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Boron assists abiotic polypeptide synthesis in evaporative environments

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Abiotic synthesis of peptides and their interactions with RNAs were a key step in the origin of life. However, the synthesis has been limited in short amino acid length and is favored in highly alkaline evaporitic conditions in which RNAs are unstable. Boron can stabilize ribose and thus contribute many steps in ribonucleotide synthesis. Thus, prebiotic environments rich in boron are reportedly ideal for abiotic RNA synthesis. However, the effects of boron on amino acid polymerization have been unclear. We report that boric acid enables the polymerization of glycine at weakly acidic to near-neutral pH levels based on simple heating experiments of amino acid solutions containing borate/boric acid at various pH levels. Boron enhances ribonucleotide synthesis, and RNAs are relatively stable under the pH range. Boron-rich evaporative basins might have allowed the formation and interactions of primordial proteins and RNAs that could enhance the diversity of the polymer's functions and could be inherited by RNA-dependent protein synthesis during the evolution of life.

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