Understanding autotrophic bacterial community structure and function along a naturally occurring iron deposit gradient

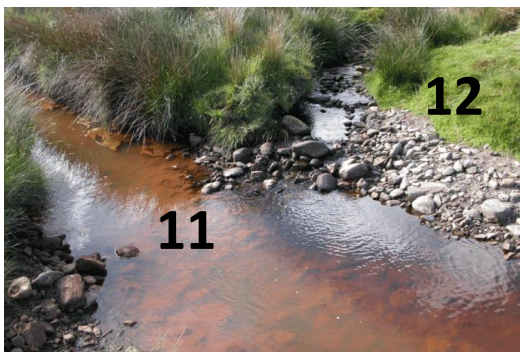
Understanding autotrophic bacterial community structure and function along a naturally occurring iron deposit gradient

Mark R Cunningham[1], Katrina A Macintosh[1], Yi-Chen Chiang[1], Neeleema Seetaloo[1], Shamsudeen Dandare[1], Cormac Rice[1], Timofey Skvortsov[1], David Griffiths[2], John W McGrath[1], Deepak Kumaresan[1].

1 School of Biological Sciences and the Institute for Global Food Security, The Queen's University of Belfast, Belfast, United Kingdom. 2 School of Geography and Environmental Sciences, Ulster University, Coleraine, United Kingdom.

Introduction

Naturally occurring iron deposits in upland streams have been studied in the context of their chemical composition, epilithic biomass, and impacts upon invertebrate community structure over an iron gradient in the Sperrin Mountains, Northern Ireland. The Sperrin Mountains consist of metamorphosed schist and unconsolidated glacial drift with peaty podzol soils. Anthropogenic influences on the study sites are limited, with only low intensity sheep farming and localised conifer plantation forestry: there is no evidence of mining occurring now or in the past in the study catchments. There is limited information on the functional diversity of autotrophic bacteria along the Iron gradient.



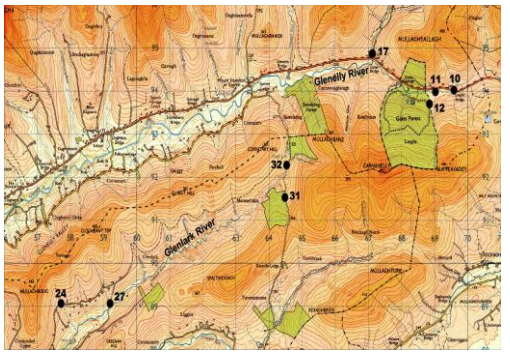


Fig. 1. (Left) River sites 11 & 12 in Sperrins have varied Iron concentrations (photo taken in summer). **Fig. 2. (Right)** Map showing the location of eight river sites selected for sampling of sediment.

Methodology

- **SIP incubations (with ^{13}C labelled substrate)**
- **DNA extraction**
- **Fractionation**
- **16S rRNA Gene PCR**
- **Functional Gene PCR (cbb genes for RuBisCO)**

Aims

1. **Explore differences in autotroph communities along the Iron gradient.**
2. **Investigate spatial & temporal difference in bacterial & archaeal community structure along the iron gradient.**

Chemical Data

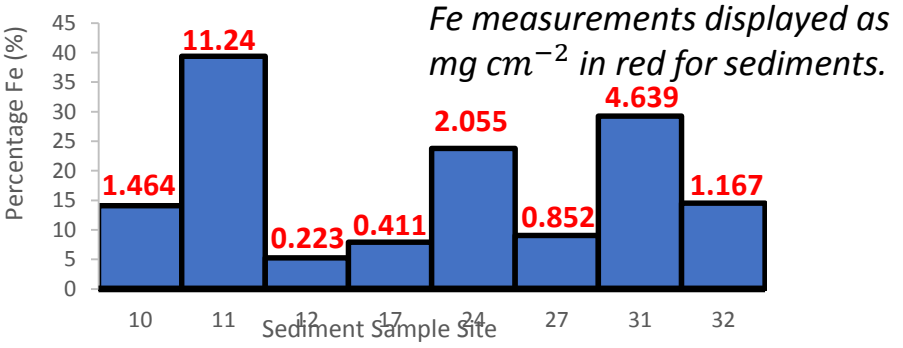


Fig. 3. Percentage (%) Iron measured in river sediment from eight sites in the Sperrins. Sampling took place in May 2008.

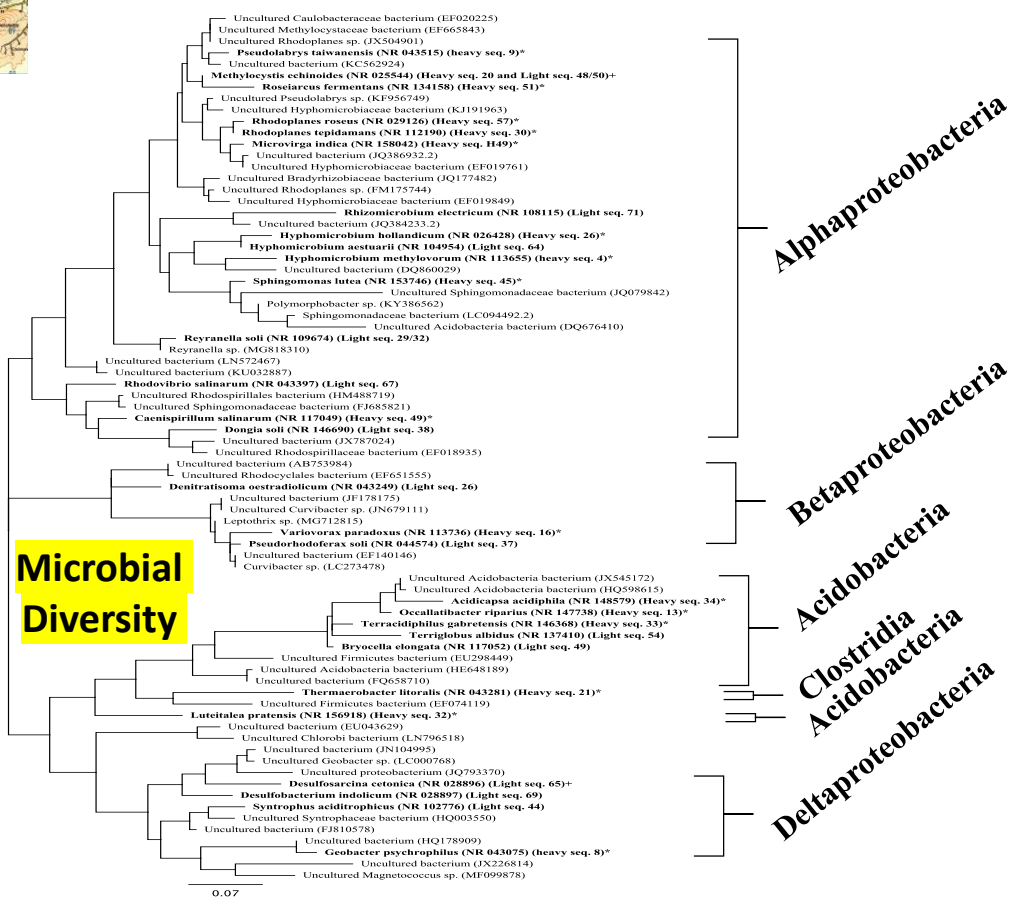


Fig. 4. Phylogenetic tree of 16s rRNA gene sequences for site 11.

Conclusion

- Elevated Iron concentrations within the region has resulted in the growth of specific bacterial species within the river sediment. ^{13}C labelling achieved using ^{13}C bicarbonate & ^{13}C Methanol as Carbon source, for sediment samples from site 11.
- Bacteria within the class Alphaproteobacteria dominate the sequences from heavy DNA at site 11.
- Bacteria involved in iron-cycling e.g. Iron (III)- reducing *Geobacter psychrophiles* and methanotroph e.g. *Methylocystis echinoides* have also been identified as members of the microbial ecosystem.