Developing Lipid Biomarkers to Study the Fate of Diazotrophs in the Ocean

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Biological nitrogen fixation is thought to limit primary production in geological time scales and small variations in the ratio of nitrogen fixation to denitrification can significantly affect the atmospheric carbon dioxide concentrations on glacial to interglacial time scales (Falkowski 1997). Thus understanding the controls on nitrogen fixation rates and the fate of the carbon fixed in association with nitrogen fixation is critical to our knowledge of how these processes affect and are affected by climate change. Tremendous progress has been made in the last decade in determining the distributions (Carpenter *et al.* 2004; Foster *et al.* 2007) and activities (Capone *et al.* 2005; Subramaniam *et al.* 2008) of various diazotrophs. However the fate of these organisms and hence that of the newly fixed N and C is essentially unknown, making it difficult to establish the link between nitrogen fixation and carbon sequestration through the biological mediated transport of carbon from the atmosphere to ocean depths. Recent work suggest that C_{35}-C_{45} polyprenols are unique markers that exist in filamentous cyanobacteria and unicellular, cyanobacteria (Bauersachs 2010; Bauersachs *et al.* 2010) and such biomarkers would be a valuable tool for investigations into the fate of newly fixed N in the environment. Unique glycolipids from heterocystous cyanobacterial species have also been recently identified (Bauersachs *et al.* 2009; Bauersachs 2010) and can be used to track the downward flux of DDA blooms. Here we propose to use lipid biomarkers to follow the fate of these various types of diazotrophs.