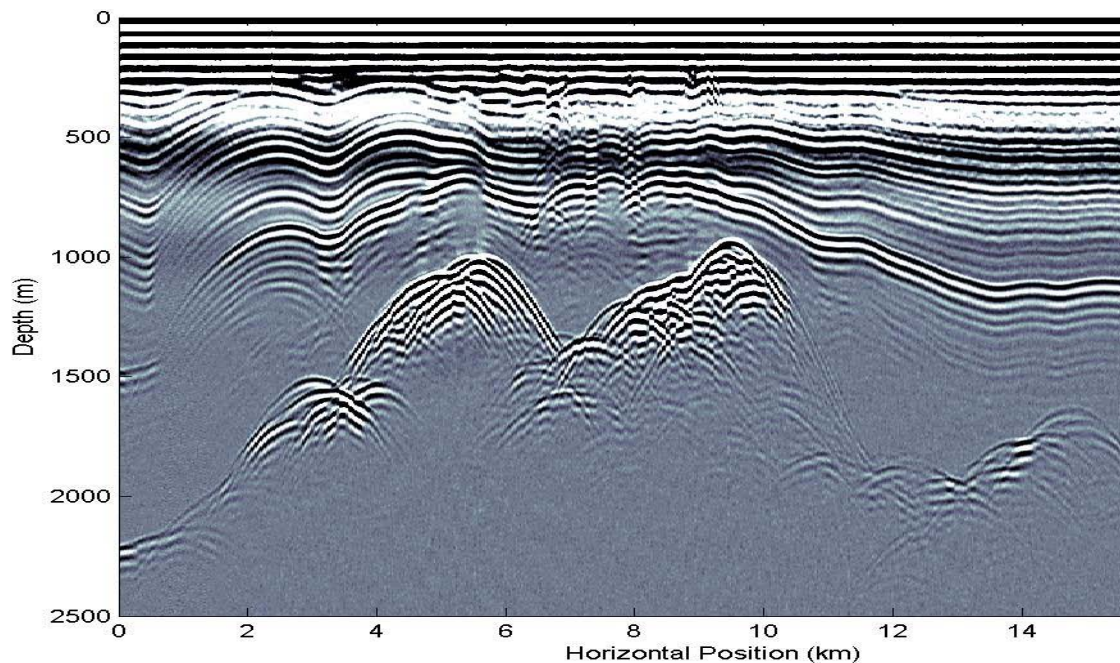




Many possibilities

- need to drill in regions where the bed is frozen

- airborne radar near Mt Hope at mouth of Beardmore (bed is 200-800m below surface)



- ground-based radar across subglacial Mt Resnick ~180km from WAIS Divide (~1000m below surface)

Summary

Drilling for ice dynamics and glacial history requires

1. hot water drilling to access the bed

We have a draft document for science requirements for such a drill; input is needed from others

2. versatile intermediate-depth drills to measure depth-age relationships at targeted locations.

We have a draft document of science requirements for such a drill; input is needed from others

