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Early diagenetic processes in brackish-marine and limnic sediments of the Gotland Deep (Baltic Sea)

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Authigenic minerals in sediments may serve as geochemical proxies for the depositional environment (e.g., productivity, salinity, bottom water redox conditions). Changing depositional conditions may result in dramatic changes in the microbial activity and biogeochemical composition of sediments. Typical examples are the sapropels of the Black Sea, the Mediterranean Sea and the deeps of the Baltic Sea. Early diagenetic processes may lead to a transformation of sedimentary phases and a transport of dissolved substances across lithological boundaries, causing a superimposition of primary geochemical signals. The present study focuses on the biogeochemical processes in the system C-S-Fe-Mn-Ba of a sediment core of the Gotland Basin (Baltic Sea).

During a cruise (07PE07/08; April 2007) with R/V “Prof. Albrecht Penck” a surface sediment core (MUC) and a 4 m long gravity core were recovered from the anoxic part of the Gotland Basin. About 120 cm of brackish-marine Littorina sediments were found to overlay limnic Ancylus Lake sediments. Pore waters were obtained onboard ship using rhizon samplers and analysed for major, minor, and trace elements (ICP-OES, ICP-MS, photometry). The pH values were measured with an ion selective electrode. Physico chemistry and transport processes in the pore waters were modelled with the software packages PROFILE and PHREEQC. The solid phase analyses for major, minor and trace components were carried out by ICP-OES, ICP-MS, XRF, photometry, and EA. AVS, pyrite sulphur, barite, and reactive iron and manganese frac-

tions were separated from the sediments using different chemical extraction methods. Textures of sedimentary barite and pyrite were investigated by means of SEM-EDX.

Compared to the freshwater Ancylus Lake sediments the laminated Littorina muds are characterized by enhanced contents of TIC, TOC, TS, Mn but less reactive Fe. Early diagenesis lead to the dissolution of authigenic barite and the formation of Ca-rhodochrosite. Microbial sulphate reduction takes place in the modern and Littorina muds sediments and the associated sulphide release leads to sulphide saturation and a downcore diffusion across the brackish-freshwater transition. Whereas pyrite is the dominate iron sulphide in the brackish and the top 30 cm of the freshwater sediments, mackinawite and greigite become relatively more important below. From the pore water gradients it is indicated that reduction of Fe(III) phases, the desorption of Ca and Ba from clay minerals take place in the deeper freshwater sediments. Extent of diagenetic reaction at the interface of brackish-freshwater sedimentation will likely depend on the sediment mass accumulation rate, the thickness of the brackish sediment layer, and the geochemical composition of the sediments (e.g. metal and organic matter contents).