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Annual dynamics of halite precipitation in the Dead Sea: In situ observations and their geological implications

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Layered halite sequences deposited in deep basins throughout the geological record. However, analogues of such sequences are commonly studied in sallow environments. Here we study active precipitation of halite layers from the only modern analog for deep, halite-precipitating basin, the hypersaline Dead Sea. In situ observations in the Dead Sea link seasonal thermohaline stratification, halite saturation, and the characteristics of the actively forming halite layers. The spatiotemporal evolution of halite precipitation in the Dead Sea was characterized by means of monthly observations of the i) lake thermohaline stratification (temperature, salinity, and density), ii) degree of halite saturation, and iii) textural evolution of the active halite deposits. We present the observed relationships between textural characteristics of layered halite deposits (i.e. grain size, consolidation, and roughness) and the degree of saturation, which in turn reflected the limnology and hydro-climatology. The lakefloor is divided into two principle environments: A deep, hypolimnetic and a shallow, epilimnetic lakefloor. In the deeper hypolimnetic lakefloor halite continuously precipitates with seasonal variations: (a) during summer, consolidated coarse halite crystals form rough surfaces under slight super-saturation. (b) During winter, unconsolidated, fine halite crystals form smooth seafloor deposits under high supersaturation. The observations also emphasize the thought regarding seasonal alternation of halite crystallization mechanism. The shallow epilimnetic lake floor is highly influenced by the seasonal temperature variations, and by intensive summer dissolution of part of the previous year's halite deposit which results in thin sequences with annual unconformities. This emphasizes the control of temperature seasonality on the precipitated halite layers characteristics. In addition, precipitation of halite in the hypolimnetic floor, on the expense of the dissolution of the epilimnetic floor, results in lateral focusing and thickening of halite deposit in the deeper part of the basin and thinning of the deposits in shallow marginal basins.