

New insights into iron-based photosynthesis

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Iron-rich and anoxic (ferruginous) ecosystems are rare today, yet they dominated oceans for much of Earth's history. Model founded estimates of nutrient supply rates suggest that Fe-based anoxygenic photosynthesis, photoferrotrophy, may have sustained global biological production in these ferruginous oceans [1]. The physiology and genetics of photoferrotrophy, however, remain poorly known, leaving open questions on the biogeochemical impact of photoferrotrophy, its ecological role, and its possible contribution to deposition of Banded Iron Formations.

We have isolated the first axenic culture of photoferrotrophic green sulfur bacteria (GSB) from a ferruginous environment. This pelagic GSB strain originated from a freshwater volcanic basin, Kabuno Bay, East Africa. The Kabuno Bay strain (KBS) has 16S rDNA 99% similar to *Chlorobium ferrooxidans* strain KoFox. Unlike KoFox, KBS uses BChl *e* as its main antenna pigment, suggesting adaptation to low light conditions. Preliminary experiments revealed that KBS oxidizes Fe at a maximum rate of 54 $\mu\text{mol L}^{-1} \text{h}^{-1}$ at a light intensity of 5 $\mu\text{E m}^{-2} \text{s}^{-1}$ and with a half-saturation constant of <0.25 $\mu\text{E m}^{-2} \text{s}^{-1}$. KBS oxidizes Fe down to 0.03 $\mu\text{E m}^{-2} \text{s}^{-1}$, demonstrating photoferrotrophy at light intensities comparable to those used by low-light adapted sulfur oxidizing GSB from the Black Sea [2]. This result extends the demonstrated physiological limits of photoferrotrophy to include light levels typical for deepwater chemoclines. Our observations also suggest that KBS is endowed with a remarkable ability to avoid encrustation by its ferric Fe metabolic products.

[1] Canfield, D. *et al* (2006) *Phil. Trans. R. Soc. B* **361**, 1819-1834; [2] Manske, A. *et al* (2005) *Appl. Environ. Microbiol.* **71**, 8049-8060.