

The wonders of green rust: A not so random journey around the periodic table

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Green rusts are mixed Fe(II)/Fe(III) layered double hydroxides (LDHs) that typically form under weakly acidic to alkaline conditions in suboxic and anoxic environments. They have been identified as products of the microbial bioreduction of Fe(III) oxides, both abiotic and microbially induced corrosion of iron and steel, the abiotic reductive dissolution of Fe(III) oxides by Fe(II), and the abiotic and microbially-mediated oxidation of ferrous iron species, and as such are key intermediates in many redox transformations controlling the biogeochemical cycling of iron. Green rusts are highly redox active and have been shown to be facile electron donors for the reduction of many contaminants of concern including various chlorinated solvents, nitroaromatics, azo dyes, toxic metals, metalloids, and radionuclides, suggesting that green rusts may be highly reactive reductants in natural and engineered terrestrial and aquatic environments. This talk summarizes over 25 years of research examining the reduction of chlorinated solvents (chlorinated methanes, ethanes, and ethenes), transition metals (V(V), Cu(II), Ag(I), Re(VII), Au(III), and Hg(II)), metalloids (Te(VI) and Te(IV)), and U(VI) by green rust.