the emergence of iron-sulfur protometabolism

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Iron-sulfur clusters are considered to be one of life's most ancient cofactors. Traditionally, the reliance of extant biology on iron-sulfur proteins has been interpreted to mean that iron-sulfur clusters of some type actively participated in the prebiotic chemistry that led to life. Since globular proteins were likely not present on the prebiotic Earth, most investigations into the early roles of iron-sulfur clusters have centered upon the potential activity of minerals, such as greigite and pyrite. Although minerals undoubtedly heavily impacted prebiotic chemistry and likely participated in the synthesis of molecules necessary for the emergence of life, it is unclear how minerals could have been later superseded by protein enzymes. Here we discuss our efforts in understanding the plausibility of synthesizing iron-sulfur clusters coordinated to prebiotically plausible peptides. We find that the solution conditions impact the type of iron-sulfur cluster formed, that UV light facilitates the synthesis of iron-sulfur clusters, and that iron-sulfur peptides can mediate the types of electron transfer reactions needed to sustain an early form of metabolism.

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