

Explained in 60 Seconds: Why Visit a Comet?

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Blazing across the night sky, comets have captured people's imaginations for centuries. Once considered harbingers of doom, we now know them to be priceless treasure troves of dust and ice with the secrets of the early Solar System locked within.

The Solar System was a chaotic place 4.6 billion years ago, but from tiny dust and ice particles to colliding boulders and swirling gas, the planets eventually took shape. Comets, the leftover detritus in this planetary construction yard, were banished to the cold outer reaches of the Solar System. But, as the planets slowly settled into the orbits we see today, huge gravitational perturbations sent showers of comets through our cosmic neighbourhood, slamming into

planets and moons, and leaving impact scars that are visible on their rocky surfaces even today.

As well as bringing destruction, comets are thought to have ferried some of the key ingredients that are needed for life as we know it on Earth; perhaps even complex organic molecules and water.

While today our corner of the Universe is, fortunately, a lot quieter, these frozen time capsules are still occasionally jolted into new orbits that slingshot them closer to the Sun. Many meet a fiery death and others are flung clear of the Solar System, but some become trapped in elliptical orbits that see them returning time and time again.

As they approach the Sun, the increasing heat slowly warms their surfaces, turning ice into vapour and dragging out dust to form the beautiful tails seen from Earth. Occasionally, unpredictable and dramatic outbursts reveal material from within the comet's interior, opening a window onto the processes that drove the evolution of the early Solar System.

By investigating a comet up close — from orbit and from its surface — and living with it for two years, the *Rosetta* mission is giving us an unprecedented opportunity to study the behaviour of these once mysterious worlds, and to better understand the role that they may have played in our origin.



Figure 1. Comet 67P/Churyumov-Gerasimenko pictured by ESA's navigation camera, NavCam, on 11 September 2015. Rosetta was 319 kilometres from the centre of the comet at this time. Credit: ESA/Rosetta/NavCam – CC BY-SA IGO 3.0