

Arctic Ocean: Geoscientific Challenges (for the French?)

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Collège de France**

Opening Statement

- French Research is present in the Arctic
- AWIPEV
- DAMOCLES
- VICTOR 6000
- But where are the marine geosciences which have a high profile at a number of French marine research institutions?
- Needs: Science Program and Access to needed Infrastructure

N.B. Reference to authorship of several slides were made orally during the presentation





ALASKA MAP SHOWING
ROUTE OF THE TRAN
ALASKA PIPELINE AND
CROSSING POINTS

ALASKA MAP SHOWING ROUTE OF THE TRAN ALASKA PIPELINE AND CROSSING POINTS

TARA during the IPY





Ny-Ålesund 79°N

AWJ

Research Base

IPEV



Facilities:

Station Buildings



Blue house



Observatory



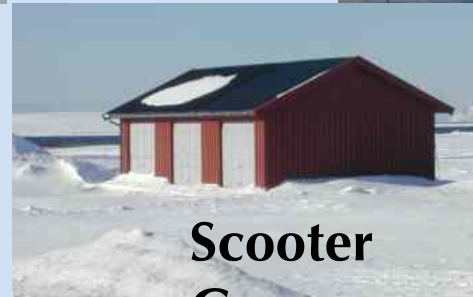
**Rabot
Station**



**Corbel
Station**



**Int. Marine
Laboratory**



**Scooter
Garage**



Vaskeriet



Alfred-Wegener-Institut für Polar- und Meeresforschung in der Helmholtz-Gemeinschaft

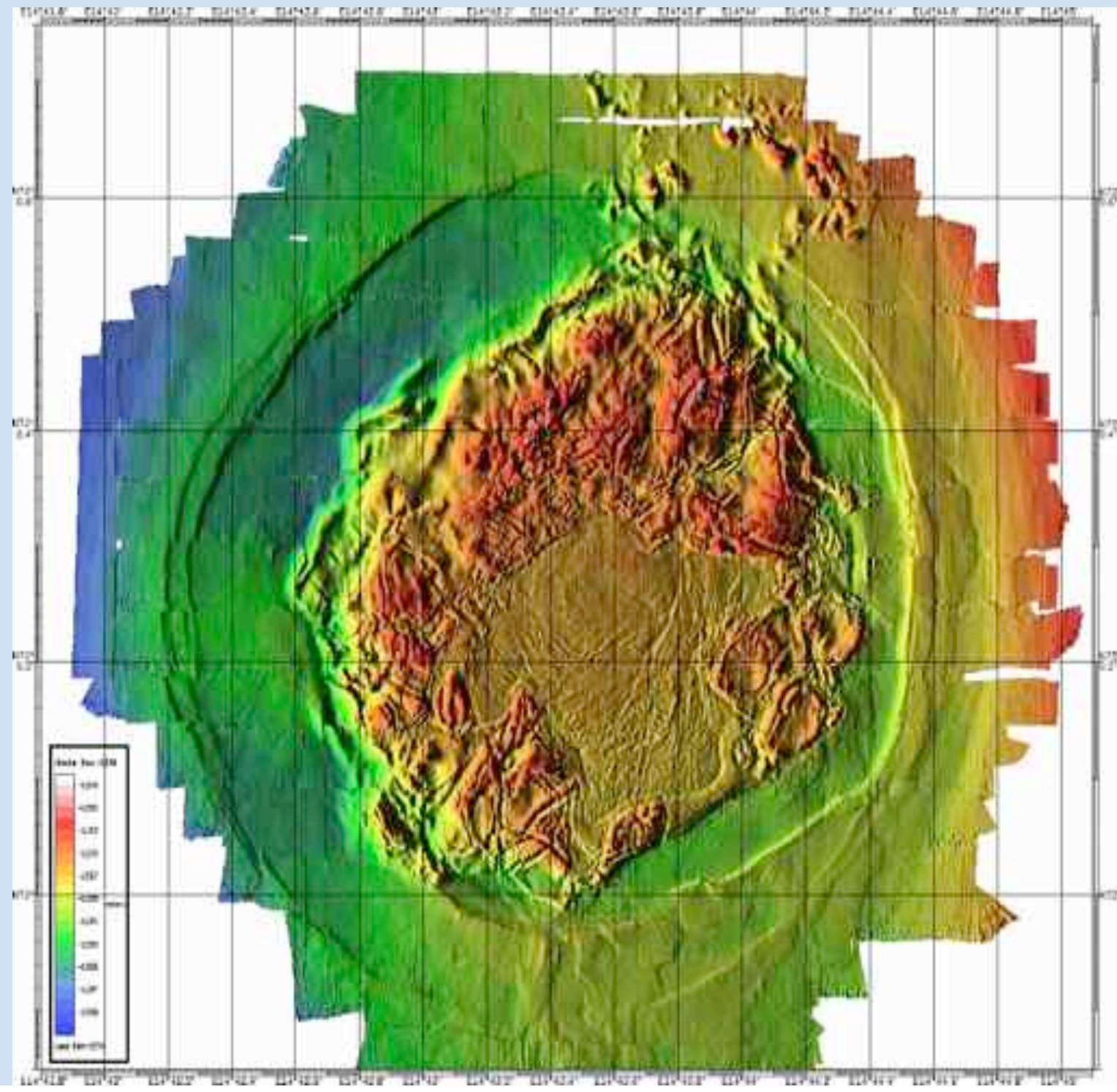


Remotely Operated Vehicle (ROV) „Victor 6000“

Depth rated: 6000 m
Weight: 4,5 Tonnen
Cameras: 7
Manipulator: 2
Payloadmodul: 2

Used onboard „Polarstern“
1999 and 2003

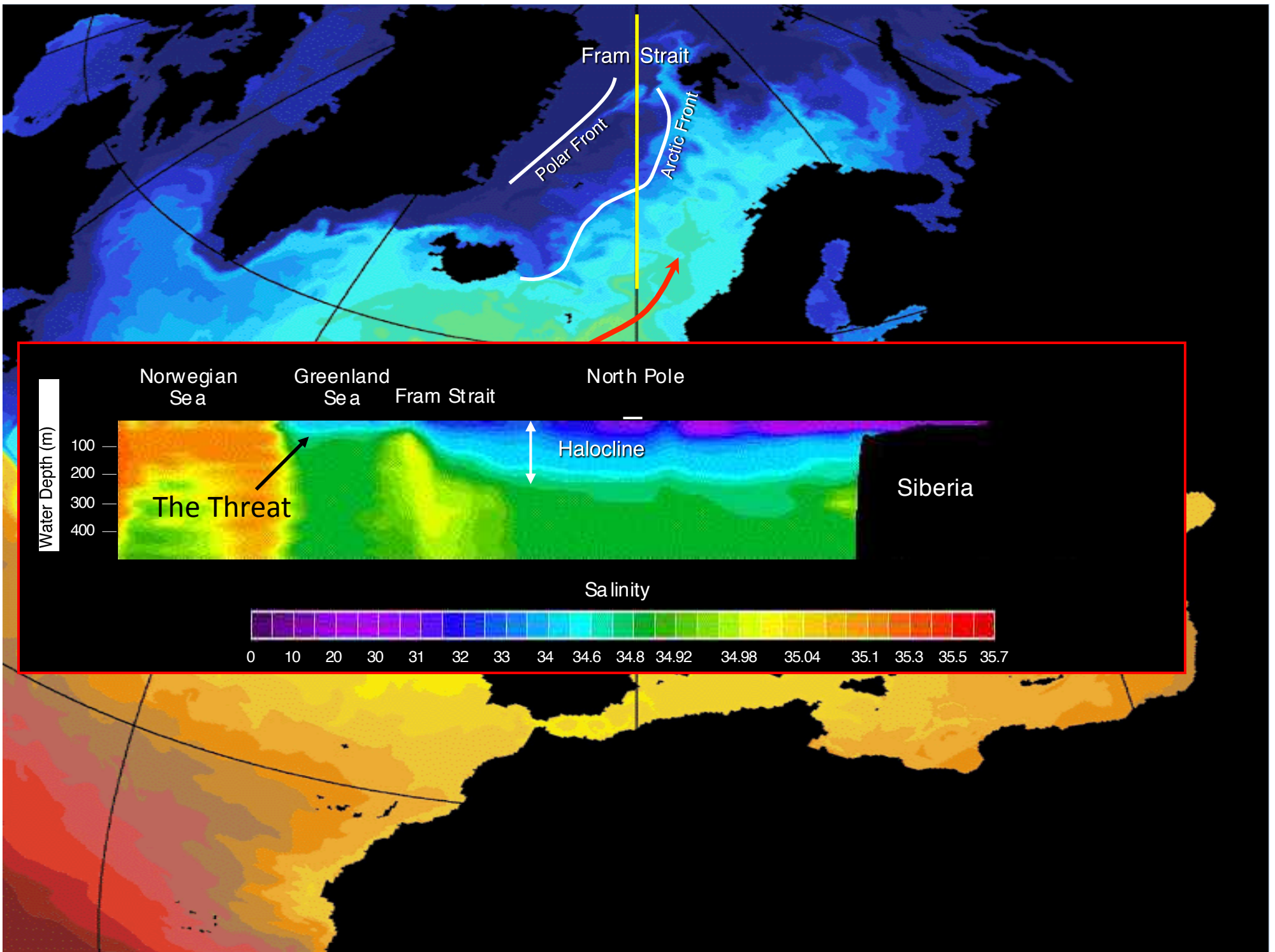
Used onboard „Atalante“
2001 and 2005

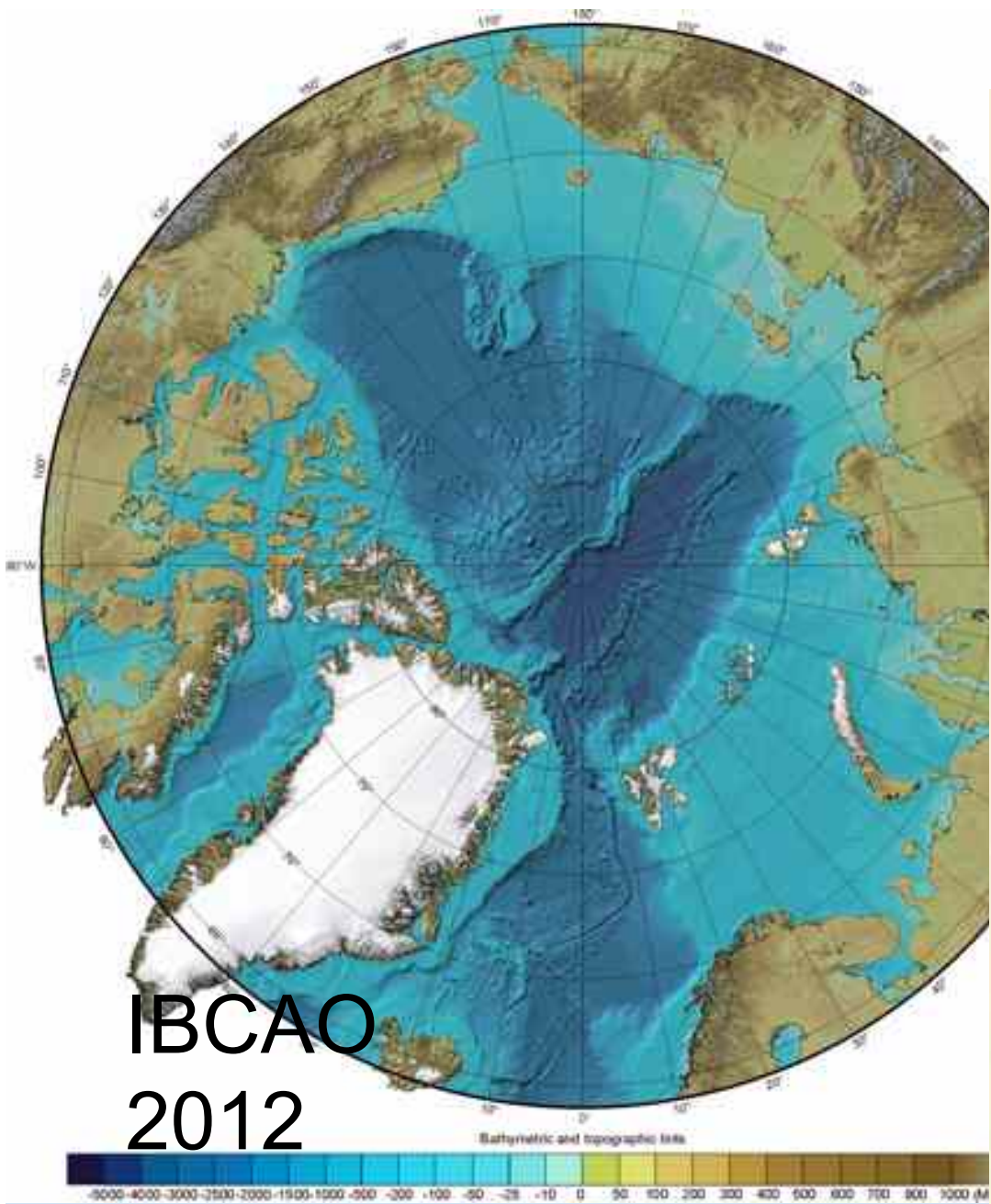




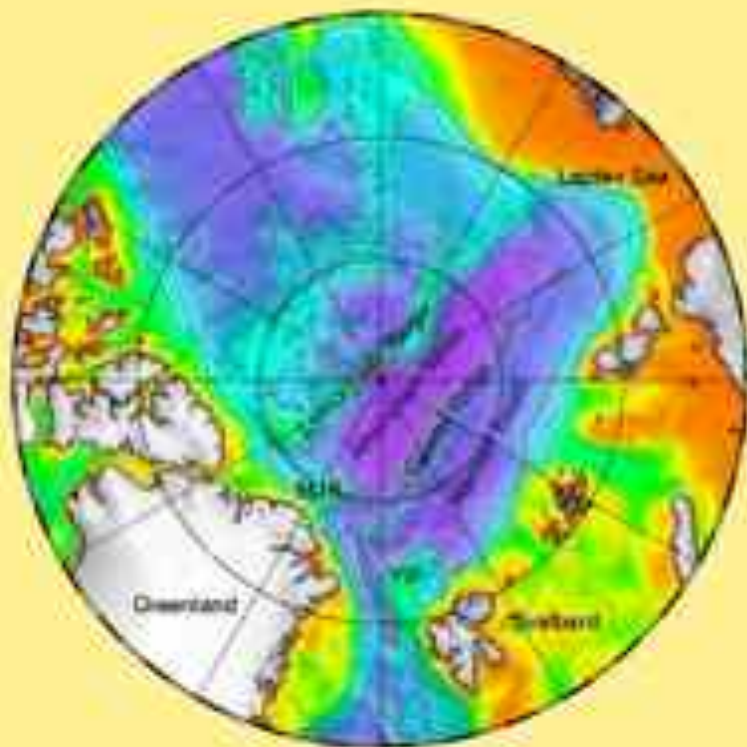
Topics to be addressed

- Structure/ nature/age of the Arctic Ocean basement
- Long term history of the Arctic environments
- Arctic Ocean during the latest past
- Isolated national efforts vs. well coordinated international programs

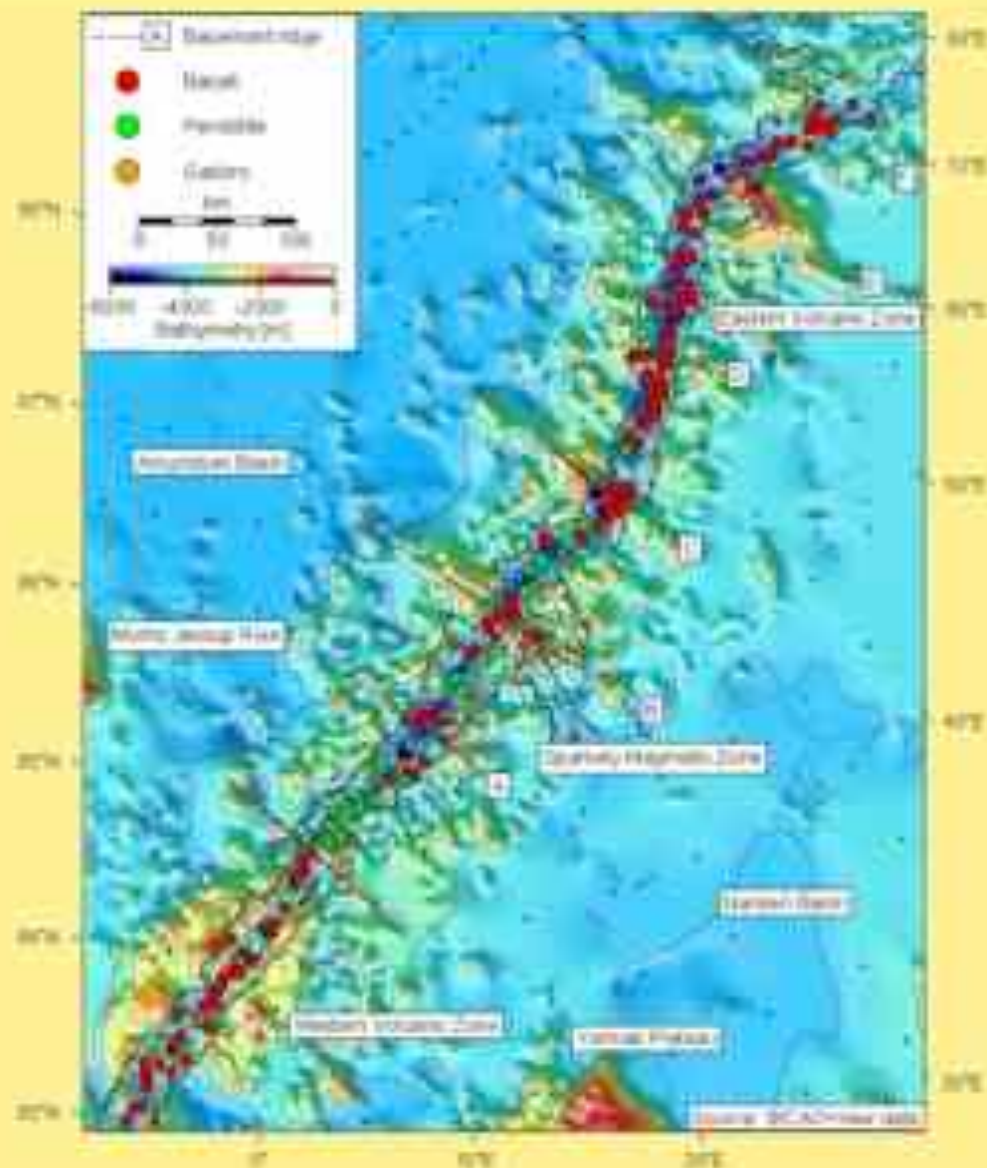


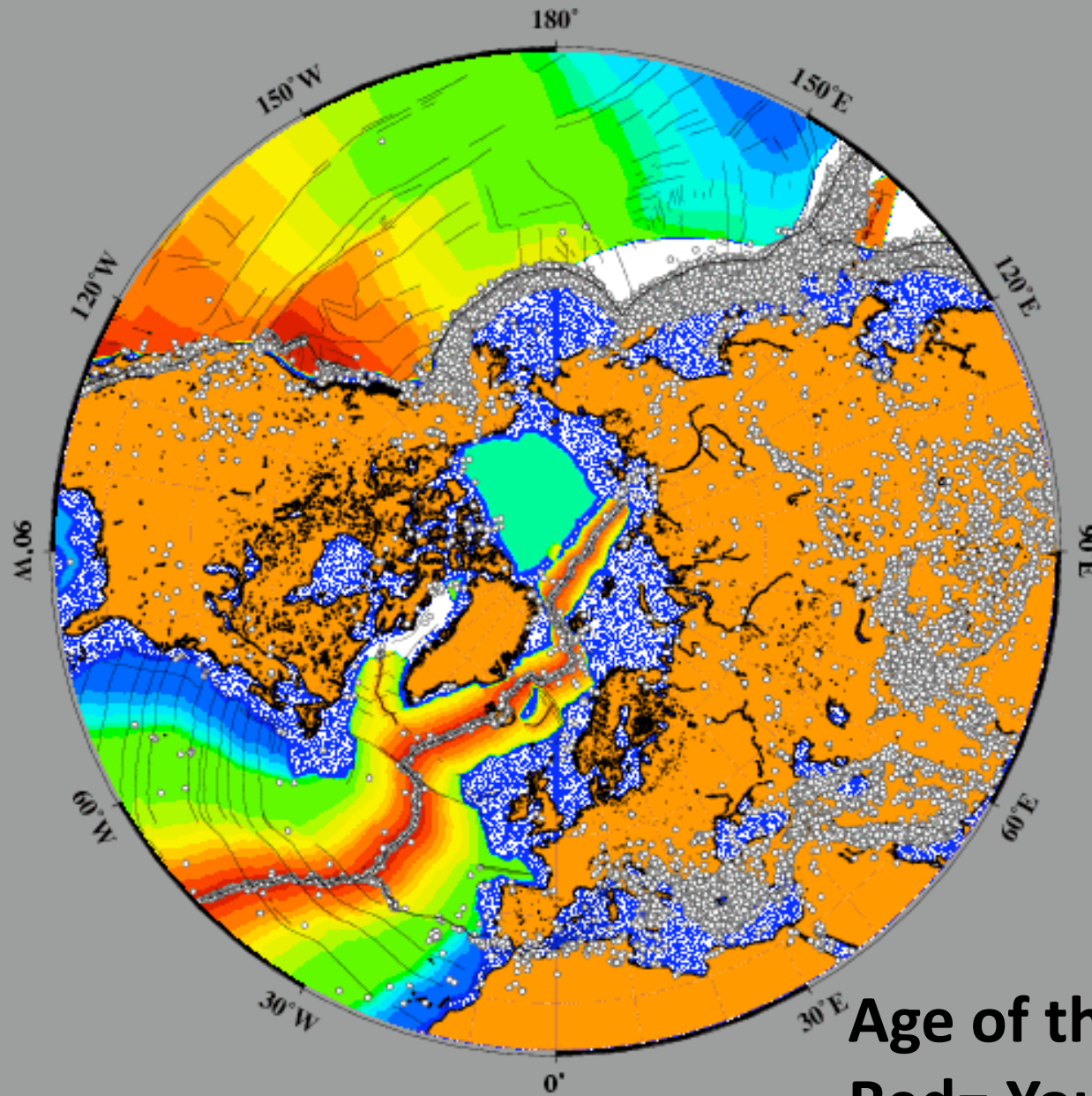


The ultraslow spreading Gakkel Ridge: Overview

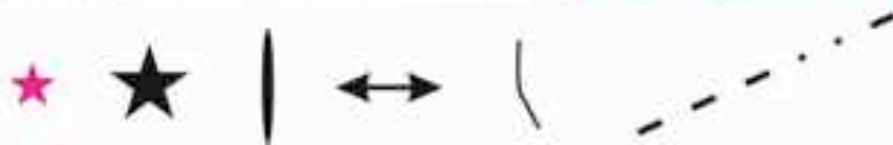
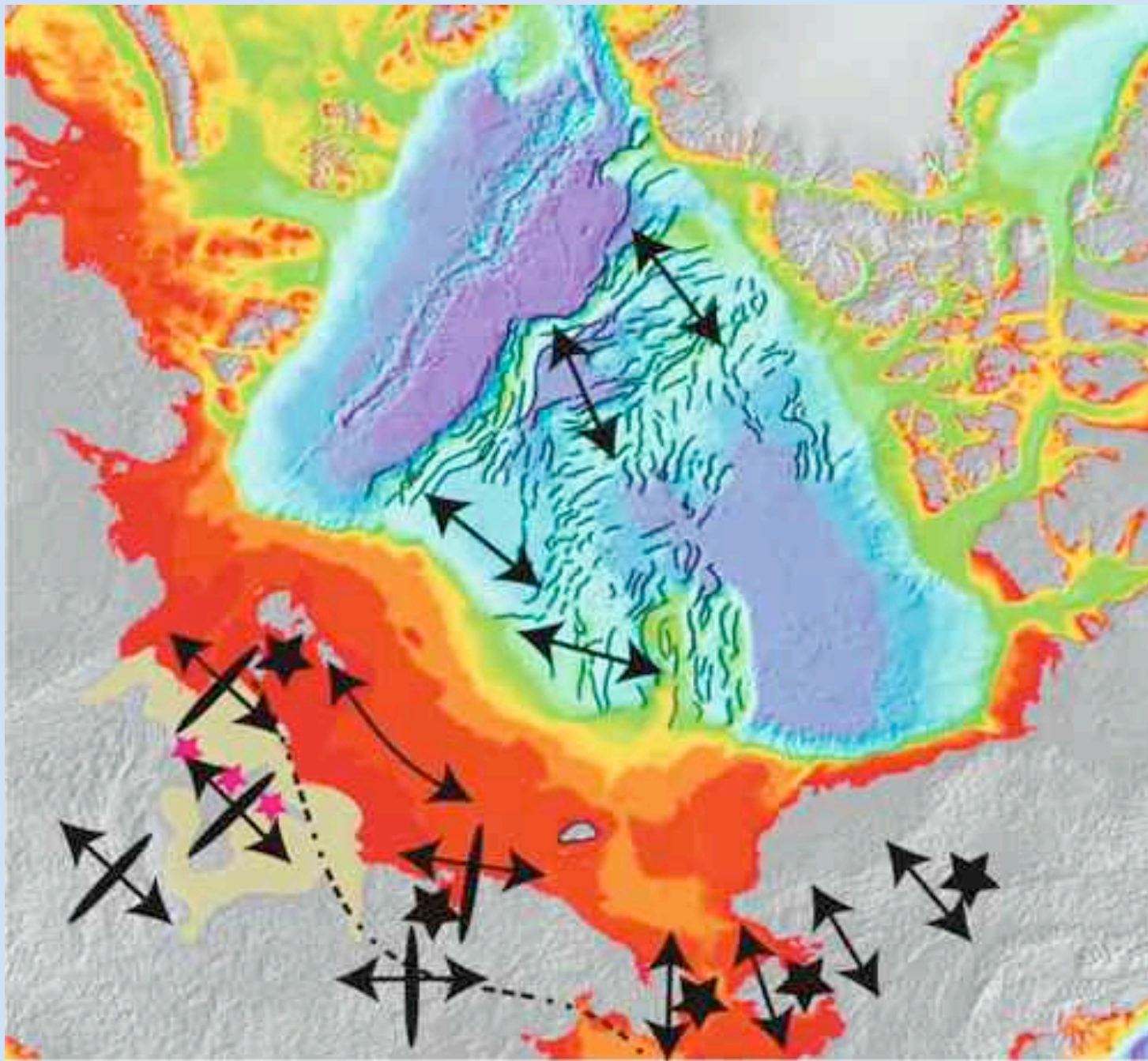


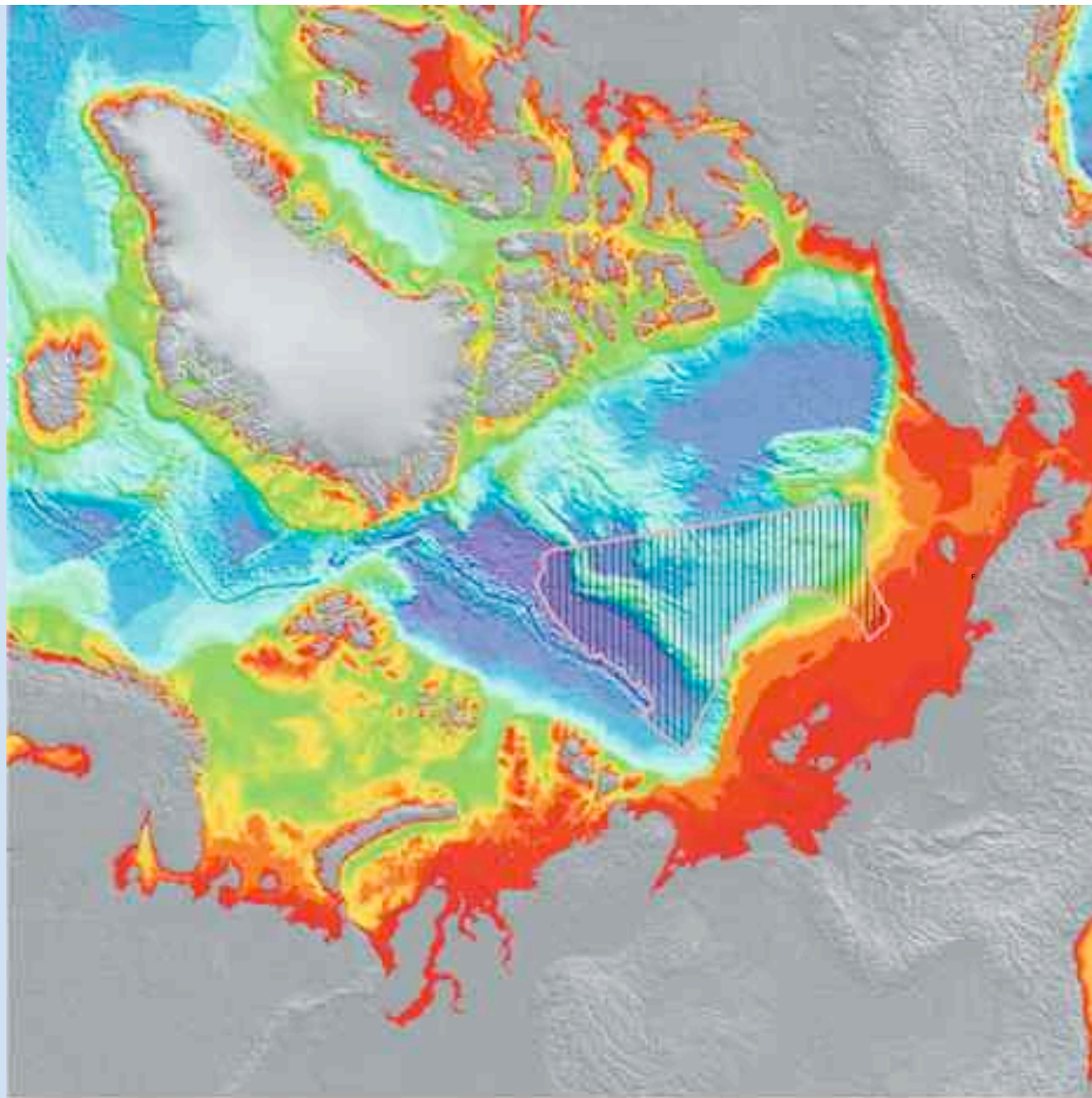
- Ultra-slow spreading (6–13 mm/yr)
- Spreading direction not oblique
- No major transform faults
- Three magmato-tectonic domains

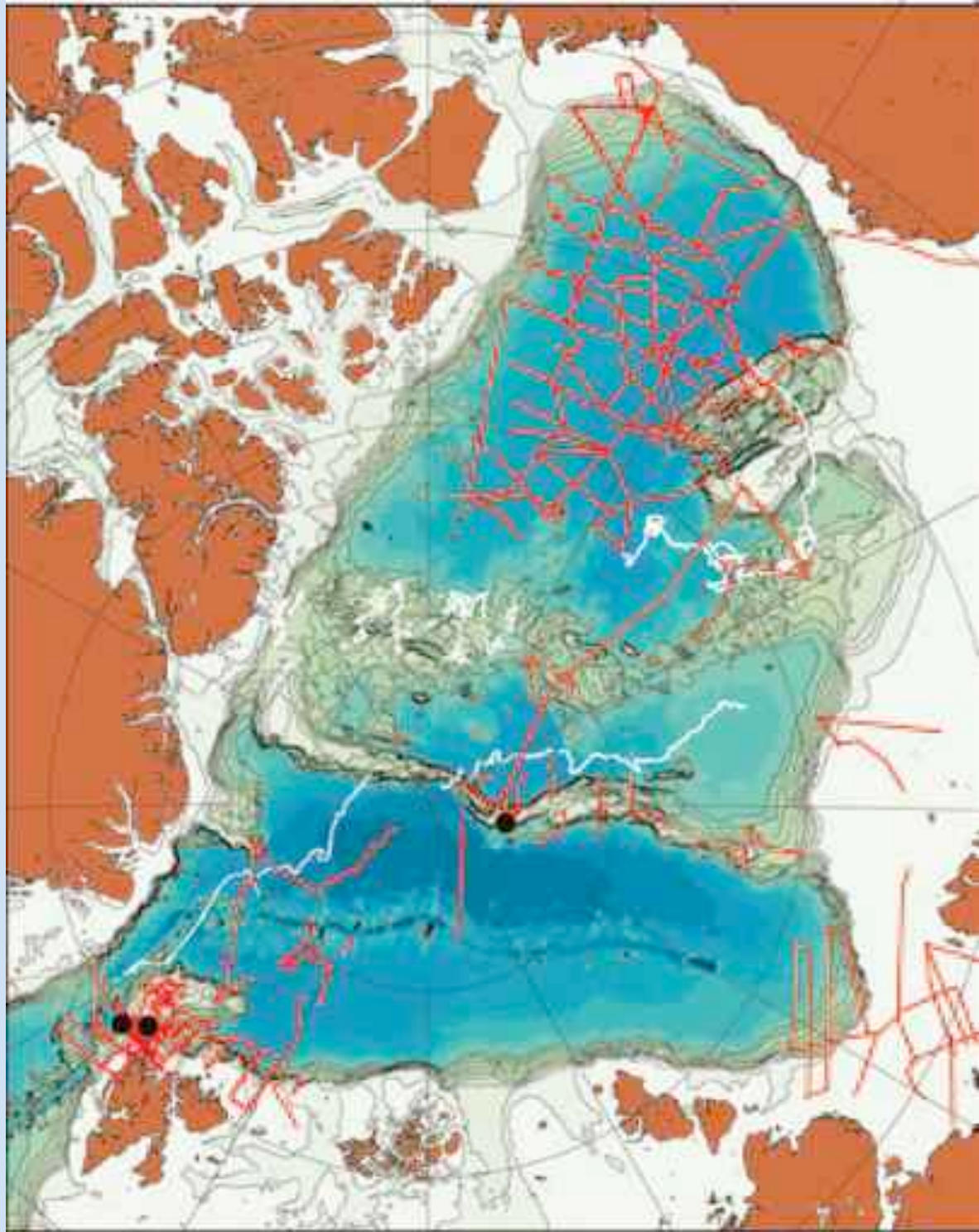




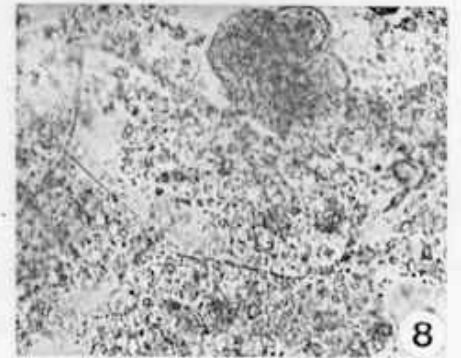
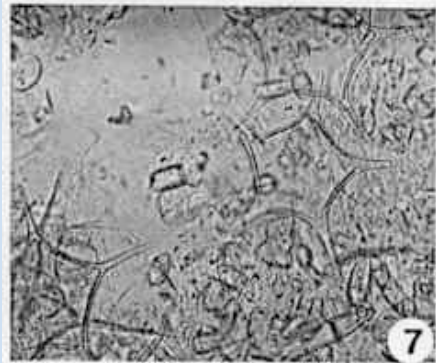
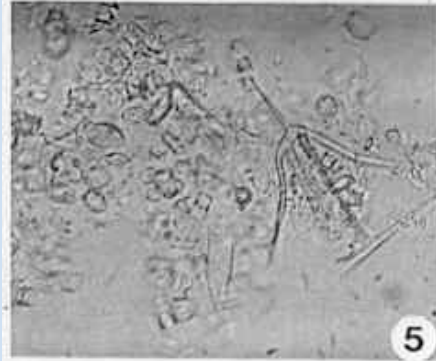
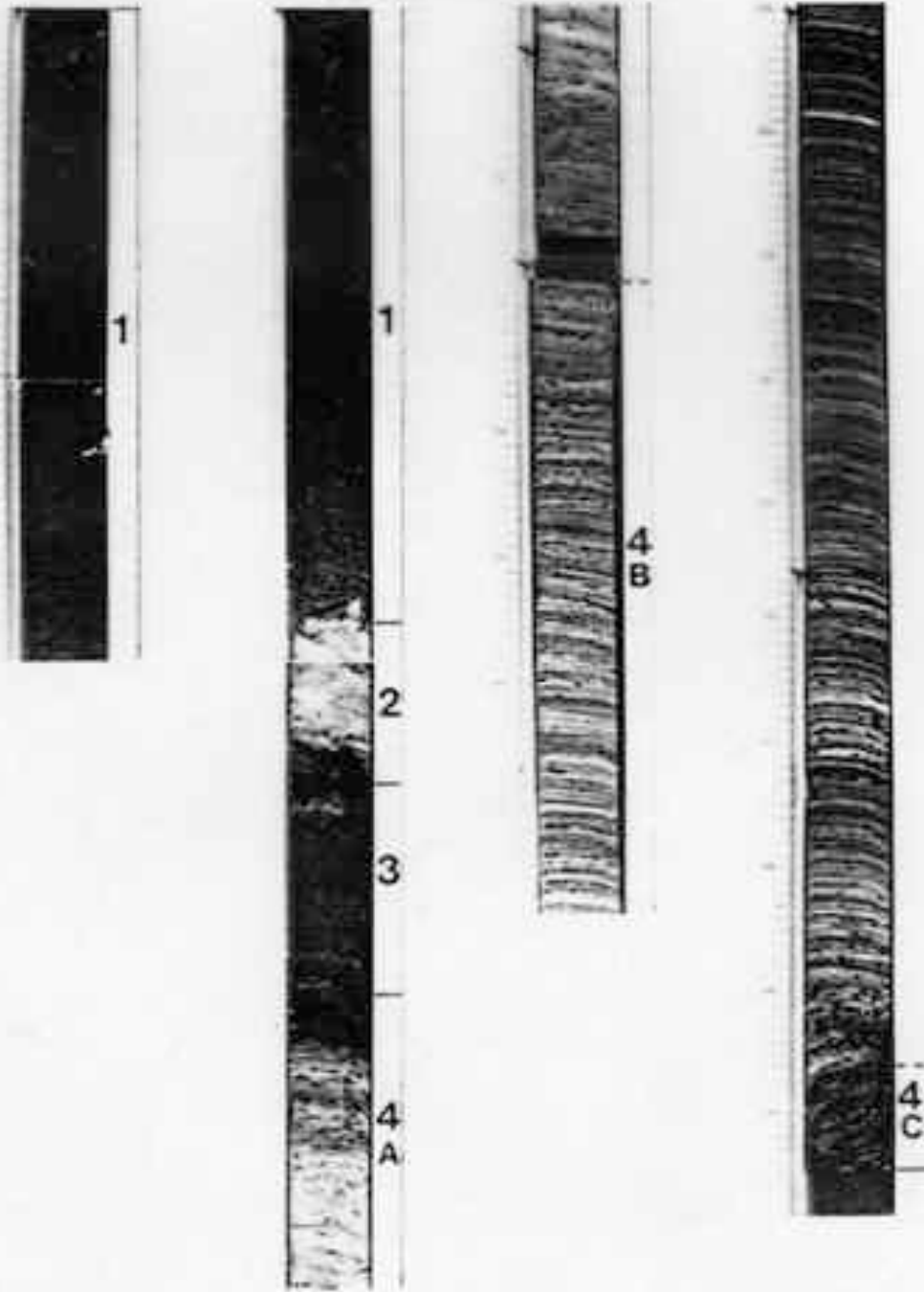
Age of the Seafloor:
Red= Young
Blue/Green: Old







CESAR CORE 6

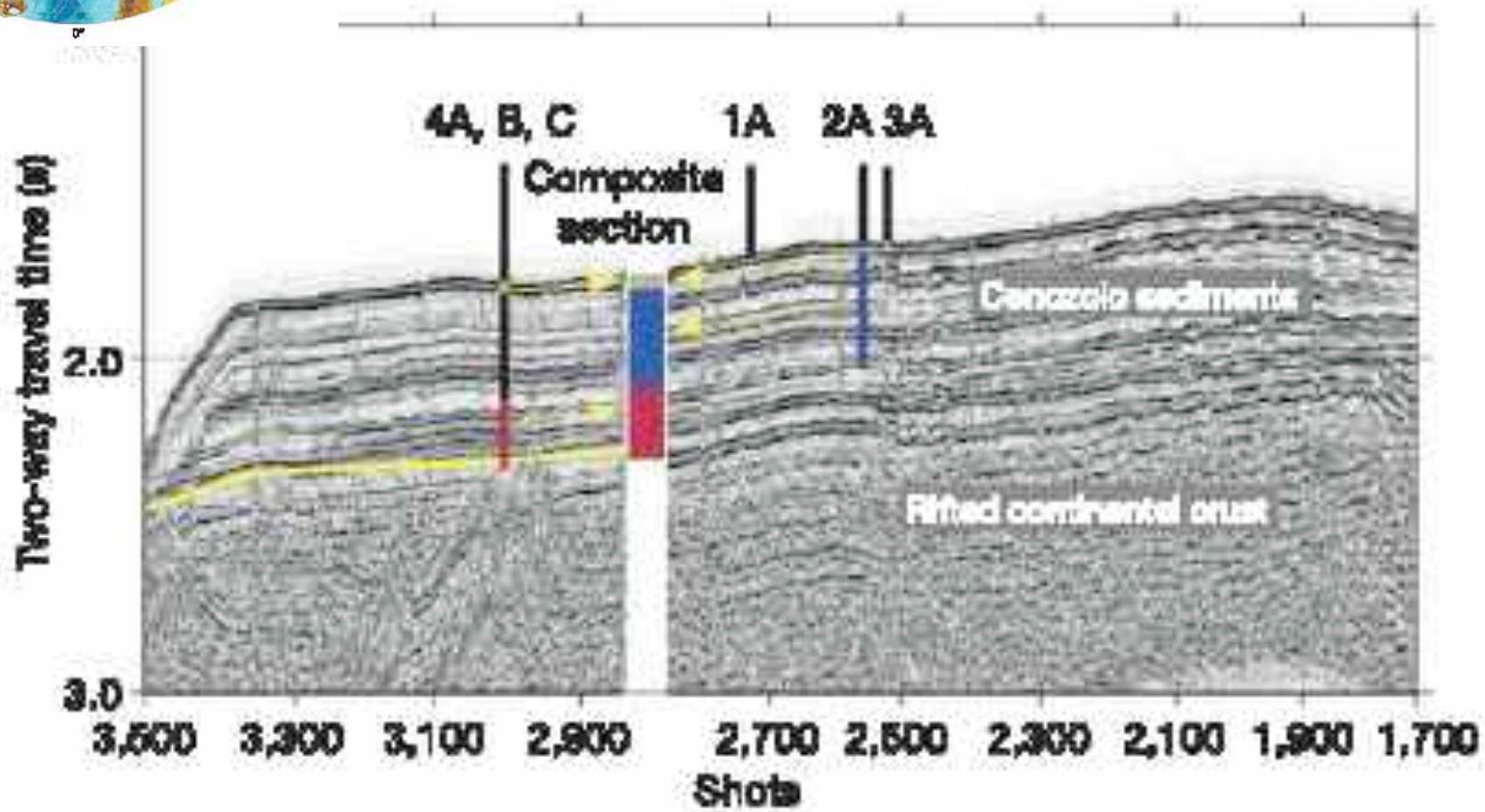
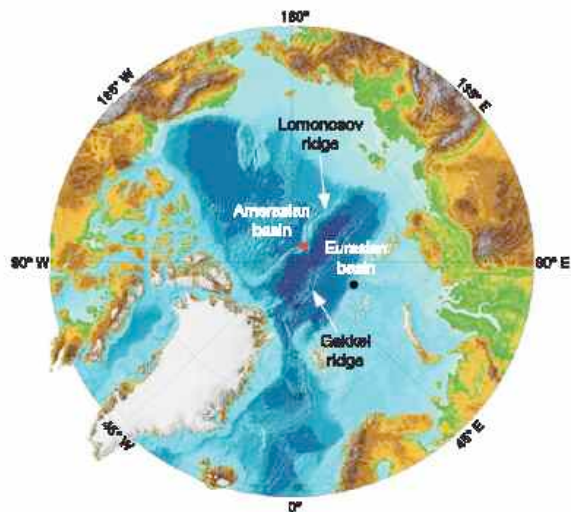


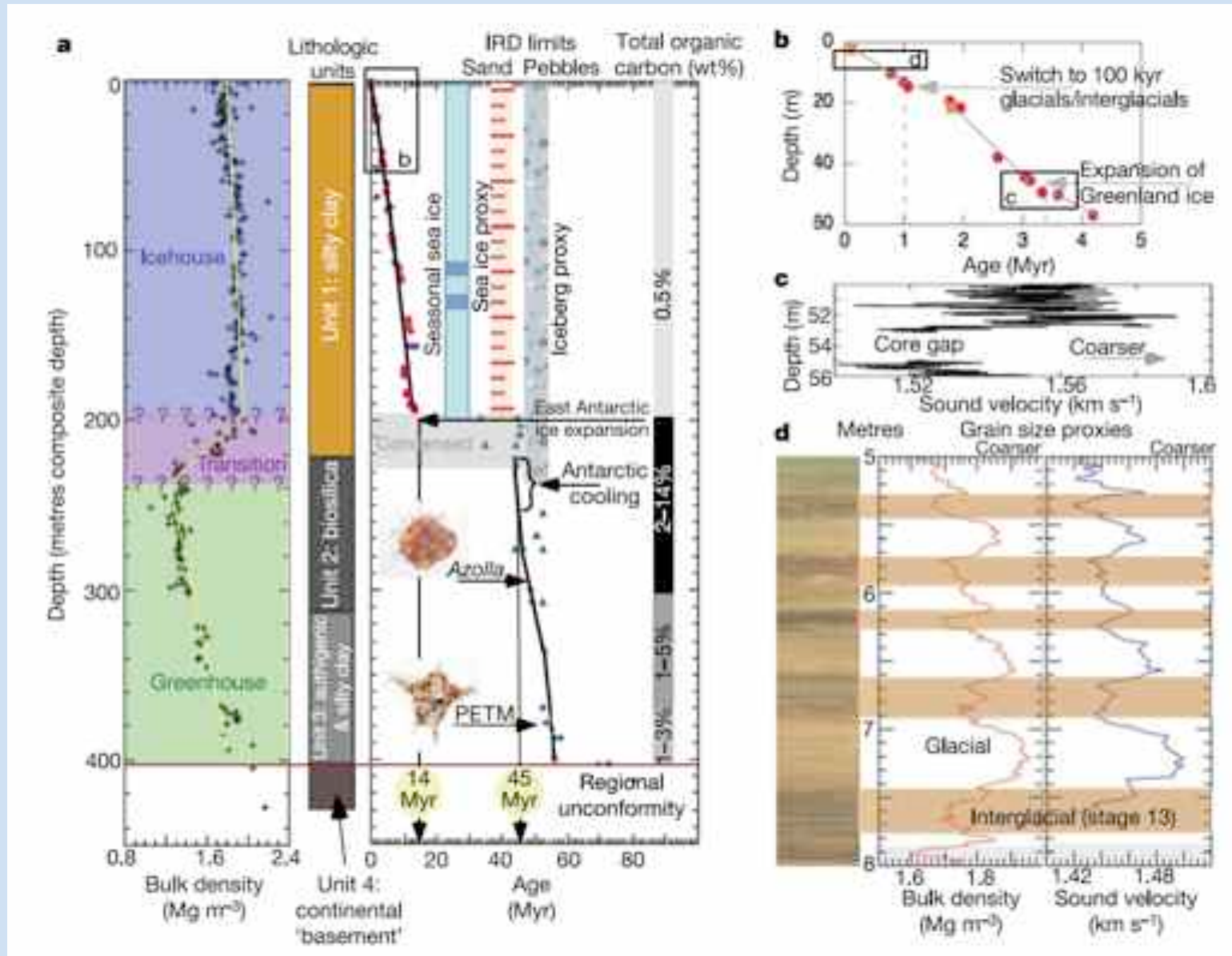
Sovetskiy Soyuz

Oden

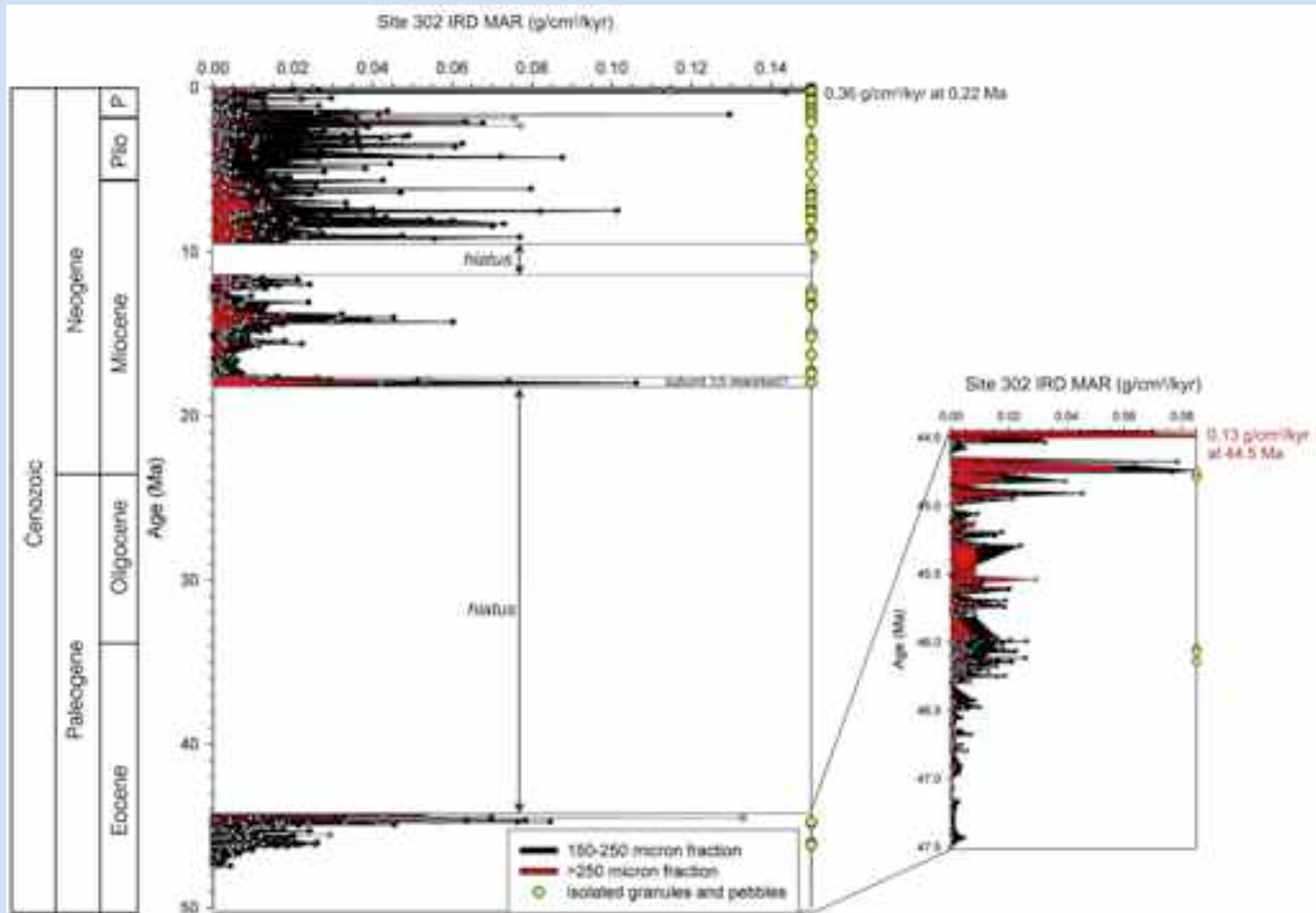
Vidar Viking



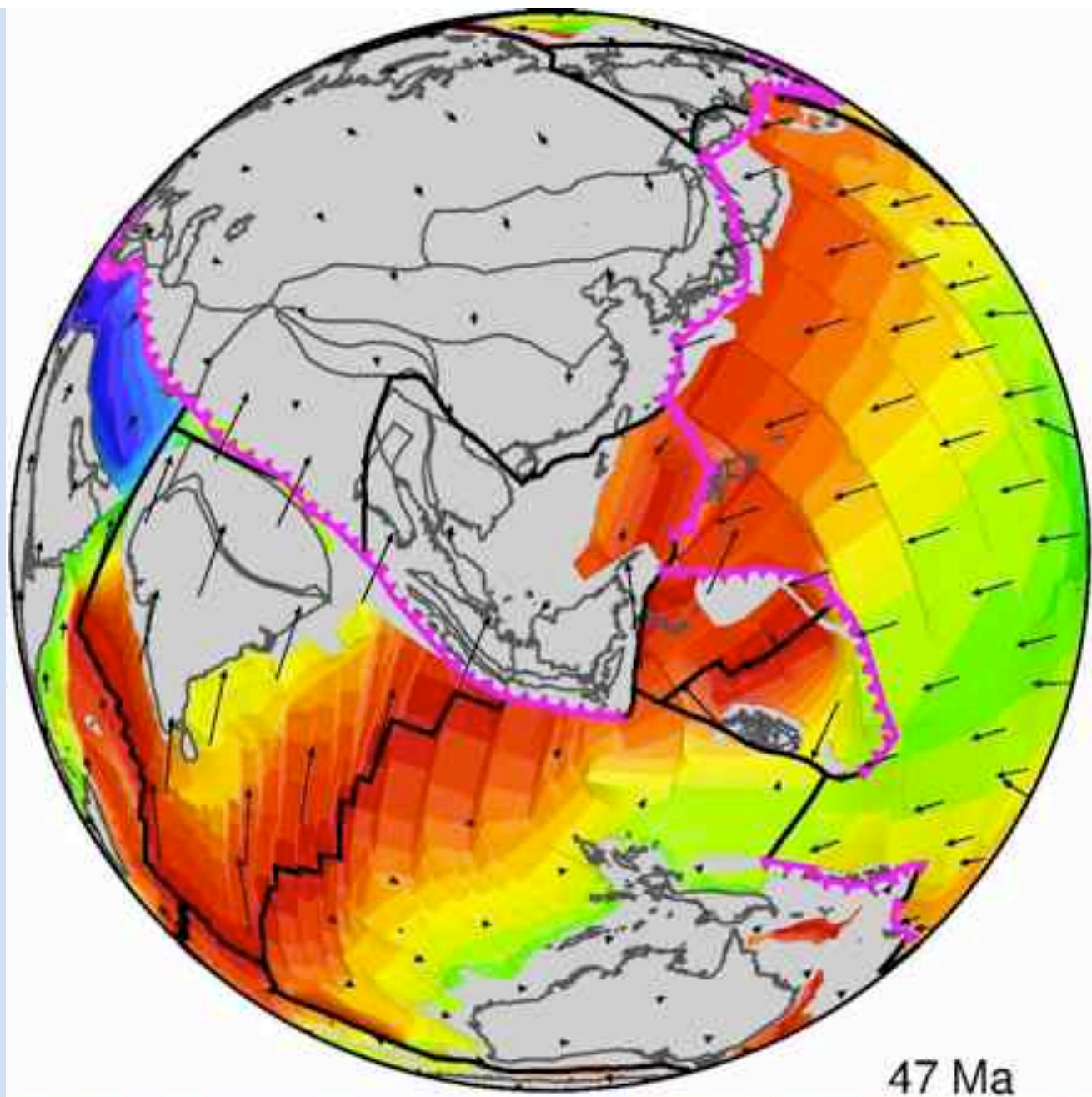




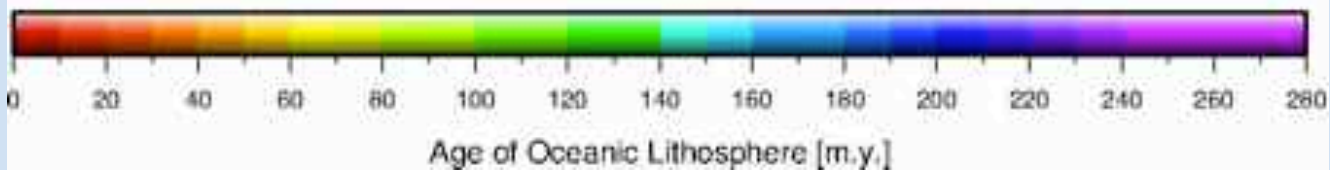
(Moran et al., 2006)



St. John (*Paleoceanography*, 2008)



47 Ma

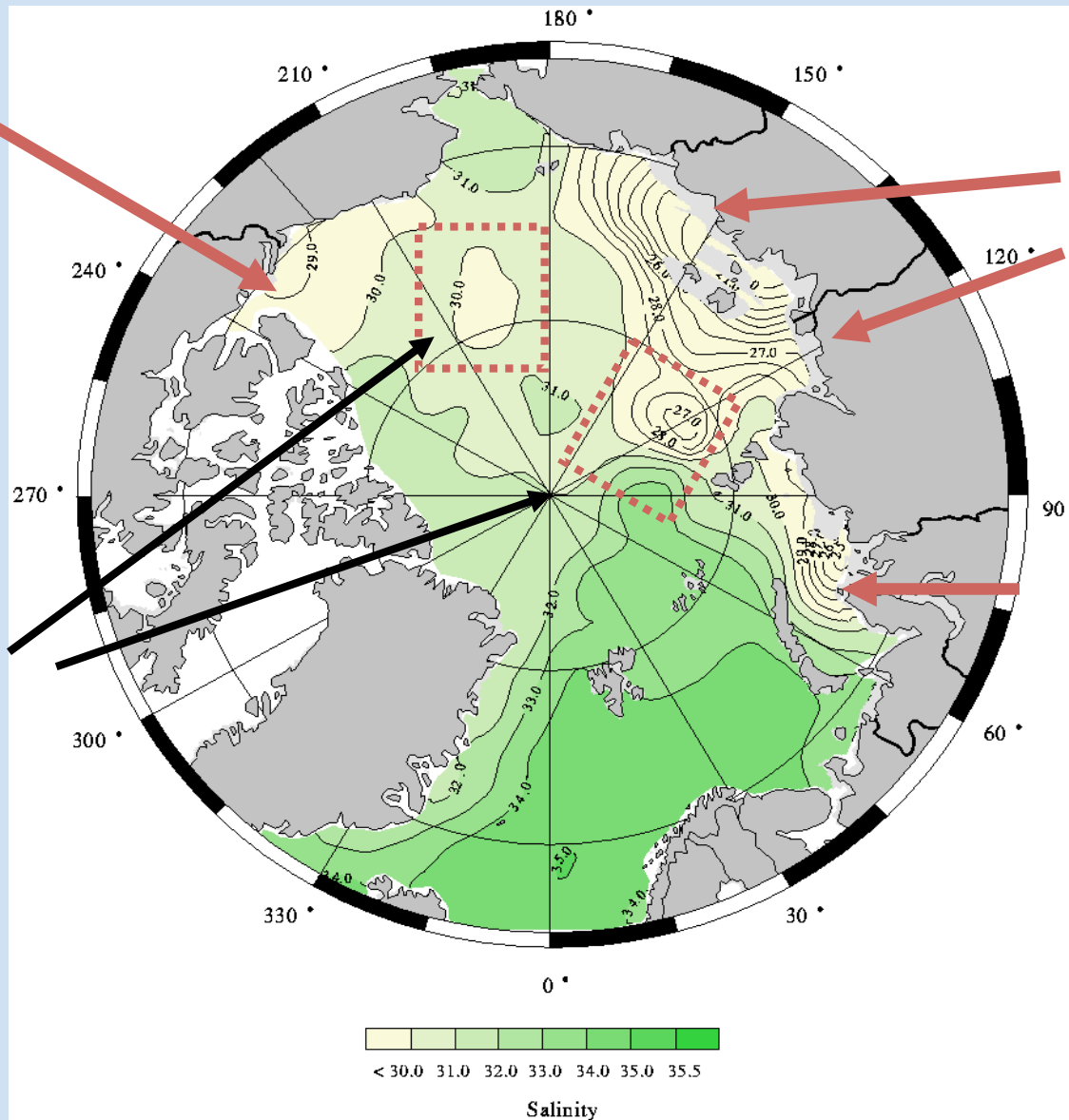


Freshwater input (summer)

- Note the high standard deviation in the Laptev and East Siberian seas -

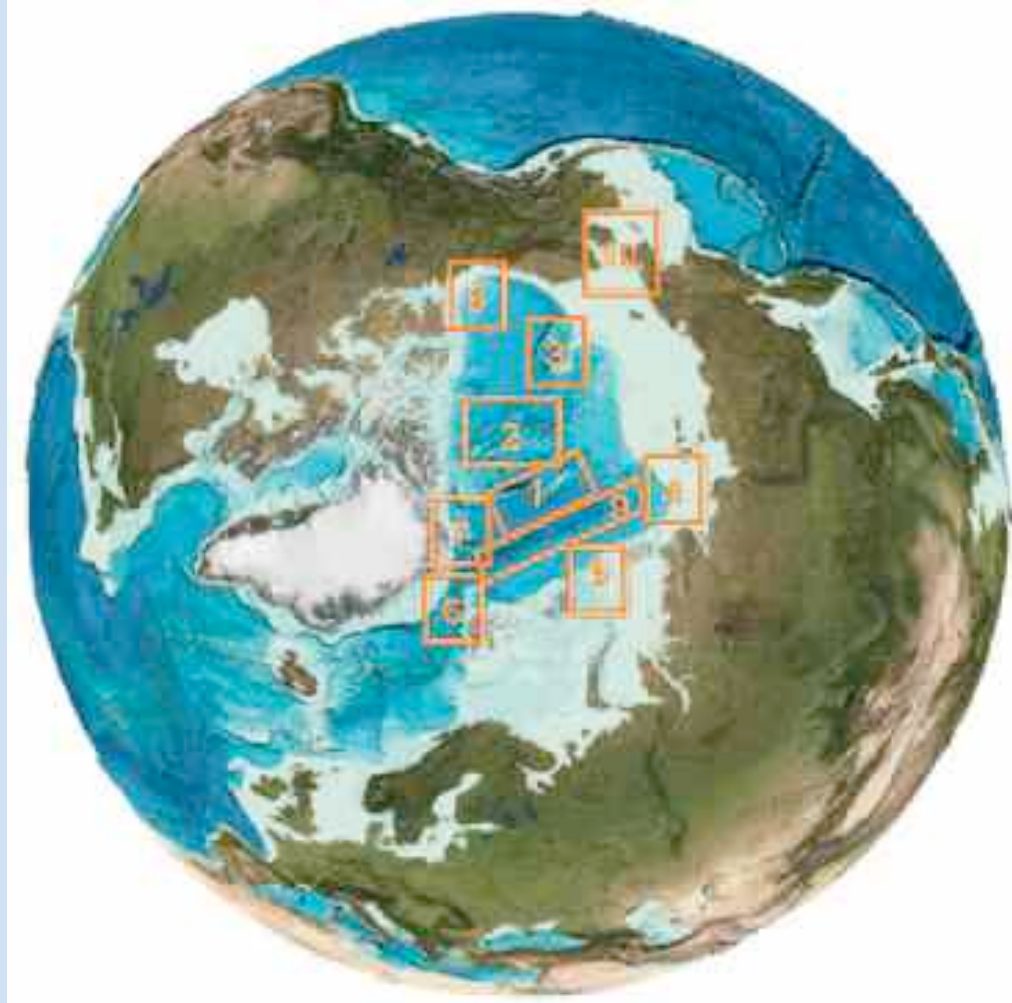
River discharge & sea-ice meltwater
2278 km³
stand. dev.= 10%

Storage of fresh-
water in the
Arctic Ocean



River discharge & sea-ice meltwater
2292 km³
stand. dev.= 40%!

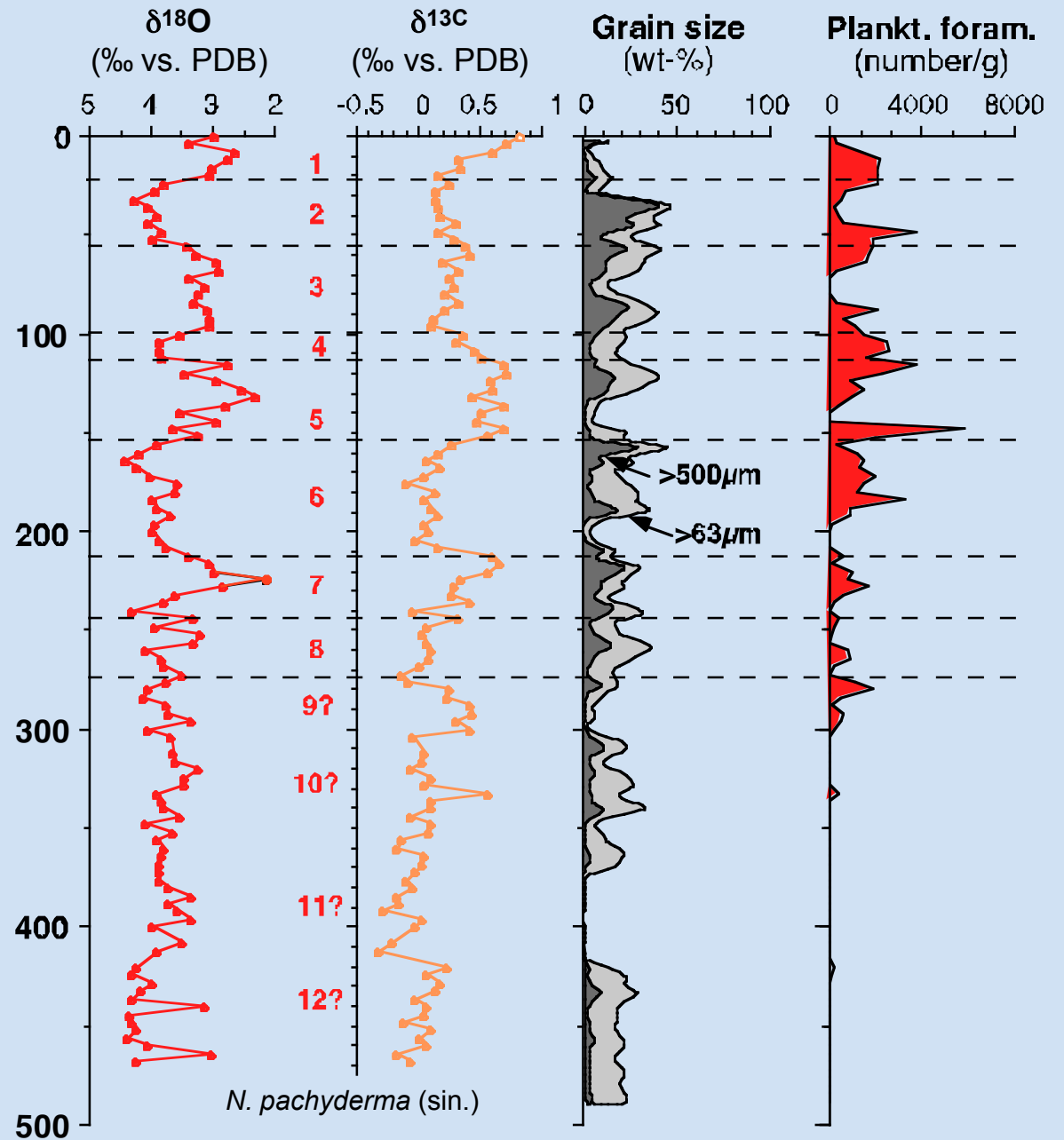
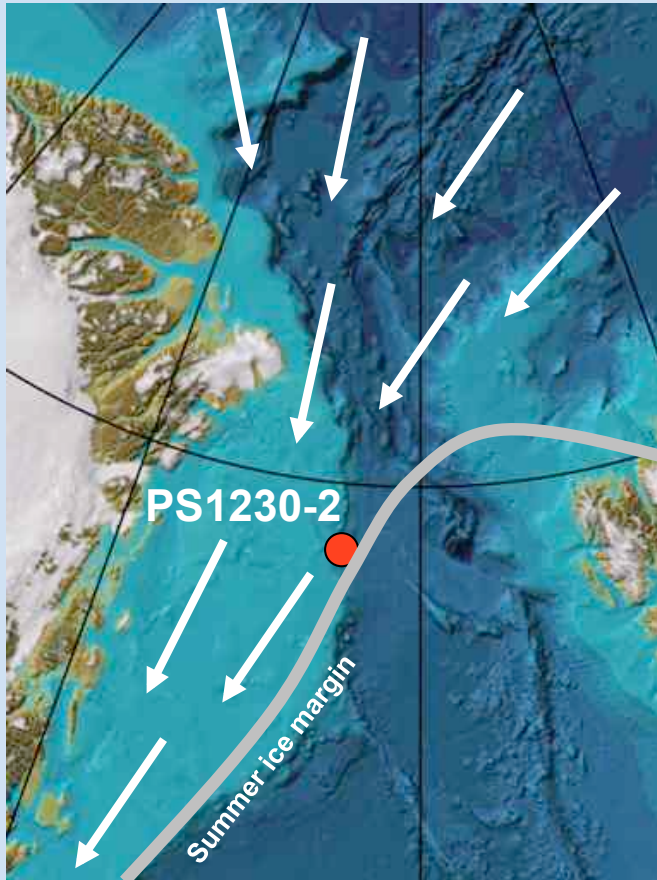
River discharge & sea-ice meltwater
2244 km³
stand. dev.= 18%



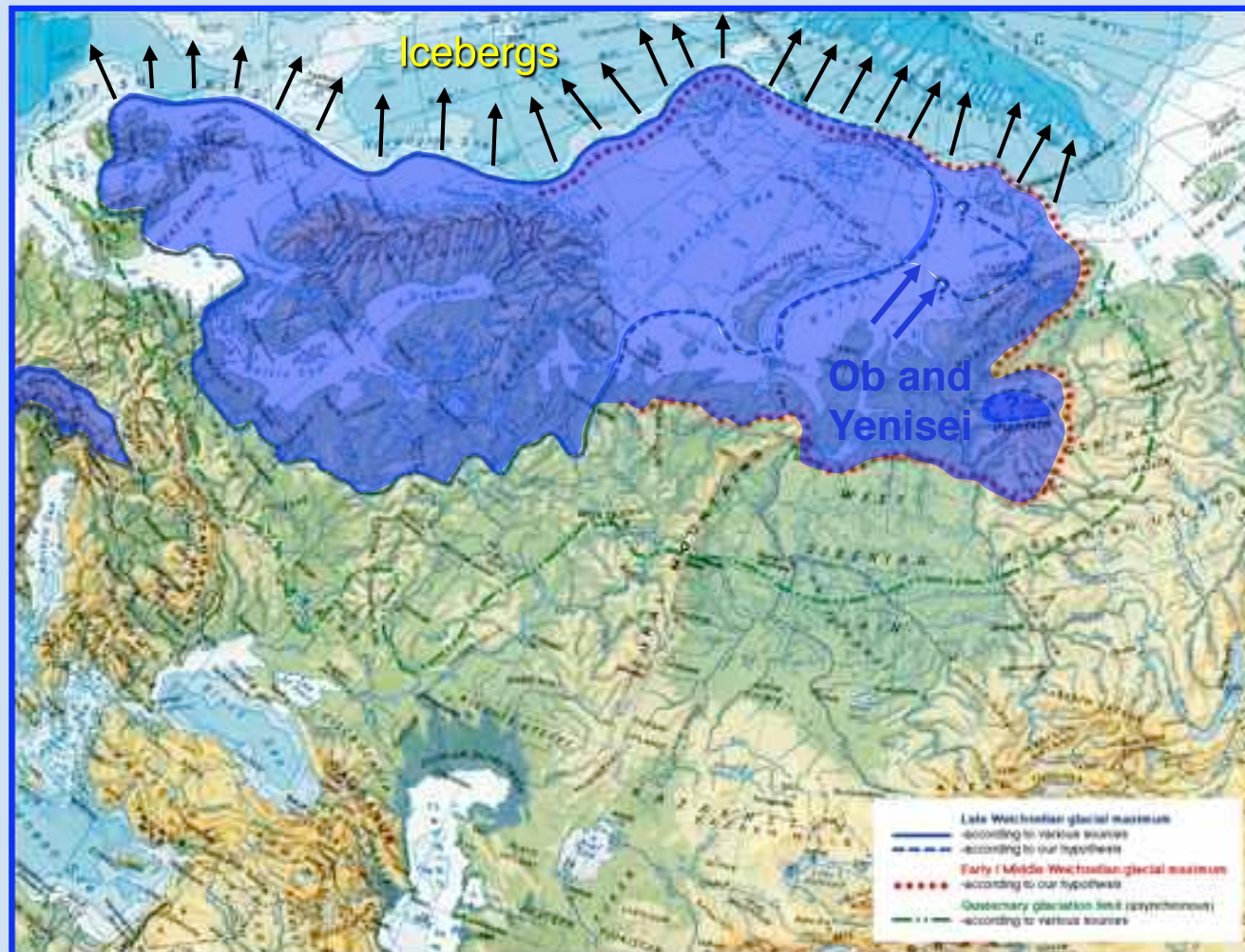


PS1230-2

Western Fram Strait
78°52.2'N 4°50.6'W
1235 m water depth

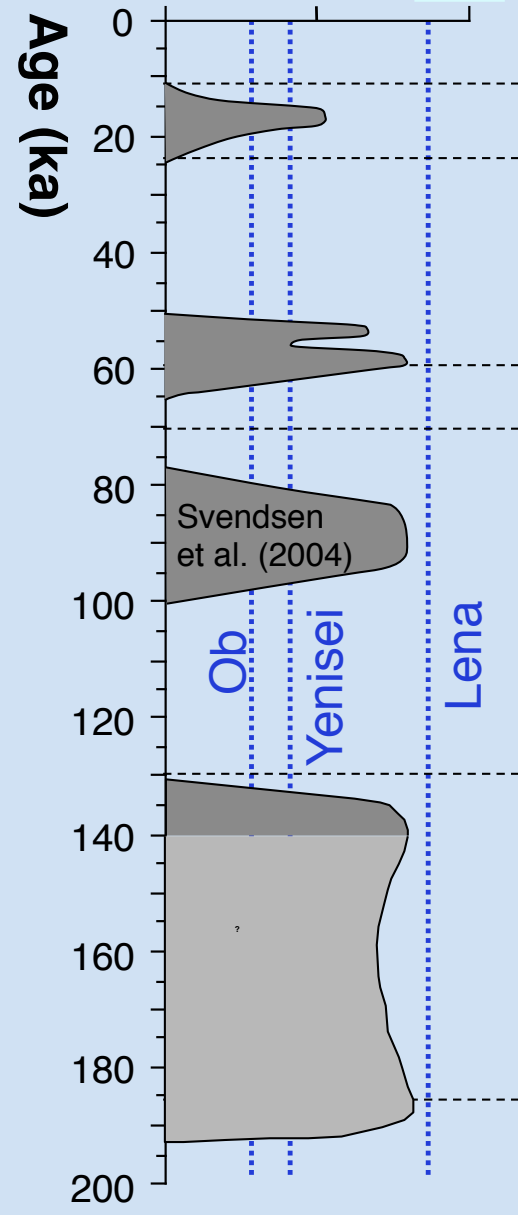


LGM

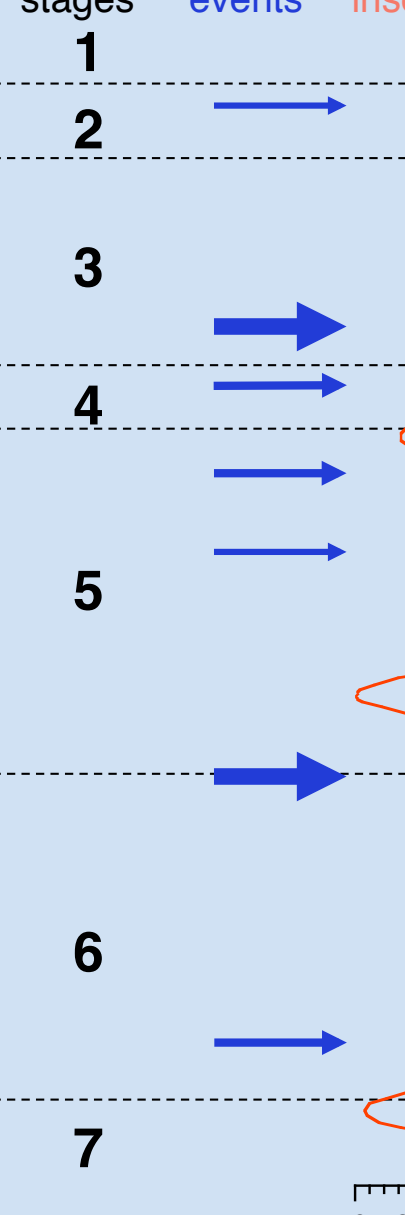


Svendsen et al., 1999

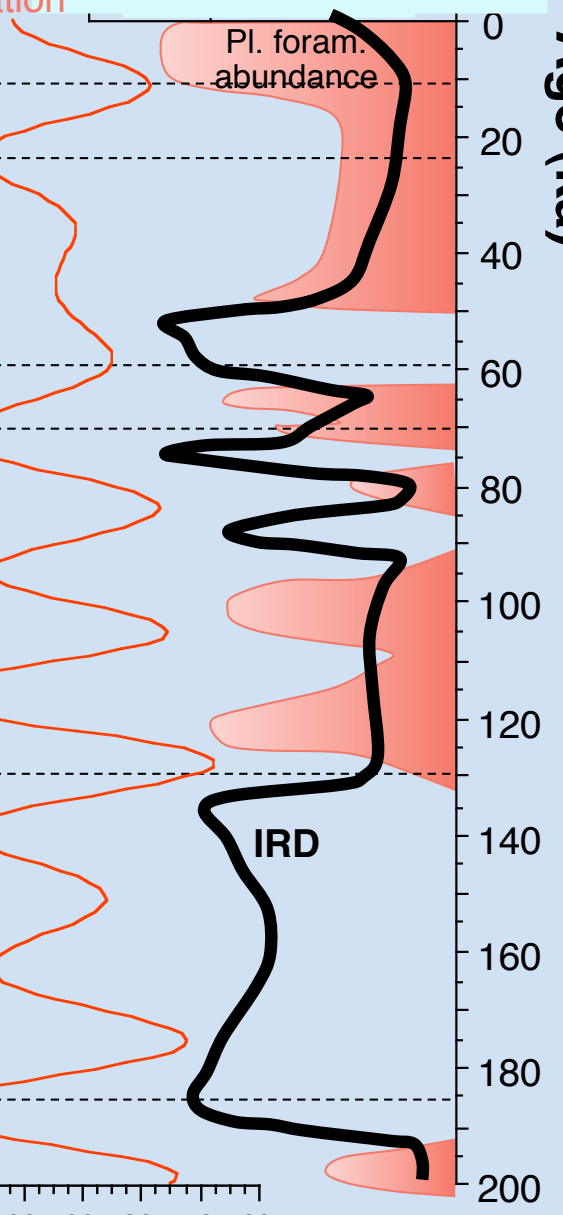
Ice sheet extension



Oxygen Isotope stages



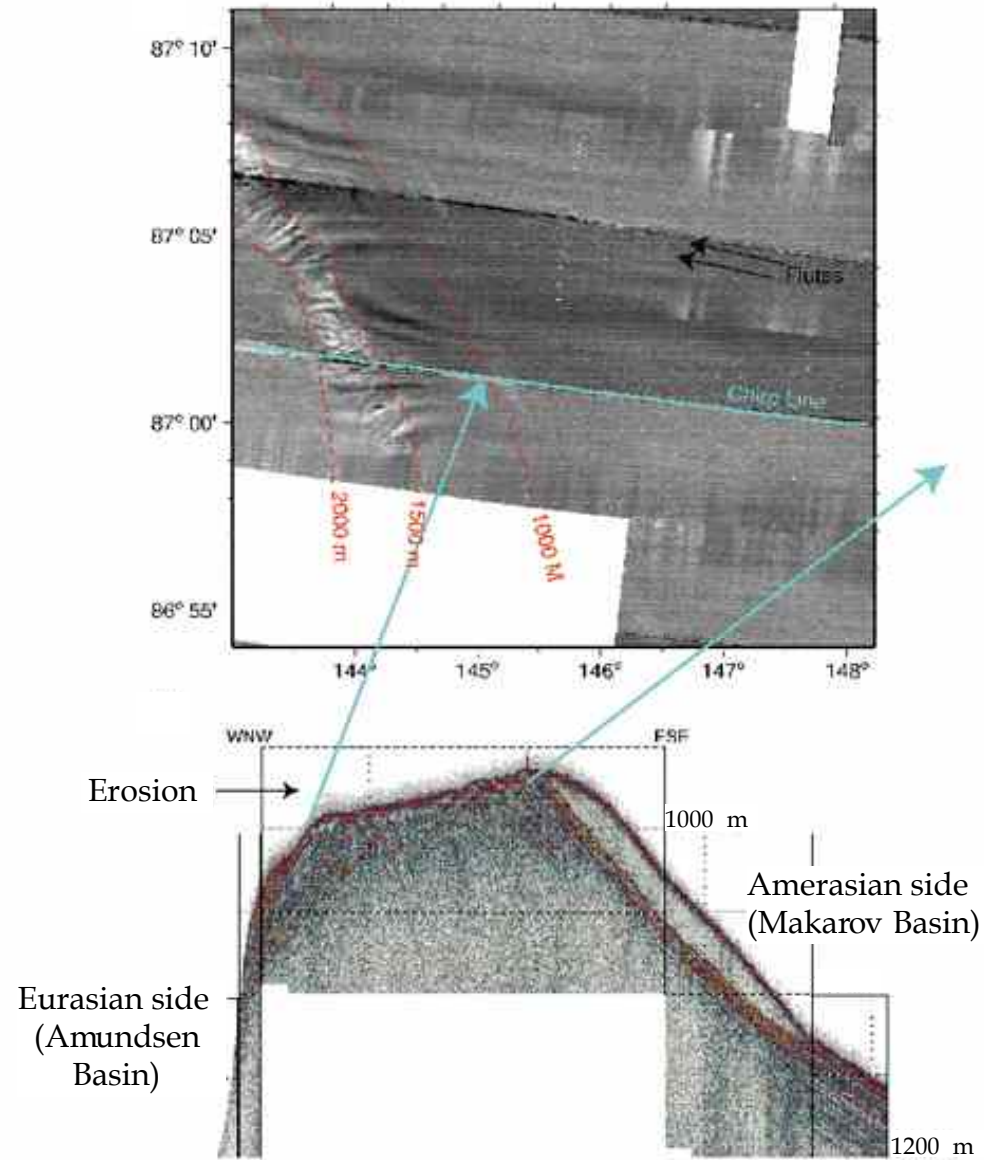
Arctic Ocean sediments



W/m² (65°N)
(Berger & Loutre, 1991)

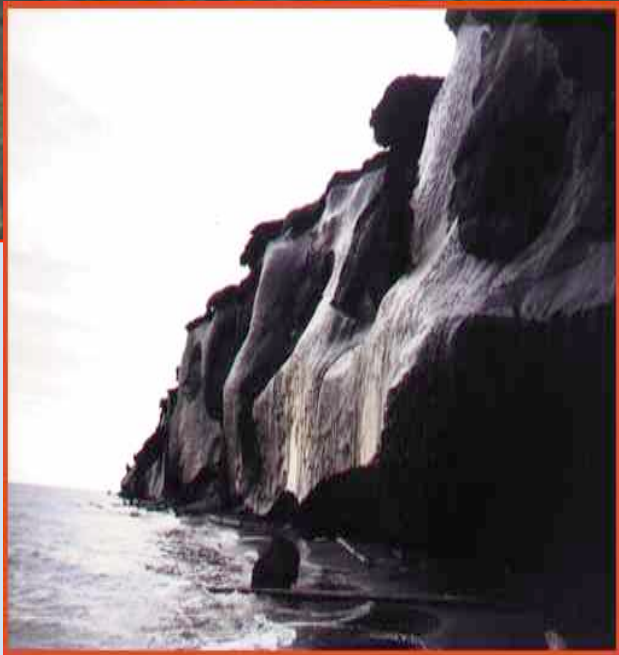
A special case:

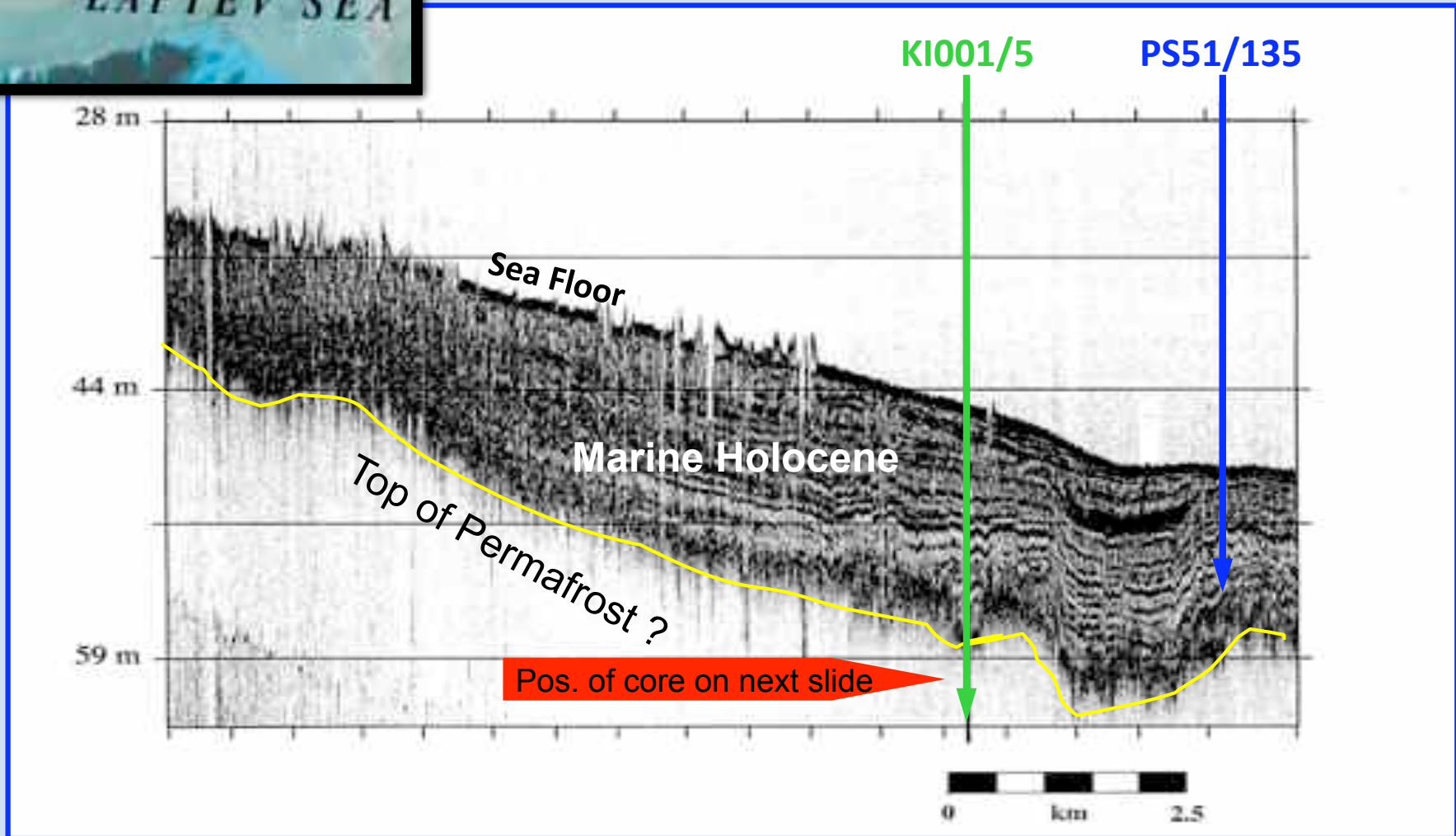
An ice shelf
in the Arctic Ocean
in stage 6
(Saalian glaciation,
ca. 185-130 ky B.P.)



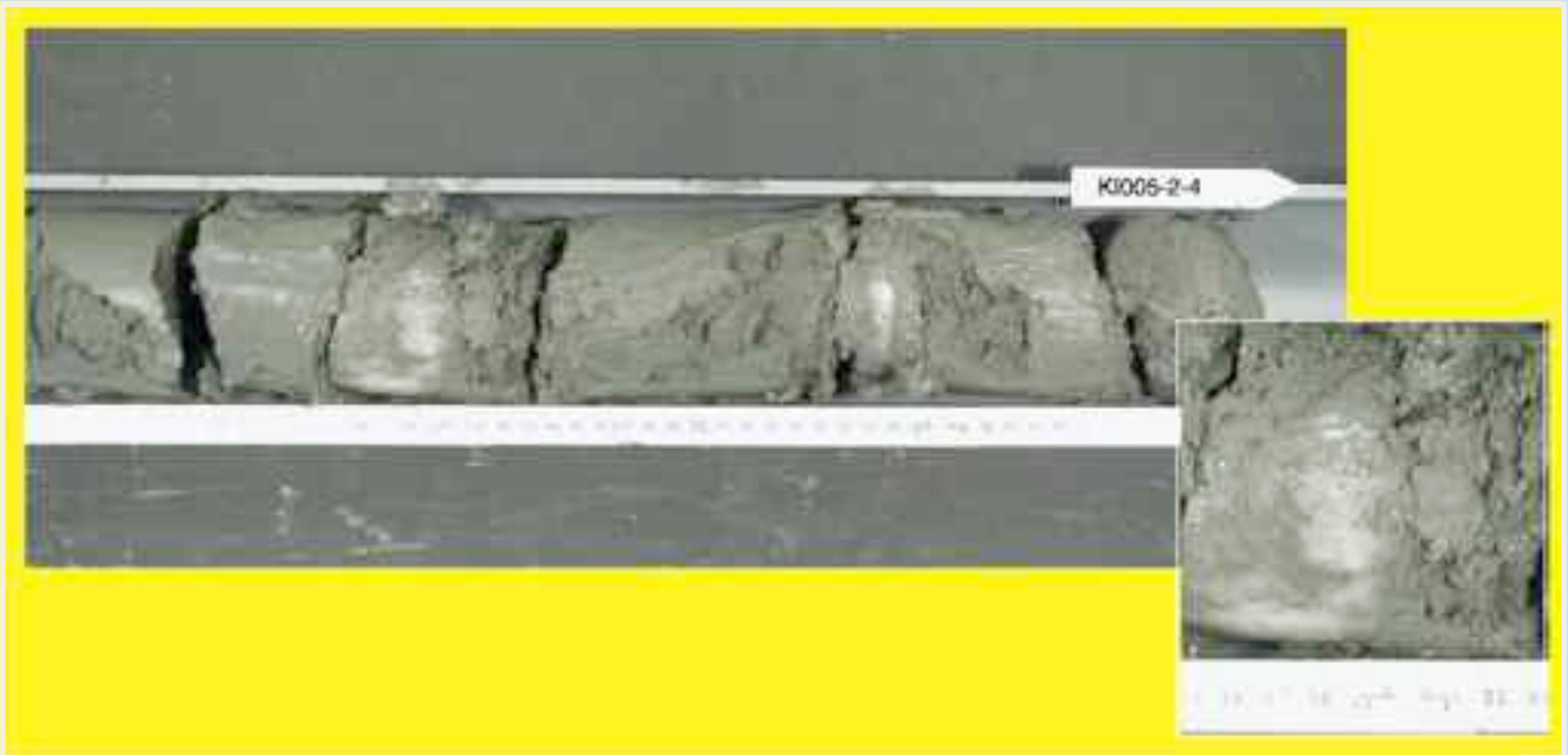
Lomonosov Ridge (ca. 87°N)

Modified from Polyak et al., 2001 (Nature)





Submarine permafrost!




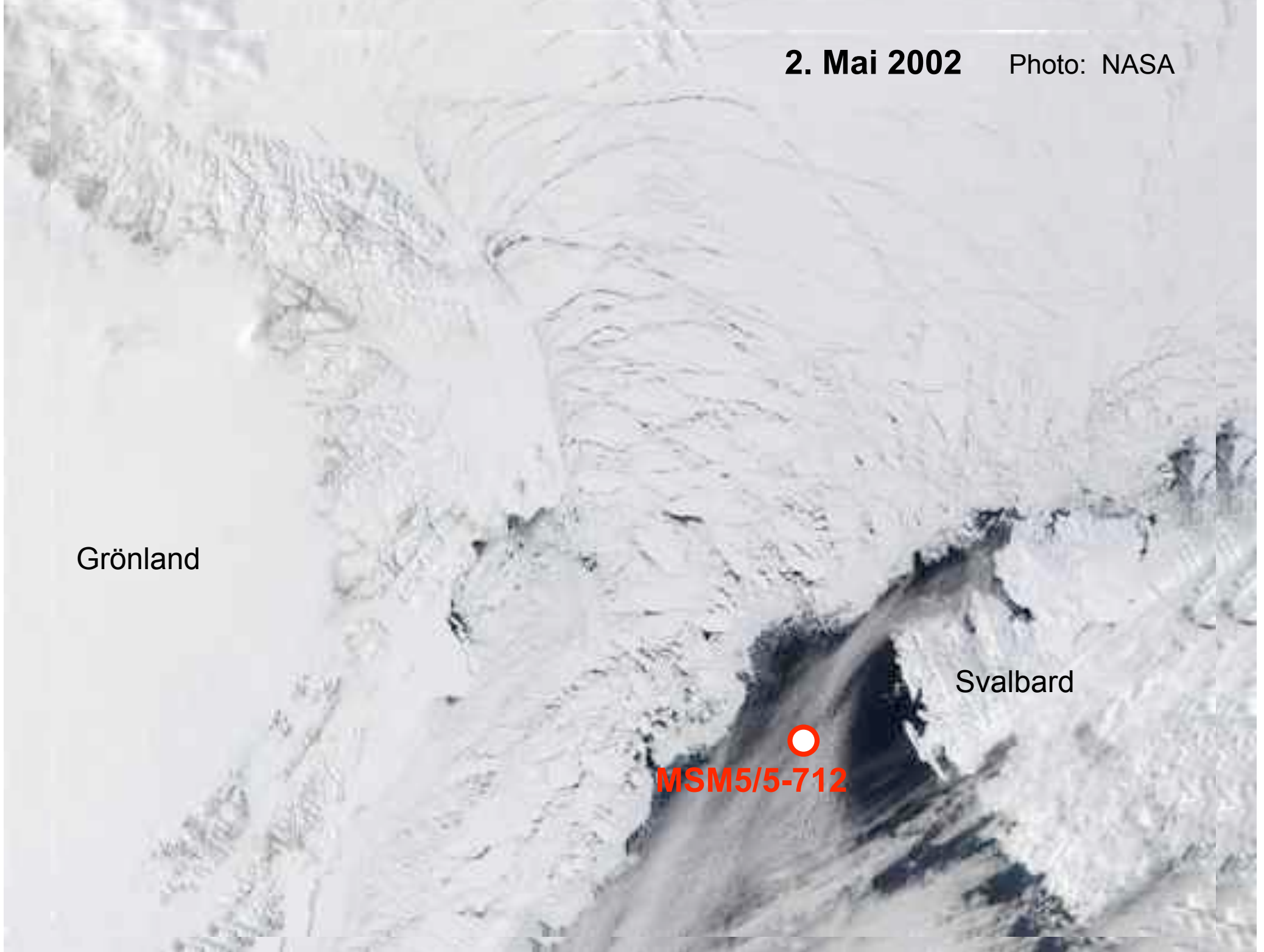
2. Mai 2002

Photo: NASA

Grönland

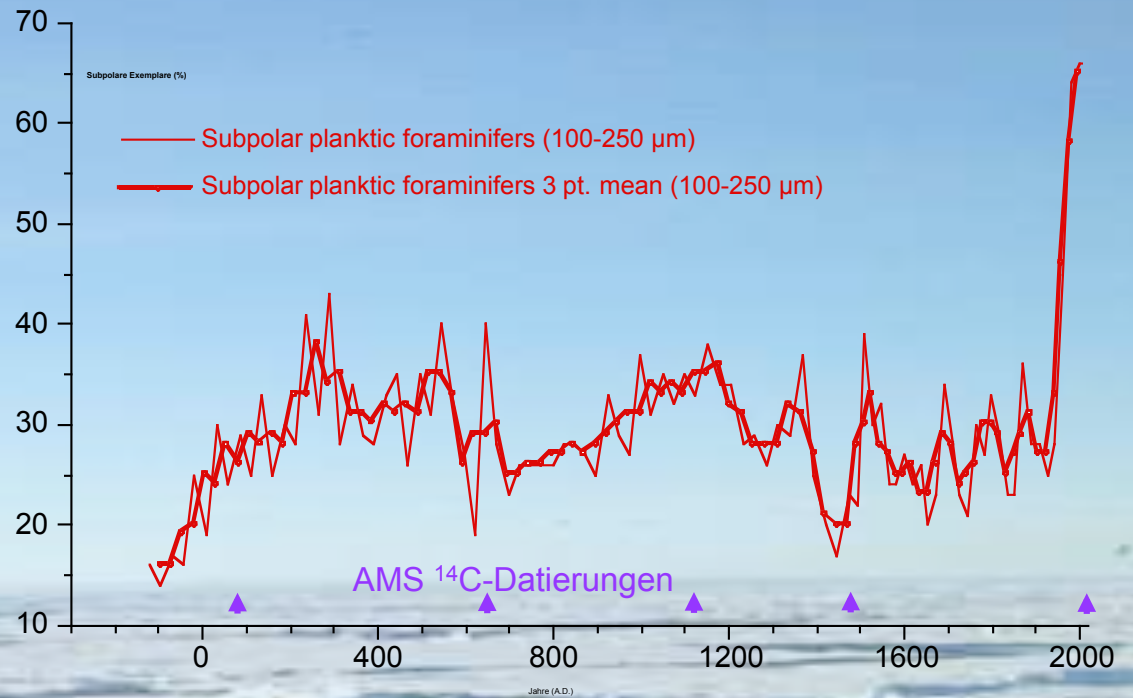
Svalbard


MSM5/5-712



Rekonstruktion of the Atlantic Inflow:

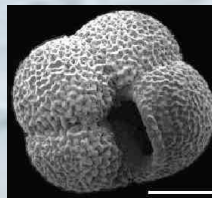
Planktic Foraminifers
as indicators of temperature
from
Spielhagen et al., 2011 (Science)



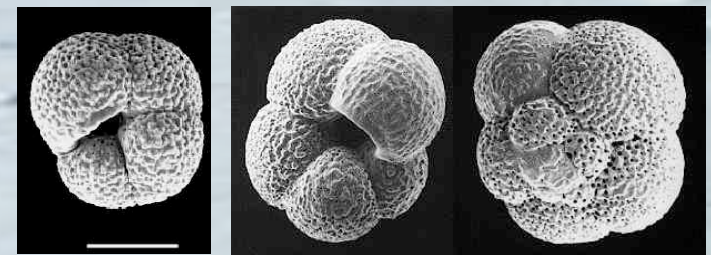
Eine polare Spezies:

Neogloboquadrina pachyderma (sin.)

100 μm



Mehrere subpolare Spezies (Beispiele):



100 μm



Date: 20030928

Status Quo: What we can do and what we cannot do

- Regular summer expeditions for all polar research disciplines
- Fullfill all logistic requirements (but at the expense of research time)
- Provide safety and experienced crews
- Bad season expeditions
- Deep-sea drilling
- Synoptic bipolar expeditions
- Deployments of ROV and AUV (or MUV) under closed sea-ice cover
- No systematic sampling under closed sea-ice cover
- etc.



Scientific research in polar seas

ERICON

Science Perspective
2015-2030



(7-990.01) Aurora Borealis
WIP 17.03.2008

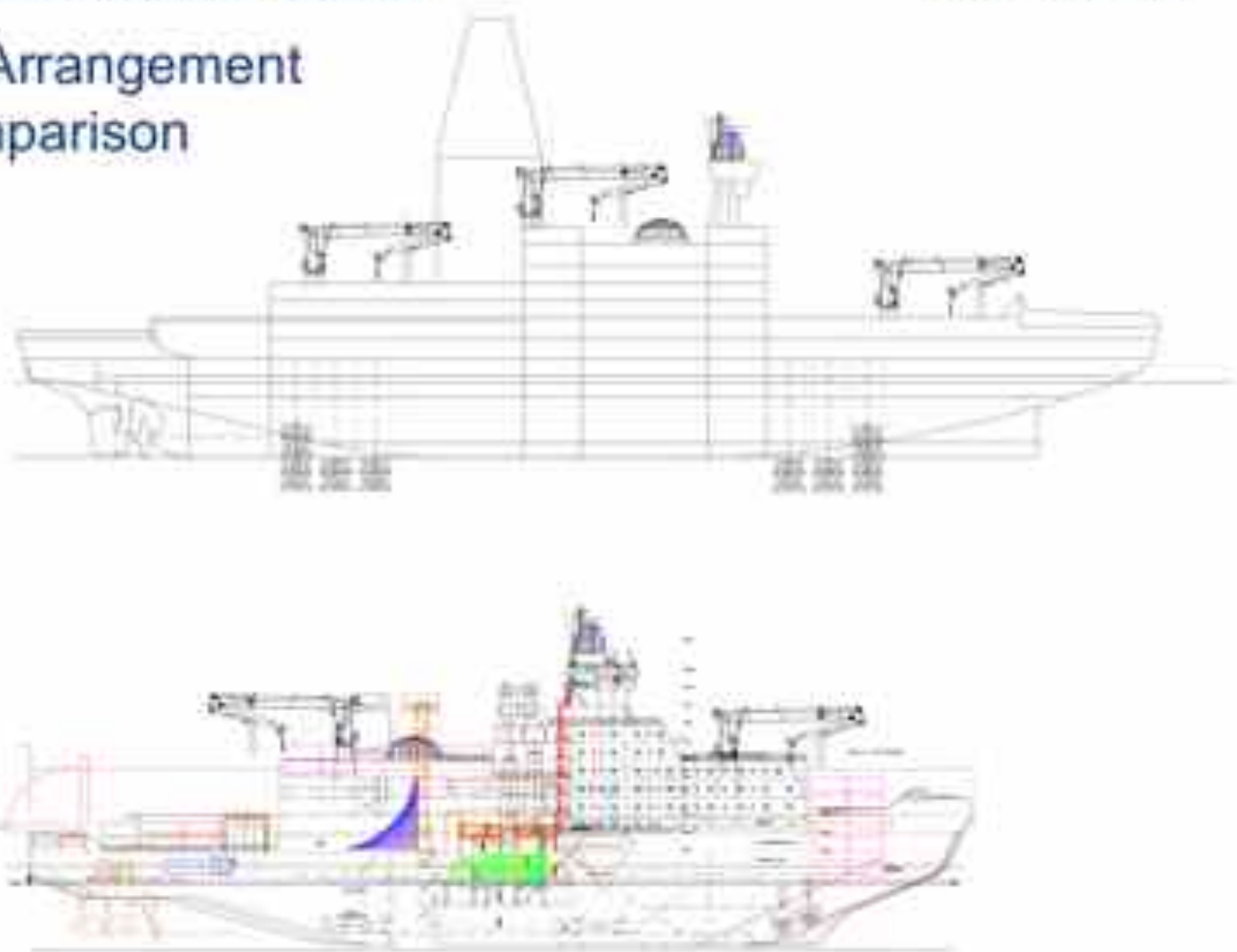


Further information is available at: <http://www.eri-aurora-borealis.eu>

Aurora Borealis Slim

Aker Arctic

General Arrangement
Size Comparison



Reduction of Expenses of approx. 30%

ESFRI

EURO-ARGO

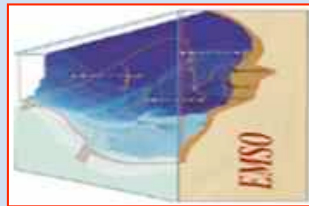


ERICON-AB



EPOS

EMSO

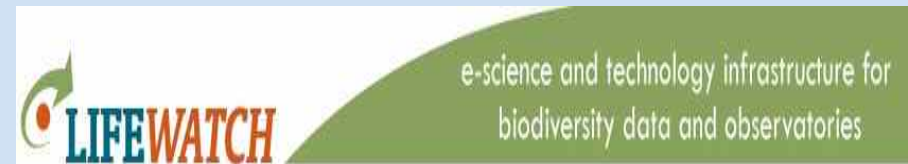


SIAOS



ICOS

European Strategy forum on Research Infrastructure



LIFEWATCH

French Arctic marine research in the Future?

- We are able to draw on the successes of the last international Polar Year (2007-2009), the biggest and most ambitious internationally coordinated effort in polar research, to investigate the impact of the dynamics of the polar region changes on the global environment. The French input is very important.
- We will be able to draw on novel infrastructure hopefully run by international consortia or by closely coordinated national polar research programs (ships, stations, aircraft, satellites, etc.). The time of isolated national programs is over.
- The Arctic is changing fast. We who depend on the properties of the Arctic Ocean and climate should be present there all the time to evaluate the potential and speed of change in real time.
- Exciting times are coming for the the next generation of polar scientiststs and we will have to prepare for them.