Formation of ferric minerals in an anoxic world

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The formation of the ferric iron which is observed inside the minerals hosted by rocks located in anoxic environments, such as the Precambrian rocks up to the early Paleoproterozoic period, is presently explained with anoxic photosynthesis using UV solar irradiation on the surface of acidic ocean water or with the anoxygenic process used by Fe-oxidizing microorganisms. The main explanation remains the process of oxygenic photosynthesis conducted by microorganisms which produce oxygen. Since 2013, a new hypothesis is presented for the formation of ferric iron in alkaline conditions, in the upper crust of the Earth or in extraterrestrial objects, where water can be near its critical point and not above [1-6]. This conclusion is established following studies of Eh-pH diagrams for the Fe-H_2O system and solubility diagrams for quartz and amorphous silica, complemented by thermodynamic calculations. Results show that ferric minerals can form in geological terrains where anoxic alkaline high subcritical water reacts with rocks containing ferrous silicates as shown in Figure 5 in [6] which represents a possible formation of ferric minerals in the absence of UV light, oxygen and microorganisms.

References

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