

Microbial transformation of iron oxide to sulfide species on steel immersed in seawater

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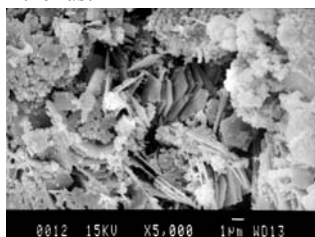
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Iron oxides and sulfides on steel immersed in seawater

In the current study, rust samples were removed from the steel immersed in seawater in China and analysed with surface observation and element analysis, microbial cultivation and molecular ecology analysis methods. Globular iron oxides and hexagonal iron sulfides could be found in the rust (Figure 1). Bacterial cells were also observed in the rust layer.

Fig.1 Globular iron oxides and hexagonal iron sulfides presented in the rust



Discussion

The sulfate-reducing bacteria (SRB) in the rust have presented a very high numbers. Especially, some culture mediums also appear pink color after longer incubation course, which indicates dissimilatory iron-reducing bacteria (DIRB) may participate in the mineralisation. The Fe(III) oxides may first reduced by DIRB as the electron acceptor, and further, the iron sulfide species were formed by biotic ferrous ion reacted with the sulfide produced by SRB. Further molecular biological analysis will reveal the ecology characteristics of rust.

Conclusion

In the microbial community of rust in seawater, anaerobic DIRB and SRB may participate in the reduction of iron oxides and the formation of iron sulfide species.

References

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Rapid precipitation of amorphous silica and aluminum phases in experimental systems with nontronite (NAu-1) and *Shewanella oneidensis* MR-1

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Rapid, microbially mediated formation of amorphous silica and aluminosilicate phases at the expense of dissolving nontronite was studied in laboratory systems containing nontronite NAu-1, *Shewanella oneidensis* strain MR-1, and lean aqueous media. The systems were undersaturated with respect to amorphous silica and amorphous aluminum hydroxide throughout the durations of experiments. Experimental runs with dissolved O₂ were initially undersaturated with respect to halloysite, a metastable clay mineral often associated with weathering products, but approached saturation during the seven-day runs. Runs in which *S. oneidensis* was forced to respire Fe(III) from NAu-1 remained undersaturated with respect to halloysite. Amorphous silica precipitation was confirmed in the immediate vicinity of bacterial cells and extracellular polymeric substances in all experimental systems that contained bacteria, whether the bacteria were respiring dissolved O₂ or Fe(III) from NAu-1, or were heat-killed prior to the start of experimental runs. Amorphous aluminosilicates were found in both aerobic and Fe(III)-respiring systems. Neither amorphous Si nor aluminosilicates were observed in bacteria-free systems. Our results show that precipitation of amorphous silica and aluminosilicate phases can proceed rapidly in aqueous solutions that are not supersaturated with respect to these phases, and that the presence of bacteria is critical to the precipitation processes. We suggest that "reverse weathering," the formation of authigenic clay minerals at the expense of dissolving clastic clays, may be more rapid and widespread than currently considered. In addition, our study proposes that the detection of silicified microfossils may not be limited to cherts and stromatolites.