Iodine speciation change by a Mn-oxidizing marine bacteria, *Roseobacter* sp. Azw-3k, through the production of reactive oxygen species

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Iodine-129 is one of the most persistent radionuclides released from nuclear reprocessing facilities. With its longevity (half-life: 16 Myr) and biophilic nature (it accumulates in thyroid glands), iodine-129 is a potential human health threat. Thus, it is important to understand the behaviour of iodine in the natural environments. *Roseobacter* spp. are widely-distributed and comprise up to 15~20% of bacterial community in coastal/marine environments, and at least one member of this genus, *Roseobacter* sp. Azw-3k, facilitates extracellular Mn oxidation by releasing superoxide anions (O_2^-). We hypothesized that *Roseobacter.* sp. Azw-3k could mediate iodide oxidation through the production of extracellular superoxide anions and/or biogenic Mn(IV) oxides. Without Mn(II), Azw-3k cultures transformed ~90% of provided iodide (10 μM) into organo-iodine and iodate within 6 days, whereas in the presence of Mn(II), iodide oxidation only occurred after an initial period of Mn(IV) formation (~12 days). Heat-killed cells did not transform iodide. O_2^- production rates peaked at day 3, corresponding to early stationary phase of the cultures and the peak of iodide oxidation, and ceased after day 15. The results suggest that biogeneic O_2^-, but not biogenic Mn oxides, were involved in the iodide oxidation process. However, iodide oxidation also occurred in the presence of the O_2^- scavengers, Cu^{2+} and superoxide dismutase. Results suggest that Azw-3k-mediated iodide oxidation could be facilitated by two reactive oxygen species, O_2^- and its hydrolysis product, H_2O_2.

Poorly-crystalline Fe(Mg) Silicates involved in early fossilization of microbes in modern microbialites

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The search for the oldest traces of life has been a long-term challenge partly because of the difficulty to distinguish abiotic artefacts from biogenic traces. One way to improve our capability to detect traces of life is to study the fossilization processes affecting microorganisms in modern environments. Here, we studied the early fossilization of microorganisms in modern microbialites from, hyperalkaline crater lakes in Mexico, which might be good analogues for some Archean deposition environments such as Tumbiana.

Scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) microanalyses on polished petrographic sections showed textures reminiscent of stromatolitic laminations and domal microstromatolites, consisting mainly of alternating aragonite and iron (sometimes magnesium)-rich silicates. Diverse microfossils of unicellular eukaryotes (e.g., diatoms) and prokaryotes were observed to be morphologically well-preserved by the precipitation of iron- or magnesium-rich silicates. The structural and chemical features of these potential fossils were further studied down to the nm-scale using a combination of focused ion beam (FIB) milling, transmission electron microscopy (TEM) and scanning transmission X-ray microscopy (STXM) at the C K-edge and Fe $L_{2,3}$-edges. The Fe(Mg)-rich silicate was characterized as a poorly-crystalline talc-like phase containing mixed-valence iron. Compared with the aragonite-dominant part, the Fe(Mg)-Si-rich laminations are richer in fossil microbes . Altogether, our results indicate that poorly-crystalline Fe(Mg) silicates can play an important role in the early stages of microbial fossilization.

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