Prussian Blue as Prebiotic Reagent

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Ferrocyanide has been proposed as a potential prebiotic reagent by Arrhenius. The complex salt named Prussian Blue, $Fe_4[Fe(CN)_6]_3$, [ferric hexacyaneferrate (II)], might be an important reservoir of hydrogen cyanide, HCN, in the early Earth. HCN is a major product of spark discharge experiments on various gas mixtures; it is considered the main precursor of amino acids and purine bases under prebiotic conditions. The presence of banded iron formations shows that dissolved iron (ferrous iron) was present in high quantities in the ocean water during Archean epoch. Recently, we observed the formation of Prussian Blue in spark discharge experiments using saline solutions of ferrous chloride, $FeCl_3$. Using Prussian Blue as starting material in ammonium solutions at different values of pH, and carrying out the reactions under middle conditions of temperature and concentration, some organic compounds were formed. We detected urea, imidazole, substituted imidazoles, methyl hydantoines and other heterocycles containing nitrogen and some amino acids by GC-MS of their trimethylsilyl derivatives. These results seem to indicate that Prussian Blue could be a sink of HCN in the early Earth. Subsequent reactions, triggered by pH fluctuations, might lead to organic life precursors.