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Solar system

To the moons of Jupiter and beyond

Two spacecraft launching in 2023 will aim to explore some of the solar system's smaller bodies, in an effort to understand how worlds become habitable, says **Leah Crane**

SMALL planetary bodies will be the big focus of space exploration in 2023. With the launches of two flagship missions, one to the moons of Jupiter and another to a strange metal asteroid, we are poised to solve many of the mysteries surrounding how these tiny worlds formed and what they are like today. The findings should lead to a greater understanding of habitability in our solar system more generally.

The first mission is the Jupiter Icy Moons Explorer (JUICE), due to launch in April 2023 and arrive in the Jupiter system in 2031. This orbiter from the European Space Agency (ESA) is designed to explore three of Jupiter's major moons: Europa, Callisto and Ganymede. All are thought to have oceans of liquid water beneath their frigid shells, and because water is crucial to life as we know it, learning more about those buried seas is a top priority.

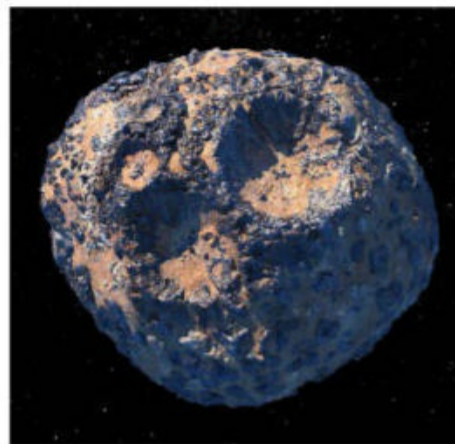
"The one aspect we are most interested in is the liquid oceans,

and in particular with Ganymede – we don't know where the ocean is, we don't know the depth of the ocean – what is the composition of these oceans, the amount of salt or dust," says ESA's Olivier Witasse, the mission's project scientist. "These are all questions that we will answer with JUICE."

While the science goals of JUICE are far-ranging and it has instruments to study the moons' surfaces and tenuous atmospheres, as well as Ganymede's strange magnetic field, the most exciting prospect is moving towards the ability to hunt for life there, says Witasse.

"Really, the goal of JUICE is to understand if life could be there, or if it could have been there in the past," he says. "If the conditions are right, then we will want the next mission to land, to send something under the crust to explore the ocean."

We know even less about the target of NASA's Psyche mission, due to launch in October



PETER RUBIN/NASA

Not much is known about the asteroid Psyche, but that is set to change

NASA engineers working on the Psyche spacecraft in March 2021

2023. It is headed to an asteroid, also called Psyche, that researchers believe to be an exposed iron core of a young planet. The spacecraft will arrive in 2029.

"We don't know what we're going to find, and with any luck, we're going to be completely surprised," says Lindy Elkins-Tanton at Arizona State University, the principal investigator of the mission. "There's a point in the proposal process when you have to write down the percentage improvement over the previous data, and we just wrote infinity, infinity, infinity, because there was no previous data. We are pretty confident that it's largely made of metal, but we really don't know much else."

Studying planetary cores is nearly impossible on actual planets because they are so deep underground, so Psyche could present a unique opportunity to directly observe a key building block of planets.

"The core is crucial to the properties of the Earth, in terms of creating the magnetic field and radiating a lot of the planet's heat," says Elkins-Tanton. "One of the ways to answer why Earth is

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NASA/JPL-CALTECH, PETER RUBIN

"The goal of JUICE is to understand if life could be found on some of Jupiter's moons"

habitable is to study how it was built, what it's made of, and Psyche is part of that story."

Habitability in our solar system is still a huge mystery, but the two spacecraft launching in 2023 should bring us one step closer to understanding it. ■