

IODP Expedition 400: Northwest Greenland Glaciated Margin



The JOIDES Resolution (IODP)



A close-up of sediment in a freshly retrieved EXP 400 core (Michelle Pratt)



Split cores showing sediment, awaiting examination by EXP400 scientists (Beth Doyle)

The Goal:

- To understand how the Greenland ice sheet responded to past climate warming

The Mission:

- A 62-day expedition aboard the scientific drilling ship, *the JOIDES Resolution (JR)*
- On this floating laboratory, an international team of 27 scientists will apply their skills to interpret the ice sheet's history.
- They will do this by studying the sediments off the coast of Northwest Greenland.

How?

- By drilling down into the seafloor to retrieve long cores of sediment
- The deeper the core, the older the sediment
- The cores record changes in the climate and ocean history and how both have affected the ice sheet through time.

Why Greenland?

- The Greenland ice sheet is the last one left in the northern hemisphere.
- The Arctic is warming faster than the rest of the world.
- This ice sheet is melting in response to warming of the atmosphere and the ocean water.

Why Do We Care?

If the Greenland ice sheet fully melted, it would add about 7 meters (23 feet) to global sea level.

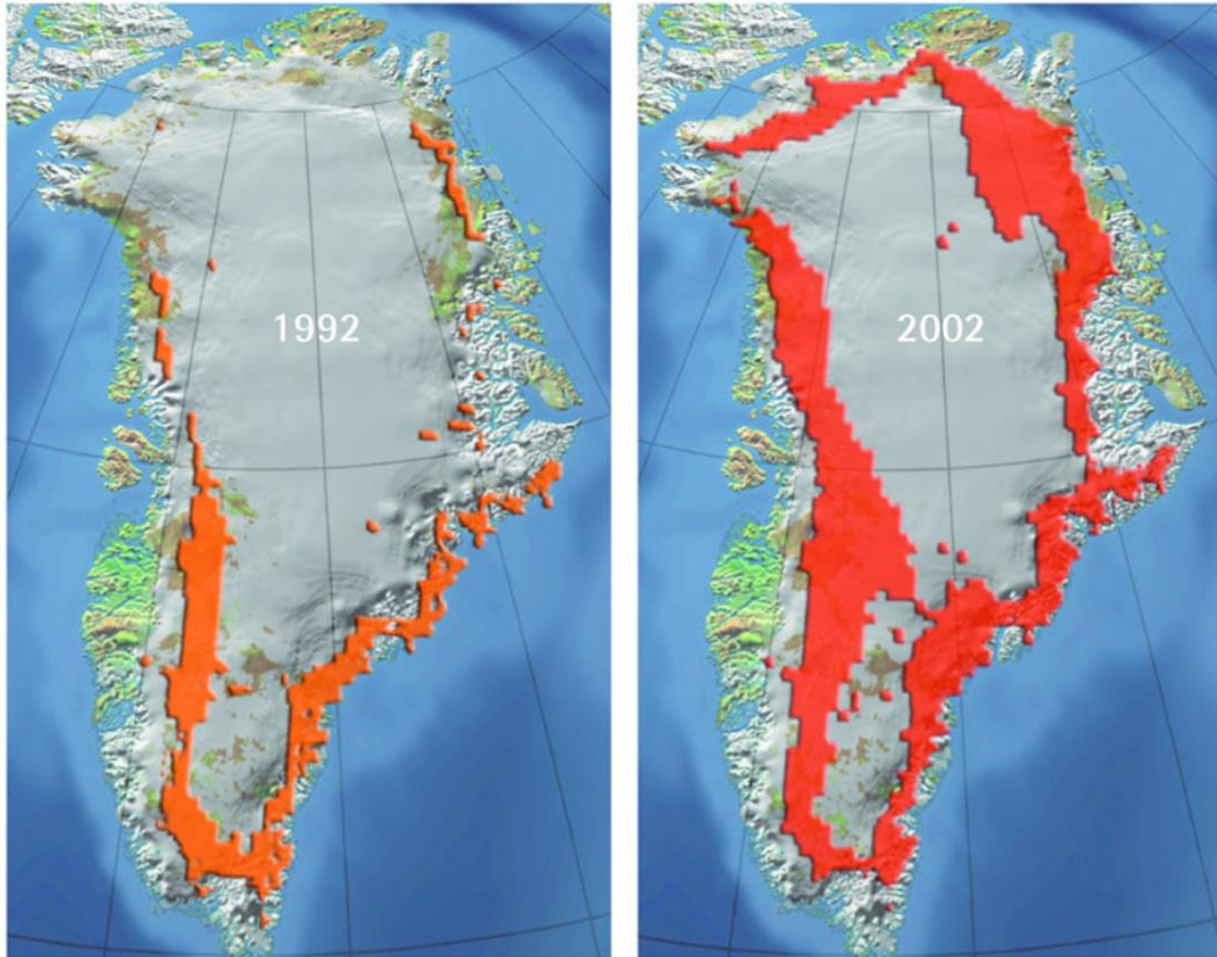
What We Want to Know and Why?

- How has the Greenland ice sheet responded to past climate warming?
- If we understand this, we can better predict how it might respond in the future.



Google Earth Image

How is the Greenland Ice Sheet Changing?



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Maps of Greenland Ice Sheet Melt in 1992 and 2002
(Steffen and Huff; <http://cires.colorado.edu/science/groups/steffen/greenland/melt2005/>)

- These maps show the area where the Greenland Ice Sheet melted a few decades ago.
- Parts of the ice sheet that experience melting are shown in red.
- This area has been increasing overall and has affected higher elevations.
- Expedition 400 scientists want to know more about how it has responded to past warming.



Icebergs in Disko Bay, west Greenland (Beth Doyle)

The Greenland Ice Sheet Has Changed Many Times

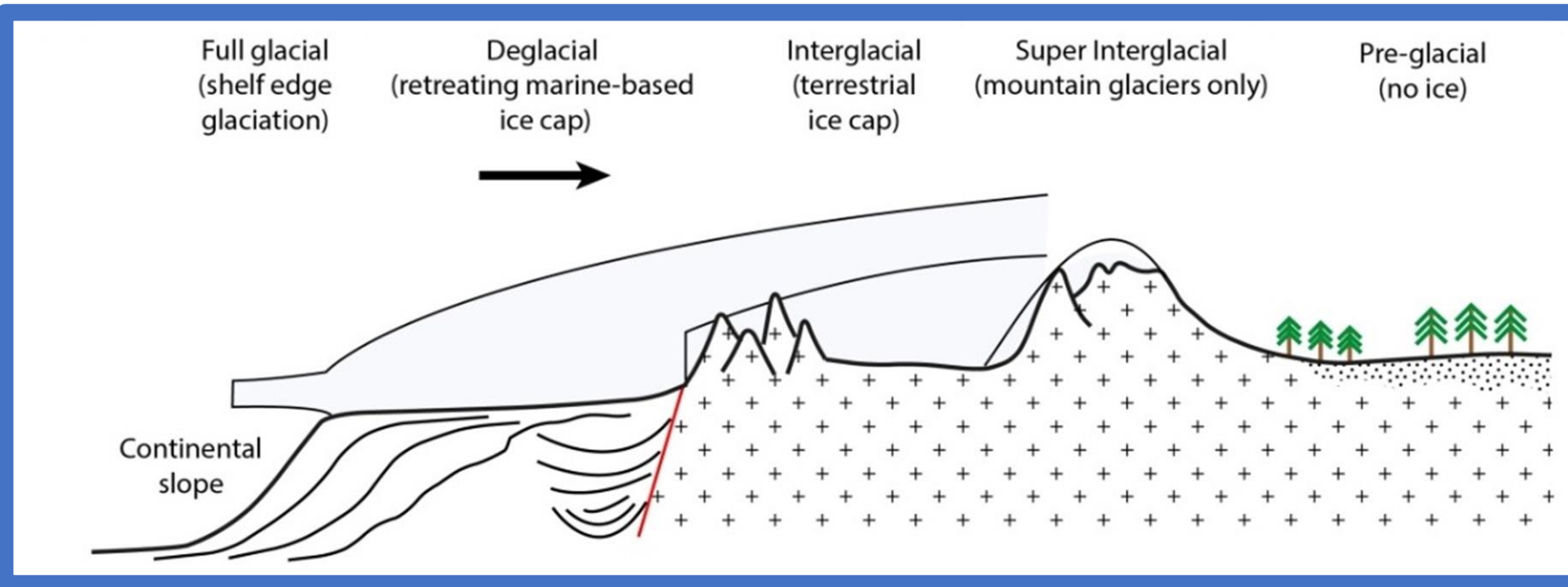
- At times, the ice sheet extended to the edge of Greenland's continental shelf.
- At least once in the past 2.5 million years, it fully melted, or nearly so.
- The 7 drill sites will include layers from all stages in its history:
 - before the Greenland Ice Sheet formed
 - early on, in the formation of the Greenland Ice Sheet
 - periods that cycled between adding ice and melting ice.



Aerial view from west Greenland of the ice sheet and a coastal inlet. (Beth Doyle)



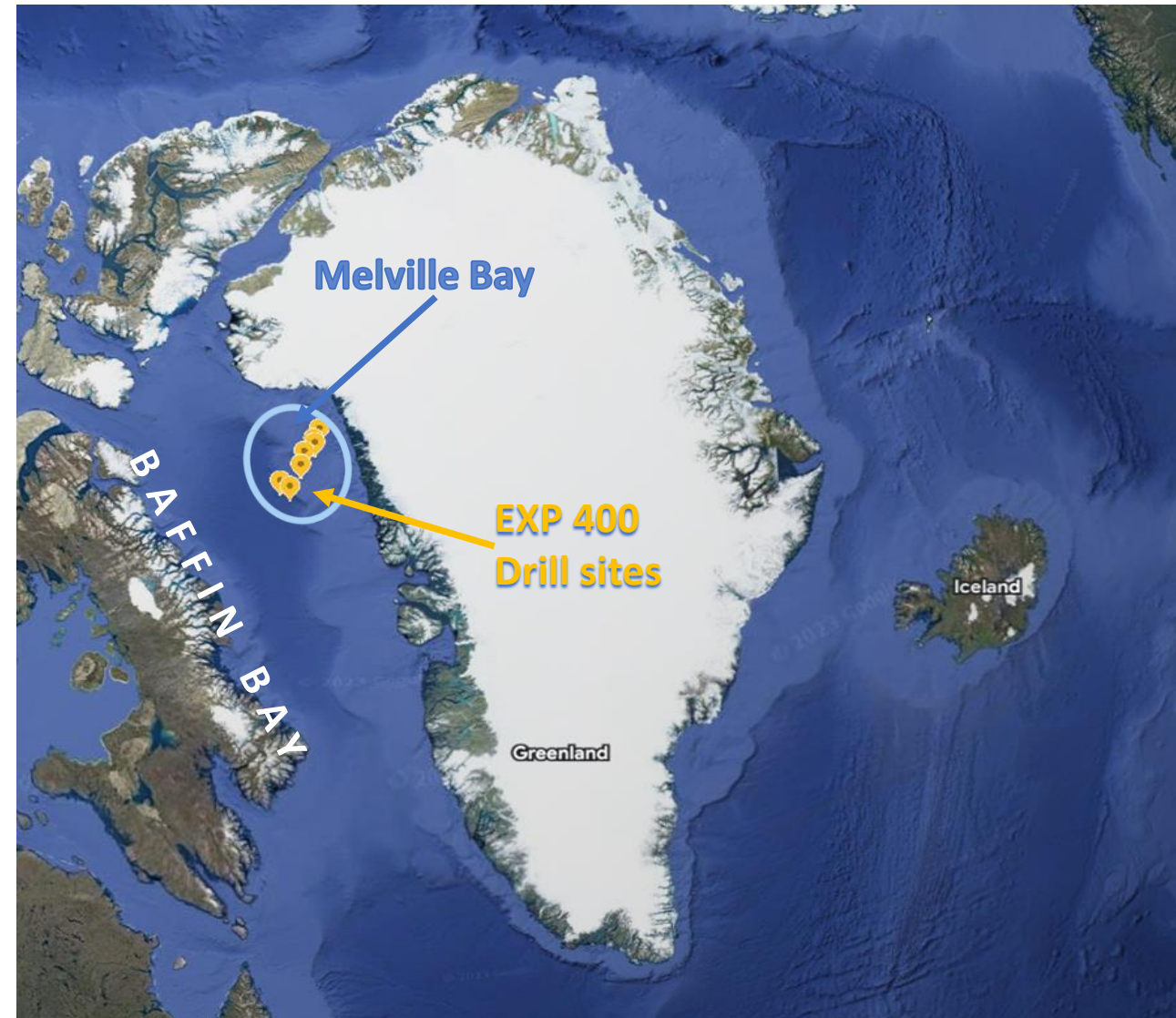
Aerial view of a west Greenland inlet (Beth Doyle)



Five conceptual stages of the Greenland Ice Sheet through the late Cenozoic (approximately the last 30 million years)
(Credit: Knutz, P., Jennings, A., and Childress, L.B., 2022).

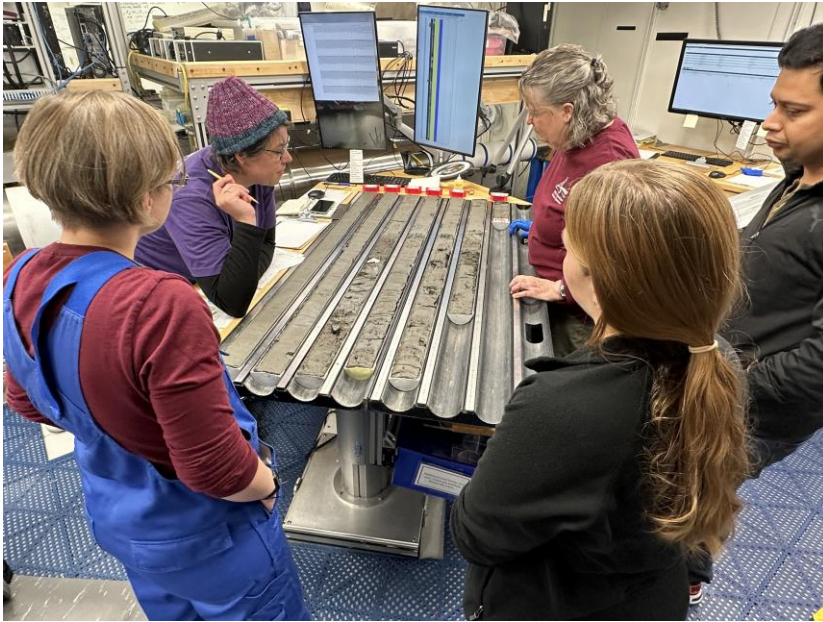
Why Northwest Greenland?

- The Greenland Ice Sheet carries sediment off the northwest coast of Greenland and into Melville Bay.
- Melville Bay is a favorable location because of:
 - its proximity to the ice sheet
 - lower amounts of sea ice so access is easier
 - its full record of Greenland Ice Sheet changes over time
- Expedition 400 is drilling for these deposits at 7 sites in Melville Bay.
- The deeper the core, the older the sediment
- The 7 drill sites tap into different times in Greenland's ice sheet history.



Google Earth Image

What are the Scientists Looking for in the Sediment?

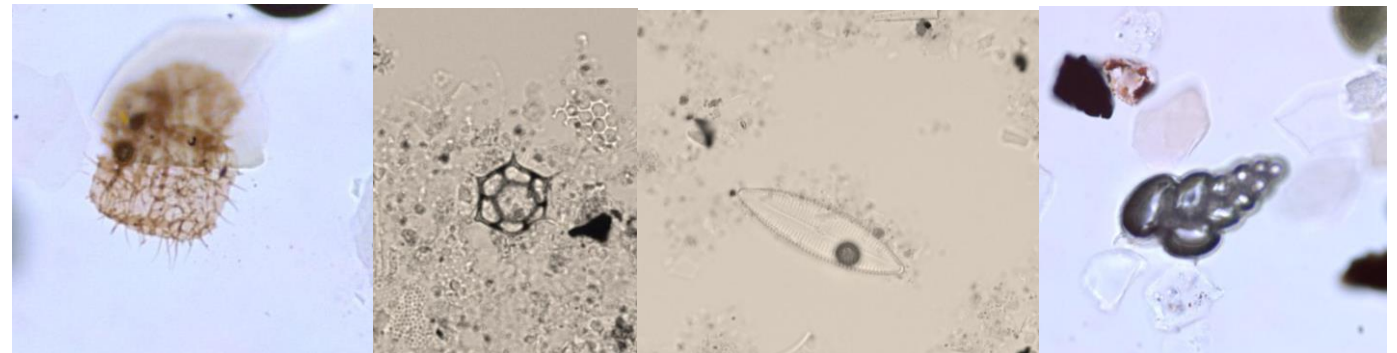


Expedition 400 scientists examine sedimentary features in cores retrieved off the coast of Northwest Greenland (Beth Doyle)

- As the ice sheet flows across the land, it picks up sediment and deposits it offshore.
- The material settles on the seafloor, along with microscopic plant and animal remains.
- Different climates have different life forms.
 - The preserved microfossils in the sediment are evidence of the different climates.
- Climates also leave distinct chemical and paleomagnetic clues in the sediment.
- **Together, these sediment details allow Expedition 400 scientists to:**
 - reconstruct the Greenland Ice Sheet's history
 - learn about the ice sheet's response to past warming.



Expedition 400 micropaleontologist examines foraminifera fossils preserved in sediment retrieved off the coast of Northwest Greenland (Beth Doyle)



Preserved microfossils from Expedition 400 sediment cores. (Expedition 400 Scientists)

IODP Expedition 400: Discover More!

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Expedition 400 Co-chief scientists Anne Jennings and Paul Knutz discuss sediment layers around a drilling site. (Michelle Pratt)



Icebergs in Disko Bay, Ilulissat, west Greenland (Beth Doyle)



JOIDESresolution.org/expedition/400/



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