Distant moon may have oxygen in ocean

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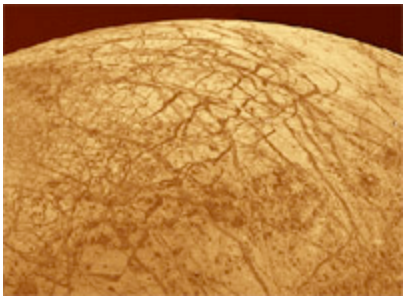
Courtesy AAS Division for Planetary Sciences
and World Science staff

A global, liquid ocean on Jupiter's moon Europa may have plenty of oxygen available to support life—even animal-like organisms, a new study suggests.

The research indicates Europa's ocean, with twice the liquid water of all Earth's oceans combined, could also have as much as 100 times more oxygen than previously estimated.



Europa as seen by NASA's Voyager 2 spacecraft. (Courtesy Voyager Project, JPL, NASA; ® C.J. Hamilton)

The chances for life in Europa have been uncertain. Europa's ocean lies beneath several miles or kilometers of ice, which separates it from the production of oxygen at the surface by energetic charged particles, researchers say.

Without oxygen, life could conceivably exist at hot springs in the ocean floor using exotic chemistries, but no one knows whether the right conditions exist.

Therefore a key question has been whether enough oxygen reaches the ocean to support the sort of oxygen-based metabolism that scientists know best.

An answer comes from considering the young age of Europa's surface, according to researcher Richard Greenberg of the University of Arizona. Its geology and the paucity of impact craters suggests the top of the ice is continually re-formed such that the current surface is only about 50 million years old, roughly one hundredth the age of the solar system, he said.

Greenberg has considered three generic resurfacing processes: gradually laying fresh material on the surface; opening cracks which fill with fresh ice from below; and disrupting patches of surface in place and replacing them with fresh material. Using estimates for the production of oxidizers at the surface, he found that the delivery rate into the ocean is so fast that the oxygen concentration could exceed that of Earth oceans in only a few million years.

Greenberg is to present his findings Oct. 10 at the meeting of the American Astronomical Society's Division for Planetary Sciences in Fajardo, Puerto Rico.

Greenberg said the concentrations of oxygen would be great enough to support not only microbes, but also larger animal-like organisms that need more oxygen. The oxygen supply could support roughly three billion kilograms (three million tons) of macrofauna, assuming similar oxygen demands to fish, he estimated.

There would be a delay of a couple of billion years before the first surface oxygen reached the ocean, Greenberg added; this delay would actually be helpful to fledgling life forms. Although oxygen is essential for big, energetic organisms, it also has damaging effects that can be deadly

to creatures that haven’t yet evolved the right sort of protection. A similar delay in the production of oxygen on Earth was probably essential for allowing life to get started here, Greenberg noted.