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METEORITE ANALYSIS ASSISTS SEARCH FOR LIFE

A NASA meteorite sample program is providing basic clues to a University of Maryland researcher in the quest for the origins of life and organic matter in our universe.

Dr. Cyril Ponnamperuma, director of the Laboratory of Chemical Evolution at the university's College Park, Md. campus, led a team of scientists which recently discovered amino acids -- the basic building blocks of life -- in meteorites found in the Antarctic.

The laboratory examines lunar samples to find evidence of organic material, attempts to create molecules which may have existed in the Earth's or other planets' atmospheres prior to life, and examines pristine meteorite samples for evidence of organic matter.

NASA supports this research in a variety of ways. The space agency has provided Ponnamperuma's team with samples of meteorites recovered from the Antarctic ice shelf, material brought from the Moon and data on the atmospheres of other planets obtained by deep space probes.

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The Antarctic meteorite program was begun three years ago as a cooperative venture between the National Science Foundation and NASA. By collecting meteorites under extremely clean conditions, essentially identical to the manner by which the Apollo astronauts collected lunar samples, joint NSF-NASA teams can provide scientists with samples so free of Earth contamination that they can be examined for evidence of an organic history before the time of their Earth impact.

Because the meteorites are protected from organic contamination while lying in the Antarctic ice and because the collection process prevents future organic contamination, Ponnamperuma considers them "the only prebiotic matter we have laid our hands on." The purpose, Ponnamperuma said, "is to find out whether in this meteorite, in this sample, there are any amino acids, any hydrocarbons."

Ponnamperuma's team has been very successful in this venture. The team has used gas chromatograph techniques to identify both right-handed and left-handed molecules of amino acids. The handedness refers to the direction to which a beam of polarized light would turn if shone through a solution of the dissolved material.

The Antarctic meteorites have provided strong evidence of both right and left-handed amino acids. Since all life forms on Earth contain only left-handed molecules, the pre-organic material found in the meteorites had to be formed somewhere else.

"The processes we postulated as taking place on the Earth before life began seem to have taken place somewhere else also," Ponnamperuma said. "What this implies is that all those events which led to life may be common in the universe, so what we said happened on the Earth may be happening somewhere else."

The meteorites which Ponnamperuma's team uses are about 4.5-billion years old. The oldest Earth material which has been identified is 3.75-billion years old and some of it shows evidence of organic matter.

"I think the conditions are such that perhaps life exists only on Earth," he said. "But what about the billions of other solar systems. There's no question that there must be innumerable possibilities for life beyond the Earth."

In addition to the sample analysis program, the chemical evolution laboratory also works to reproduce the atmospheres of other planets.

Ponnamperuma is working with data provided by the Voyager Jupiter encounter to simulate that planet's outer atmosphere in a laboratory bottle.

"If we simulate a Jovian atmosphere in our lab, we can come up with some of the colors we've seen on Jupiter, some of those reds and yellows. These colors are made by various molecules but can be synthesized in a Jovian atmosphere," he reported.

The important aspect of this research, Ponnamperuma said, is that "if you have an atmosphere, if you have a source of energy -- and we've seen pictures of lightning on Jupiter -- organic molecules can be synthesized."

The laboratory also is proceeding with simulations of the Saturnian atmosphere and that of the major Saturn moon, Titan. These simulations are being conducted now in the hope of being able to compare results with that of the upcoming Voyager Saturn encounter this November.

Ponnamperuma and his team are also progressing in their simulations from gases (planetary atmospheres) to solids.

Both the meteorite work and the planetary atmosphere synthesis experiments bear on the same questions -- the origins of life.

"In the case of Jupiter, we are looking at reactions which are taking place right now. In the case of the meteorites we analyze, we are looking at what happened four-and-a-half-billion years ago when the gases of the primordial solar system gave rise to these molecules," Ponnamperuma said.

The meteorite program is administered by the National Science Foundation, Washington. The samples are controlled by NASA's Johnson Space Center, Lunar and Planetary Division, in Houston. So far the program has produced as many meteorites in three years as had been collected in all years previous.

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