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Solar system

Europa's secret lakes may host life

One of Jupiter's moons could have large, habitable bubbles of liquid water near its icy surface

Jonathan O'Callaghan

POCKETS of liquid water trapped in the thick ice shell of Jupiter's moon Europa may be shorter-lived than previously thought, but they may still be present and potential habitats for life.

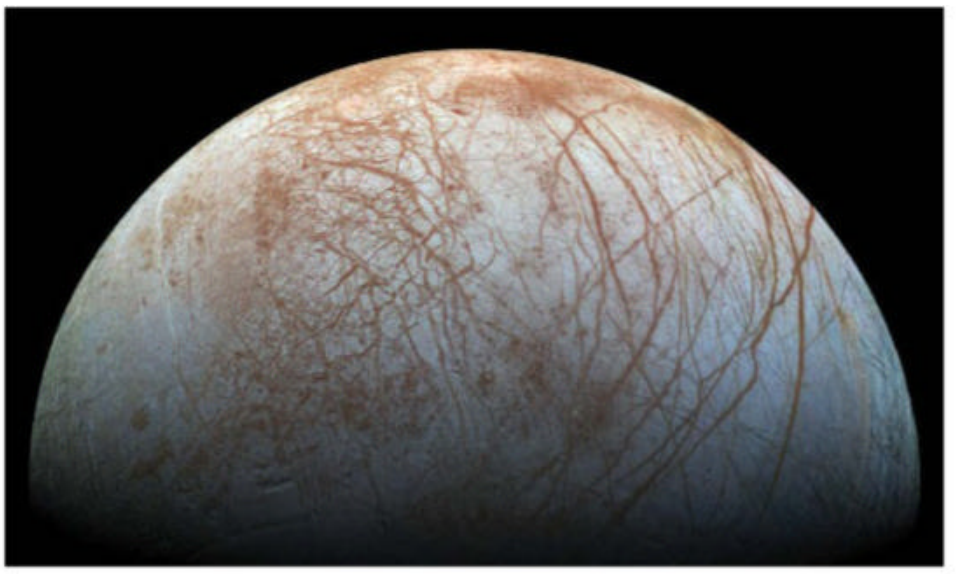
Europa, the fourth-largest moon of Jupiter, is believed to have a liquid water ocean buried tens of kilometres under its frozen surface. This water may be in contact with an ocean floor that provides the necessary mix of materials for life to arise. Previous research suggested that parts of the icy shell might also be liquid, in pockets of water 10 kilometres or so wide that sit much closer to the surface, perhaps only a kilometre down.

Chase Chivers at the Georgia Institute of Technology in Atlanta and his colleagues have modelled these pockets in greater detail, finding that while they might be shorter-lived than thought, they are still promising locations for life (*JGR Planets*, doi.org/gcdk).

"We find that they last for tens of thousands of years" before they refreeze, says Chivers. Previous research suggested they would last hundreds of thousands of years.

Evidence for the pockets comes from images taken by NASA's Galileo spacecraft in the 1990s and 2000s. It spotted pits and markings called lenticulae on the surface of Europa, some of which appear dark in colour – thought to be linked to salt that keeps water liquid in subsurface pockets. These features suggest that water pockets are still present today, says Chivers, possibly hundreds of them. They may be a result of the ocean seeping into the icy crust or portions of the crust itself melting.

Europa is covered in a thick shell of ice, but life might lurk below



NASA/JPL-CALTECH/SETI INSTITUTE

"We think there is still shallow water under some of these features," says Chivers. Some may even erupt onto the surface as plumes, which were previously thought to come directly from Europa's subsurface ocean.

If these pockets do exist, they could be potential habitats for life, says Mark Fox-Powell at the Open University in the UK. "If there is life in the subsurface ocean, and it gets incorporated into the ice shell and later remelted, that could kick-start a community," he says. But once the pockets refreeze, that life would become trapped. "It's a doomed community."

The pockets are close enough to the surface that they may be detectable by upcoming missions such as NASA's Europa Clipper spacecraft, scheduled to launch in 2024 and arrive in 2030. The craft will fly by and use a radar to peer beneath the surface. It also has a dust analyser that could detect material from one of these pockets – perhaps even microbial life itself – if it were to pass through a plume linked to one.

Steve Vance at NASA's Jet Propulsion Laboratory in California says having evidence of liquid water so close to the surface would be "really intriguing". If these pockets do exist, they would be a much shallower target to perhaps directly sample with a future lander mission on Europa, says Vance. "Drilling through a kilometre of ice sounds a lot easier than drilling through 5 or more kilometres." ▮

Animal behaviour

Female mice that lose a partner are wary of a new one

FEMALE mice that mate for life seem to take longer to get over the loss of their partner than male mice. The females are slower to begin a sexual relationship with a new partner – perhaps because life experience has taught them that a new male might not be able to stick around and help care for pups.

California mice (*Peromyscus californicus*) form lifelong relationships with a partner, sharing a nest and parenting duties. But if the partner dies or disappears, the bereaved mouse often finds a new life partner and reproduces.

Amber Valentino at Saint Joseph's University in Pennsylvania and her colleagues found that this process happens more quickly if the bereaved mouse is male. The researchers examined the birth records of 59 California mouse couples in their labs in which one was a virgin and the other had lost a partner within the preceding 24 hours, usually because of death from natural causes.

The team found that roughly 85 per cent of the couples had a litter of pups – a similar success rate to that the researchers reported in a connected experiment involving 525 virgin-virgin mouse couples.

However, the pups typically arrived sooner when it was the male getting a new partner. Bereaved males entered a sexual relationship with a virgin female just as fast as they did with their first partner, and pups were born on average 55 days after the first meeting.

"Females may wait longer than males to take a new partner because their investment is greater"

When it was a bereaved female mouse being offered a virgin partner, though, pups were born on average 65 days after the adult mice first met (*Behavioural Processes*, doi.org/gcgm).

The team thinks females wait longer than males because their reproductive investment is greater, through pregnancy and nursing.

"We suspect their decision to go ahead and have pups with another male takes longer based on the previous experiences they have faced," says Valentino. ▮

Christa Lesté-Lasserre