

Heme *b* distributions in the tropical Atlantic Ocean are influenced by iron demand for nitrogen fixation

DAVID J. HONEY¹, CHRISTIAN SCHLOSSER^{1,2},
JOSEPH SNOW¹, C. MARK MOORE¹,
ERIC P. ACHTERBERG^{1,2}
AND MARTHA GLEDHILL^{*1,2}

¹Ocean and Earth Science, University of Southampton,
National Oceanography Centre, Southampton, UK

²Geomar-Helmholtz Center for Ocean Research, Kiel,
Germany (*corresponding author: mgledhill@geomar.de)

Heme *b* is the iron-containing prosthetic group of an important pool of iron proteins known as the hemoproteins. Hemoproteins are integral to numerous fundamental biological processes, including photosynthetic and respiratory electron transfer (e.g. cytochrome *b₆f*, photosystem II, cytochrome *bc₁*). Heme *b* abundance and nitrogen fixation rates were determined on board the UK funded GEOTRACES cruise in the tropical Atlantic Ocean. Heme *b* concentrations in the Equatorial and tropical North Atlantic were generally lower than observed previously in the (sub)-tropical North Atlantic [1,2]. Heme *b* concentrations were particularly low in areas of high nitrogen fixation and *Trichodesmium* abundance, suggesting a potential trade off between cellular processes requiring hemoproteins and the high iron demand of the nitrogen fixing enzyme nitrogenase.

We therefore investigated heme *b* abundance in two diazotrophs, *Crocospaera watsonii* (WH8501) and *Trichodesmium erythraeum* (IMS101), grown under varying total dissolved iron concentrations (between 0 and 120 nmol L⁻¹). The Intracellular heme *b* content of *Crocospaera* was significantly higher than for *Trichodesmium*. While nitrogen fixation increased with iron availability in cultures of both *Crocospaera* and *Trichodesmium*, cellular heme *b* abundance was observed to decrease in *Trichodesmium*. Low heme *b* content in *Trichodesmium* under iron replete conditions thus suggested optimisation of iron-protein pools in order to facilitate nitrogen fixation and is thus consistent with previous work showing that iron is primarily allocated to nitrogenase and photosystem I in this species[3].

[1]Honey *et al* 2013, *Mar. Ecol. Prog. Ser.* **483**:1-17

[2]Gledhill *et al* 2013, *Glob. Biogeochem. Cyc.* **27**:1-11

[3]Richier *et al* 2012, *PLoS ONE* **7**(5):e35571