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REE distribution and Nd isotope composition of sediment leachates as tracers of Holocene lithogenic inputs in the Estuary and Gulf of St. Lawrence (eastern Canada)

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Based on the comparison of the Nd isotope compositions (expressed in epsilon units, εNd) of leached and detrital core-top samples to those of bottom water samples, a previous study has shown that the Nd isotope compositions extracted from bulk sediment leachates from the Estuary and Gulf of St. Lawrence (EGSL; eastern Canada) mainly represent unradiogenic εNd detrital signals from the adjacent continents [1]. Based on this approach, here, we present the rare earth element (REE) concentrations, Nd and strontium (Sr) isotopic compositions obtained from leached Fe-Mn oxyhydroxides of two sediment piston cores recovered in the EGSL. These data were used to evaluate changes in the origin, transport and dynamics of detrital sediment related to variations in weathering regimes and oceanographic conditions over the last 10,000 years. Between 10-8 cal ka BP, the authigenic εNd data reveal very unradiogenic values, with mean values of -24.3 and -21.4 for the estuary and gulf cores, respectively (Fig. 1). We suggest that these εNd values are controlled by the weathering and erosion of Precambrian continental rocks on the North Shore associated with the melting of the Laurentide Ice Sheet. Beyond 8 cal ka BP, relative sea level variations following the deglaciation appear to be the predominant forces acting on the sedimentation in the EGSL (Fig. 1). During this period, the εNd ~ -18.9 values, negative europium anomaly, and low heavy/light REE (HREE/LREE) ratio recorded in the estuary core, suggest that the sediments originated primarily from the North Shore. In contrast, sediments from the Gulf are characterized by εNd values ~ -17.8, a slight positive europium anomaly and a high HREE/LREE ratio, indicating a sedimentary origin mainly from the Appalachian Mountains and the Maritime provinces, with a secondary influence from the North Shore. Overall, our results highlight the potential of REE and Nd isotopes from bulk sediment leachates to reconstruct and document past variations in continental inputs and sediment dispersal related to climate changes in the EGSL.

[1] Casse et al., 2019. *REE distribution and Nd isotope composition of estuarine waters and bulk sediment leachates tracing lithogenic inputs in eastern Canada*. Marine Chemistry 211, 117-130.

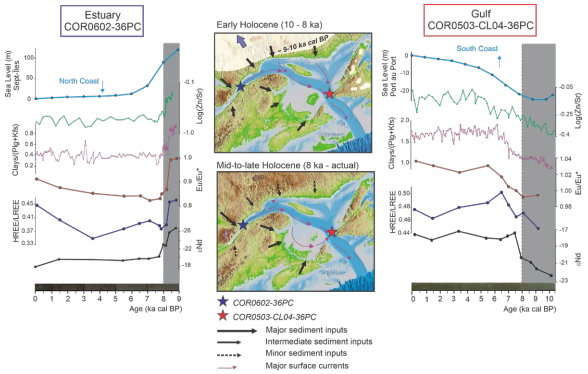

Figure 1. Multiproxy analysis for core COR0602-36PC and core COR0503-CL05-37PC illustrating the evolution of sedimentary dynamics between 10–8 cal ka BP and since 8 cal ka BP. The relative sea level variations, Log(Zn/Sr), Clays/(Plg+Kfs), Eu/Eu*, HREE/LREE and εNd are compared for each sediment core during the Holocene. During the early Holocene, the meltwater discharges induced by the rapid retreat of the LIS on the North Shore appear to be the predominant force acting on the sedimentation (LIS position is schematic for the period from 10 to 9 cal ka BP; [2]). Beyond 8 cal ka BP, the sediment dynamic is mainly controlled by variations in the relative sea level. Log(Zn/Sr) and Clays/(Plg+Kfs) data are from [3].

[2] Shaw J., Gareau P. & Courtney R.C., 2002. Palaeogeography of Atlantic Canada 13–0 kyr. Quaternary Science Reviews 21(16), 1861-1878.
[3] Casse et al., 2017. Influence of the Laurentide Ice Sheet and relative sea-level changes on sediment dynamics in the Estuary and Gulf of St. Lawrence since the last deglaciation. Boreas 46, 541-561.