p96

FULLY DEUTERATED ALIPHATIC HYDROCARBONS OBTAINED FROM IRON CARBIDE TREATED WITH DCl AND D_2O

C. Marquez[1], A. Lazcano[2], S. L. Miller[3], and J. Oro[1]

[1]Department of Biochemical and Biophysical Sciences

University of Houston, Houston, Texas 77004-5934, USA

[2]Facultad de Ciencias, UNAM
Apdo. Postal 70-407
Cd. Universitaria, Mexico D. F., 04510 MEXICO

[3]Department of Chemistry and Biochemistry
University of California, San Diego
La Jolla, California 92093-0506, USA

According to Oparin (1938, 1957), Mendeleev thought that the origin of petroleum was the result of the hydrolysis of iron carbides by superheated steam under pressure from the deep interior of the Earth through geological formations where the metal carbides exist. As early as 1877, Mendeleev (1927) described the reaction leading to the synthesis of hydrocarbons according to the general equation $3Fe_mC_n + mH_2O \rightarrow mFe_3O_4 + C_{3n}H_{8m}$. Other experimental studies on the production of hydrocarbons from cast iron have been reported (Oparin, 1957; Hoering, 1966). Because of the possibility that hydrocarbons may have been trapped within the carbon matrix of the cast iron, which usually has a high content of carbon, we have studied the reaction of pure iron carbide with deuterium chloride and deuterated water. This was done in order to distinguish any newly formed deuterated hydrocarbons from any possible impurities of trapped hydrocarbons.

The experiments were carried out by simply allowing iron carbide to react with concentrated deuterium chloride in D_2O. The volatile hydrocarbon fraction examined by gas chromatography-mass spectrometry (GC/MS), using a Finnigan 1020/OWA instrument, contained low molecular weight hydrocarbons in a range C_3 to C_7.
Lower molecular weight hydrocarbons were not detected by GC/MS

because the MS scanning mode was preset above mass 40 to exclude components of air. The identified hydrocarbons are similar to those obtained under prebiotic conditions using high frequency discharge (Goto and Ishigami, 1986). The hydrocarbons found in common were propane, butane, pentane, 3-methylpentane, hexane, and heptane. The percent yields decline with increasing carbon number (propane 11%, n-heptane 1%). Similar results have been obtained by the direct treatment of metal carbides by pulse laser vaporization mass spectrometry.

These results show that the hydrolysis of iron carbides may have been a significant source of hydrocarbons on the primitive Earth. There appears to be a predominance of straight chain isomers, which may have been important in the prebiotic synthesis of membrane-forming compounds.

Goto, K., and Ishigami, M: 1986, *Origins of Life* 16, 293

Hoering, T. C.: 1966, *Carnegie Institute Yearbook*, Washington, D. C., p. 365

Mendeleev, D.: 1927, *Principles of Chemistry*, Gosizdat, Moscow/Leningrad, 1, 379 (in Russian)

Oparin, A. I.: 1938, *Origin of Life*, MacMillan Publ. Co., New York

Oparin, A. I.: 1957, *The Origin of Life on the Earth*, Academic Press, New York