# Article: Comets hold life chemistry clues

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Comets hold life chemistry clues
By Jonathan Amos
Science reporter, BBC News, San Francisco

The idea that comets delivered the chemical "seeds" for life to the early Earth has been given a big boost.

Scientists studying the tiny grains of material recovered from Comet Wild−2 by Nasa's Stardust mission have found large, complex carbon−rich molecules.

They are of the type that could have been important precursor components of the initial reactions that gave rise to the planet's biochemistry.

The first full analysis of the Wild−2 grains is reported in Science magazine.

"Whatever it took to get life started, the more variety of molecules you had in the mix and the more they looked like the kinds of molecules that life uses now then the easier it should have been," Dr Scott Sandford from Nasa's Ames Research Center told BBC News.

The Stardust spacecraft flew past the 5km−wide icy "mud−ball" known as Comet 81P/Wild−2 in January 2004.

The probe swept up particles fizzing off the object's surface as it passed some 240km (149 miles) from the comet's core, or nucleus. These tiny grains, just a few thousandths or a millimetre in size, were then returned to Earth in a sealed capsule.

Lab clues

Distributed among the world's leading astro−labs, the specimens are giving researchers a remarkable insight into the conditions that must have existed in the earliest phases of the Solar System when planets and comets were forming.

Dr Sandford led the organics investigation; some 55 researchers in more than 30 institutions. His team sees many delicate, volatile compounds that are quite unlike those familiar in meteorites that have fallen to Earth.

These Wild−2 compounds lack the aromaticity, or carbon ring structures, frequently found in meteorite organics. They are very rich in oxygen and nitrogen, and they probably pre−date the existence of our Solar System.

"It's quite possible that what we're seeing is an organic population of molecules that were made when ices in the dense cloud from which our Solar System formed were irradiated by ultraviolet photons and cosmic rays," Dr Sandford explained.

"That's of interest because we know that in laboratory simulations where we irradiate ice analogues of types we know are out there, these same experiments produce a lot of organic compounds, including amino acids and a class of compounds called amphiphiles which if you put them in water will spontaneously form a membrane so that they make little cellular−like structures."

No−one knows how life originated on the cooling early Earth, but it has become a popular theory that a bombardment of comets may have deposited important chemical units for the initiating reactions.

The Stardust results, also reported here at the American Geophysical Union Fall Meeting, will give support to this idea.

Hot and cold

They will also allow researchers to "re−tune" the models they use to describe how materials were moved and mixed up in the early Solar System.

The Stardust mineral grains generally show a huge diversity, and, very surprisingly, there are materials incorporated into the samples that must have formed close in to the proto−Sun.

These include calcium−aluminium and magnesium−olivine fragments.

"They form in the hottest possible place in the Solar System, so it's quite stunning to find something like them in a body that came together in the coldest place in the Solar System," said Dr Don Brownlee from the University of Washington and who is the principal investigator, or lead scientist, on Stardust.

"There must have been some way of getting them from the new Sun to the outer fringes of the proto−planetary disc," commented Professor Monica Grady from the UK's Open University.

"There must have been major turbulence and currents and disc−wide mixing, which hadn't really been predicted."

The international team of scientists has used a wide variety of sophisticated laboratory analytical techniques to study the samples. But there is a realisation that technologies improve and some comet samples will

be kept back for future study.

Just as with the Moon rocks returned by the Apollo programme, researchers are likely to be working on the Stardust samples for decades.

"The information from Stardust has been a revelation and will continue to be as we couple it with other comet data we get from Nasa's Deep Impact mission and Europe's Rosetta mission, which is coming up in seven years' time," said Professor Grady.

In the UK, scientists from the Open University, Imperial College London, the Natural History Museum and the Universities of Kent, Manchester and Glasgow have been involved in the analysis.

Source: BBC
http://news.bbc.co.uk/2/hi/science/nature/5173992.stm

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