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Water in the high subcritical state as a trigger for the formation of ferric minerals and geobiotropic molecules of life

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Session: Habitability, water and interior evolution of planets

Abstract:
Water in the high subcritical, hsc, state shows properties which allow the synthesis of minerals in symbiosis with prebiotic matter. It is shown that five chemical processes occuring at the T&P conditions of hsc water lead to the formation of prebiotic matter and of ferric oxide and silicate minerals: 1. Contact of hsc with ferrous silicate containing rocks; 2. High dissolution of silica in hsc; 3. Oxidation of Fe^{II} into Fe^{III} in hsc; 4. Reduction of hsc to form H2; 5. Formation of CO in hsc.
When crustal rising anoxic water encounters ferrous silicate containing rocks, while at 300°-350°C, 10-25 MPa, dissolution of the rocks can occur. Indeed, the solubility of silica is high, below the critical point of water and drops abruptly above this point. The chemical equation for the anoxic alkaline oxidation of ferrous iron in hsc can be applied to the hydrolyses of fayalite, Fe_2SiO_4 and ferrosilite, $FeSiO_3$, as I propose since 2013. Fe^{III}-oxides and Fe^{III}-silicates can form and H_2 is released. H_2 reacts with CO_2 also in hsc water to form CO. Components of life can form at ~350°C such as macromolecules of amino acids which are experimentally synthesized from gaseous mixtures of (CO, N_2, H_2O) in Sabatier-Senderens/Fischer-Tropsch & Haber-Bosch reactions or microwave or gamma-ray excitation reactions.
Such geobiotropic synthesis may occur inside fluid inclusions located in the quartz chert or hematite or Fe^{III}-silicates, of geological terrains, and also inside siderite located near ferric oxides and ferric silicates. No oxidation by photosynthesis, neither by oxygen is needed to explain the ferric minerals formed in Archean anoxic terrains. The intervention of any kind of bacteria, sulfate-reducing, Fe^{II}-oxidizing or O_2-producing cyanobacteria is not required.

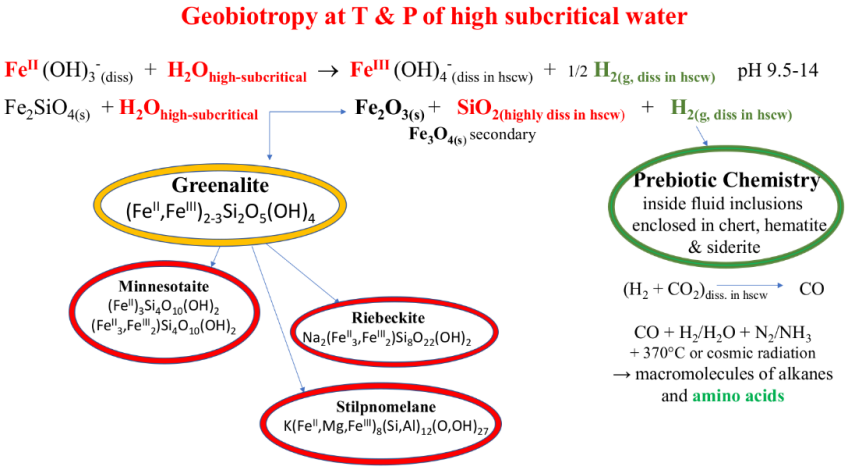

Fig. The process of geobiotropy in anoxic alkaline high subcritical water.

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