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Phosphorus Cycle and Phosphorite Formation in Marine Sediments of High Productive Areas

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The aim of this study is to investigate the benthic phosphorus cycle in regard to the recent formation of phosphorites. For this purpose we compare geochemical characteristics in sediment-pore water systems from three of the most important upwelling areas in the ocean, the shelf and upper continental slope areas off Namibia, Senegal and Peru.

After a recent study, the pore water and high-resolution solid phase analyses as well as microbial investigations on the Namibian shelf indicate that sharp phosphate peaks, observed in 2-3 cm sediment depth, correspond to the depth where great sulfur bacteria are most abundant (Schulz and Schulz, 2005). Beside the well known connection between the benthic cycles of iron and phosphorus it could be shown that under anoxic conditions these bacteria consuming acetate and simultaneously release tremendous amounts of phosphate to interstitial waters, which lead to the formation of hydroxyapatite, a preliminary phase of phosphorites.

Our new results from pore water analysis indicate, that respective processes also occur in the surface sediments of both other areas. For the Peruvian Shelf this interpretation is supported by microbial investigations. In order to gain additional information about the distribution of elements in different phosphorus phases and the mode of their fixation in the sediment column, a modification of the SEDEX procedure (Ruttenberg, 1992; Schenau et al., 2000) was applied. Again, iron-bound phosphorus was identified as the dominant reservoir in these sediments. The main release of both ferrous

iron and phosphate occurs due to microbial reduction of iron oxyhydroxides in the suboxic zone.

Schulz HN, Schulz HD (2005) Large Sulfur Bacteria and the Formation of Phosphorite, Science, 307: 416-418