# Mechanistic insight into microbial biomineralization of iron oxides

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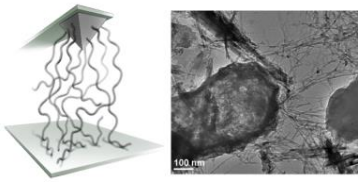
Microbial control over mineralization is a widespread phenomena that has shaped the near-surface mineralogy and chemistry of the earth, oceans and atmosphere. However, the mechanistic understanding of these interactions is poorly constrained. We quantitively addressed the mechanisms behind the controls that microbial extracellular polymeric substances (EPS) exert in directing mineral formation and transformation. We used atomic force microcopy (AFM) and captured the collective bond behavior of model and natural EPS during interaction with the two common iron oxides hematite and ferrihydrite and applied nucleation theories to relate the measurements to observed controls.

One of the main findings is that EPS, as well as less complex polysaccharides, strongly bind iron species and iron oxides to such an extent that they modulate the interfacial free energy of the iron oxide-polymer system, thus promoting nucleation on the polymer matrix by decreasing the nucleation barriers. We relate these findings to results from reduction experiments and discuss implications for mineral formation in both oxic and anoxic conditions as well as for carbon burial.




*EPS linked to an AFM tip and brought in contact with iron oxide gives insight into microbial mineral formation.*