Mineralogy and Nd and Pb isotope signatures of clay-size fraction of northern North Atlantic sediments during the Holocene and Late Glacial: Implications for the inception of modern deep circulation pattern

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The production rate of North Atlantic Deep Water (NADW) is a critical component of the high-latitude ocean-climate system. Here we analyse the mineralogy and Sm/Nd and Pb isotope signatures of the clay-size fraction of four sediments cores collected in Labrador Sea and adjacent basins. Clay composition and their isotopic ratios bring information on the origin of particles driven by deep currents. Our aim is to monitor deep current variability through the Holocene and the Late Glacial.

The cores are located along gyres of NADW components in the NW North Atlantic. In the Iceland basin, cores MD99-2254 (2440 m deep, on the eastern side of the Bight Fracture Zone) and HU91-045-091 (3870 m deep on the western side of the Charlie Gibbs Fracture Zone) are used to document water outflow originating from the Norwegian Sea. In the Labrador and Irminger seas, cores MD99-2227 (3460 m deep, off Southern Greenland) and HU91-045-080 (3024 m deep, on the western side of the Charlie Gibbs Fracture Zone) illustrate conditions along the pathway of the Western Boundary UnderCurrent that carries NADW masses in their deep Labrador Sea gyre.

Based on sedimentary mixings of four regional end-members, our isotopic dataset emphasizes several main changes in the relative contribution of the two major components of North Atlantic Deep Water, i.e. the North East Atlantic Deep water (NEADW) and the Danmark Strait Overflow Water (DSOW) throughout the last 12 kyr, and especially during the Late Holocene.

An innovative tool for *in situ* monitoring of Fe and associated trace metal mobilization in soils

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Iron (III) oxides are common mineral components of soils, sediments, aquifers and geological materials. Trace metals associate with Fe (III) oxides as adsorbed or co-precipitated species and, consequently the biogeochemical cycles of Fe and trace metals are closely linked. Therefore, the sorption and redox chemistry of Fe (III) oxides have been widely studied because of recognition that they control water chemistry and contaminant behaviour in near-surface geochemical systems. However, most previous experimental approaches, set up to study the *in situ* evolution of such oxides through redox alternations within soils, suffered from drawbacks related to the disturbance of the soil system during the recovery of the Fe oxides.

The aim of this study was to design and test a new tool for the *in situ* monitoring of Fe and associated trace metal mobilization within soils and for tracking the potential changes of mineralogy of the Fe solid phases. Fe oxides characterized by various (i) mineralogical phases (ferrihydrite, lepidocrocite and goethite) and, (ii) associated co-precipitated trace metals (Cd or As) were directly precipitated on little (2-cm-side square) striated polymer supports. These plates were inserted both in laboratory soil columns under anaerobic conditions and, in three different soil horizons (organic-rich, albic and redoxic) belonging to a wetland located in the western part of France. The pedo-climatic setting and the hydrological and geochemical behaviour of this long-term surveyed wetland is well known. Reductive conditions allowing Fe oxides to dissolve when soils are waterlogged occur annually during the winter season.

The polymer supports were unaltered through time, suggesting that this technique can be safely used to study Fe oxide evolution. Fe amounts were quantified by XRF before and after incubation. The evolution of Fe oxides was also observed by SEM and characterized by XRD. Over a period of three months during the winter season, 69% of ferrihydrite and 15% of lepidocrocite were dissolved while the more crystallized goethite remains unaltered. SEM observation coupled with XRD showed that new iron sulphide and oxide phases precipitated on the polymer supports. Moreover, SEM observation showed that the supports were highly colonized by bacteria and biofilms suggesting that micro-organisms played a key role in the occurring mineralogical changes as well as in the Fe and associated trace metal release. Further studies dedicated to the identification of both the involved bacteria consortium and the secondary mineralogical phases as well as, kinetic study of metal release in solution will be undertaken.