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Early microbial impact on carbonate diagenesis in lagoon sediments on Aldabra, Western Indian Ocean

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An expedition to the Aldabra Atoll, conducted in November 2017 at the end of dry season, revealed new insights regarding the sedimentation, pore water chemistry and the microbial impact on early diagenesis of fine grained carbonate sediments. Aldabra, located in the Indian Ocean northwest of Madagascar, is an elevated atoll consisting of karstified Pleistocene reef limestones surrounding an approximately 30 kilometres long and 10 kilometres wide flat lagoon. Sedimentation strongly varies within the inshore waters, due to tidal currents, organic input and the relief of the submerged limestones. Forty to seventy centimetres long soft sediment cores were taken at four different sites:
(i) At the northern lagoon margin which was strongly affected by tidal currents and organic input of seabirds. (ii) At the southern lagoon margin surrounded by mangrove shrubs and (iii) at a site in the southwest among vast flats of carbonate silt and sand. (iv) Further sediment cores were gathered in the south-eastern part of Aldabra, a region called Cinq Cases, which comprises a lacustrine, landlocked setting.
The water chemistry at the lagoon margins shows elevated values with respect to alkalinity and nutrients compared to open marine conditions, due to influx from mangrove swamps during low tide. The northern cores show a thin layer of brownish carbonate mud above gastropod shell accumulations and exhibit anoxic conditions throughout the whole section. Similar redox values are found in cores from the southern site, which contain a homogeneous section of white-grey carbonate mud with dispersed mangrove detritus. In contrast, the sediments in the southwestern lagoon consist of an oxic section of white-grey carbonate silt to sand, whereas the Cinq Cases pool deposits show oxic to anoxic, grey carbonate mud covered by a microbial mat.
With respect to pore water chemistry, all cores except from the south-western site, show elevated nutrient levels and lower pH values. Furthermore, nutrient peaks at the top of anoxic zones are most pronounced in sediments with low permeability.
Metagenomic and metatranscriptomic community analyses, in combination with pore water analysis, stable isotope measurements, and SEM investigations will be employed to test potential alteration effects on the carbonate components caused by microbial activity.