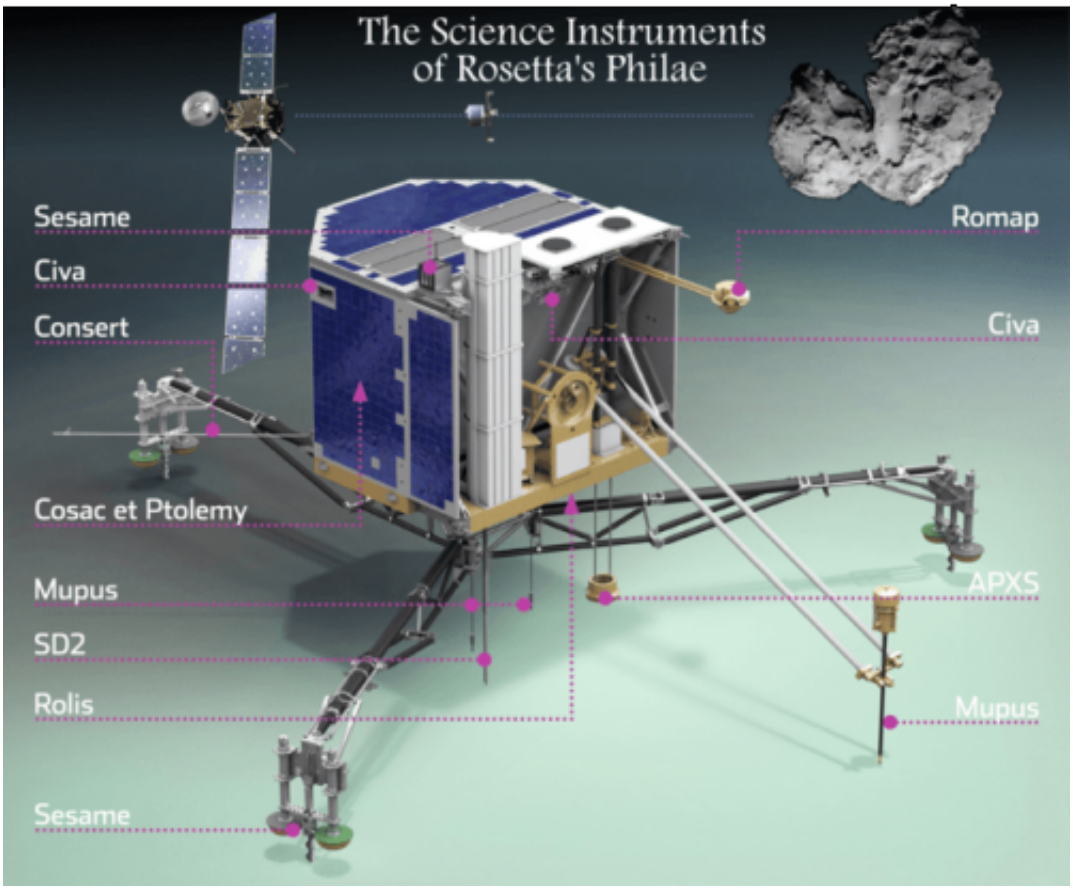
# What Philae did in its 60 hours on Comet 67P

November 18 2014, by Mark Lorch




It’s all science. Credit: Emmanuel Hebrard

The drama of Philae's slow fall, bounce and unfortunate slide into hibernation was one of the most thrilling science stories of a generation. But what in its short 60 hours of life on Comet 67P did it achieve?

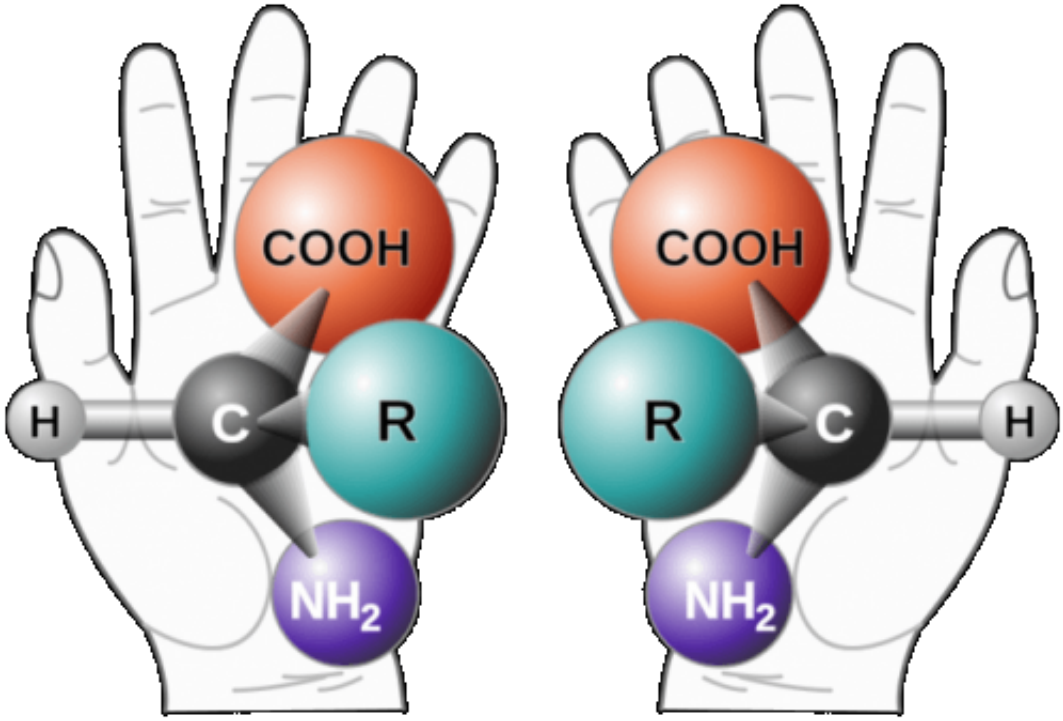
The short answer is analytical chemistry.

Philae's payload included three instruments that are quite common in chemistry labs, but when deployed on a comet could answer questions about the origins of the solar system and life itself.

## Right- or left-handed life

Four billion years ago the solar system was an unsettled place. Earth was undergoing heavy bombardment by asteroids and comets. This continuous shower may have delivered a significant amount of water to our planet. But the comets weren't just dirty snowballs. A third of their contents was probably complex organic (that is, carbon-based) molecules. These compounds may well have triggered the chemistry that led to life on our planet.

One of Philae's goals is to provide evidence that the organic chemicals on a comet are sufficiently similar to the building blocks of life to support the comet impact theory for abiogenesis. A key factor is whether Comet 67P (and by extension other comets) contain predominantly right- or left-handed molecules.




It's all science. Emmanuel Hebrard Life on Earth is based on only left-handed molecules, such as the amino acid on the left. Credit: Inconnu, CC BY

Many molecules come in one of two forms, known as stereoisomers, which chemists designate as left- or right-handed. These two forms are identical apart from the fact that they are mirror images of each other.

Your hands are a perfect analogy. Structurally, they are the same except for the fact that you can't superimpose one on the other. And so it is with stereoisomers.

Strangely, life on Earth is based entirely on left-handed molecules. It is perfectly possible to make the right-handed versions, but life just doesn't. Where this preference for left-handedness comes from is a mystery. One theory is that the bias came from within the chemistry of comets. In the comets, right-handed molecules may have been

preferentially destroyed by a combination of sunlight (to provide energy to trigger chemical reactions) and liquid water (with which the organic compounds could react).

Philae's COSAC instrument is designed to sniff away at the comet's organic contents and figure out whether they look like the building blocks of life and, importantly, whether the comet contains the same preference for lefty chemistry as Earth-bound life.

## Homegrown detritus or alien debris

Most theories hold that comets were formed from the same nebula that gave birth to rest of the solar system. But this need not be the case. It could be that they are truly ancient bodies that entirely, or in part, pre-date the solar system, or perhaps they have congregated here much more recently? Philae's Ptolemy instrument aims to answer this question by comparing the ratios of different isotopes within Comet 67P.

A given element is defined by the number of protons in its nucleus. For example carbon always has six protons. However the number of neutrons can vary giving rise to carbon-12 (six protons and six neutrons), carbon-13 (with seven neutrons) and carbon-14 (with eight neutrons). All these different variations are known as isotopes. The ratio of these isotopes in any given body will vary depending on its origins. And since the material in the solar system came from more or less the same place, the isotopic carbon ratios for the Sun, the Earth and asteroids are pretty much the same.

But comets might be different, in fact remote measurements of comet Hale-Boop suggest that it may be an extra-solar alien. The problem is there were large uncertainties in these readings, so we can't be sure of their accuracy. By sending the Ptolemy instrument to the surface of a comet this should all be resolved, as its isotopic measurements are meant

to be as accurate as those performed on Earth, and the solar or alien origins of Comet 67P can be confirmed.

## The snowball factories

If comets came from the same stock as the rest of the solar system where and how were they produced? The Hubble telescope spotted comets in the Kuiper belt just beyond Neptune, meanwhile the Oort Cloud (another 10,000 times further away) is thought to contain icy bodies that may, paradoxically, have condensed nearer to Jupiter and Saturn.

Figuring out where 67P may have originated is the job of APXS, an instrument designed to determine the elemental composition of dusty parts of the comet. By comparing this to material on Earth, the origins of which we are more confident about, we should be able to figure out the birth place of 67P.

*This story is published courtesy of* The Conversation *(under Creative Commons-Attribution/No derivatives).*

Source: The Conversation

Citation: What Philae did in its 60 hours on Comet 67P (2014, November 18) retrieved 12 May 2024 from https://phys.org/news/2014-11-philae-hours-comet-67p.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.