



Formation of framboidal pyrite in estuarine sediments of the Achterwasser lagoon, SW Baltic Sea, and implications on trace metal mobility

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Pyrite is the most common sulfide mineral on earth and acts as a major sink for trace metals. Especially in coastal environments, authigenic pyrite formation is of particular interest because the chemistry of Fe in the ocean plays an important role in controlling primary production in the surface ocean. In comparison to similar low-sulfate coastal environments with anoxic-sulfidic sediments, the Achterwasser lagoon, which is part of the Oder estuary in the SW Baltic Sea, reveals unexpectedly high pyrite concentrations of up to 7.5 wt% with Fe pyritization values between 80 and 95%. The lack of free Fe(II) in the pore waters combined with the possibility of a very efficient transformation of Fe-monosulfides to pyrite near the sediment/water interface suggests that authigenic pyrite formation in the Achterwasser is controlled by (i) the availability of reactive-Fe, which limits the FeS formation, and by (ii) the availability of an oxidant, which limits the transformation of FeS into pyrite. Pyrite occurs mainly as framboidal grains variable in size with diameters between 1 and 20 μm . μXRF studies carried out on single pyrite framboids show that certain metals, such as Co, As, Mn and Mo, display relatively high concentrations and are supposed to be incorporated preferentially into pyrite, whereas Ni and Co show relatively low concentrations. High-resolution trace element mapping of single pyrite grains reflect that Co and As are clearly distributed inhomogeneous with lower concentrations in the centre of the framboid, which is interpreted to be due to changing pore water composition during pyrite growth. The study emphasizes the role of authigenic pyrite formation controlling the solubility of many trace metals and burial rates in coastal sediments.