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Intact Polar Lipid Profiles and Diagenesis in Dynamic Phosphate-Limited South Texas Microbial Mats

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Tidal flat microbial mats along the southern Texas Gulf Coast have been identified to form in both mud-dominated embayments and sandy back-barrier island environments. Microbial mats endure oxidative and nutrient stresses borne from intensive diel redox gradients combined with periodic stranding from seawater. This study aims to describe and quantify unique mat lipid profiles concomitant to dynamic physiochemical conditions influenced by elevation gradients relative to sea level. Intact polar lipids (IPLs) were quantified using tandem normal phase high pressure liquid chromatography – heated electron spray ionization ion trap mass spectrometry. IPLs were identified based on neutral loss and product ion masses paired with ms^n fragmentation. The mats were found to be dominated by the betaine lipids DGTS/DGTA, SQDG, and the more rarely described tri-methylated ornithine lipids. Phospholipids were detected in lower concentrations, most notably the near absence of identifiable PG species. The predominance of nitrogen- and sulfur- headgroups were consistent across the elevation gradient, indicating wide-spread phosphate limitation in both sand- and mud-dominated mat environments. Moreover, the presence of the cyanobacterial sheath pigment scytonemin further suggests UV / photooxidative stress as a ubiquitous factor in the mat environment. Future analysis will include depth profiles and expanded identification of oxylipins through the LOBSTAHs lipidomics framework. This will enable a more in-depth view into lipid oxidation states in response to environmental stressors and sediment burial.