Reconstruction of the provenance of detrital sediments in the Skagerrak region by using radiogenic Nd-Sr-Hf isotopes and clay mineral compositions

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The Skagerrak represents a major sink area for fine-grained sediment in the North Sea region and provides natural deposition centre for sediment that is transported from the North Sea, Baltic Sea and Scandinavian rivers. However, the end-members contributing to Skagerrak deposits are still not well constrained and their proportions have not yet been quantified.

To trace the predominant sources of sediment material that is deposited in the Skagerrak, radiogenic Sr, Nd, and Hf isotopes together with clay mineral compositions were measured for surface sediment samples from the North Sea, Scandinavian margins, North Atlantic and the Baltic Sea.

The analyses reveal geographical areas of distinct isotopic compositions and concentrations of clay mineral phases of illite, kaolinite, chlorite and smectite. Surface sediment samples in the southern North Sea (transported from European rivers) and the Baltic Sea area (Kattegat) are characterized by high ¹⁷⁶Hf/¹⁷⁷Hfand ¹⁴³Nd/¹⁴⁴Nd-ratios and low ⁸⁷Sr/⁸⁶Sr-ratios. In contrast, surface sediments collected from Scandinavian fjords flowing into the Skagerrak exhibit low 143Nd/144Nd- and 176Hf/177Hfratios but high 87Sr/86Sr-ratios. Moreover, the distribution pattern of the clay minerals shows high smectite contents in the Southern North Sea, especially in the German Bight. High concentrations of illite and chlorite were detected in the northern and central part of the North Sea as well as in the Scandinavian fjords. Radiogenic isotope signatures and clay mineral contents in sediments from the central part of the Skagerrak suggest a mixture of material derived from the southern North Sea, Baltic Sea and Scandinavian margins.

The isotope and clay mineral dataset of this study allow the determination of different sediment sources and to quantify the main end-members that contribute to the Skagerrak. These findings will be applied to down-core sediments of the Skagerrak to assess temporal and spatial changes of sedimentary transport processes in the North Sea, which will help to evaluate infuences of human activities and climate forcing factors in the last century.