Potentiometric analysis of marine biogeobatteries

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Filamentous, multicellular bacteria of the Desulfobulbaceae family form a biogeobattery in marine sediments by mediating an electrical coupling between sulphide oxidation in deeper anoxic layers and oxygen reduction at the sediment surface[1,2].

The electrical fields generated in such biogeobatteries were determined with micro electrodes. The electrical fields collapsed immediately when oxygen was removed and re-establish when oxygen was re-introduced. The fields also collapsed when bacterial filaments were cut with thin wires. Modelling of the field in experimental sediment cores showed that anodic oxidation was confined to the sulphide free anoxic zone. This can suggest that the sulphide source was iron sulphides.

Field application of the potentiometric methodology was demonstrated by in situ measurements of electrical fields generated by biogeobateries in the Bay of Tokyo, Japan.

[1] Nielsen *et al* (2010) *Nature* **463**, 1071-1074. [2] Pfeffer *et al* (2012). *Nature* **491**, 218-221.