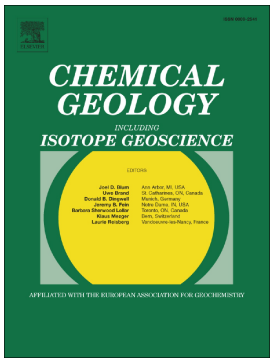

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Symbiosis mechanism of iron and manganese oxides in oxic aqueous systems

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Abstract: Iron and manganese oxides are ubiquitous in soils and sediments, and their formation and conversion processes affect the migration and transformation of heavy metals and organic pollutants. Mn^{2+} was found to affect the formation of iron oxides from Fe^{2+} oxidation. However, little attention has been paid to the oxidation process at the initial stage and generation of manganese oxides in the reaction system of Fe^{2+}_{aq} and Mn^{2+}_{aq}. This work investigated the formation process and mechanism of iron and manganese oxides in a mixed solution system of Fe^{2+}_{aq} and Mn^{2+}_{aq} under oxic condition. The effect of pH (5.0–9.0) on the reaction process and products was further studied. The results indicated that Fe^{2+}_{aq} was oxidized to goethite and lepidocrocite, and Mn^{2+} adsorbed on the surface of iron oxides was catalytically oxidized to poorly crystalline manganese oxides by dissolved O_2 in a mixed solution of Fe^{2+}_{aq} and Mn^{2+}_{aq}. Compared with the absence of Mn^{2+}_{aq}, the presence of Mn^{2+}_{aq} caused no obvious changes in the species of iron oxides, but significantly increased the oxidation rate of Fe^{2+}_{aq}. Formation of manganese oxides on the surface decreased the crystallinity of the iron oxides. The increase of pH enhanced the oxidation of Fe^{2+}_{aq} and Mn^{2+}_{aq} and formation of lepidocrocite. This work expands our understanding of the interactions and geochemical processes of Fe^{2+}_{aq} and Mn^{2+}_{aq}.

Keywords: Coexistence of Fe^{2+}_{aq} and Mn^{2+}_{aq}; Oxidation; Goethite; Lepidocrocite; Crystallinity