Variations of north Atlantic inflow to the central Arctic Ocean over the last 15 million years inferred from hafnium and neodymium isotopes

Supervisor	PhD Student	Start of project
Martin Frank	Tianyu Chen	November 2010

The warm and saline North Atlantic inflow to the Arctic Ocean is a major component of high northern latitude circulation and the main mechanism of deep water renewal in the Arctic Ocean, which also strongly affects sea ice distribution. Knowledge of its past variability is thus critical for understanding the high latitude feedback mechanisms of the climate system (Fig. 1).

This study presents the first attempt to extract the seawater Hf isotope composition from the authigenic Fe-Mn oxyhydroxide fraction of two sediment cores recovered near the North Pole to reconstruct changes in past Atlantic inflow.

Results:

- Hafnium and Nd isotopic compositions are very closely coupled and environmentally controlled over the past 15 million years (Fig. 2, 3).
- Evolution of central Arctic Hf isotopes is primarily controlled by changes in ocean circulation including glacial brine formation on the Eurasian shelf and source provenance of weathering inputs rather than weathering regime changes.
- Hafnium leached from marine sediments represents a past seawater signal, providing a potentially powerful proxy in high time resolution paleoceanographic studies.

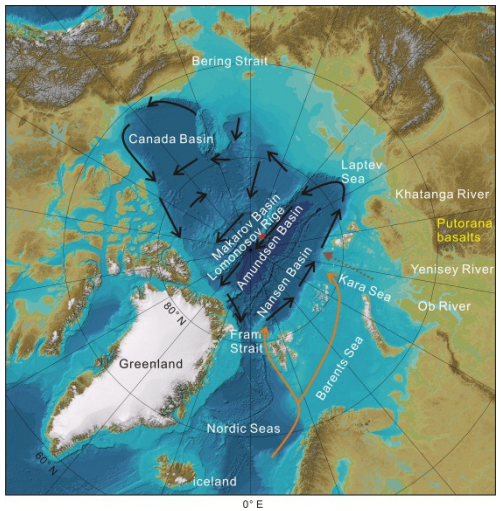

Fig. 1 Map of the high northern latitude seas and schematic modern ocean circulation patterns

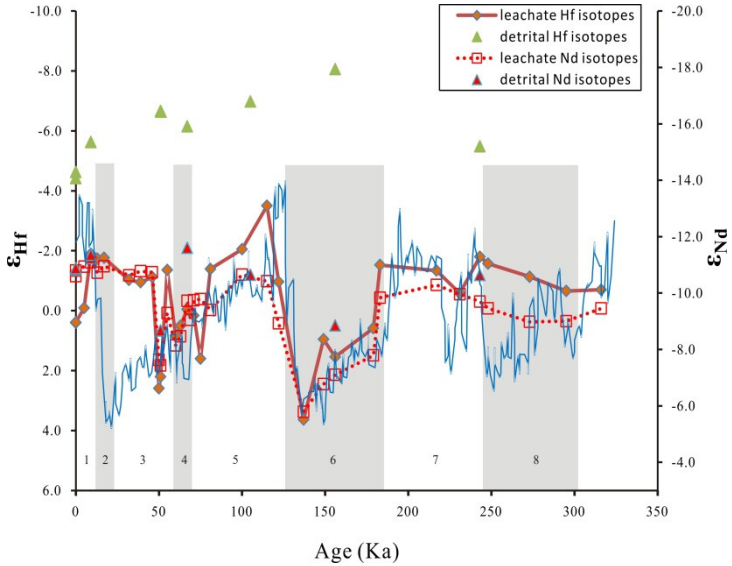

Fig. 2 Late Quaternary Nd – Hf isotopic evolution of Arctic Intermediate Water. Glacial-interglacial cycles of Nd and Hf isotopes are compared with the globally stacked benthic foraminiferal $\delta^{18}O$ data

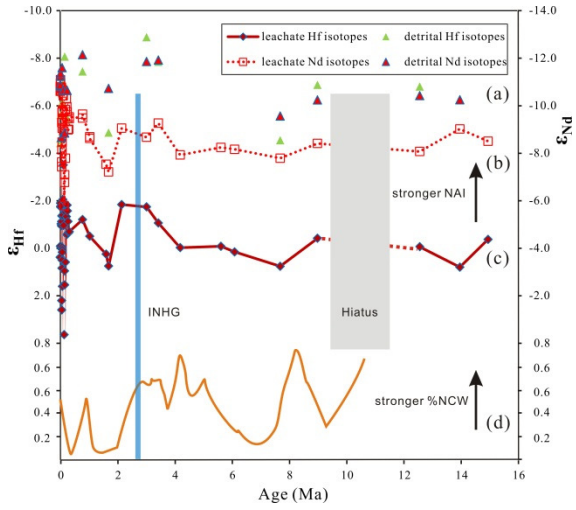

Fig. 3 Nd-Hf isotopic evolutions of the detrital fraction of the core sediments (a) and Arctic Intermediate Water (b, c) from the Middle Miocene to the present.