Post-mortem of a Comet: Scientists put the Comet Wild 2 under the microscope

May 28 2010

Researchers at the University of Leicester are examining extraterrestrial material from a comet to assess the origins of our Solar System.

For the first time ever, material samples from a comet were collected in the Stardust Mission. It was the first mission since the Apollo landings to have successfully returned extraterrestrial material for scientists to study in the laboratory. At the University of Leicester's Space Research Centre and at Diamond Light Source, the UK's national synchrotron facility - a series of super microscopes - scientists are currently finding out what a comet is really made of.

The Stardust probe travelled 3.2 billion km in space, and flew through the coma of Comet Wild2 collecting tiny grains of dust, returning them back to Earth in 2006. They are being dissected at NASA and the University of California and being sent to a few laboratories around the world, with the University of Leicester being one of them.

By developing micro manipulation techniques, researchers at the University of Leicester have further dissected the tiny samples to study the comet to atomic precision under a Transmission Electron Microscope. This 'post-mortem' of Comet Wild2 has revealed for the first time the true composition of a comet.

Hitesh Changela, one of the researchers in the project, said:

"Understanding the true nature of comets may also help us to answer one

of the fundamental questions in science - how the Solar System evolved in its early stages and how water and organics were delivered to the Earth. It's an exciting time when we can use new techniques to analyse the most distant Solar System bodies in our laboratories at Leicester."

Funding for Hitesh's PhD has been provided by the Science and Technology Facilities Council (STFC).

The researchers are obtaining unprecedented chemical information about the smallest grains of the comet, with sizes less than 1/10th the width of a human hair. The Diamond synchrotron is an electron particle accelerator that produces highly intense X-ray beams which can be used to delve deep into matter and materials to reveal information on the atomic and molecular scale. These X-rays were used to probe Stardust to the highest sensitivity.

Dr. John Bridges of the Space Research Centre at the University of Leicester is the principal investigator of this project. He commented:

"Comet Wild2 is a big analytical challenge as the total mass of samples is about 1 ten thousandth of a gram. By comparison the Apollo missions brought back 380 kg. The Microfocus Spectroscopy beamline at Diamond Light Source enabled us to examine these tiny particles and map the elements within them. These are exciting times in planetary science and once we have worked out what this comet is made of we can use these new techniques to study asteroids and the planets in unprecedented detail."

Using a globally unique technique at Diamond which enables the mapping of the widest range of elements, the group found X-ray signatures of iron oxides. Further research at Leicester has shown that the small grains of iron oxide contained in the Stardust samples may have formed by low temperature aqueous activity on Wild2. However,

other grains formed at very high temperature - around 2000oC which is not what was expected from this icy comet that would have formed in the coldest, outermost reaches of the Solar System. This unexpected discovery has raised new questions about how these 'dustbins' of the early Solar System really formed.

This research is being presented to the public at the University of Leicester on June 24.

Provided by University of Leicester