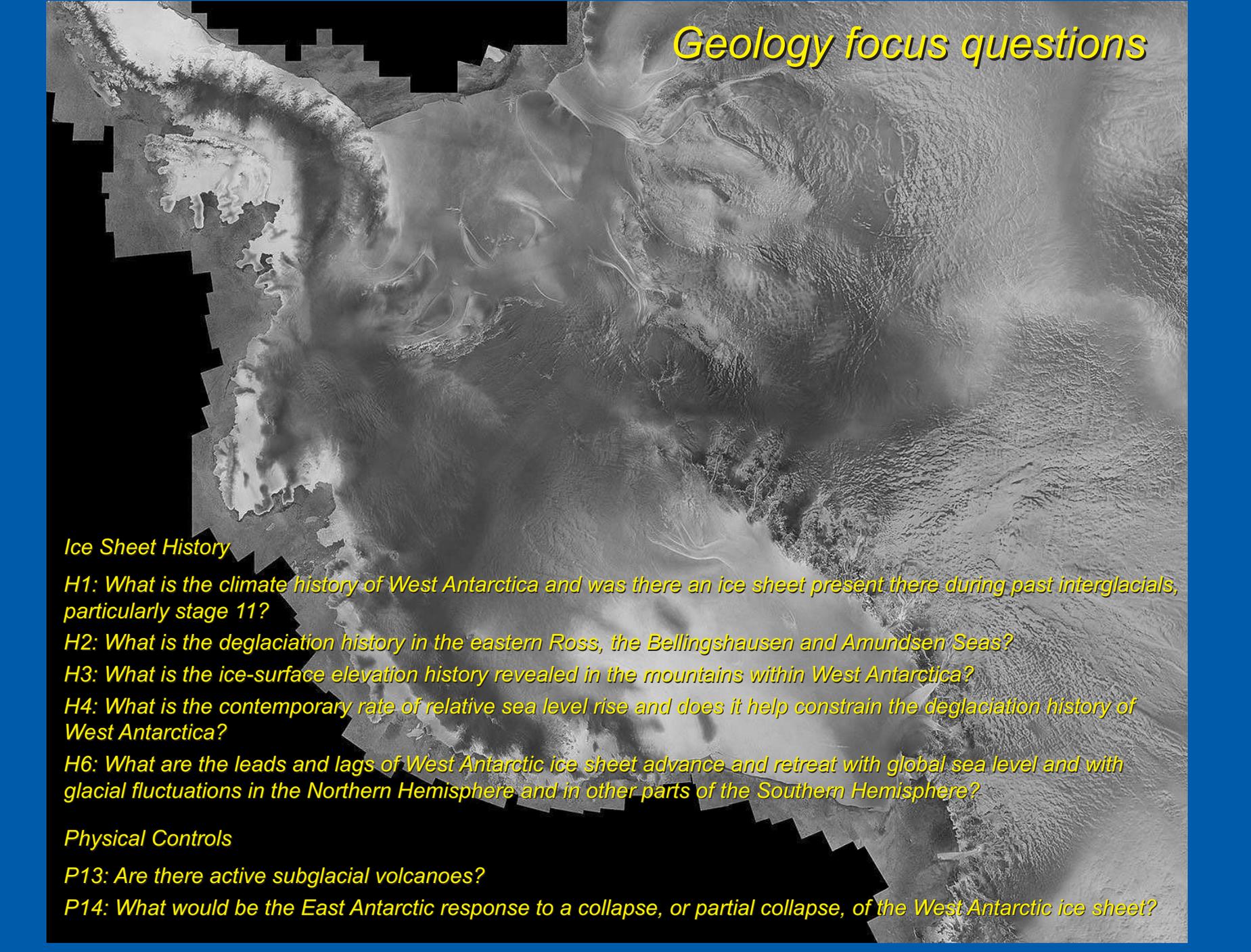


*Geologic History of the WAIS Project*



## *Geology focus questions*

### *Ice Sheet History*

*H1: What is the climate history of West Antarctica and was there an ice sheet present there during past interglacials, particularly stage 11?*

*H2: What is the deglaciation history in the eastern Ross, the Bellingshausen and Amundsen Seas?*

*H3: What is the ice-surface elevation history revealed in the mountains within West Antarctica?*

*H4: What is the contemporary rate of relative sea level rise and does it help constrain the deglaciation history of West Antarctica?*

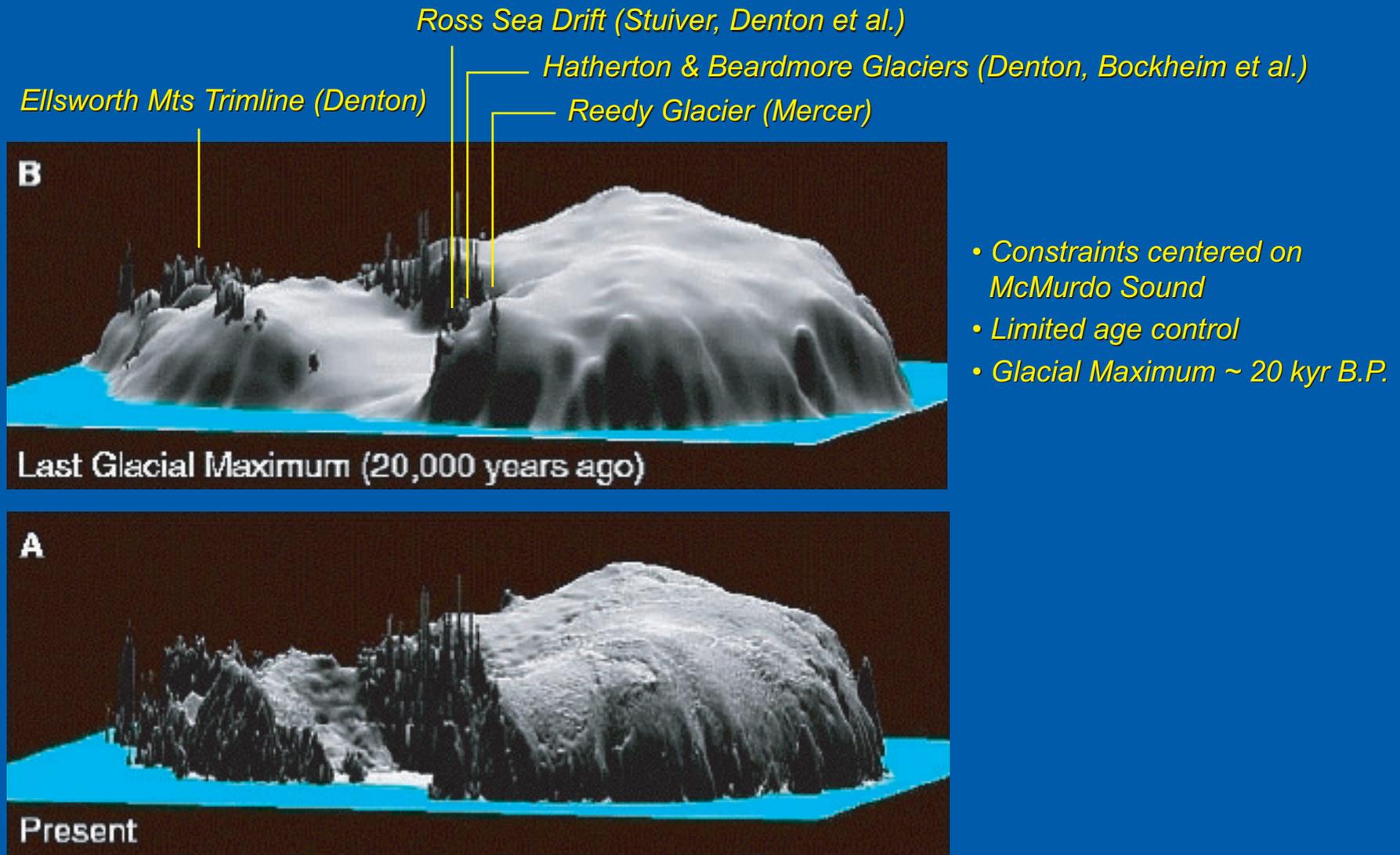
*H6: What are the leads and lags of West Antarctic ice sheet advance and retreat with global sea level and with glacial fluctuations in the Northern Hemisphere and in other parts of the Southern Hemisphere?*

### *Physical Controls*

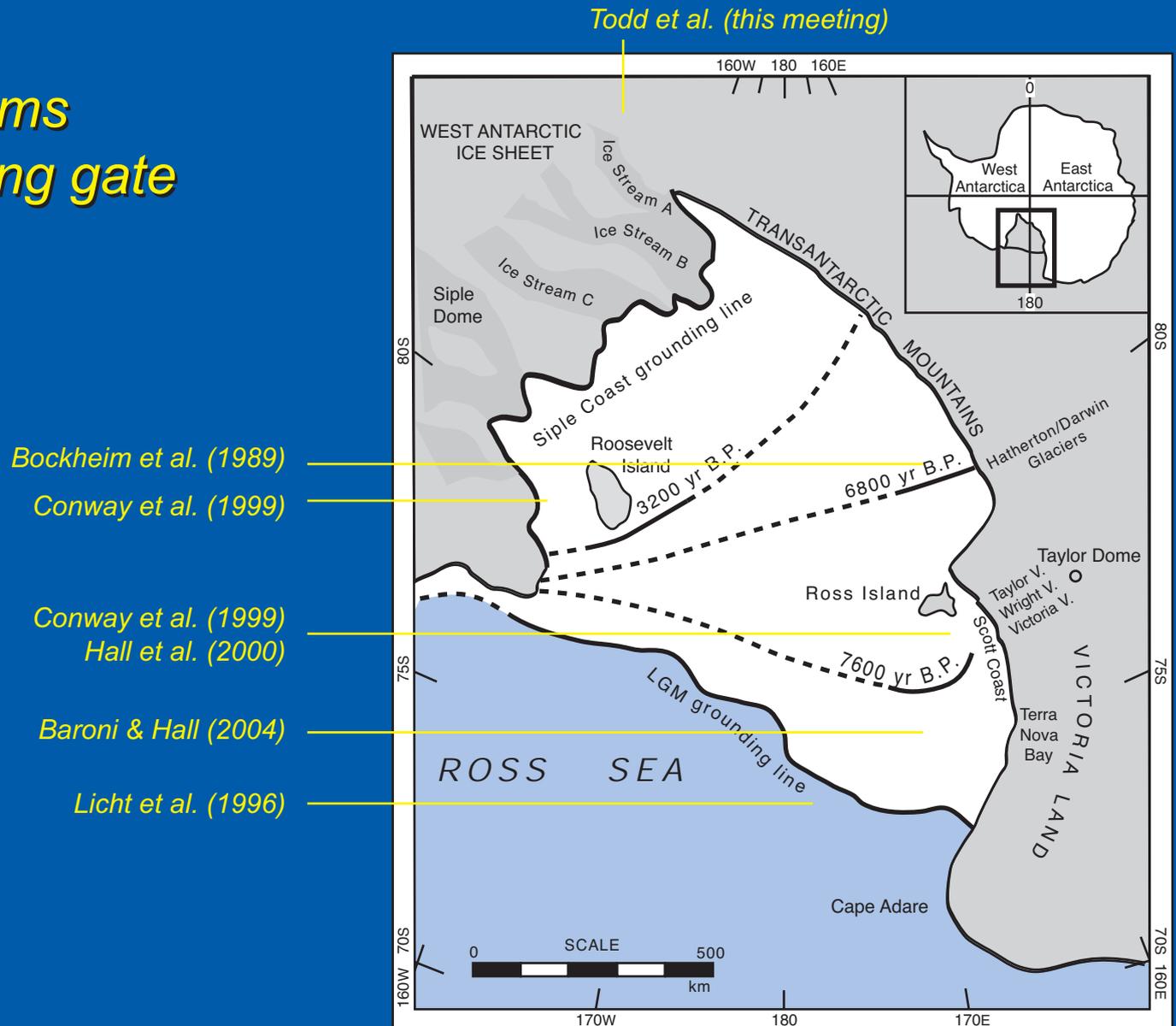
*P13: Are there active subglacial volcanoes?*

*P14: What would be the East Antarctic response to a collapse, or partial collapse, of the West Antarctic ice sheet?*

# The paradigm ca. 1990



# WAIS paradigms ... the swinging gate



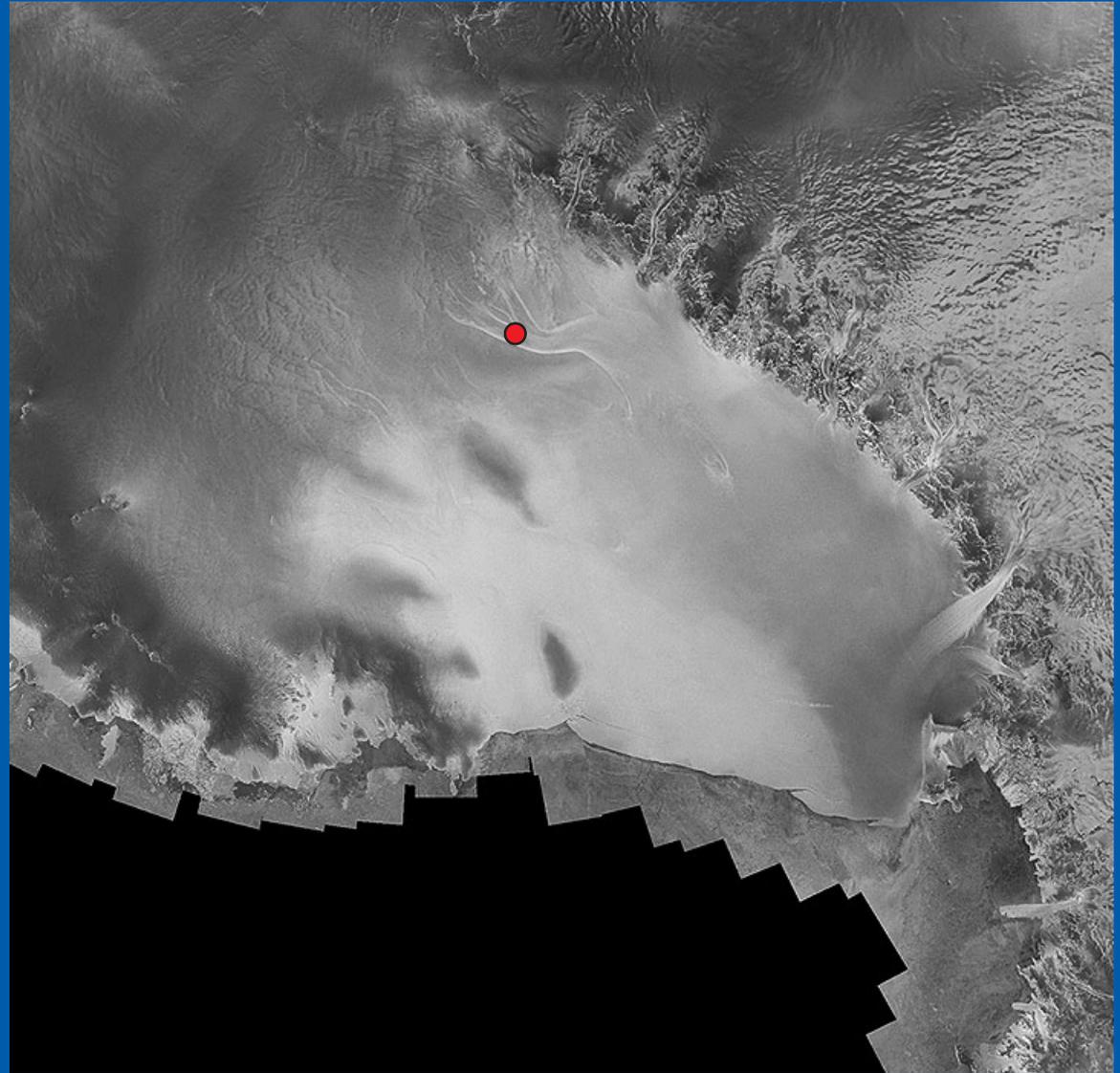
## Ice Sheet History

H2: What is the deglaciation history in the eastern Ross, the Bellingshausen and Amundsen Seas?

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# WAIS paradigms ... collapse!



## REPORTS

### Pleistocene Collapse of the West Antarctic Ice Sheet

Reed P. Scherer,\* Ala Aldahan, Slawek Tulaczyk, Göran Possnert, Hermann Engelhardt, Barclay Kamb

Some glacial sediment samples recovered from beneath the West Antarctic ice sheet at ice stream B contain Quaternary diatoms and up to  $10^8$  atoms of beryllium-10 per gram. Other samples contain no Quaternary diatoms and only background levels of beryllium-10 (less than  $10^6$  atoms per gram). The occurrence of young diatoms and high concentrations of beryllium-10 beneath grounded ice indicates that the Ross Embayment was an open marine environment after a late Pleistocene collapse of the marine ice sheet.

The West Antarctic ice sheet (WAIS) is the world's only large ice sheet that is grounded well below sea level at its margins, making it susceptible to collapse (1). Collapse of the WAIS would result in a rise in eustatic sea level of 5 to 6 m. A sea level higher than at present during the penultimate interglacial [marine oxygen isotope stage 5e (MIS 5e)],

permanent ice cover results in little or no diatom or  $^{10}\text{Be}$  flux (6). Subsequent grounding generally results in erosion of the basin floor.

Fast-flowing ice stream B is underlain by a layer of deformable clay-rich diamicton, generally several meters thick. This thin blanket of sediment has been interpreted as mobile drift (till), which is actively deforming with the flow of ice and eroding underlying

## Ice Sheet History

H1: What is the climate history of West Antarctica and was there an ice sheet present there during past interglacials, particularly stage 11?

## Beyond the Ross Sea

Orville Coast  
Bentley et al. (2000)

Shackleton Range  
Fogwill et al. (2004)

Heritage Range  
Todd et al. (2003)

Mt Takahe  
Wilch et al. (1998)

Mt Waesche  
Ackert et al. (1999)

Ford Range  
Stone et al. (2003)

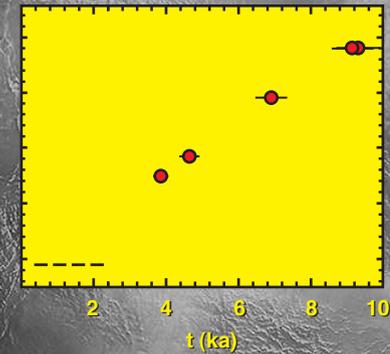
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## Age control



Orville Coast  
Bentley et al. (2000)

Shackleton Range  
Fogwill et al. (2004)

Heritage Range  
Todd et al. (2003)

Mt Takahe  
Wilch et al. (1998)

Reedy Glacier  
Todd et al. (2004)

Mt Waesche  
Ackert et al. (1999)

Ford Range  
Stone et al. (2003)

Scott Coast  
(e.g. Hall et al. 2000)

### Ice Sheet History

H3: What is the ice-surface elevation history revealed in the mountains within West Antarctica?

H6: What are the leads and lags of West Antarctic ice sheet advance and retreat with global sea level and with glacial fluctuations in the Northern Hemisphere and in other parts of the Southern Hemisphere?

# Prospects and Challenges

- Geographic coverage - prospects for international collaboration.
- Tighter integration with marine geology (dating concerns - e.g. Eastern Ross Sea).
- Data-driven ice-sheet models
- Re-visit constraints from glacio-isostasy (new sea level and GPS data).

