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# Linking Algal Assemblages and Organic Matter Enrichment in a Middle Eocene Saline Lacustrine Basin

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Phytoplankton are important precursors of organic-rich sediments in the saline lakes during the Cenozoic. The saline lacustrine basin are highly sensitive to climatic forcing, resulting in pronounced environmental variability. However, the composition and abundance of the algal communities, as well as their contributions to organic matter accumulation under such dynamic conditions, remain poorly understood. Here, we investigate the lower unit of the third member of the Shahejie Formation ($Es_3^L$) in the Dongpu Depression, a typical Cenozoic saline lacustrine basin in China. Based on integrated analyses of mineralogical, organic and inorganic geochemistry, organic carbon isotopes and algae communities, we systematically investigated the paleoenvironmental conditions, organic matter enrichment (OME) and algae communities.

The results show that the high temperatures during the Middle Eocene, combined with the influence of the East Asian monsoon, led to increased summer precipitation. This resulted in cyclical changes between arid and humid climates and variable terrigenous clastic inputs during the interval presented by the $Es_3^L$. A moderately restricted lacustrine basin against an overall arid background promoted increasing paleosalinity and enhanced reducing conditions in bottom waters due to the water column stratification, thereby enhancing OM preservation and OME. With increasing paleosalinity conditions, algae communities were mainly composed of *Phthanoperidinium*, *Bohaidina* and *Parabohaidina* with strong paleosalinity-controlled ecological partitioning: *Phthanoperidinium* and *Bohaidina* dominated at 10‰-13‰, *Sinocysta* was most abundant at 7‰-10‰, whereas *Parabohaidina* prevailed below 7‰. The TOC and paleoproductivity proxy constraints indicate that the *Phthanoperidinium* and *Bohaidina* were the primary hydrocarbon contributors during the $Es_3^L$ deposition period. This study identifies dominant algal species and provides new constraints on the mechanisms of organic matter enrichment in saline lacustrine basins.