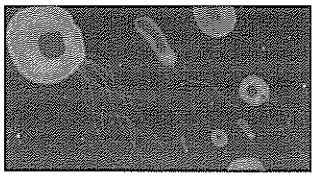
SCIENCE



# Is there life in space?

BACK in the '50s, the Posadas group, an odd offshoot of the Fourth International, saw the existence of flying saucers as proof of the existence of communism elsewhere in the universe, since only a workers' society would be advanced enough to master interstellar travel. Now it seems that we have been visited by the inhabitants of a red planet, albeit single-celled and unfortunately some 3.5 billion years after their death.

Even without the possible presence of fossil bacteria, the story of meteorite ALH84001 is strange enough. The rock it came from was formed about 3.5 billion years (3.5Ga) ago on Mars. Approximately 15 million years (15Ma) ago, something, an asteroid or another meteorite, slammed into the surface of Mars with enough force to knock the bit of rock now known as ALH84001 into space. It floated round the Solar System until about 13,000 years (13ka) ago when it was captured by the Earth's gravity and plummeted into the Antarctic ice-sheet. 12 years (12a) ago, it was found by scientists and has been under investigation since.

The present revelations come from a team of US scientists, led by David S McKay, of the Johnson Space Centre. Their findings are published in the US magazine *Science*, following press conferences and world-wide excitement. Taking precautions not to contaminate the meteorite, they fractured it and examined the appearance and chemical make up of the fresh surfaces. Their evidence for life on Mars consists of the following:

(i) the presence of chemicals called polycyclic aromatic hydrocarbons (PAHs). This is not decisive; PAHs have been found in meteorites not from Mars (but see below). However, they can be and are produced by the decomposition of dead organisms.

(ii) the presence of carbonate globules, formed in the presence of water. The carbon isotope composition is similar to that produced by living things (which tend to reject the heavier carbon-13 in favour of carbon-12). Shapes in the carbonate are reminiscent of those produced by Earth bacteria but are rather small.

(iii) the presence within these globules of magnetite and iron sulphide crystals. Many of these are asymmetrical, suggesting production by living things. Similar crystals are produced by some micro-organisms on Earth and have been found in fossil bacteria. Each observation could have a non-biological explanation, though the conditions necessary would be rather special. Taken together, they suggest the presence of tiny bacteria on Mars 3.5Ga ago.

Of course, what would be more interesting would be the presence of living bacteria (and even bigger life forms) on Mars today. Mars appears a very inhospitable planet, bathed by ultra-violet light from the Sun, average surface temperature -23°C, atmospheric pressure one two-hundredth that of Earth, with no liquid water on the surface, which is whipped by ferocious sand storms. However, it was not always thus. Pictures sent back by the Viking I orbiter show channels that can only have been formed by rivers and flash floods. The composition of the atmosphere indicates a massive loss throughout the life of Mars, with lighter molecules escaping into space, leaving heavier ones, such as carbon dioxide. Gravity on Mars is a bit over a third that of Earth so more molecules would have possessed the escape velocity. Even on Earth, hydrogen and helium move fast enough to escape into space.

With a thicker atmosphere, Mars would have been warmer and more conducive to the evolution of life. It is interesting to note that the Martian micro-fossils date from a time when life had only recently evolved on Earth. The effect of vulcanism could also have assisted life by melting frozen ground water and increasing the pressure of the atmosphere. Mars possesses the Solar System's largest volcano, the 15 mile-high Olympus Mons, which last erupted only 200Ma ago.

In the opinion of some scientists, given the mixture of gases present at the formation of the planets and the presence of liquid water, the evolution of life is almost inevitable. Some are hoping to find life on Europa, one of Jupiter's moons. It's also been suggested that life may evolve on Titan, Saturn's largest moon, when the Sun becomes a swollen red giant in 6Ga from now. Our descendants will have been incinerated, unless they can escape first. Whether "higher" forms evolve is another matter. On Earth, it took perhaps 2.5Ga before animals developed (1Ga ago), by which time photosynthetic bacteria had transformed the atmosphere by using up lots of $CO_2$ and producing oxygen. By this time on Mars, the atmosphere had become thinner and volcanic activity had waned, removing another source of heat that, on Earth, helps provide niches for living things.

Does this mean that life on Mars has died out, though? Many scientists take comfort from knowledge of the many apparently inhospitable environments on Earth where life survives. These include hot mud pools and springs, "smokers" (vents on the sea bottom where superheated water rich in chemicals pours out from volcanic rocks), inside rocks hundreds of metres below the Earth's surface, and in pools of liquid water many metres below polar ice sheets.

A final point for speculation: did life here arrive from Mars? A minority position held by astronomers Fred Hoyle and Chandra Wickramasinghe is that life evolved in deep space and then "seeded" fertile planets by arriving on meteorites. That is pure speculation at present but we know that meteorites can reach us from Mars. More than a dozen have been recognised, including one that killed a dog in Egypt in 1911. The return journey is much less likely, because of Earth's greater gravity.

***Les Hearn***