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Phosphorite deposits on the Namibian shelf

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Phosphorite deposits provide a source of fertilizer to feed an increasingly populated world and they provide a record of palaeoceanographic changes in upwelling systems linked to climate. The Benguela Upwelling System (BUS) is among the most productive today and is associated with major phosphorite deposits exposed over an area of 24,700 km² on the Namibian shelf. Analyses of cores associated with recent offshore mineral exploration provide new insights into the age and origin of these phosphorite deposits. The deposit consists of coarsening upward muddy to gravelly pelletal phosphorite sand, up to several metres thick, on the middle to outer shelf (190 and 350 m water depth) offshore of Lüderitz and Walvis Bay. Less extensive and less continuous deposits continue offshore of Walvis Bay as far north as the Kunene River mouth on the inner to middle shelf (50 and 250 m water depth). Pelletal phosphorite sand (some concentrically banded) and concretionary phosphorite pebbles are the dominant grain types consisting of up to 90 wt% carbonate fluorapatite (francolite) cement and inclusions of organic matter, pyrite and terrigenous mud. Strontium isotope stratigraphy and foraminiferal biostratigraphy indicate that phosphogenesis was initiated in the latest Miocene but that most of the phosphorite formed during the Plio/Pleistocene from the early burial diagenesis (sulphate reduction zone) of organic-rich mud. The highly-condensed, coarsening-upward succession reflects increasingly high-amplitude Pleistocene sea-level fluctuations. Phosphorite formation correlates to terrestrial aridification as well as to marine proxies of intensified coastal upwelling in the 600 m thick equivalent successions on the upper slope. Repeated phosphorite formation and reworking over Pleistocene glacial to interglacial cycles resulted in the economic concentration of phosphorite, with an estimated total resource of 7800 million tons of phosphate rock at an average grade of 19 wt% P₂O₅ on the Namibian shelf.

