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Redox processes as revealed by voltammetry in the surface sediments of the Gotland Basin, Baltic Sea

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Sulfur cycling in marine sediments undergoes dramatic changes with changing redox conditions of the overlying waters. The upper sediments of the anoxic Gotland Basin, central Baltic Sea represent a dynamic redox environment with extensive mats of sulfide oxidizing bacteria covering the seafloor beneath the chemocline. In order to investigate sulfur redox cycling at the sediment-water interface, sediment cores were sampled over a transect covering 65 – 174 m water depth in August-September 2013. High resolution (0.25 mm minimum) vertical microprofiles of electroactive redox species including dissolved sulfide and iron were obtained with solid state Au-Hg voltammetric microelectrodes. This approach enabled a fine-scale comparison of porewater profiles across the basin. The steepest sulfide gradients (i.e. the highest sulfide consumption) occurred within the upper 10 mm in sediments covered by surficial mats (2.10 to 3.08 mmol m⁻² day⁻¹). In sediments under permanently anoxic waters (>140m), voltammetric signals for Fe(II) and aqueous FeS were detected below a subsurface maximum in dissolved sulfide, indicating a Fe flux originating from older, deeper sedimentary layers. Our results point to a unique sulfur cycling in the Gotland basin seafloor where sulfide accumulation is moderated by sulfide oxidation at the sediment surface and by FeS precipitation in deeper sediment layers. These processes may play an important role in minimizing benthic sulfide fluxes to bottom waters around the major basins of the Baltic Sea.