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Self-Assembly of Prebiotic Organic Materials from Impact Events of Amino Acid Solutions[1] NIR GOLDMAN, Lawrence Livermore Natl Lab — Proteinogenic amino acids can be produced on or delivered to a planet via abiotic sources and were consequently likely present before the emergence of life on early Earth. However, the role that these materials played in the in the emergence of life remains an open question, in part because little is known about the survivability and reactivity of astrophysical prebiotic compounds upon impact with a planetary surface. To this end, we have used a force matched semi-empirical quantum simulation method in development in our group to study oblique impacts of aqueous glycine solutions at conditions of up to 40 GPa and 3000 K. We find that these elevated conditions induce the formation of glycine-oligomeric structures with a number of different chemical moieties such as hydroxyl and amine groups diffusing on and off the C-N backbones. The C-N backbones of these structures generally remain stable during cooling and expansion, yielding relatively large three-dimensional molecules that contain a number of different functional groups and embedded bonded regions akin to oligo-peptides. Our results help determine the role of comets and other celestial bodies in both the delivery and synthesis of polypeptides and homochirality to early Earth.

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