

CALICO – an ESA M7 proposal to Explore Dwarf Planet Ceres

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Dwarf planet Ceres was the first member of the asteroid belt to be discovered. It is much richer in water than the other objects in the asteroid main belt, which suggests an origin elsewhere. Ceres' surface also shows clear signs of recent, possibly ongoing, geological activity and is regarded as the closest ocean world to Earth. The ocean worlds of the outer Solar System are of extreme interest for their potential to support biological activity over geological timescales. Unsurprisingly, the exploration of these enigmatic bodies is one of the priorities of ESA's Voyage 2050 strategy.

One region on Ceres of particular interest is Occator crater with its bright evaporite deposits, the so-called faculae. Formed by the extrusion of subsurface liquids, these deposits offer a window into Ceres' interior. In response to ESA's call for an M7 mission the international CALICO consortium, led by Luleå University of Technology, proposed CALICO (Ceres Autonomous Lander Into Crater Occator), a mission that will land in Occator crater and analyse the salt- and organics-rich deposits of Vinalia Faculae.

CALICO's science questions cover three themes:

1. Ceres as an active ocean world
2. Ceres' potential for habitability
3. Ceres' origin and evolution

CALICO will investigate carbon and organic material in the subsurface brine to assess the potential for complex organic chemistry, it will determine the physicochemical conditions to assess habitability. It will look for the chemical elements required for the building blocks of life and the elements required for biological energy production.

In order to unravel Ceres' origin and evolution, CALICO will pay special attention to the role of ammonia in its interior and the origin of Ceres' water as well as its magnetic history. CALICO will investigate the links between Ceres, asteroids, comets and carbonaceous chondrites.

In this talk, the mission concept and science payload of the CALICO mission will be presented, with a brief overview of the evolution and status of the proposal.