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High-resolution multiproxy records from Early Cretaceous lacustrine deposits (Araripe Basin, NE Brazil) and their palaeoenvironmental significance

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Lake deposits represent valuable archives of past environmental changes and their impact on terrestrial environments. The laminated carbonates of the Early Cretaceous Crato Formation (Araripe Basin, NE Brazil) were deposited in a lacustrine setting and offer the opportunity to study the biogeochemical processes controlling a Mesozoic lake system. Based on palynological studies, the age of the Crato Formation has been assigned the Late Aptian to Early Albian. The fossil-bearing carbonates occur in several horizons (up to $\sim$10 m thick) intercalated with mudstones and siltstones and consist of weakly cemented, calcitic micrite with total organic carbon (TOC) contents of up to 2.5 %. They exhibit a distinct and laterally consistent lamination pattern with couplets of dark-grey and pale-grey laminae ranging in thickness between 0.5 and 2 mm. High-resolution XRF scanning in combination with stable isotopes (δ^{13}C, δ^{18}O), optical and organic geochemical analyses provide information on the processes and factors which controlled the formation of the laminated sedimentary pattern in the Araripe basin. Shape and size of the individual calcite crystals and the absence of displacive and/or replacive structures point to authigenic calcite precipitation triggered by cyclical shifts in the chemical and physical properties of the lake surface waters. Fluctuations in relative Fe and Mn intensities across dark-pale couplets reflect variations in pyrite abundance, which in turn correspond to changes in organic matter (OM) content. Optical analysis reveals the mass occurrence of two types of aquatic green algae (*Scenedesmus*, *Pediastrum*) which form the majority of the partic-

ulate OM within the laminated carbonates. In contrast, the deposits below and above the carbonates are dominated by land plant-derived organic remains. The occurrence of isorenieratene derivatives in these deposits provides evidence for photoautotrophic green sulphur bacteria (*Chlorobiaceae*) which are strictly anaerobic and require both light and free H_2S. Their presence is limited to the laminated carbonates and indicates the occurrence of euxinic conditions reaching into the photic zone of the Araripe palaeo-lake. The sudden shift from clay-rich lithologies into laminated limestone facies was accompanied by the occurrence of euxinia in the hypolimnion, indicating the establishment of a chemically stratified lake. The formation of the individual laminae was most probably induced by cyclical (seasonal?) shifts in the productivity cycle, e.g. during algal blooms. The concomitant decrease in surface water CO_2 is interpreted to have triggered the precipitation of authigenic calcite. Enhanced surface water productivity during periods of carbonate precipitation could also explain the establishment of euxinic conditions in the hypolimnion of the lake. Our preliminary results emphasise the high potential of multiproxy records for the reconstruction of the biogeochemical cycling and the controlling palaeoenvironmental conditions in Mesozoic lake deposits.