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Banded Iron Formation: texture study and implication for redox evolution during GOE

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First oxidation events, named as Great Oxidation events (GOE) occurred during the early paleo-protozoic and later Archean (c.a. 2.22 to 2.45 Ga), it rebuilt heavily the global surficial environments. The huge change was recorded in global distribution, huge scale sedimentation of banded iron formations (BIFs) and siliceous formations. The geochemical proxies have being raised, i.e. redox-sensitive elements and minerals. However, the advent of microbes in Archean no later than 3.6 billions also changed gradually the global surficial system (Dong et al., 2023). The first reported Iron Formation occurred at about 3.3 billions years. The redox-states was recorded in the Iron formations and presented as the iron minerals with different valances. During 4.0-3.0 billions, the iron minerals was composed mainly by Fe(II) but evolved to mixed valences, such as siderite, magnetite, greigite ($[Fe^{2+}Fe^{3+}{}_2S_4$) and franklinite etc. During 3.0 – 2.22 billion years, large scale of iron formation occurred globally. Then, the hematite or its precursors were present in the iron formation as major minerals. And the levels of oxygen in the atmosphere simultaneously elevated greatly to about 0.01 present atmospheric level (PAL). In other words, to the end of great oxidation event stages, and since the elevated level of oxygen in atmosphere that constructed one slightly habitable Earth, and potentially resulted in the evolution of eukaryotes. Since then, large amounts of ferric minerals formed in the sediments and strata. However, the relation between the redox changing and microbe evolving is very fuzzy and much more controversial. We have being carried microscale observation and in-situ-analysis to discover the reaction texture among different iron minerals, intend to screen the redox sensitive iron minerals, then to build the sequence of redox minerals, and further with the combination of geochemical proxies to construct the relation between the redox evolution in the ocean and atmosphere.

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