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Molecular characterization of coral reef exometabolites

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Marine DOM constitutes one of the most complex chemical mixtures on earth containing hundreds of thousands of different compounds. In nearshore systems like coral reefs metabolites exuded by primary producers comprise a significant fraction of this marine DOM pool. To learn more about the chemical composition we performed untargeted molecular analysis of exudates released by coral reef primary producers (corals and algae) using liquid chromatography–tandem mass spectrometry. Of 10,568 distinct ion features recovered from reef waters, 1,667 were primary producer exudates; the majority (86%) of these exudates were organism specific, reflecting a clear divide between coral and algal exometabolomes. The stoichiometric analyses of the exudates revealed a significantly reduced nominal carbon oxidation state of algal- compared to coral exometabolites, illustrating an ecological mechanism by which algal phase shifts engender fundamental changes in the biogeochemistry of reef biomes. Coral exometabolomes were enriched in diverse sources of nitrogen and phosphorus, including tyrosine derivatives, oleoyltaurines, and acyl carnitines. In contrast DOM released by algae was dominated by nonnitrogenous compounds, including diverse prenol lipids and steroids. Additional experiments indicate that exudates, specifically exudates unique to the respective treatment, were the main substrate used by heterotrophic microbes exposed to the respective exometabolome. This data provides molecular-level insights into biogeochemical cycling on coral reefs and illustrates how changing benthic cover on reefs influences reef water chemistry with implications for microbial metabolism.