Manganese reduction and associated microbial communities in Antarctic surface sediments

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Introduction

Iron reduction was intensively studied in many environments, including permanently cold sediments, showing that this process is driven mainly organoclastically [1]. Manganese reduction is less investigated, especially in permanently cold environments [2]. Consequently, mechanisms and responsible players for microbial manganese reduction in permanently cold sediments, such as in the Antarctic, are so far understudied. At the study site Potter Cove (King George Island/ Isla 25 de Mayo, Antarctica), elevated concentrations of dissolved manganese and iron were previously detected in the pore water close to the terminating glacier [3]. The aim of this study is to identify the biotic mechanistic sources of the dissolved manganese and the responsible microorganisms.

Conclusion

- Organoclastic microbial manganese reduction contributes to organic matter degradation in Potter Cove sediments (Fig. 2, 3)
- Tested reduced sulfur compounds did not contribute to manganese reduction (Fig. 3A)
- *Desulfuromusa* was the main organoclastic manganese reducer (Fig. 4A, E)
- Sva1033 (Desulfuromonadales) was involved in acetate degradation, potentially using manganese (Fig. 4B, F)
- *Desulfuromonas* thrived on unidentified underlying processes (Fig. 4C, G)
- *Arcobacteraceae* was involved in acetate degradation with residual electron donors in the sediment (Fig. 4D, H)
- Sva1033, *Desulfuromonas* and *Arcobacteraceae* were all previously identified in iron reducing Potter Cove incubations [4]

Iron and maganese reduction in the glacial influenced surface sediments of Potter Cove

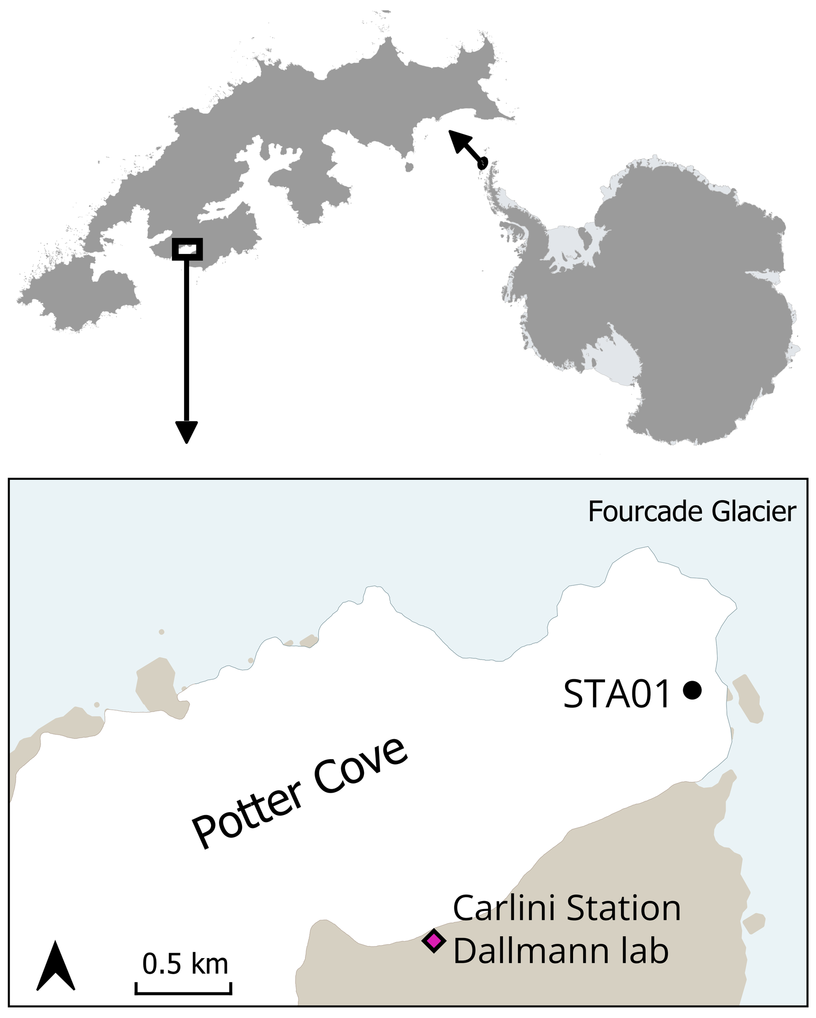

Fig 1: Sediment cores were taken at STA01. The sampling site is highly influenced by the glacial meltwater of the retreating glacier, fueling it with iron oxides.

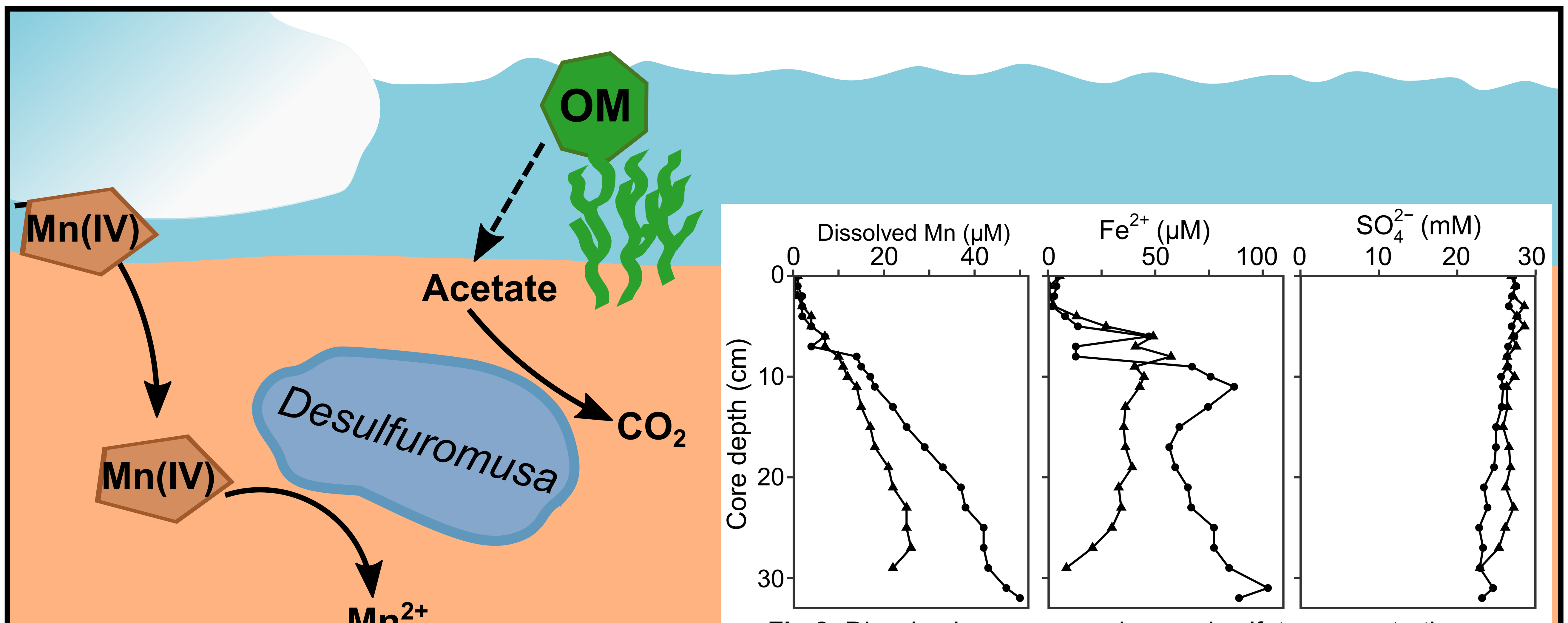

Fig 2: Dissolved manganese, iron and sulfate concentrations over depth in two replicate sediment cores.

Manganese reduction stimulated by organic electron donor

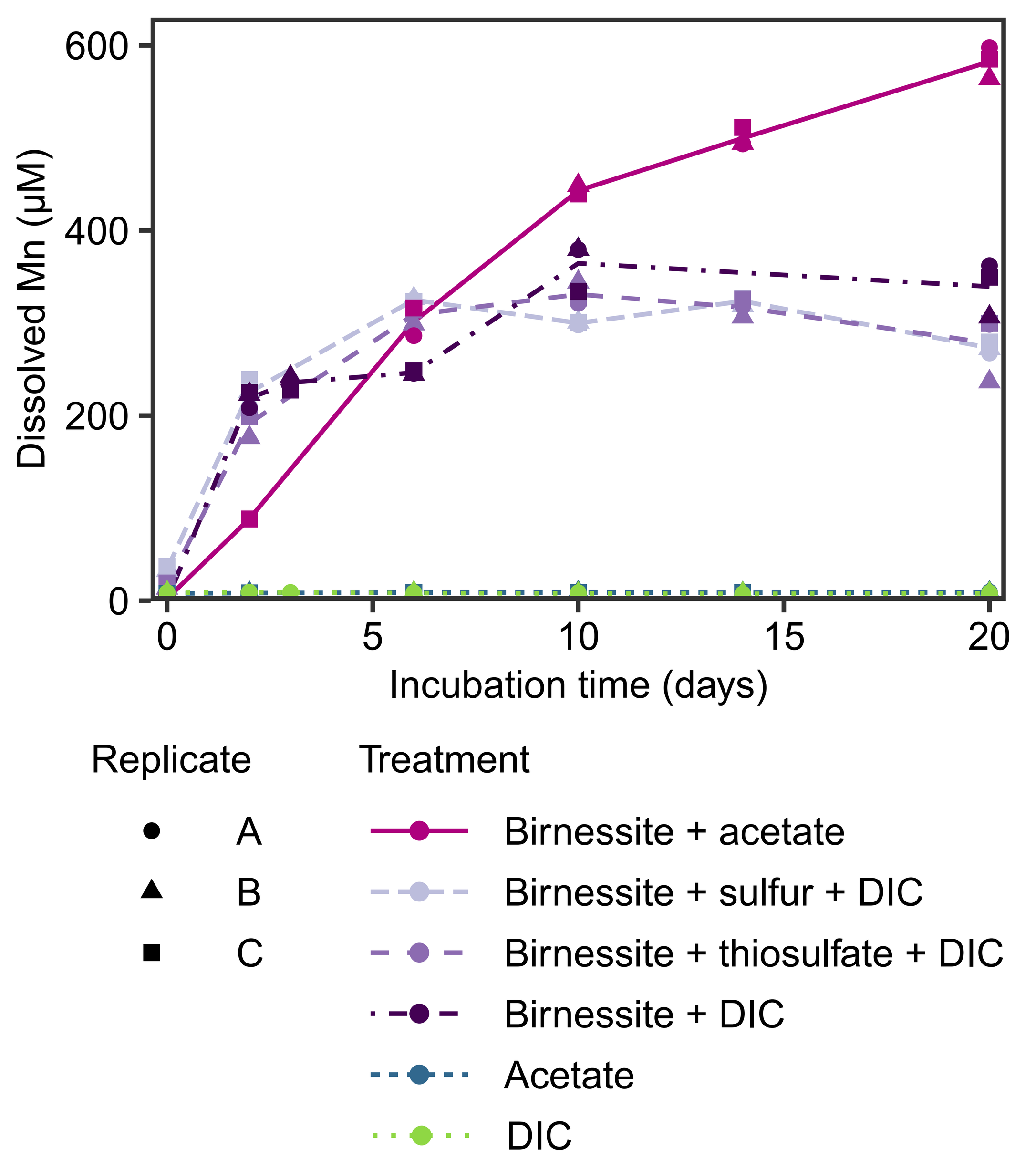

Fig 3: Slurry incubations prepared in 1:5 ratio with manganese oxide birnessite (10 mM) as electron acceptor and acetate, elemental sulfur or thiosulfate (1 mM) as electron donor with dissolved inorganic carbon (DIC, 20 mM) in the background, incubated at 2°C.

Desulfuromusa occupies niche of organoclastic manganese reduction in permanently cold sediments

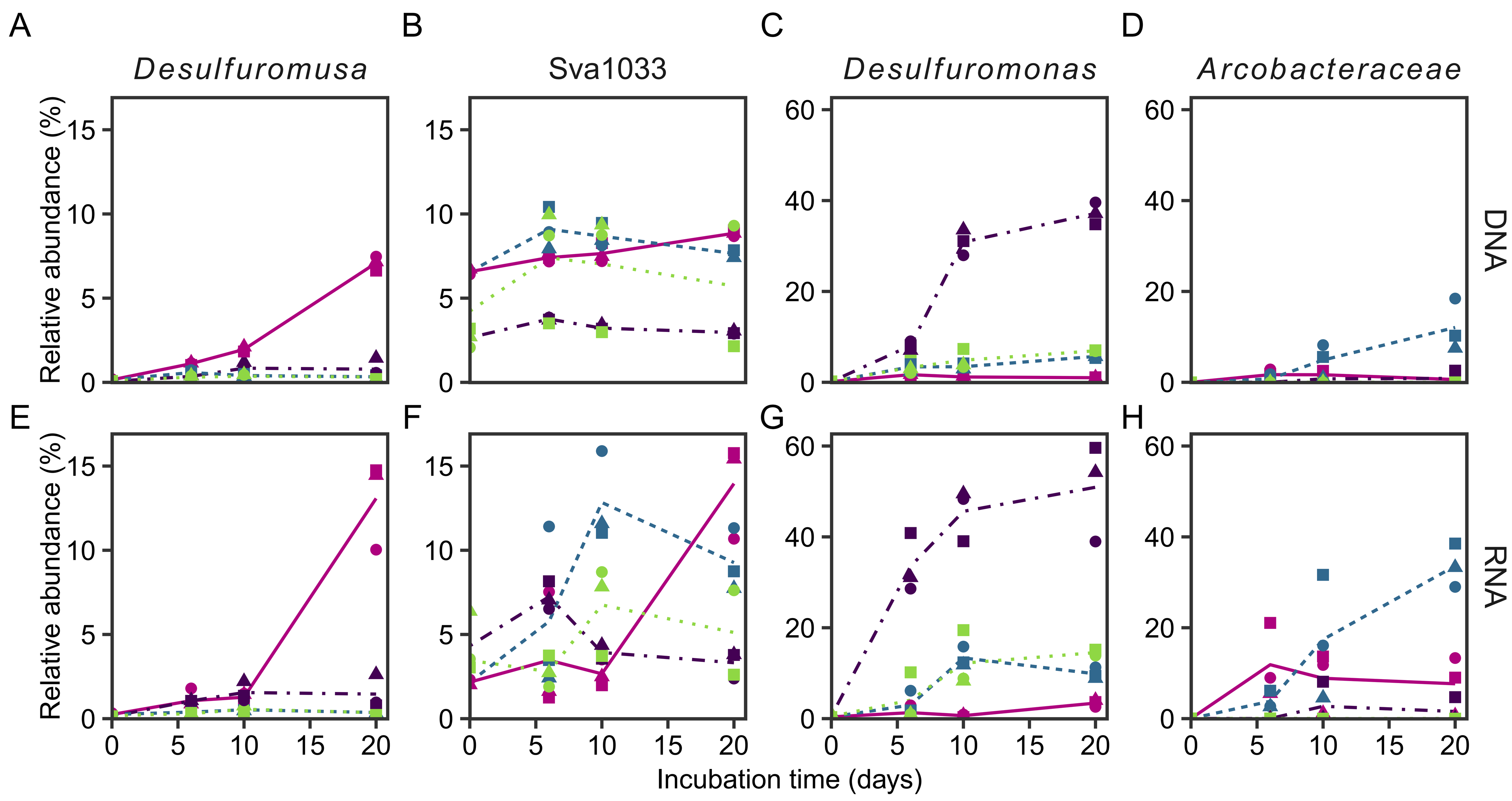

Fig 4: Stimulated bacterial community identified by 16S rRNA (**E-H**) and 16S rRNA gene (**A-D**) sequencing. *Desulfuromusa*, uncultivated family Sva1033 (Desulfuromonadales) and *Arcobacteraceae* were stimulated by acetate addition while *Desulfuromonas* thrived on an unidentified underlying process. Sva1033 occupies an acetate utilizing niche in the permanently cold, glacial influenced sediments as also apparent from its abundance in situ and stimulation in previous experiments [4].

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Literature
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