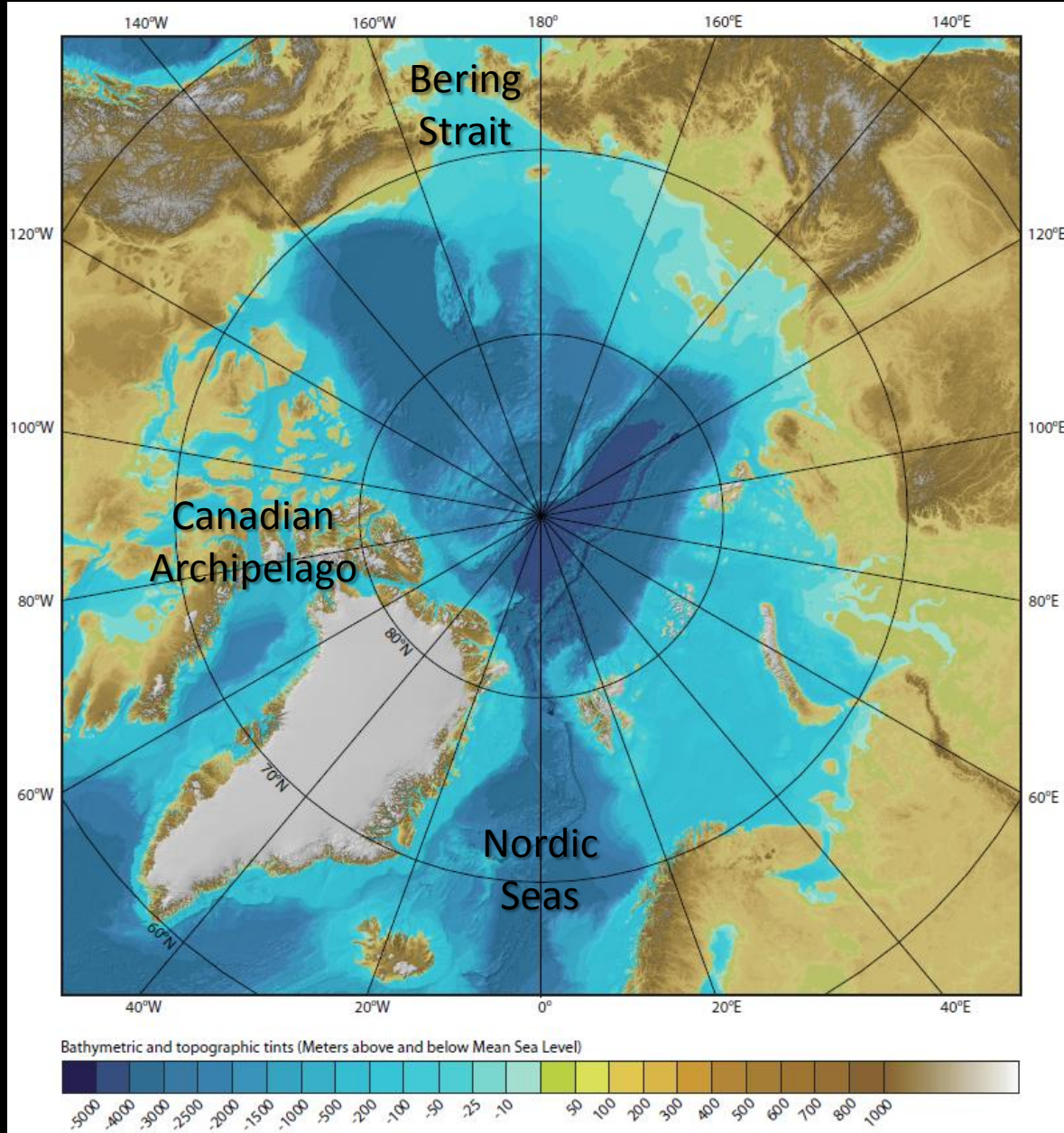


The Arctic Ocean

An aerial photograph of a sea ice field in the Arctic Ocean. The ice is broken up into numerous irregular, interconnected floes of varying sizes. Between these floes are dark, open water channels and melt ponds. The ice floes have a textured, granular appearance, likely due to snow or ice crystals. The overall scene is a complex, maze-like pattern of white and light blue ice against a dark blue water background.

Not a textbook sea

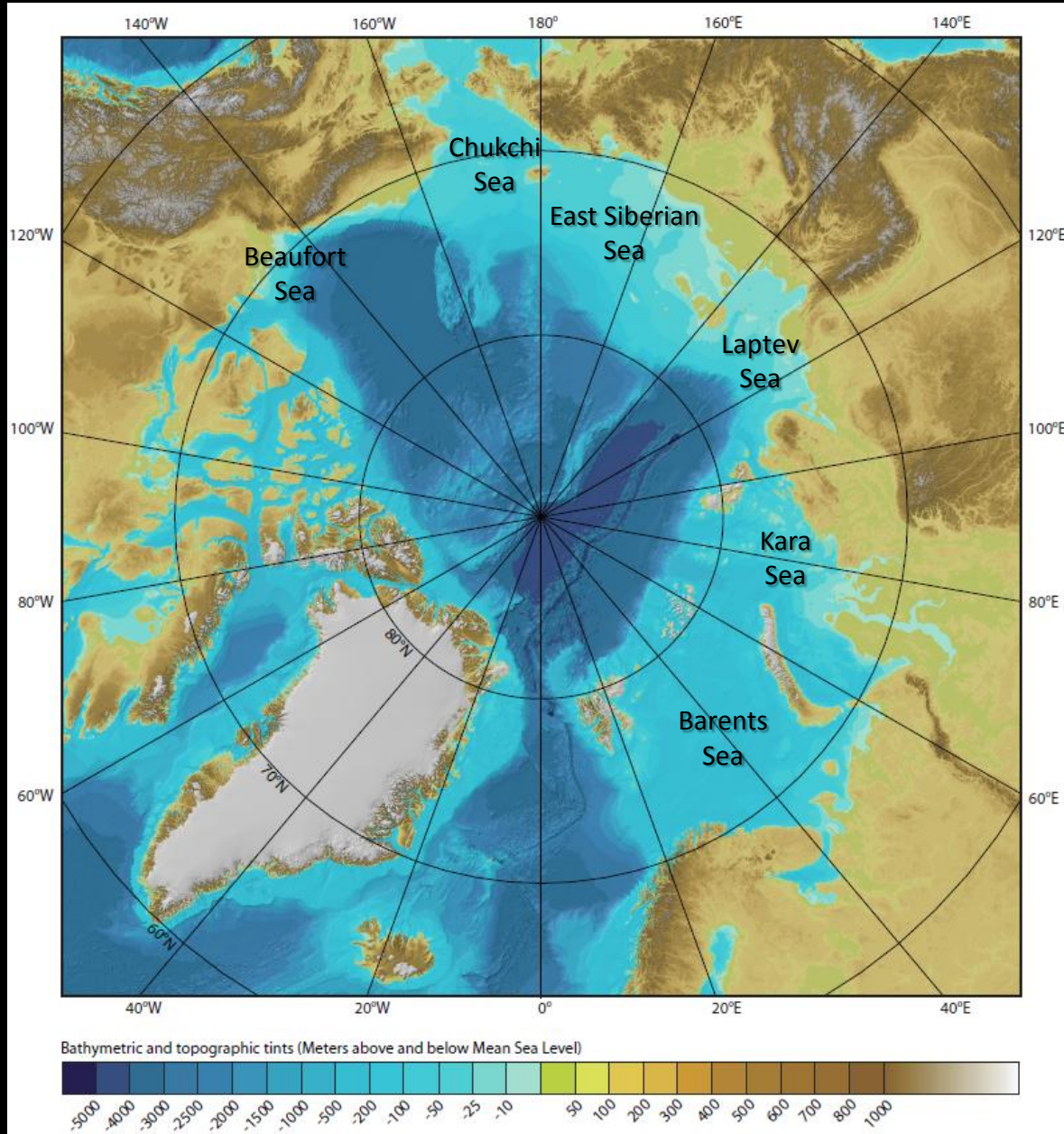
Arctic Ocean Geography



Surrounded
by land

- only 3 openings
- Large river influence
 - 9000 km³/yr

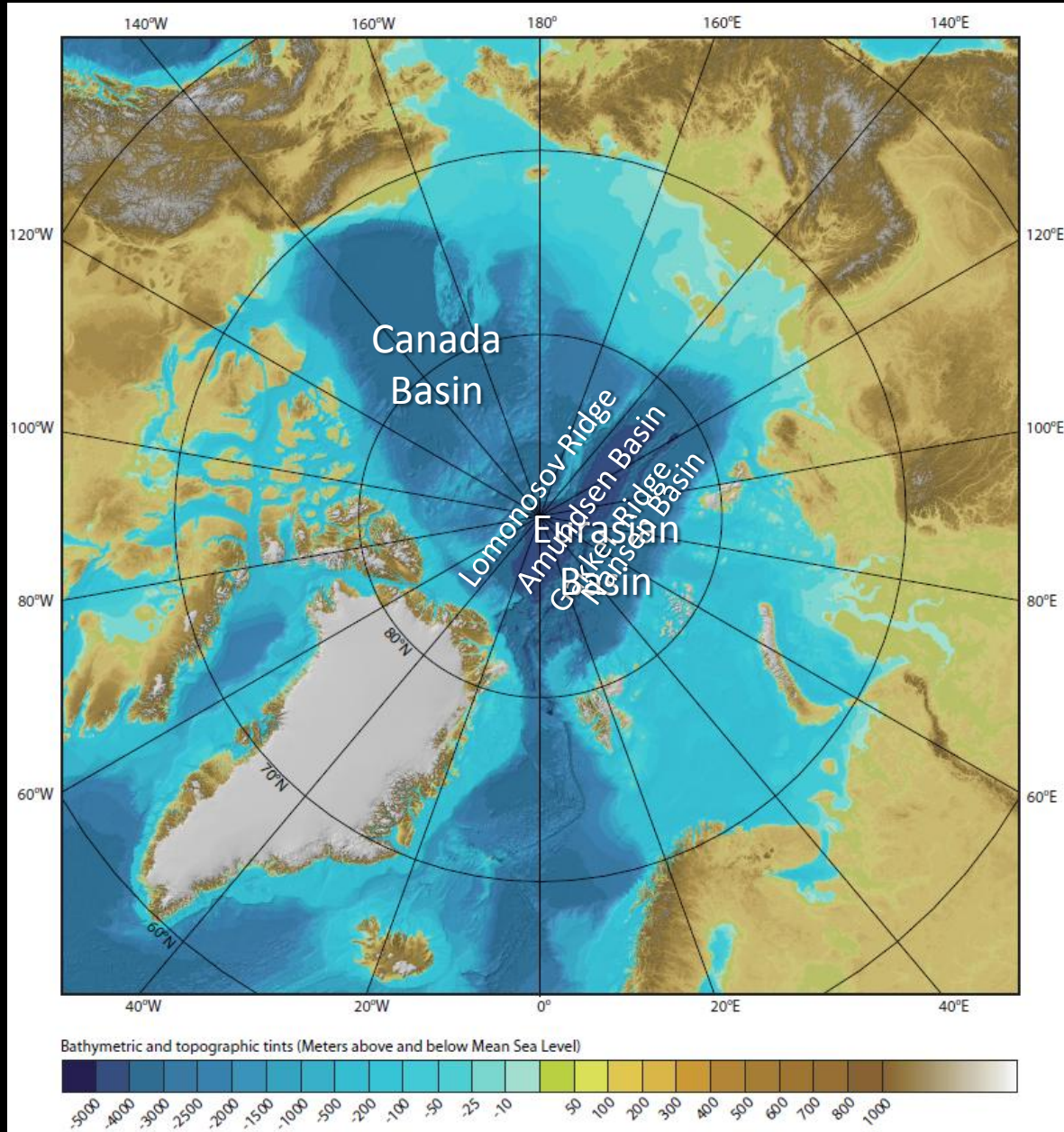
Arctic Ocean Geography



Large shelves

- 50% of the total area is shallower than 250 m
- extending up to 1200 km from the coast
- Comprise oceanographically distinct coastal seas

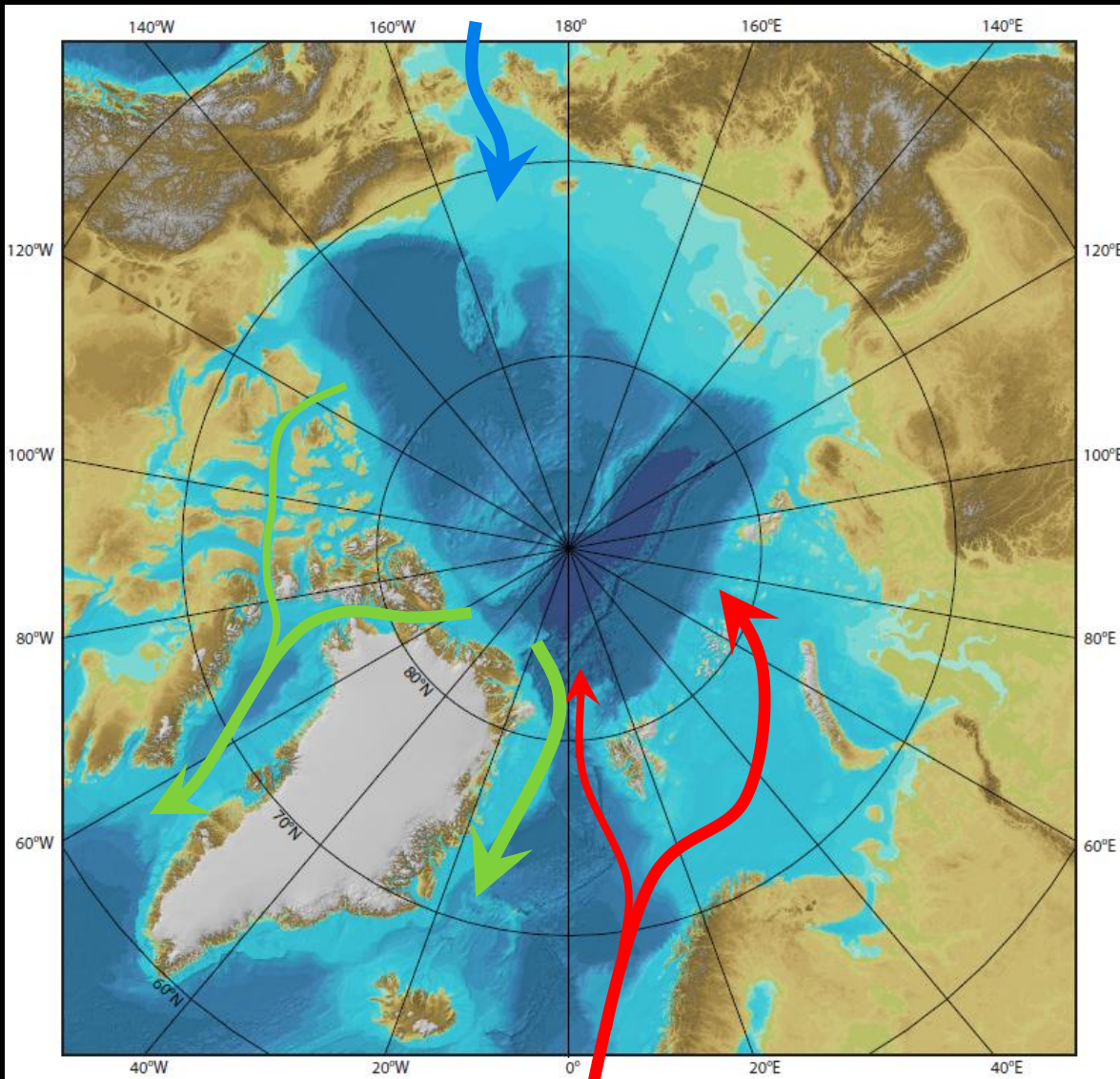
Arctic Ocean Geography



2 deep basins

- Waters up to 450 years old (compared to 30 in the North Atlantic & 1500 in the North Pacific)

Arctic Ocean Circulation



Inflows

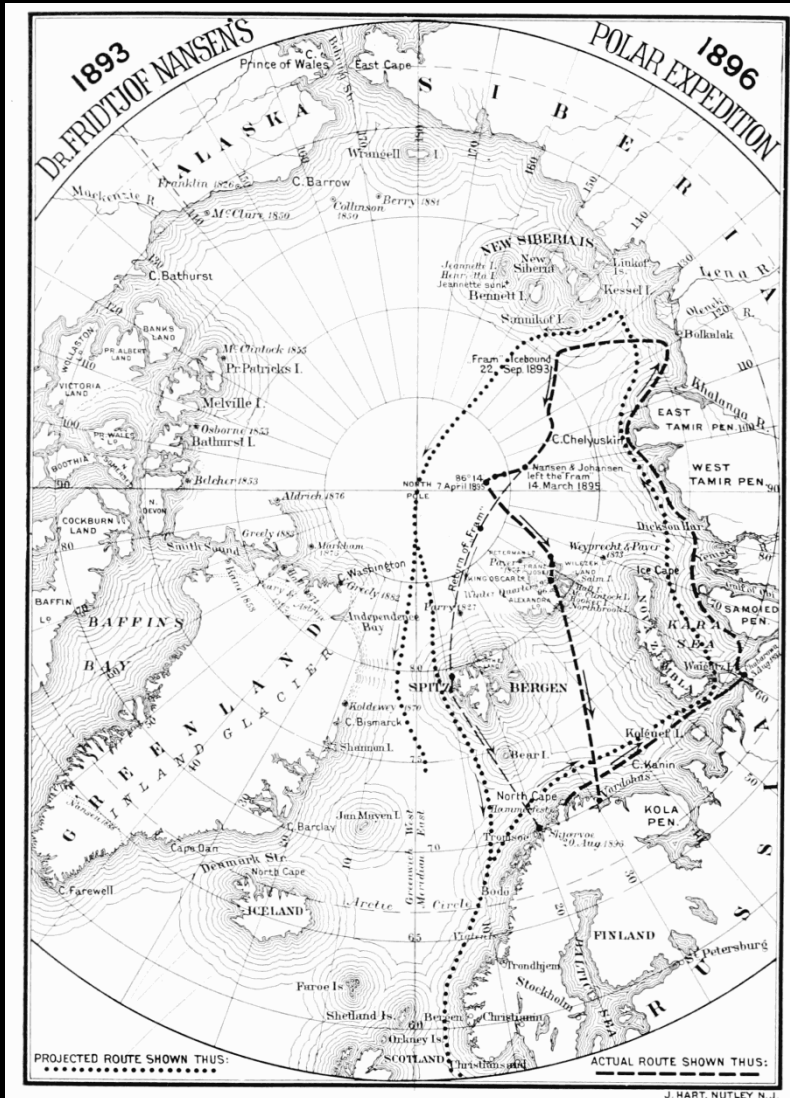
- Atlantic: warm and salty
- Pacific: cold and fresh

Outflows

Mostly shallow

Arctic Ocean Circulation

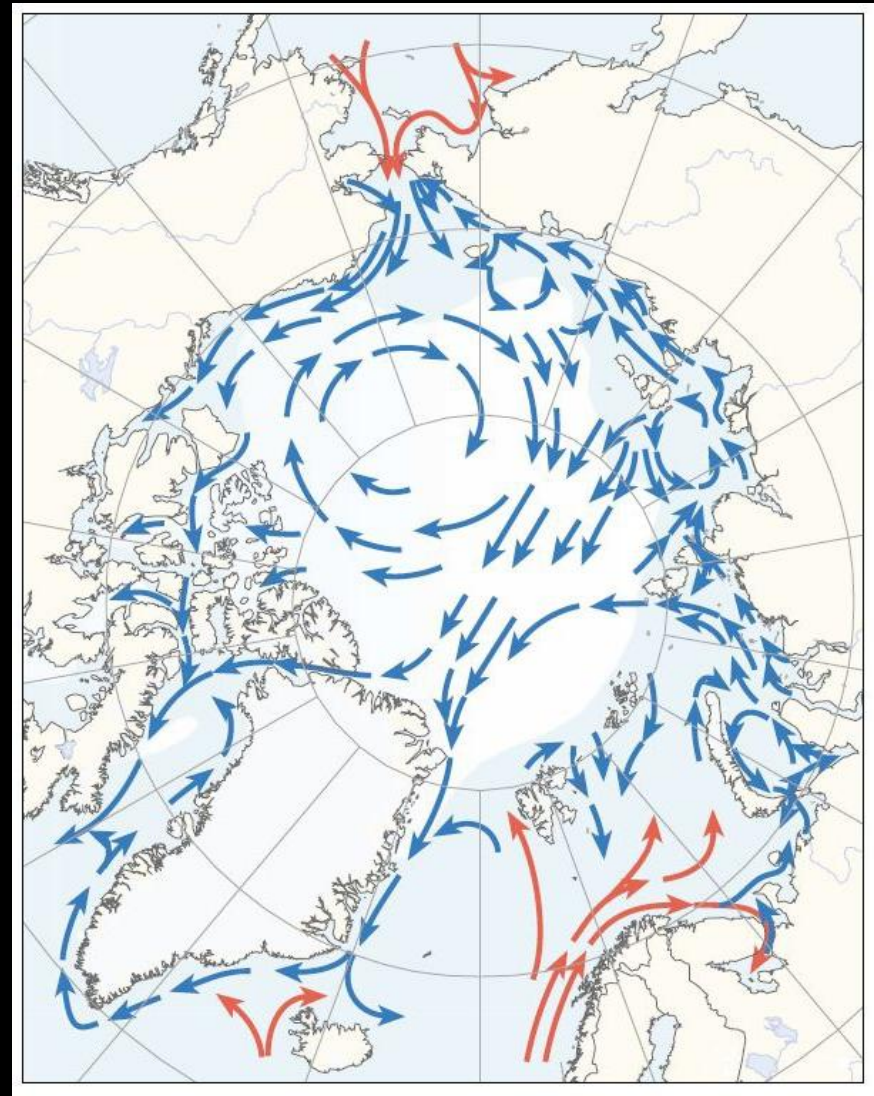
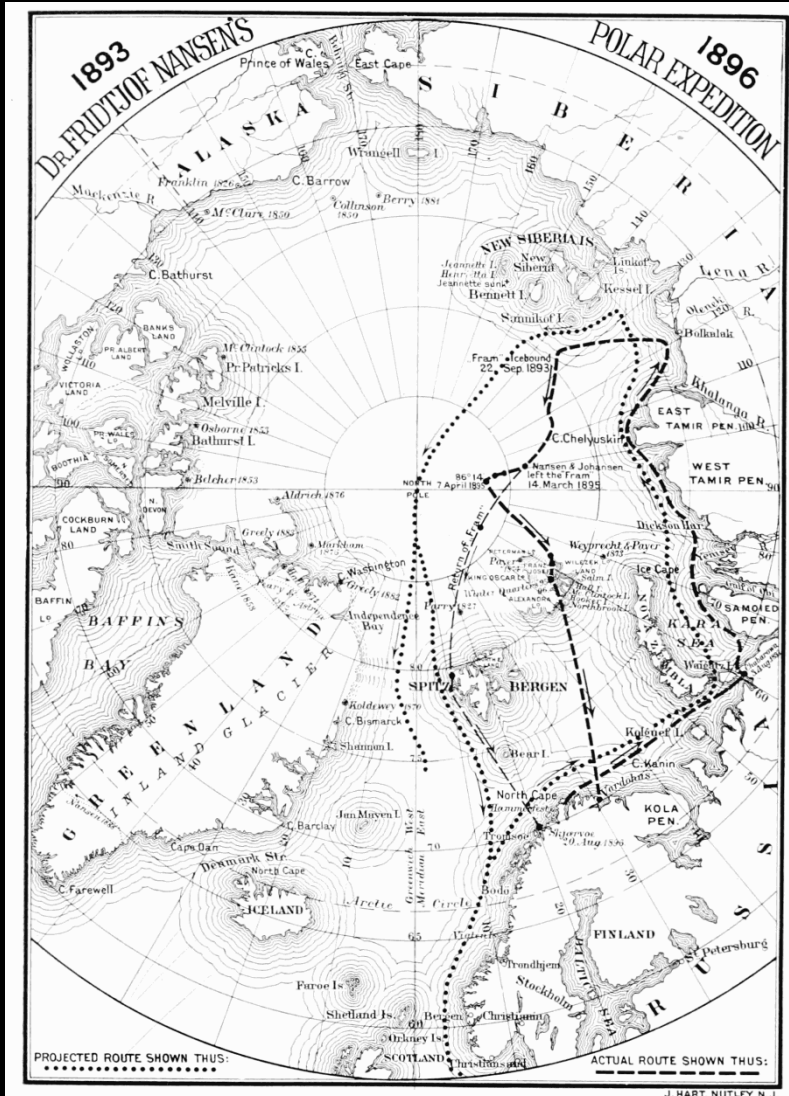
Surface currents



THE FRAM IN THE ICE, MIDSUMMER, 1894.

Arctic Ocean Circulation

Surface currents



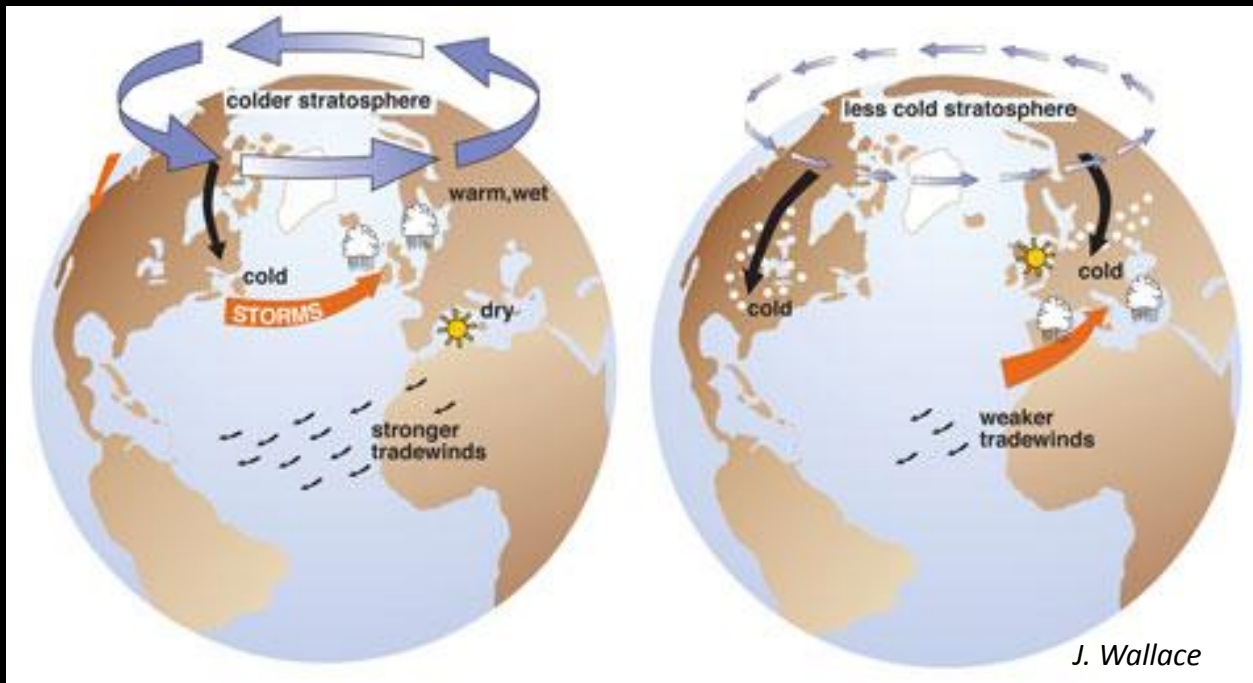
Arctic Ocean Circulation

Arctic Oscillation

“an atmospheric circulation pattern in which the atmospheric pressure over the polar regions varies in opposition with that over middle latitudes... on time scales ranging from weeks to decades” (NSDIC)

Positive phase: Pressure low in the Arctic & high at mid-latitudes.

Negative phase: Pressure high in the Arctic & low at mid-latitudes.

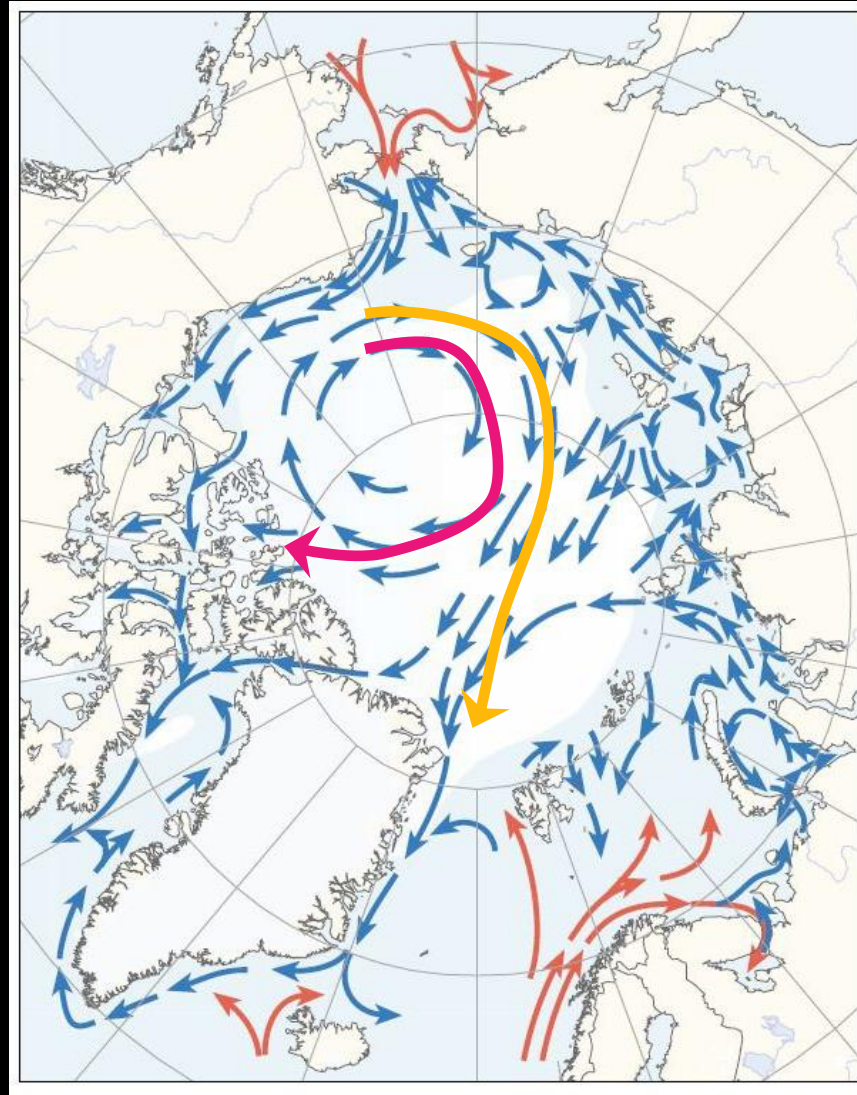


Arctic Ocean Circulation

Arctic Oscillation

Positive phase:

- Pressure low in the Arctic & high at mid-latitudes
- Stronger polar vortex
- More water exits through the Archipelago

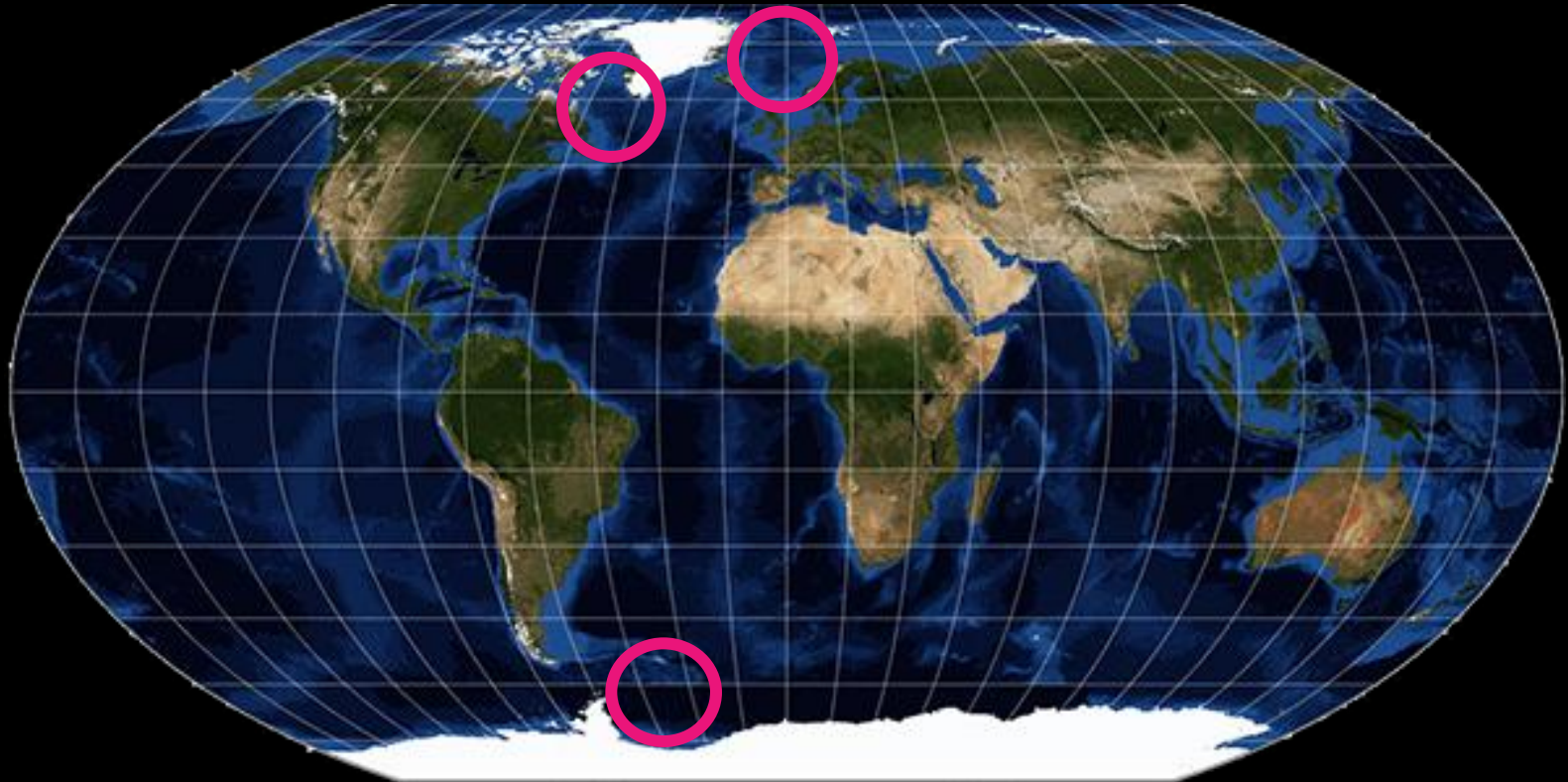


Negative phase:

- Pressure high in the Arctic & low at mid-latitudes
- Weaker polar vortex
- More water exits through Fram Strait

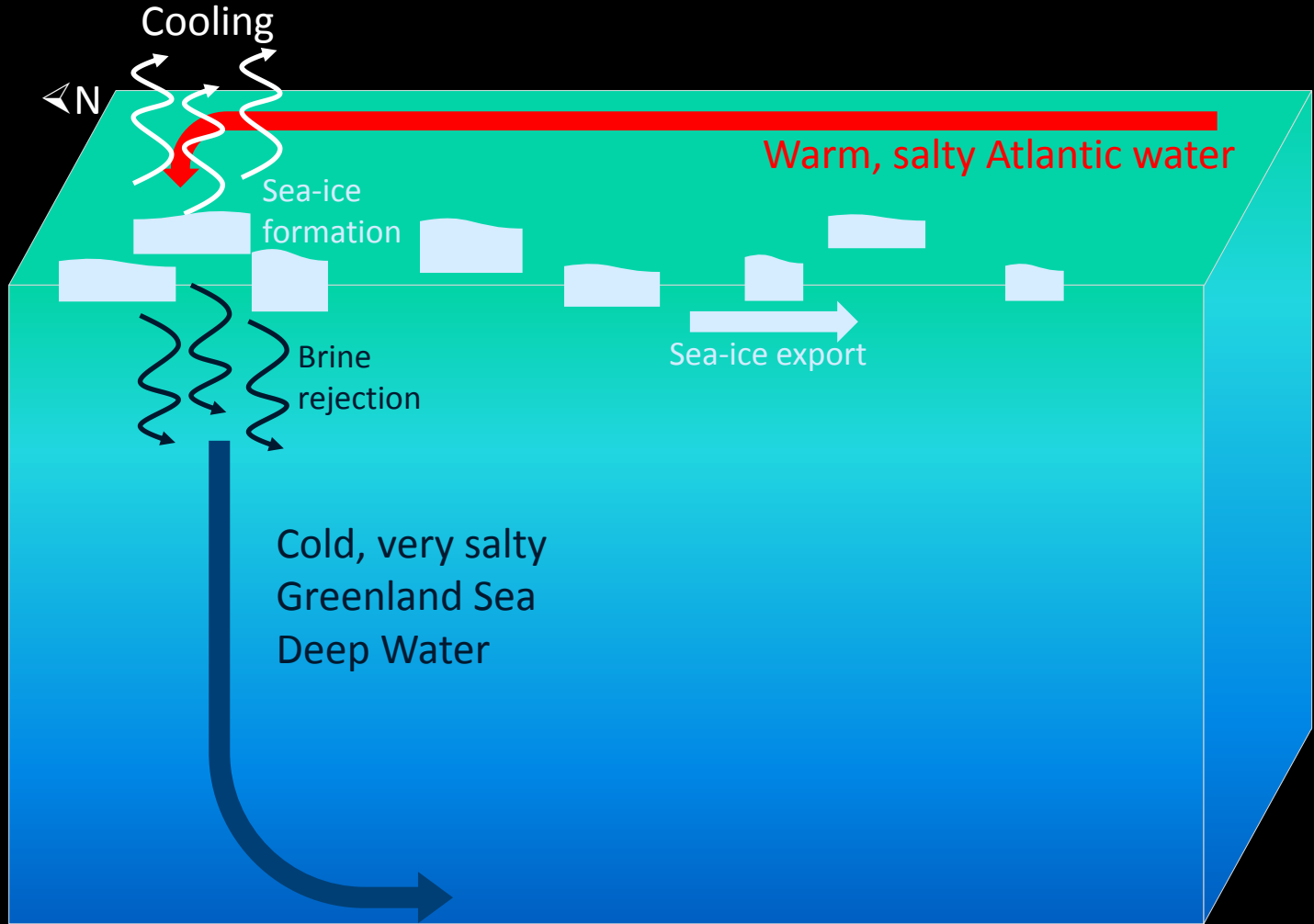
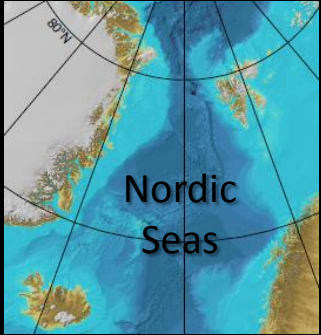
Arctic Ocean Circulation

Deep water formation



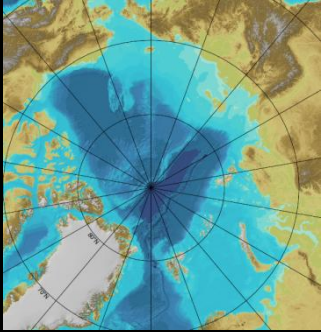
Arctic Ocean Circulation

Deep water formation



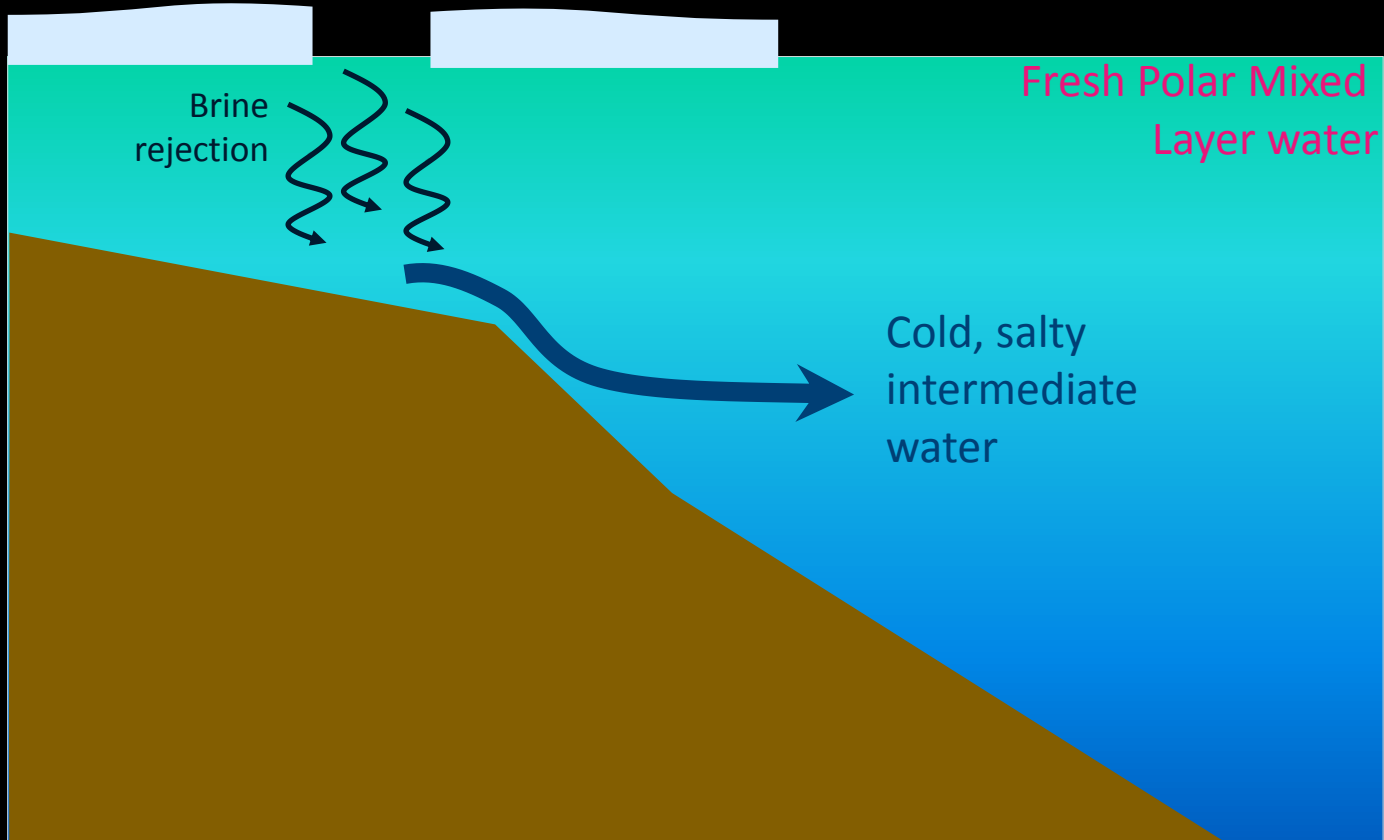
Arctic Ocean Circulation

Shelf water formation



Requires local excess ice formation over melt

Sea-ice formation in flow leads



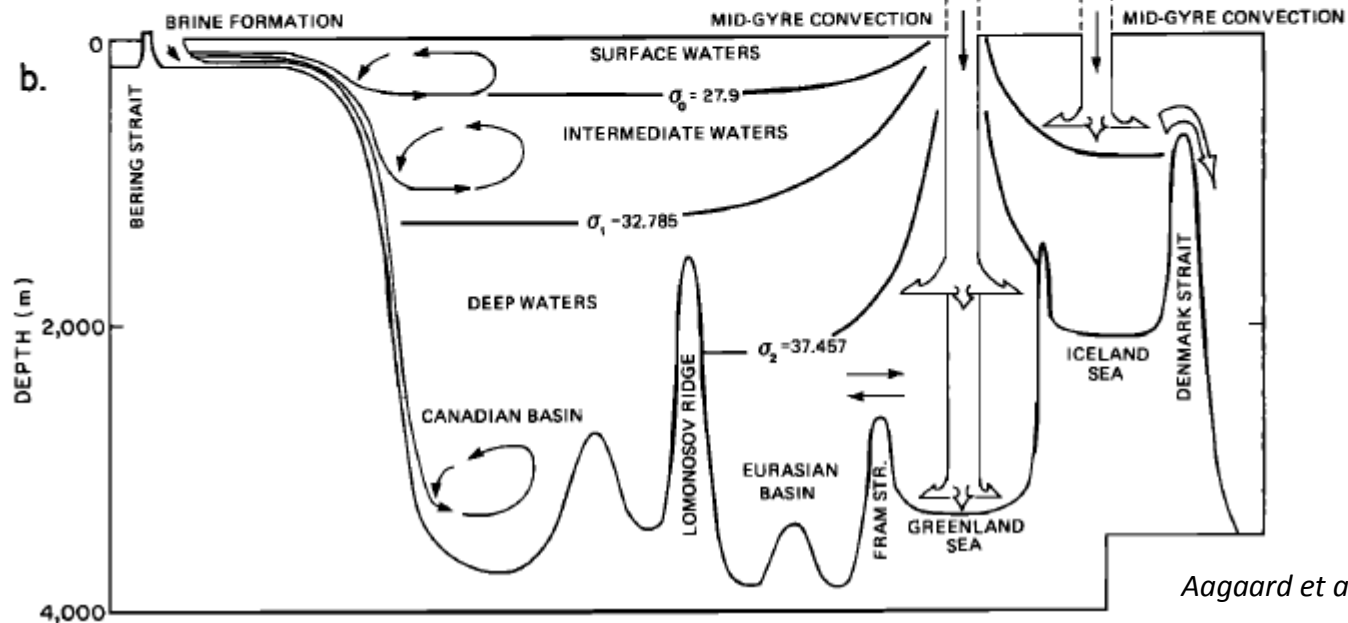
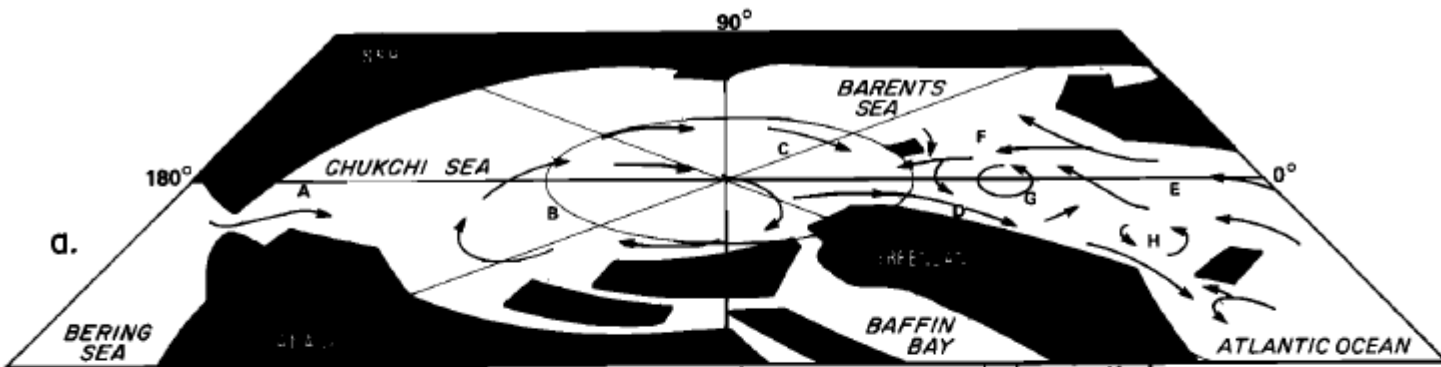
Brine rejection

Fresh Polar Mixed Layer water

Cold, salty intermediate water

Arctic Ocean Circulation

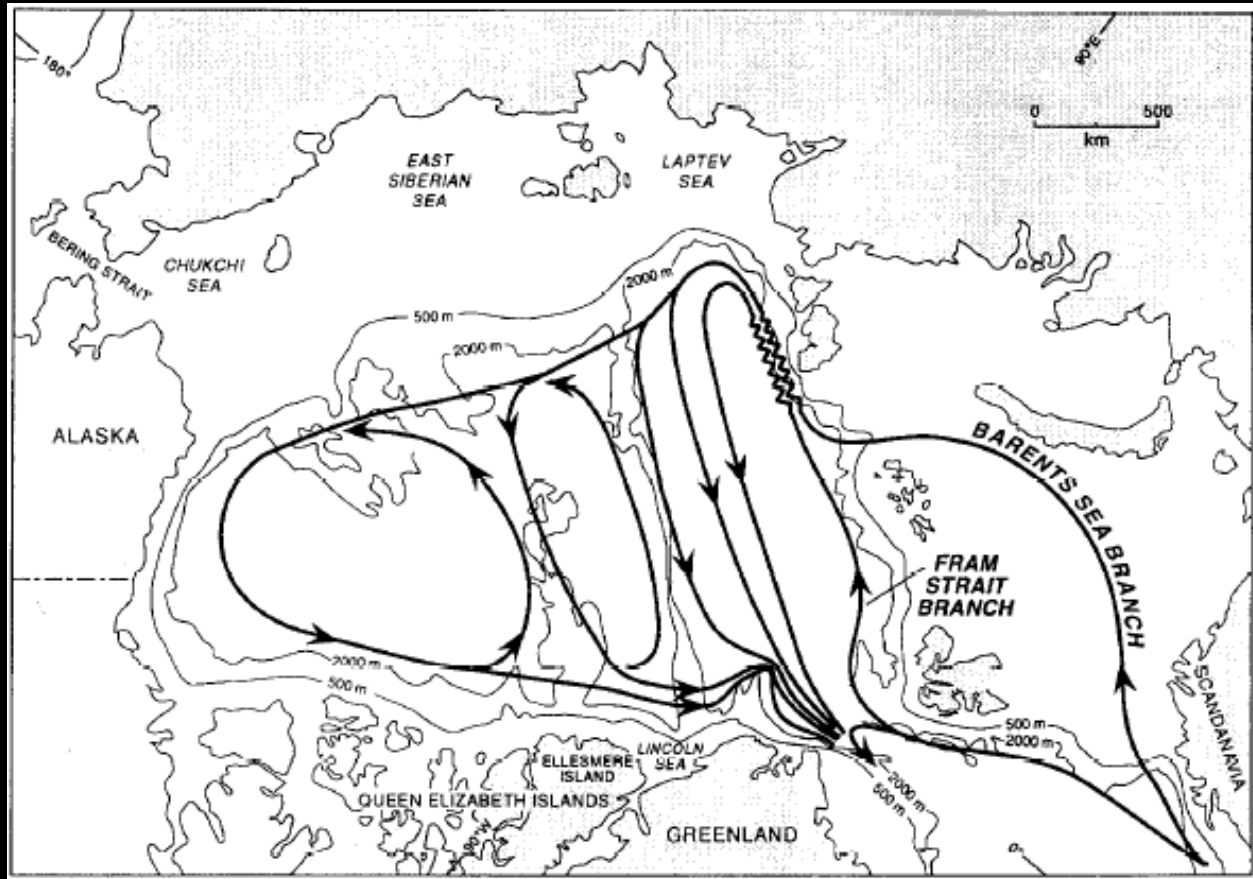
Deep waters



Aagaard et al., 1985

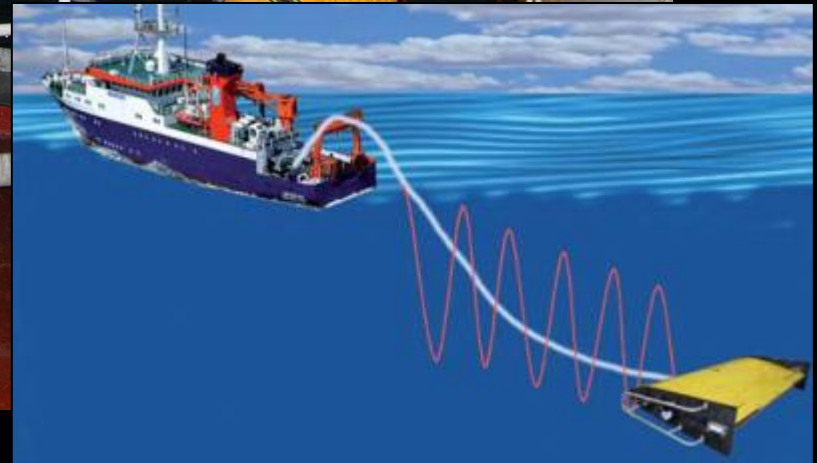
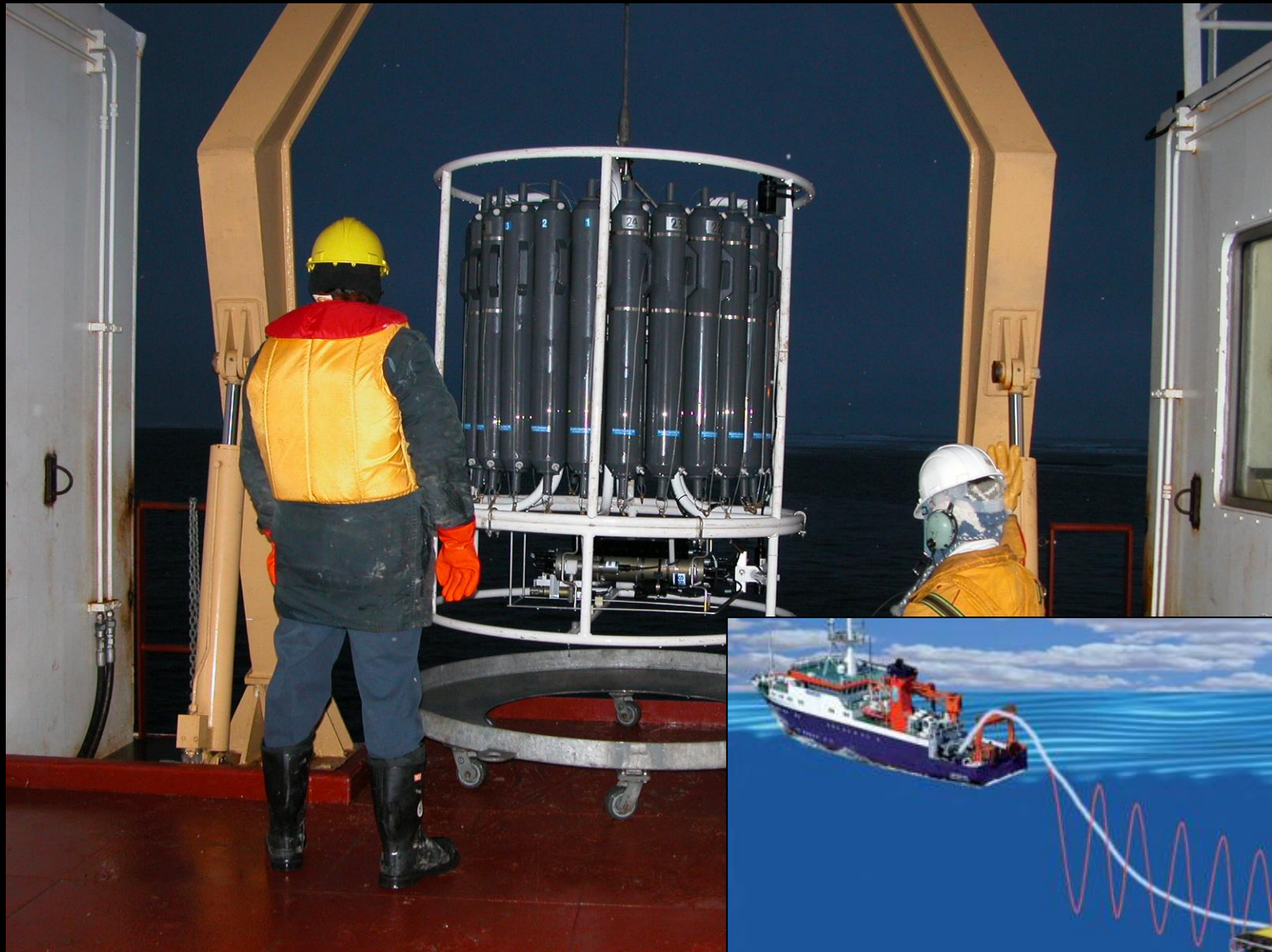
Arctic Ocean Circulation

Deep waters

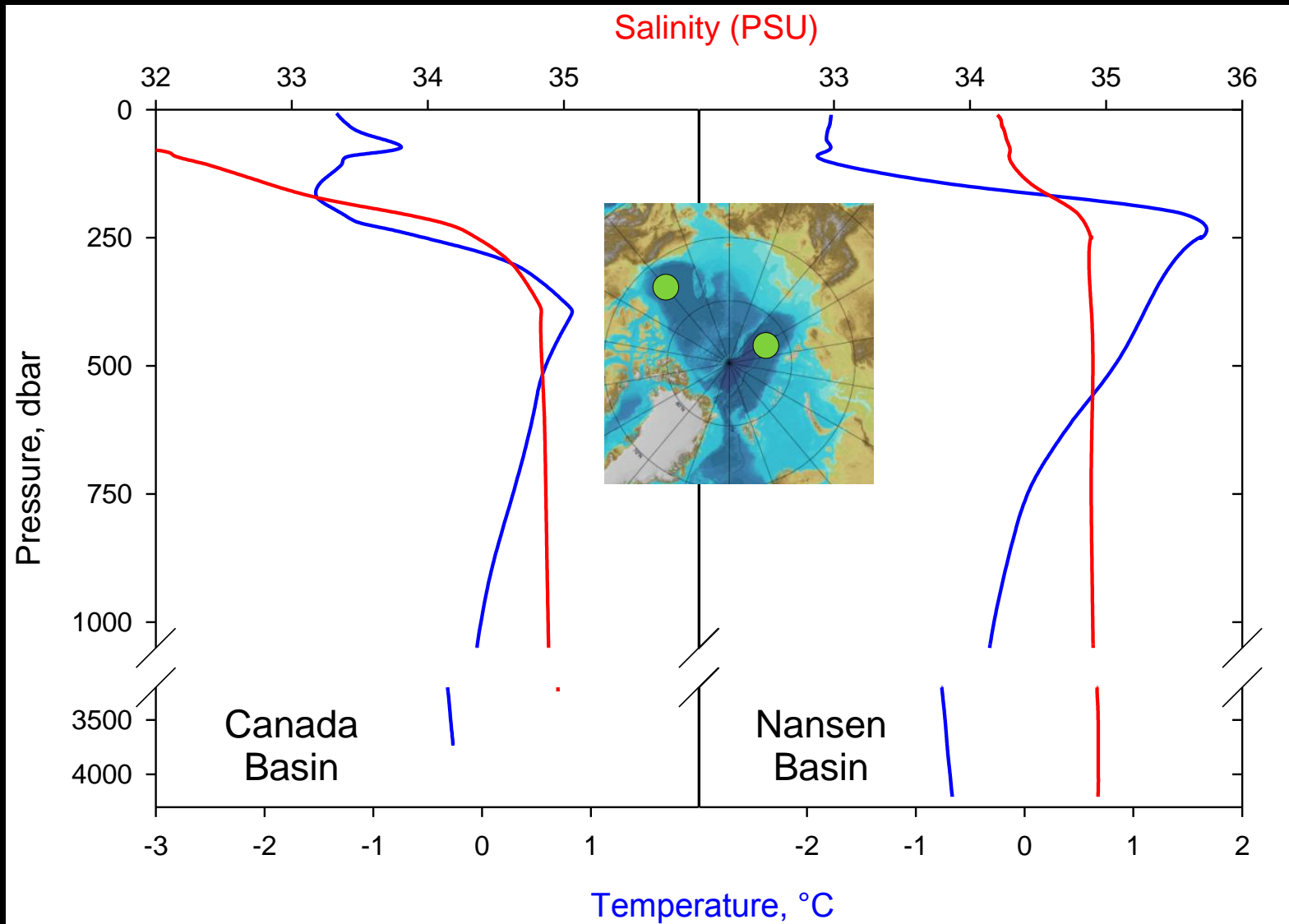


Jones et al., 1995

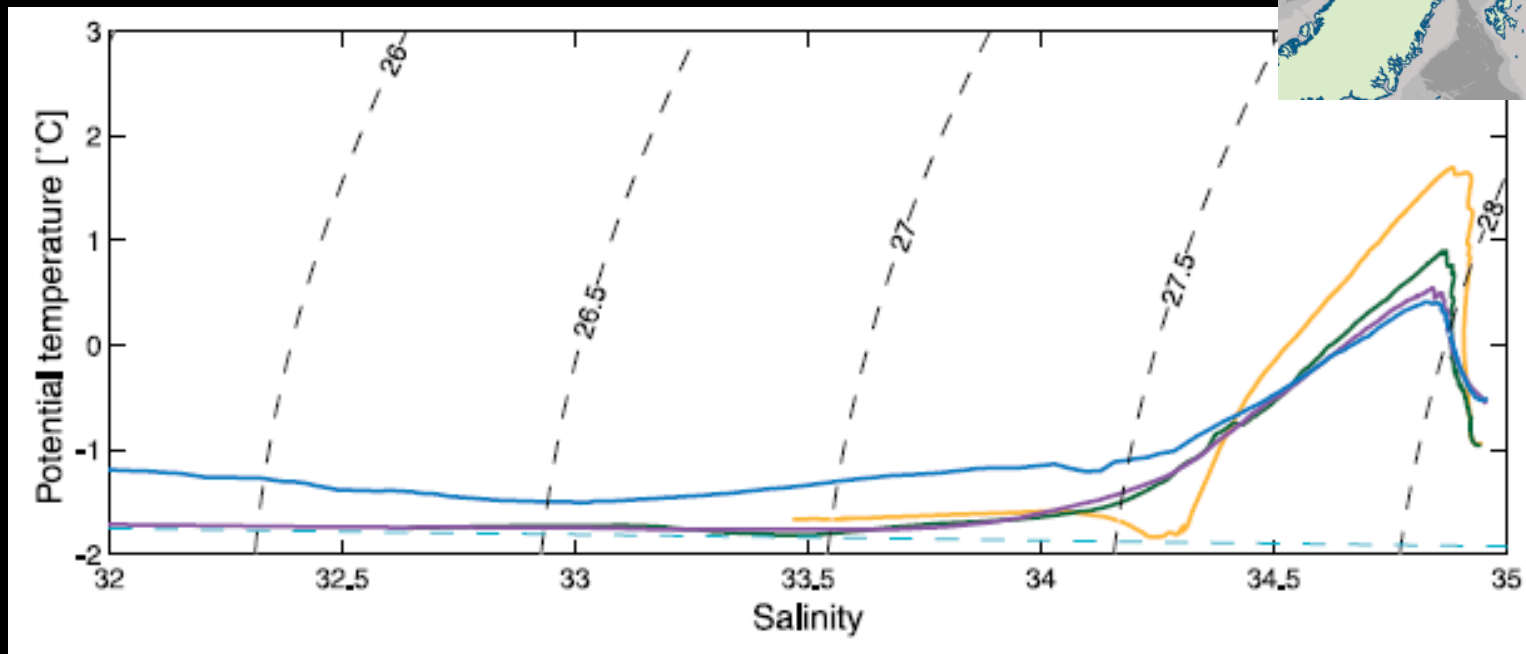
Arctic Ocean Water Masses



Arctic Ocean Water Masses



Arctic Ocean Water Masses



Rudels et al., 2004

$$\text{Density: } \sigma_T = (\rho - 1)1000$$

Intro to Arctic Marine Biogeochemistry

