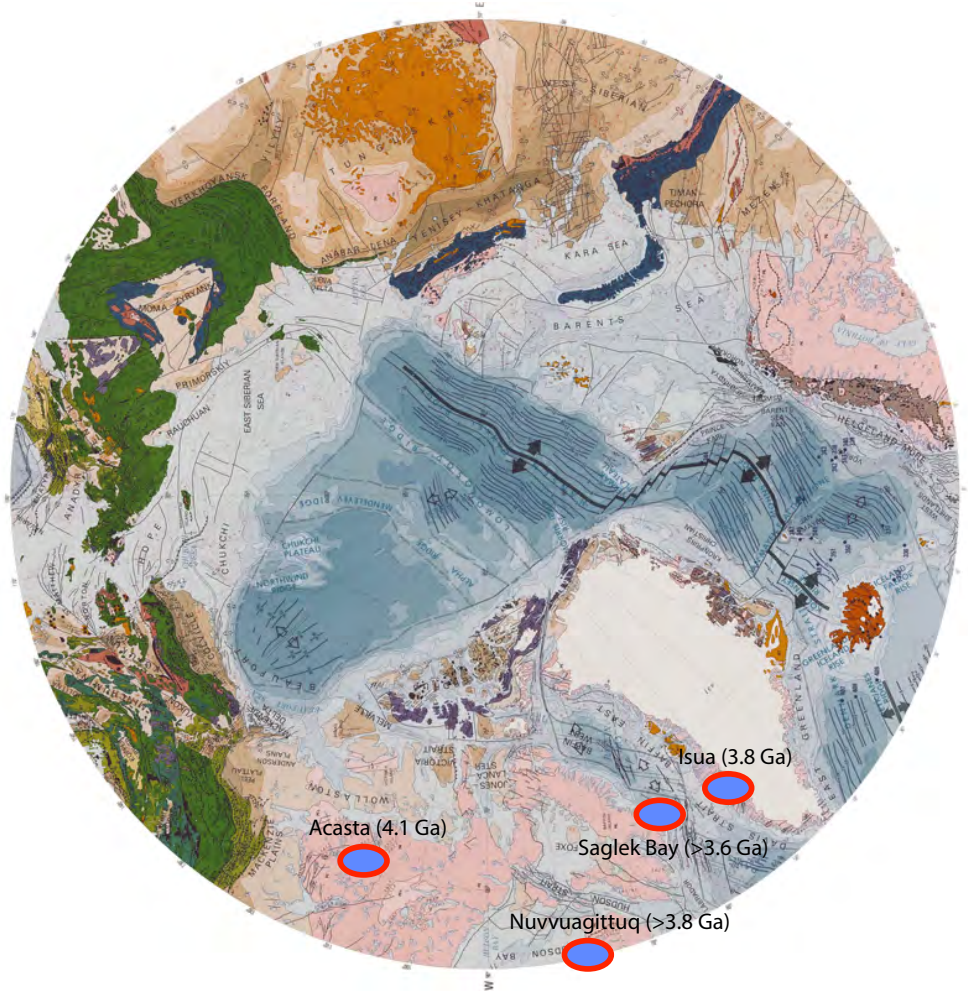
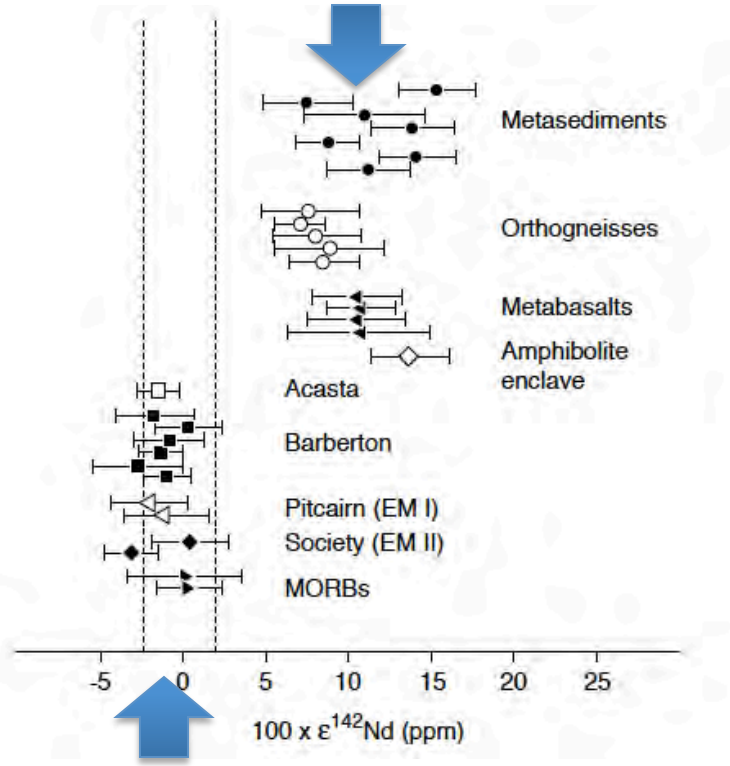
Greenland and Canadian Arctic played a major role in the understanding of the Early Earth and the origin of life



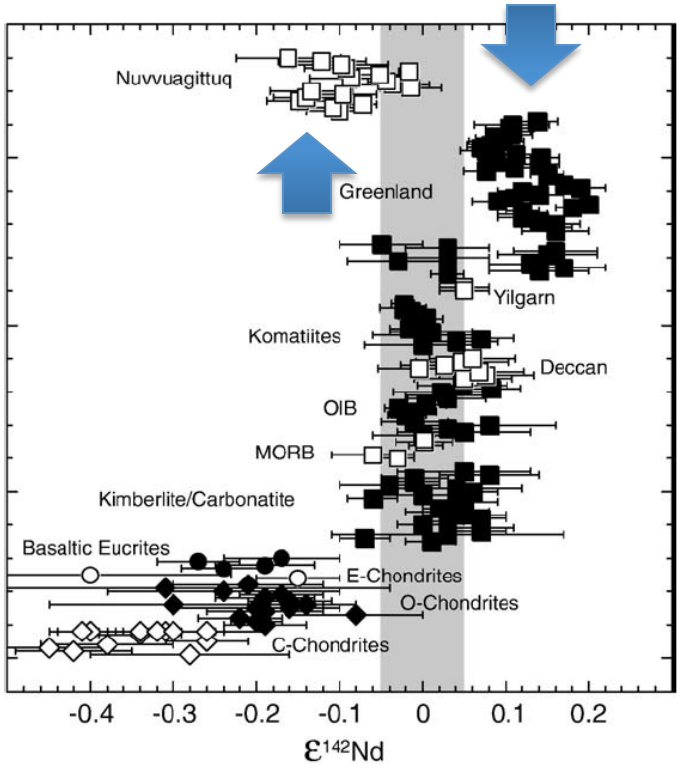
Quelques résultats fondamentaux permis par le travail dans l'Arctique

- Résultat 1: la Terre a eu un océan magmatique 50-150 millions d'années après sa formation
- Résultat 2: l'eau liquide et l'océan existaient il y a au moins 3,8 et probablement 4,1 milliards d'années
- L'atmosphère initiale était dépourvue d'oxygène
- La vie est apparue avant 3,8 milliards d'années

Les roches volcaniques d'Isua et de Nuvvuagittuq (3,8 Ga) ont été émises par un manteau qui porte les traces d'une radioactivité éteinte dans les premiers 2-300 Ma du l'histoire de la Terre



Caro et al. (2006)

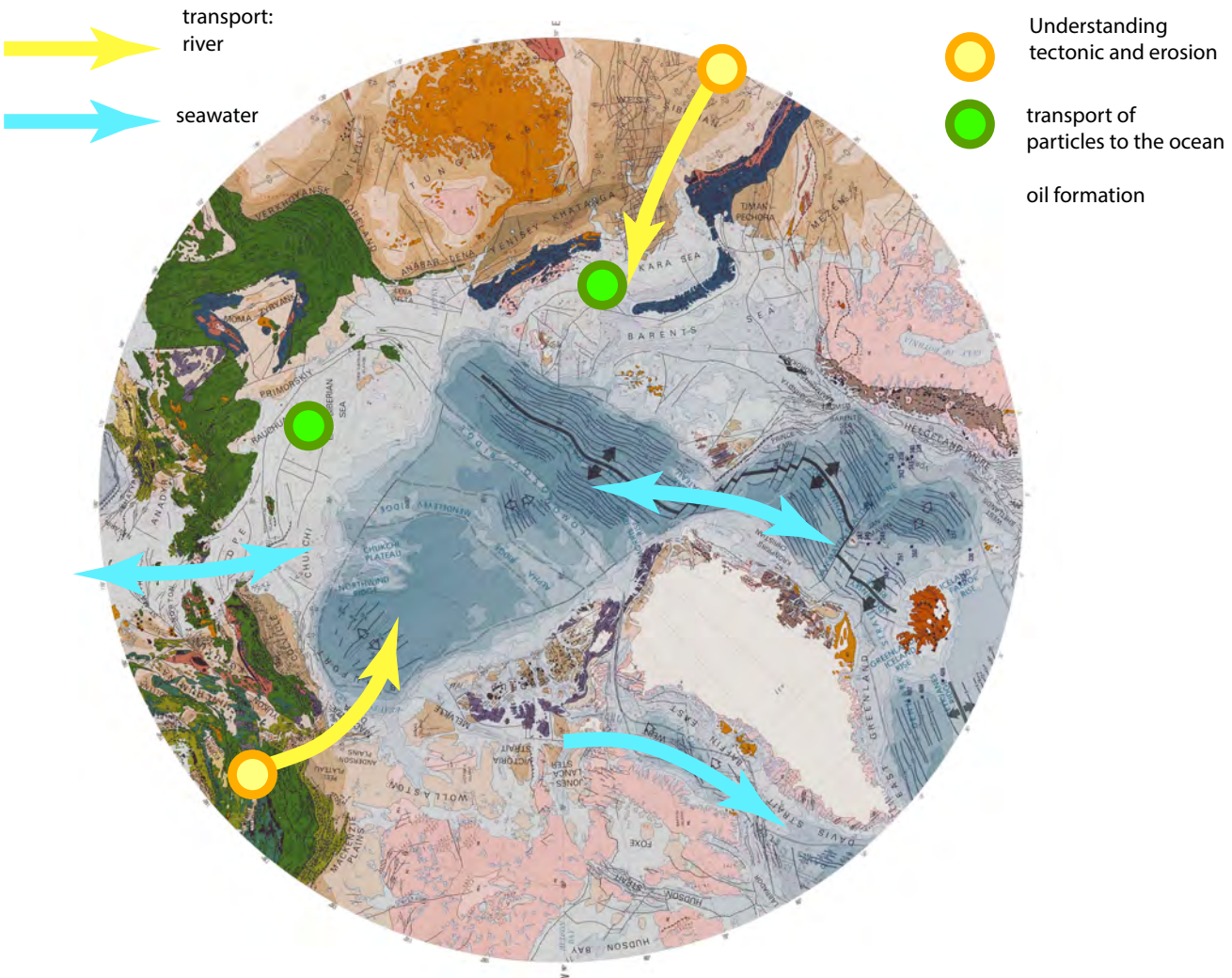


Carlson et Boyet (2009)

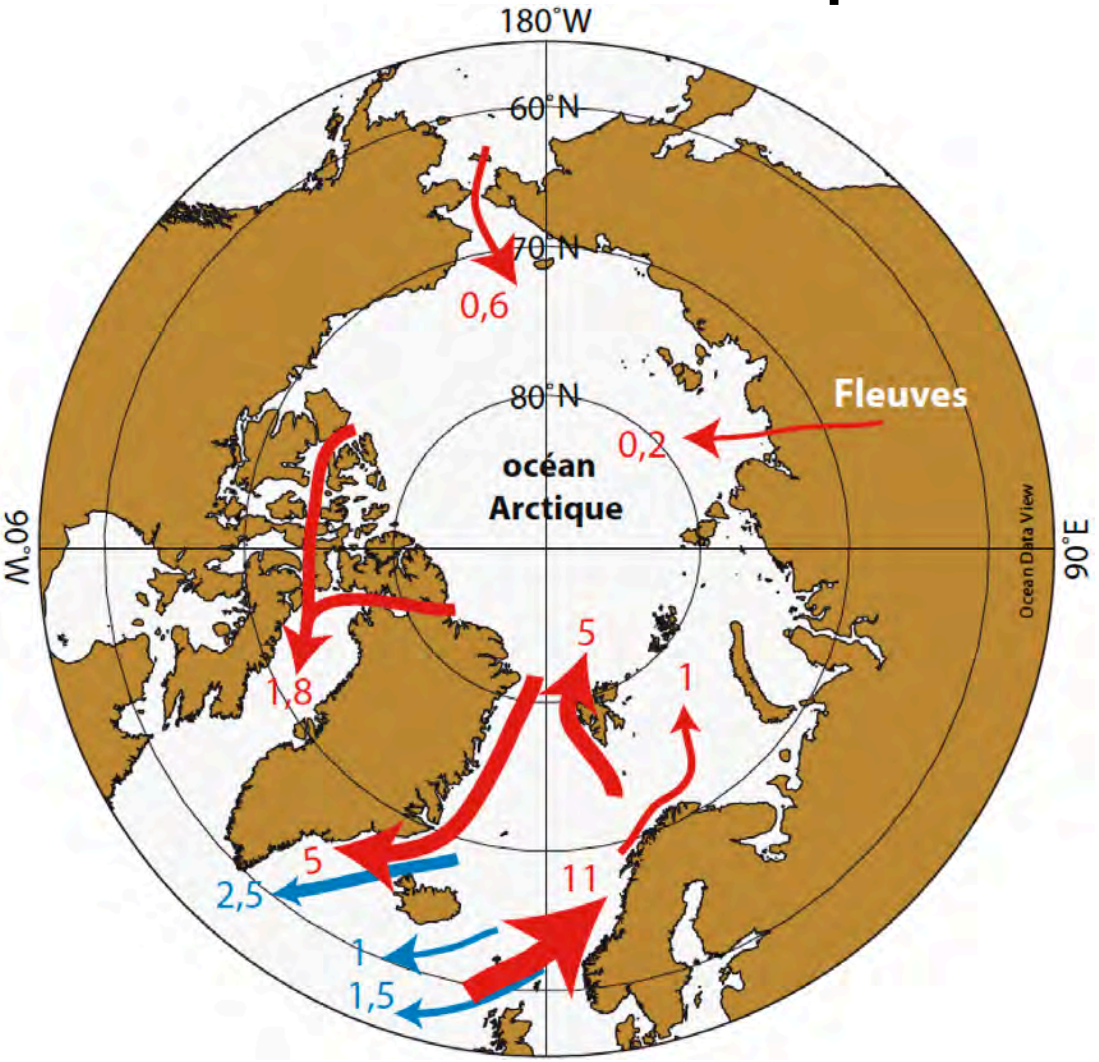
Questions en suspens

- Monde Archéen = monde sous-marin (jusqu'à 2.3 Ga) – Origine des nutriments
- Rôle des continents dans l'oxygénation de l'atmosphère
- Début et causes de la tectonique des plaques
- Datation plus précise de l'origine de la vie

Strongly connected scientific targets

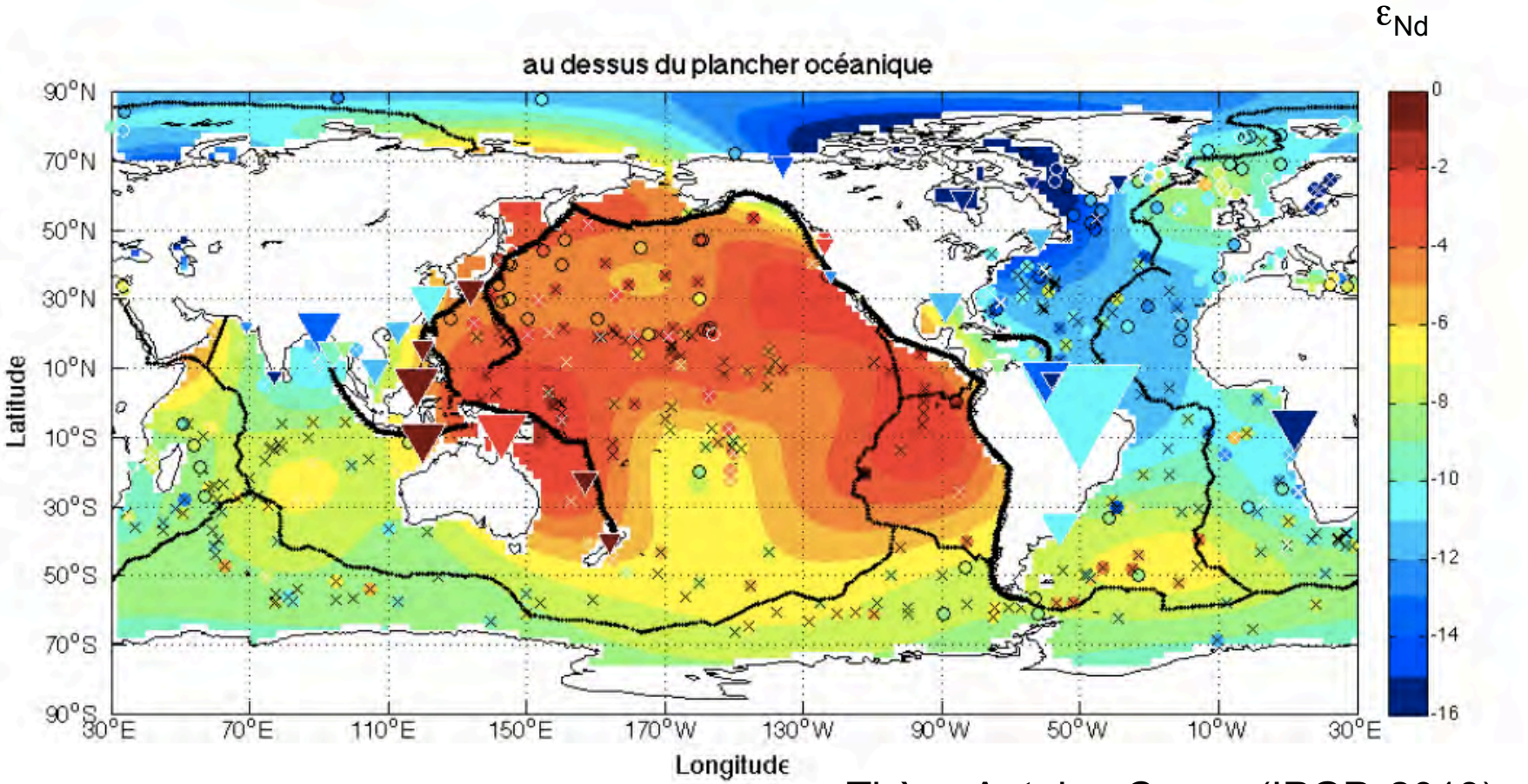


Bilan des transports d'eau (en Sv : 10^6 m^3/s) de la Méditerranée Arctique



Fieux 2010 *ENSTA*
« L'Océan Planétaire »

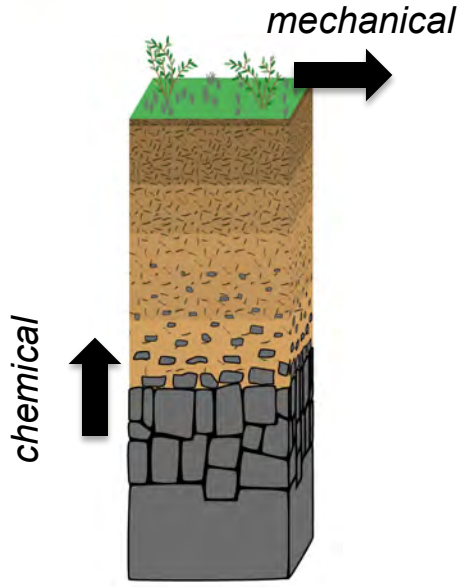
Neodymium isotopes(long half-life, near steady-state) : substantial contribution of the Arctic to deep water masses



Thèse Antoine Cogez (IPGP, 2013)

WHY SHOULD WE CARE ABOUT ARTIC WATERHEDS ?

- Drain waters from large surface areas: a connection between the Artic ocean and the global water cycle.
- Riverine products are discharged into a relatively close oceanic basin : a good « source to sink » laboratory.
- Landscape are peculiar geomorphologically and characterized by extreme events.



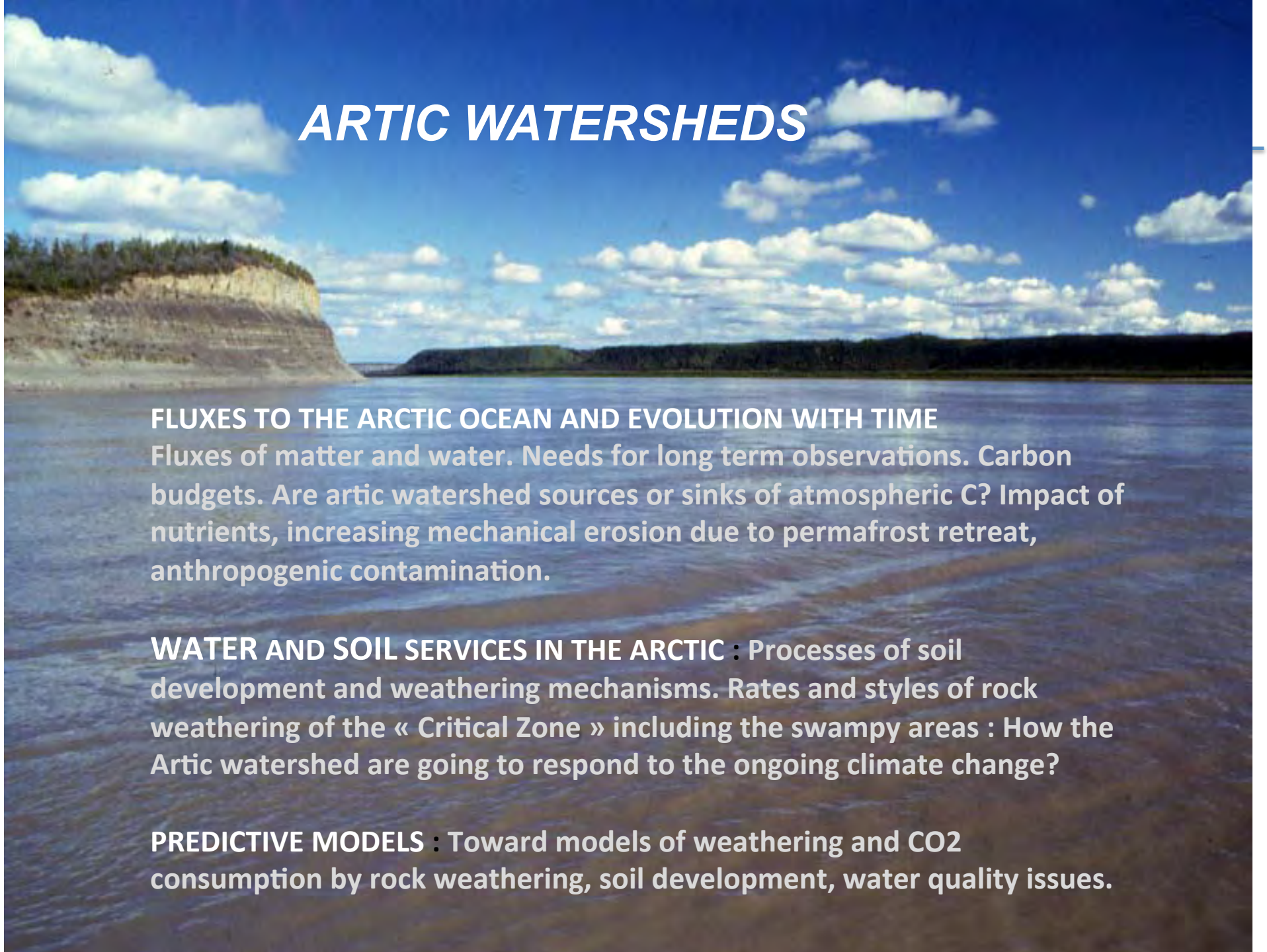
The Critical Zone and the soil conveyor belt

WHY SHOULD WE CARE ABOUT ARTIC WATERHEDS ?

- The « Critical Zone » in the Artic is particularly critical: the soil and water resource.

- Continental surfaces are a strong component of the carbon cycle and hence climate evolution at small (100 yrs) and long time scales (Myrs).

- Relatively pristine areas, just deglaciated, strong climate and ecosystem gradients, low temperature and high sediment production due to the erosion of glacial tills. Water rock interactions are driven by organic matter.

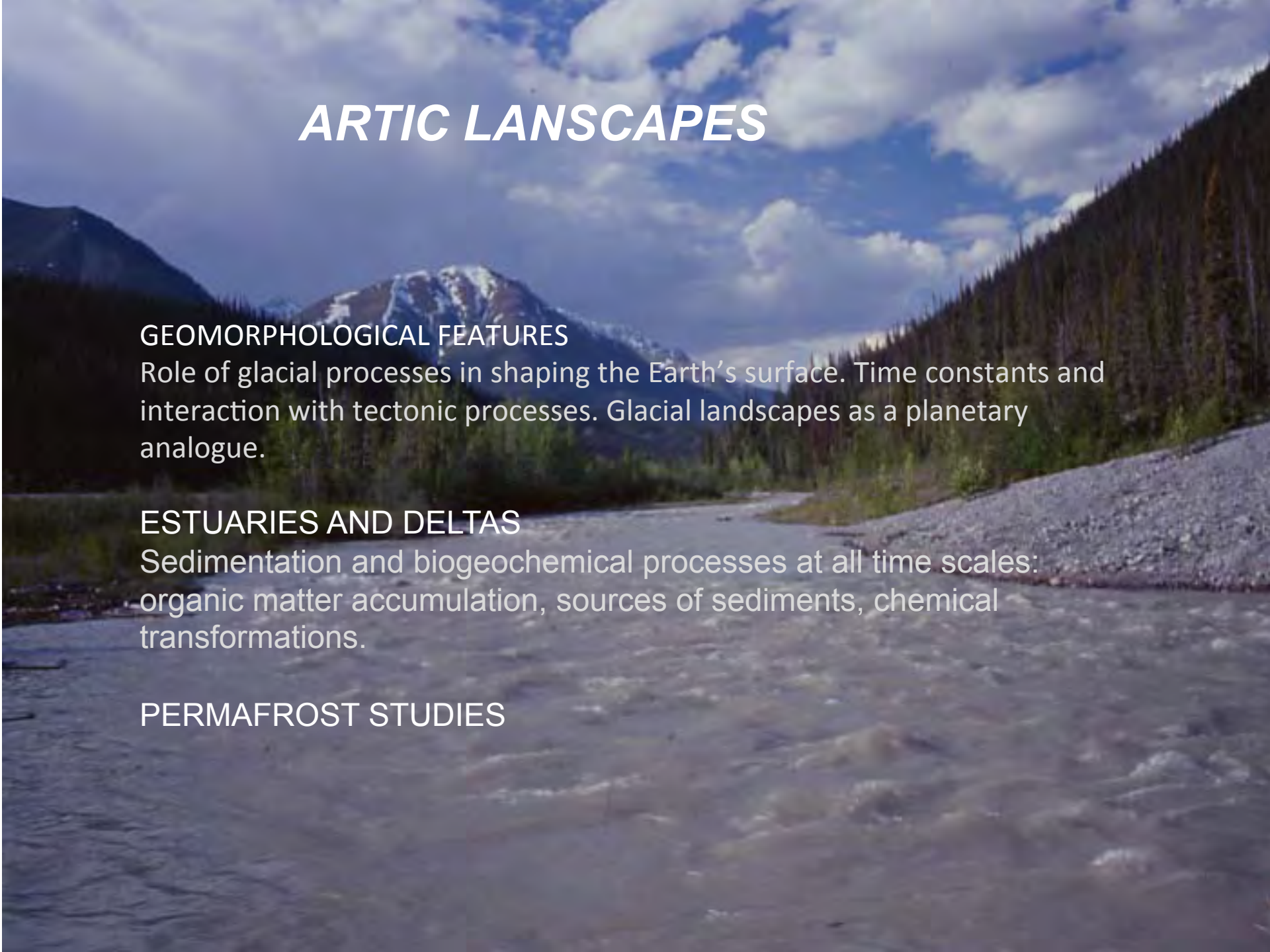


ARTIC WATERSHEDS

FLUXES TO THE ARCTIC OCEAN AND EVOLUTION WITH TIME
Fluxes of matter and water. Needs for long term observations. Carbon budgets. Are artic watershed sources or sinks of atmospheric C? Impact of nutrients, increasing mechanical erosion due to permafrost retreat, anthropogenic contamination.

WATER AND SOIL SERVICES IN THE ARCTIC : Processes of soil development and weathering mechanisms. Rates and styles of rock weathering of the « Critical Zone » including the swampy areas : How the Artic watershed are going to respond to the ongoing climate change?

PREDICTIVE MODELS : Toward models of weathering and CO2 consumption by rock weathering, soil development, water quality issues.



ARTIC LANSCAPES

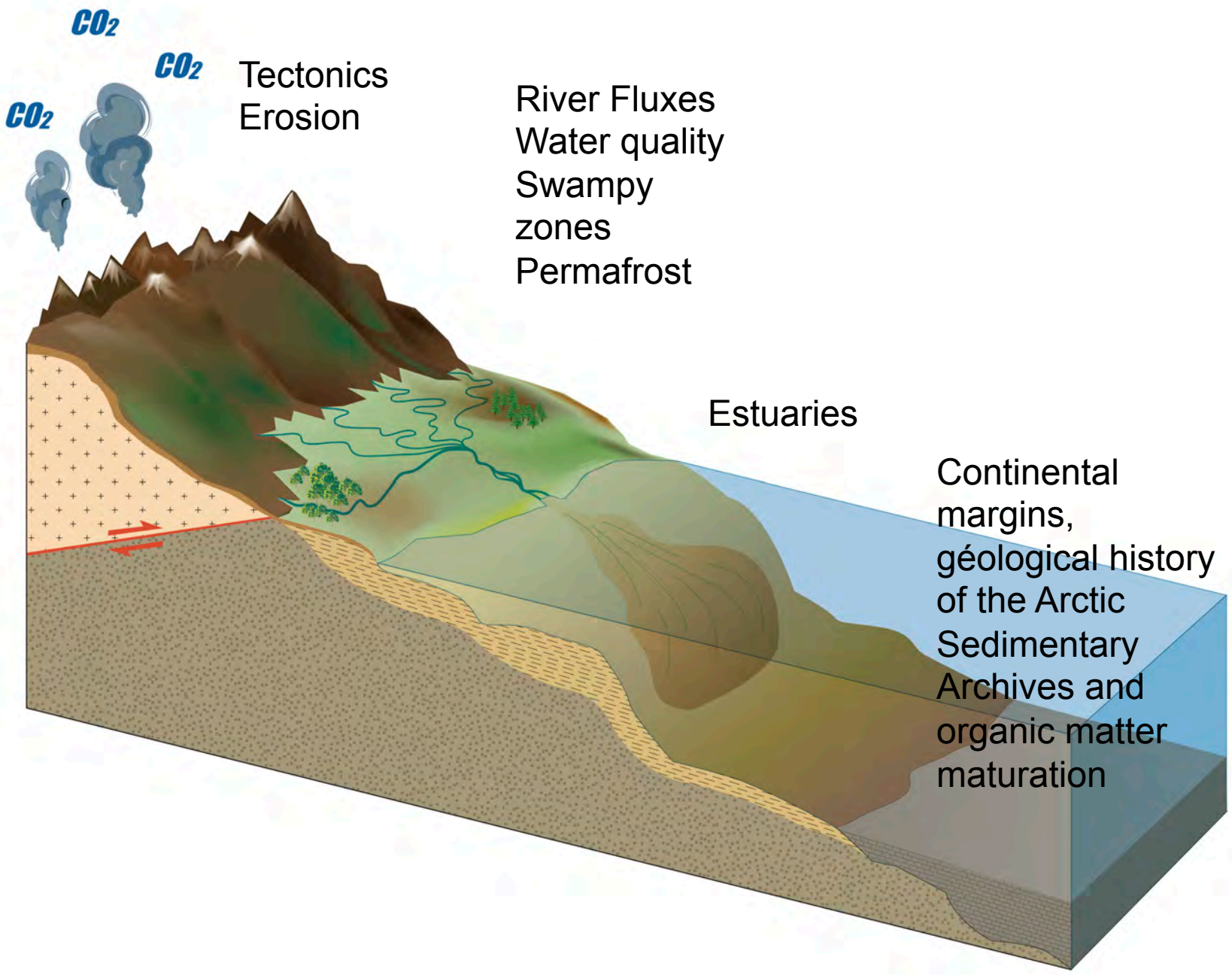
GEOMORPHOLOGICAL FEATURES

Role of glacial processes in shaping the Earth's surface. Time constants and interaction with tectonic processes. Glacial landscapes as a planetary analogue.

ESTUARIES AND DELTAS

Sedimentation and biogeochemical processes at all time scales: organic matter accumulation, sources of sediments, chemical transformations.

PERMAFROST STUDIES


CO_2
CO_2
CO_2
Tectonics
Erosion
River Fluxes
Water quality
Swampy
zones
Permafrost
Estuaries
Continental
margins,
géological history
of the Arctic
Sedimentary
Archives and
organic matter
maturation