

Scientists find hints of ocean on Jupiter's moon

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National Aeronautics and Space Administration (NASA) scientists recently published tantalising evidence that Europa, one of Jupiter's 17 moons, is covered in a salty ocean underneath an icy crust. This makes it a very good candidate for containing life beyond Earth, as water is considered an essential medium for producing life.

The research was published in the August 25 issue of the journal *Science*. University of California at Los Angeles geophysicist Margaret Kivelson commented that "water is the most probable medium on Europa" and that the finding "makes it likely that liquid water persists in the present epoch".

Researchers analysed data obtained by the Galileo space probe on January 3, when Europa's magnetic field was measured by a magnetometer. Galileo is in orbit around Jupiter. Indications are that Europa's ocean is at least seven kilometres deep and lies beneath an ice layer, which is 0.8 to 10 kilometres thick. The scientists had located the position of the moon's magnetic pole on a previous flyby and predicted that if it was covered by an ocean of salt water the pole would shift due to the conductivity of salt water. The probe confirmed that the pole changed direction every 5.5 hours.

The presence of a fluctuating pole is known to be associated with tidal movements due to the gravitational pull of Jupiter and its other moons. The scientists concluded that the presence of a salt water ocean was the most likely reason for the shift in the pole. Although the results are very promising, further work will have to be done to verify the result. Torrence Johnson of NASA's Jet Propulsion Laboratory stated that "the magnetometer data is the only indication we have that there's an ocean there now, rather than in the geological past. The evidence is still indirect and requires several steps of inference to get to the

conclusion that there really is a salty ocean." NASA plans to send a future probe to Europa, scheduled for launch in 2003. This would take more accurate measurements to ascertain any manifestations of Europa's tides.

Scientists previously suspected that Europa may contain a liquid ocean. Europa is about the size of Earth's moon, and recent close-up pictures from Galileo revealed that its entire surface is covered in ice, which is criss-crossed by a myriad of cracks and fissures caused by stresses from Jupiter's gravitational pull. In some areas it appears as if the fissures have opened up and water has come to the surface and has immediately frozen solid. Some pieces of ice appear as if they have broken up and then floated away.

An alternative explanation may be that water was present in a much earlier period but has been solidified for a long time. Europa's surface temperature is minus 162°C. Scientists have speculated that warmth generated by tidal heating due to the enormous pressure from Jupiter's gravitational pull may have been sufficient to soften or even liquefy some portion of Europa's icy covering. Some scientists speculate that the movement of softened ice may be responsible for the complex ice patterns observed on the surface.

Europa has now become a second likely candidate after Mars for finding life in the solar system. Recent studies on Earth have located living things in the most extreme environments where it was previously thought it would be impossible for anything to live. In the Antarctic biologists have found smudges within the ice which consist of microbes. Scientists have also found whole communities of micro-organisms and more complex animals living on the edge of deep underwater volcanic cracks. Such communities use the volcanic emissions as their sole source of energy. Future probes

to Europa may unveil similar communities of living things.



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