

Role of Ferrocyanides in the Prebiotic Synthesis of α -Amino Acids

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Abstract We investigated the synthesis of α -amino acids under possible prebiotic terrestrial conditions in the presence of dissolved iron (II) in a simulated prebiotic ocean. An aerosol-liquid cycle with a prebiotic atmosphere is shown to produce amino acids via Strecker synthesis with relatively high yields. However, in the presence of iron, the HCN was captured in the form of a ferrocyanide, partially inhibiting the formation of amino acids. We showed how HCN captured as Prussian Blue (or another complex compound) may, in turn, have served as the HCN source when exposed to UV radiation, allowing for the sustained production of amino acids in conjunction with the production of oxyhydroxides that precipitate as by-products. We conclude that ferrocyanides and related compounds may have played a significant role as intermediate products in the prebiotic formation of amino acids and oxyhydroxides, such as those that are found in iron-containing soils and that the aerosol cycle of the primitive ocean may have enhanced the yield of the amino acid production.

Keywords Prebiotic synthesis · Ferrocyanides · Amino acids · Carboxylic acids · Aerosol chemistry · Strecker reaction

Introduction

Since Miller's famous experiment (Miller 1953) that probed the abiotic synthesis of amino acids under plausible prebiotic conditions, the investigation of the pathways that may have allowed prebiotic chemical evolution has become a fascinating field of research whose main questions are still unanswered. Amino acids are the monomers of proteins, which, along with nucleic acids, are the most important biopolymers in biochemistry. Amino acids are formed more readily from CH_4 -based atmospheres than any other biomonomer. Several routes have been proposed to account for

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