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That's life on rock ALH 84001

Meteorite reveals 4 billion-year-old secret from Mars

By Roger Highfield, Science Editor, and Robert Uhlig

THE FIRST evidence of life on Mars, notably "microfossil forms" resembling hair-like bacteria, was outlined yesterday by US scientists after a 30-month study of a potato-sized meteorite. The space agency Nasa described it as "a fascinating detective story".

Dr David McKay, the head of the Nasa-funded team of scientists, said: "All evidence points to the simplest explanation — that these are evidence of the remains of early Martian life."

However, he admitted that "there will be a lot of disagreement" as the evidence was thrown open to study by scientists around the world.

President Clinton hailed the find and said that the White House would convene a summit in November on the future of the United States space programme to "discuss how America should pursue answers" to scientific questions raised by "rock 84001".

The rock "speaks to us across all those billions of years and millions of miles," he said. "It speaks of the possiblity of life.

"If this discovery is confirmed, it will surely be one of the most stunning insights into our universe that science has ever uncovered."

Nasa's administrator, Daniel Goldin, said that the study was "certain to create lively scientific debate".

He went on: "What a time to be alive. This is an unbelievable day — very exciting for me." Turning to the team of scientists, he said: "I am so proud of you — words can't describe it."

Mr Goldin spoke of the "unbelievable excitement" among the world space leadership. But he emphasised that the results of this "fascinating detective story" were not conclusive, "for there is not yet scientific consensus that life might have existed beyond the confines of this small planet, the third rock from the Sun".

He said that Nasa would offer samples of the rock to other research teams for analysis. "We will be driven by the scientific process and not a rush to go to Mars."

Inside the meteorite the team discovered the first organic molecules thought to be of Martian origin; several mineral features characteristic of biological activity; and "strange structures", possibly microscopic fossils of primitive, bacteria-like organisms.

The largest of the possible fossils are less than a hundredth of the diameter of a human hair and most are about a thousandth of the diameter of a human hair — so small that it would take about a thousand laid end-to-end to span the dot at the end of this sentence.

Some are egg-shaped and others are tubular. The structures are very similar to microscopic fossils of the tiniest terrestrial bacteria.

The igneous rock in the 4·2lb meteorite has been dated to about 4·5 billion years, the period when the planet Mars formed. The rock is believed to have originated under the surface and to have been extensively fractured as meteorites bombarded the planets in the early inner solar system.

Between 3·6 billion and 4 billion years ago, a time when it is generally thought that Mars was warmer and wetter, water is believed to have penetrated the sub-surface rock. Since the water was saturated with carbon dioxide from the Martian atmosphere, carbonate minerals were deposited in the fractures.

The team's findings indicate that living organisms could have assisted in the formation of the carbonate and some remains of the microscopic organisms could have become fossilised in a fashion similar to the formation of fossils in limestone on Earth. Then, 16 million years ago, a huge comet or asteroid struck Mars, ejecting a piece of the rock from its sub-surface location with enough force to escape the planet.

For millions of years the chunk of rock floated through space. It encountered Earth's atmosphere 13,000 years ago and fell in Antarctica as a meteorite.

It is in the tiny globs of carbonate that the researchers found a number of features that can be interpreted as suggesting past life. Besides organic molecules called polycyclic aromatic hydrocarbons, the researchers found possible microscopic fossil structures.

This array of indirect evidence of past life will be reported in this month's issue of the journal *Science*, presenting the investigation to the scientific community at large for further study. Dr McKay said: "There is not any one finding that leads us to believe that this is evidence of past life on Mars. Rather, it is a combination of many things.

"They include detection of an apparently unique pattern of organic molecules — carbon compounds that are the basis of life.

"We also found several unusual mineral phases that are known products of primitive microscopic organisms on Earth. Structures that could be microsopic fossils seem to support all of this. The relationship of all of these things in terms of location — within a few hundred thousandths of an inch of one another — is the most compelling evidence."

Yesterday the bookmakers William Hill slashed the odds on the existence of intelligent life on Mars from 500/1 to 25/1.

And to be on the safe side the Pennsylvania town of Mars (pop: 1,800) decided to twin itself with the planet (pop: unknown).

The evidence: the elongated, tube-like structures seen on this electron micrograph are most likely to be microfossils of Martian bacteria, say Nasa scientists

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