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Paleoenvironments of Late Triassic evaporites determined from coupled microfacies – stable isotopes characterization, Mohilla Fm of the Levant margin

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The Late Triassic evaporite-bearing parts of the Mohilla Fm were deposited in small basins on the Levant margin during the Carnian. The Makhtesh Ramon outcrops in southern Israel display rapid changes between restricted and peri-tidal carbonates, carbonate-rich fine clastics, and gypsum evaporites, disrupted several times by events of subaerial exposure.

Samples from outcrops of the Ramon basin, and from one borehole from the Kurnub basin to the north, were analyzed by petrographic and CL microscopy. Depositional environments were defined by microfacies, and stages in diagenetic history were deciphered. Ground whole-rock samples of the carbonates were measured for δ18O and δ13C, with control points confirmed by point sampling using micro-drilling.

Each evaporite-bearing basin was bounded on one side by a large normal fault, explaining the probable origination of accommodation space. Remotely, other faults of the same system presumably created the sills or barriers to explain restriction of circulation and evaporite accumulation. The faults today are high-angle reverse faults, as the tensional regime became reversed to compressional later in the Mesozoic.

The Ramon outcrops reveal a consistent shallowing trend from west to east. This trend is indicated by the evaporite facies developed during the exposure events. Sporadic gypsum nodules occur in the substrate in the west, passing eastwards into a well-developed sabkha profile, and then to karst channels filled by gypsum in the easternmost outcrops. There also, new subaerial surfaces formed that are not found to the west. Eastern outcrops are also affected by small, probably syn-sedimentary faults that seem to be part to the development of the basin.

Oxygen and carbon stable isotope distribution patterns show enrichment in light isotopes of carbon and heavy isotopes of oxygen from east to west. This pattern is attributed to lateral changes in the makeup and layering of the water body from which these units precipitated

The model of sedimentation consistent with these observations is of a periodically stratified water body with periodic influx of fresh water by major runoff events, e.g., mega monsoons. The resulting pycnocline and oxycline in the lower water body were responsible for creation of dysoxic or anoxic conditions, indicated in the δ13C profile of the carbonates by enrichment in light isotopes to the west in the deeper parts of the basin. δ18O becomes lighter to the east due to influx of runoff, and higher temperatures and more effective evaporation to the west.