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Dynamic coupling of ferrihydrite transformationand associated arsenic desorption/redistributionmediated by sulfate-reducing bacteria.

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Sulfate-reducing bacteria play an important role in the geochemistry of iron (oxyhydr)oxide and arsenic (As) in natural environments; however, the associated reaction processes are yet to be fully understood. In this study, batch experiments coupled with geochemical, spectroscopic, microscopic, and thermodynamic analyses were conducted to investigate the dynamic coupling of ferrihydrite transformation and the associated As desorption/redistribution mediated by *Desulfovibrio vulgaris* (*D. vulgaris*). The results indicated that *D. vulgaris* could induce ferrihydrite transformation via S^{2-}-driven and direct reduction processes. In the absence of SO_4^{2-}, *D. vulgaris* directly reduced ferrihydrite, and As desorption and re-sorption occurred simultaneously during the partial transformation of ferrihydrite to magnetite. The increase in SO_4^{2-} loading promoted the S^{2-}-driven reduction of ferrihydrite and accelerated the subsequent mineralogical transformation. In the low and medium SO_4^{2-} treatments, ferrihydrite was completely transformed to a mixture of magnetite and mackinawite, which increased the fraction of As in the residual phase and stabilized As. In the high SO_4^{2-} treatment, although the replacement of ferrihydrite by only mackinawite also increased the fraction of As in the residual phase, 22.1% of the total As was released into the solution due to the poor adsorption affinity of As to mackinawite and the conversion of As^{5+} to As^{3+}. The mechanisms of ferrihydrite reduction, mineralogy transformation, and As mobilization and redistribution mediated by sulfate-reducing bacteria are closely related to the surrounding SO_4^{2-} loadings. These results advance our understanding of the biogeochemical behavior of Fe, S, and As, and are helpful for the risk assessment and remediation of As contamination.