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Desert dust deposition supplies essential bioelements to Red Sea corals

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Abstract:

Climate change-related increase in seawater temperature has become a leading cause of coral bleaching and mortality. However, corals from the northern Red Sea show high thermal tolerance and no recorded massive bleaching event. This specific region is frequently subjected to intense dust storms, coming from the surrounding arid deserts, which are expected to increase in frequency and intensity in the future. The aerial dust deposition supplies essential bioelements to the water column. Here, we investigated the effect of dust deposition on the physiology of a Red Sea coral, *Stylophora pistillata*. We measured the modifications in coral and Symbiodiniaceae metallome (cellular metal content), as well as the changes in photosynthesis and oxidative stress status of colonies exposed during few weeks to dust deposition. Our results show that 1 mg L^{-1} of dust supplied nanomolar amounts of nitrate and other essential bioelements, such as iron, manganese, zinc and copper, rapidly assimilated by the symbionts. At 25°C, metal bioaccumulation enhanced the chlorophyll concentration and photosynthesis of dust-exposed corals compared to control corals. These results suggest that primary production was limited by metal availability in seawater. A 5°C increase in seawater temperature enhanced iron assimilation in both control and dust-enriched corals. Temperature rise increased the photosynthesis of control corals only, dust-exposed ones having already reached maximal photosynthesis rates at 25°C. Finally, we observed a combined effect of temperature and bioelement concentration on the assimilation of molybdenum, cadmium, manganese and copper, which were in higher concentrations in symbionts of dust-exposed corals maintained at 30°C. All together these observations highlight the importance of dust deposition in the supply of essential bioelements, such as iron, to corals and its role in sustaining coral productivity in Red Sea reefs.

Keywords: coral, dust deposition, ionomics, metal, Red Sea, symbiosis