Iron isotopic compositions in shelf, slope and abyssal sediments from the Arctic Ocean

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To better document sources and sinks of Fe across the well-oxygenated Canada Basin in the Arctic Ocean, profiles of the concentrations and isotopic compositions of total Fe (Fe_{TOT}), 1M HCl extractable Fe (Fe_{HCl}), and residual Fe (Fe_{RES}) remaining after the HCl extraction were determined in sediment cores collected at 51, 653 and 3250 m depth, respectively in the shelf, slope and abyssal portion of this basin. Concentrations of Fe associated to pyrite (Fe_{PY}) were also determined in each of the cores through an operationally defined extraction protocol. We show that the isotopic composition of Fe_{TOT} is slightly lighter in shelf sediments than in slope and deep basin sediments. In the shelf core, where the degree of pyritization (i.e., DOP=$Fe_{PY}/Fe_{HCl}+Fe_{PY}$) progressively increases below the sediment-water interface reaching up to 42% at 25 cm depth, there is no pronounced difference between the isotopic composition of Fe_{TOT} and those of Fe_{HCl} and Fe_{RES} in samples exhibiting significant pyrite enrichment. In contrast, the Fe_{HCl} pools in the slope and deep basin cores are characterized by a light isotope composition relative to that of Fe_{TOT}, undetectable or negligible concentrations of Fe_{PY}, and much higher concentrations and inventories of Fe_{HCl} than in shelf sediments. These results from the Arctic Ocean will be discussed by comparing them with those of earlier studies showing that dissimilatory iron reduction during early diagenesis is responsible for producing Fe oxyhydroxides with a light isotopic composition relative to Fe_{TOT}, and that the efflux of isotopically light Fe from shelf sediments can eventually migrate and be deposited at greater depth.