Rapid pyrite formation during interaction between ferric (hydr)oxides and S(-II)

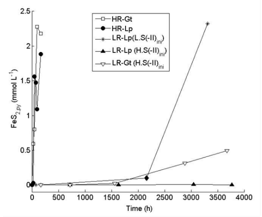
MOLI WAN*[1] AND STEFAN PEIFFER[1]

[1]Department of Hydrology, University of Bayreuth, D-95440, Bayreuth, Germany. (*correspondence: moli.wan@uni-bayreuth.de)

Pyrite formation during the interaction between ferric (hydr)oxides and dissolved sulfide (S(-II)) was investigated under anoxic condition and neutral pH. It was demostrated that the formation rate of pyrite has a strong dependence on the initial molar ratio of Fe/S. Rapid pyrite formation (within 1-2 days) occurred only in the high Fe/S ratio (>1) where ferric (hydr)oxides are in excess to S(-II). While in the low Fe/S ratio (<0.5) experiments, pyrite did not occur until months.

Important intermediates forming during electron transfer between ferric (hydr)oxides and S(-II) comprise not only FeS and elemental sulfur, but also excess Fe(II) and surface associated polysulfides with predominance of disulfide [1-3]. Excess Fe(II) is the ferrous iron species which can be extracted with 1M HCl but is not bound as FeS [2] [3]. It is a fraction of electrons which are donated by S(-II) and temporarily stored in the bulk ferric (hydr)oxide mineral[2] [4]. The concentration of excess Fe(II) becomes significant only in the high Fe/S ratio experiments with high reactive ferric (hydr)oxides such as ferrihydrite and lepidocrocite [2] [3].

It appeared that such intermediates, especially excess Fe(II) and surface disulfide, are essential for rapid pyrite formation. Here we propose, that a non-crystalline Fe(II)-S_2 species forms in the presence of excess Fe(II) and surface disulfide, leading to supersaturation with respect to pyrite, and finally to the nucleation of pyrite within 1-2 days.



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