

SEDIMENTS

Iron is a major element of freshwater and oceanic sediments. Concentrations range from 1% to 9% [6,9]. The form of iron varies, depending on the redox conditions. Surface sediments may be somewhat oxidized and often contain ferric iron. Soluble (reduced) iron content increases with sediment depth. Ferrous sulfide (FeS), the predominant inorganic form of iron [9], may in turn be transformed to pyrite (FeS₂), a common iron sulfide in sediments [2].

In sediments containing enough organic matter, anaerobic bacteria reduce sulfate in the interstitial water to form sulfide species, which react with iron-containing minerals in the sediment to form a variety of iron sulfides.

Hydroxides of iron (e.g., FeOOH) can precipitate from natural waters to form colloidal particles that aggregate and settle on the bottom. The particles adhere to surfaces and aggregate to form coatings, granules, and nodules.

6.8.5 Effect of Iron on Concentrations of Other Metals

Although iron itself is not considered toxic, it is environmentally significant because of its interaction with metals that are toxic. Iron oxides adsorb many elements and participate in the attenuation of most trace and heavy metals. In soils and sediments where conditions are not strongly reducing, adsorption by solid iron oxides is one of the most important controls on the distribution of trace elements. In an aerobic sediment or water system, the metal bonding may be almost irreversible. If the oxides are dissolved by reduction, the adsorbed metals may be released and appear in solution, or they may be precipitated as some other phase, such as a sulfide [2,9]. (However, if ferrous iron is present in large quantities, it can tie up the sulfide to the extent that insufficient amounts are available to precipitate heavy metals [9].)

Precipitation of iron oxides during dredging operations has been reported to decrease dissolved concentrations of cadmium, copper, lead and zinc [15]. Iron (and manganese) oxides are used as scavengers in wastewater treatment and may be very effective in retarding the migration of pollutants in the subsurface [2]. Deep-sea nodules, concretions of manganese and iron oxides growing on the ocean floor, are known to concentrate trace elements, such as Co, Ni, Zn and Pb, from seawater. As the oxides aggregate and settle, they act as scavengers for trace elements. (Data on adsorption of trace elements by iron oxides are given in the various chapters on individual elements, and a general discussion is presented in section 2.12.)

In soils, various trace elements are concentrated by iron oxides, including Zn, Pb, Mn, Ni, Cu, Co, V, Mo, and Cr. The most widely observed sorption capacities of iron oxides are those for phosphates, molybdates, and selenites. The adsorption is dependent on pH and is greatest for various ions on iron oxides at pH 4-5. Iron oxides also react with carbonates in soil systems. Fe(III) can be incorporated in hydrated phosphates, and Fe(II) reacts with sulfur to form the stable minerals pyrite and jarosite [7].

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Packed with Information
Reviewed in the United States on April 18, 2015

I have been looking for a book like this for months now! It is loaded with information on the macro/micronutrients in the soil. I am currently studying how iron affects the growth of a species of cactus, and this book presented more information than I needed on the chemistry behind iron uptake, chemical makeup of soils, and primary resources from which the information originally came. Here is just a portion of the table of contents:

2.2 Vapor Pressure
2.3 Photolysis in Air
2.4 Gas Adsorption on Solids
2.5 Atmospheric Deposition
2.6 Activity Coefficient
2.7 Acid/Base Equilibria
2.8 Polymerization

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