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Sulfur isotope biogeochemistry of soils from an episodically flooded coastal wetland, southern Baltic Sea

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Coastal wetlands are under dynamic impact both from fresh water and salt water sources, thereby experiencing temporarily sulfur-excess and -limiting conditions. In the present study, nine up to 10 meter long sediment cores from a recently rewetted fen (Hütelmoor, southern Baltic Sea) which has been under impact by episodic flooding with brackish waters were investigated (isotope) geochemically. The sites are positioned at different distances to the Baltic Sea coastline. The soils were analyzed for the elemental composition (CNS), reactive iron and sedimentary sulfur contents, iron sulfide micro-textures, as well as the stable sulfur isotope composition of inorganic and organic sulfur fractions to understand signal development for the biogeochemical carbon-sulfur cycles in such a dynamic ecosystem.
We found evidence for the activity of dissimilatory sulfate-reducing microorganisms and the associated formation of pyrite with different textures (framboids, single euhedral crystals and clusters) and sulfurization of organic matter. Sedimentary sulfur fractions and their stable isotope signatures are controlled by the availability of dissolved organic matter or methane, reactive iron, and in particular dissolved sulfate and thereby from the relative position to the coast line and the given lithology. d34S values in the pyrite fraction vary in a wide range between -21 and +15 per mil versus VCDT, in agreement with spatial and temporal dynamics in the extend of sulfate-limiting conditions during the oxidation of reduced carbon.