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METEORITES, ORGANICS AND FISCHER-TROPSCH TYPE REACTIONS: PRODUCTION & DESTRUCTION.

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Background: There has been an ongoing debate about the relative importance about the various chemical reactions that formed organics in the early solar system. One proposed method that has long been recognized as a potential source of organics is Fischer-Tropsch type (FTT) synthesis [*e.g.,* 1, 2]. This process is commonly used in industry to produce fuels (*i.e.*, complex hydrocarbons) by catalytic hydrogenation of carbon monoxide [3]. Hill and Nuth [4] were the first to publish results of FTT experiments that also included Haber-Bosch (HB) processes (hydrogenation of nitrogen. Their findings included the production of nitrile-bearing compounds as well as trace amounts of methyl amine. Previous experience with these reactions revealed that the organic coating deposited on the grains is also an efficient catalyst [5] and that the coating is composed of insoluble organic matter (IOM) and could be reminiscent of the organic matrix found in some meteorites [6]. This current set of FTT-styled experiments tracks the evolution of a set of organics, amino acids, in detail.

Experimental Procedure: The FTT/HB reactions are conducted in a closed gas circulating system that monitors the evolved gases in real time using Fourier Transform infrared spectroscopy. The experiment reported here was heated to 550°C and used a catalyst of iron-silicate amorphous grains. The gas mixture combines 75 torr of CO, 75 torr of N_2 and 550 torr of H_2. Individual reactions proceed until ~90% of the CO is depleted. The reactants are then pumped away, the bulb is refilled with the same gas mixture and another reaction using the same catalyst is carried out. Fifteen such runs were done at the specified temperature and results in coated iron silicate grains ~10% by mass carbon and 0.2% nitrogen. A complete description of the experiment methodology can be found in previous publications [4, 5]. The coated catalyst/grain sample was analyzed at different time steps to follow the evolution of the amino acids. The amino acids were analyzed using derivatization and liquid chromatography-fluorescence detection/time-of-flight mass spectrometry.

Results: We will present a time sequence for a select set of amino acids and their abundance over the course of the reaction. The data show that the amino acids are produced early in the reaction cycle and then are either destroyed or are incorporated into the IOM on the catalyst/grain surface. We will also report on the generation of a rare, non-biogenic amino acid.

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