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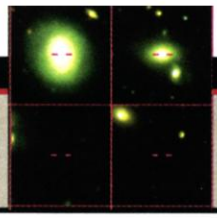
Chemotherapy without hair loss



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Life story of a black hole

PLANETARY SCIENCE

Jupiter's Two-Faced Moon, Ganymede, Falling Into Line

SAN FRANCISCO—An ocean within Jupiter's giant moon Ganymede was all the news here last month, but planetary scientists were more intrigued by what they were learning about how the moon acquired its odd visage: half bright and new and half dark, heavily cratered, and ancient.

At the fall meeting of the American Geophysical Union, researchers studying data returned by the Galileo spacecraft—which has been orbiting Jupiter since 1995—reported that Ganymede, like its neighbors Callisto and Europa, probably has a salty ocean. Ganymede's is far below its icy surface and far less promising of life than Europa's, however. As for Ganymede's split personality, researchers now believe that the more youthful-looking half could be due to a crust that stretched—as has happened in the past few million years on Europa—rather than any sort of icy volcanism, as many had assumed. All in all, Jupiter's set of four satellites "really is, as Galileo proclaimed back in 1610, another planetary system" all its own, says planetary physicist David Stevenson of the California Institute of Technology in Pasadena.

Siblings. Io, Europa, Ganymede, and Callisto (l. to r.). All but Callisto have young, bright terrain.

Signs of an ocean showed up in magnetic field measurements made by the magnetometer aboard Galileo during the closest Ganymede flyby ever, on 20 May of last year. Space physicist Margaret Kivelson of the University of California, Los Angeles, and her team members reported at the meeting that Ganymede shows the same subtle signs of a buried ocean as do Europa and Callisto. As Jupiter rotates, it sweeps its mighty magnetic field through the salty subsurface waters of those satellites, inducing magnetic fields that stretch outward from the oceans. And when the great planet wobbles on its rotation axis, sometimes it immerses a moon in a magnetic field of the opposite sign, causing the moon's induced field to flip. Kivelson reported that Galileo saw such a flipped induced field on its May pass of Ganymede. That's "very strong evidence of a layer of melted water beneath Ganymede's icy surface," she said.

But the ocean is a distant one. To judge by the shape of its induced field, it most likely lies 170 kilometers down, compared with perhaps 10 or 20 kilometers on Europa. And, like Callisto's, it's layered between ice above and below. Europa's is underlain by rock that might have the volcanic activity needed to energize life.

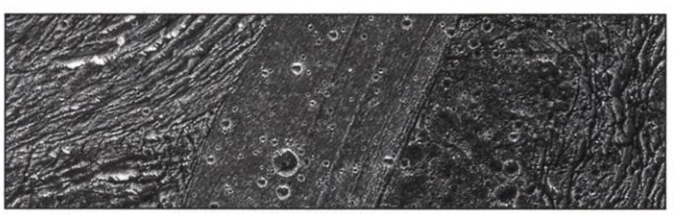
The Ganymede ocean may be deep-seated today, but it was not always so. Planetary geologist James Head of Brown University in Providence reported that Galileo's best look yet at Ganymede's surface shows "similarities to Europa we did not suspect before." In the bright, young-looking areas where fuzzier images suggested smooth surfaces, he and his fellow camera team members expected to see lavalike water and ice flows from "ice volcanoes"; instead, they could see rugged terrain marked by grooves formed by pervasive fracturing. At the boundary between dark and bright areas, they found deep depressions with no sign that icy lavas ever filled them. And in bright lanes where they expected signs that the crust had collapsed and water had flooded the surface, they saw that the crust had stretched and spread, as happens at mid-ocean ridges on Earth and on Europa. "This new data indicates tectonic activity seems to dominate the surface of Ganymede as it does on Europa more than the icy volcanism we expected," said Head. An ocean near the surface, more like Europa's today, helped shape the surface of Ganymede some time in the past, he implied.

Another Galileo instrument, the Near Infrared Mapping Spectrometer (NIMS), also saw signs of an ancient ocean on or near the surface. Planetary scientist Thomas McCord reported that NIMS detected signs of hydrated ocean salts—most likely magnesium sulfate—on the ancient dark areas of Ganymede's visage.

Today's deep-seated ocean, crustal stretching, and surface salts all fit into a history of Ganymede that has been emerging from Galileo observations, said Stevenson. The salts seem to have been left from the moon's formative years, when the warm and watery newborn froze from the outside in as its inner heat seeped away. Callisto went through a similar slow freeze without ever altering any of its primordial crust; half of Ganymede remained unaltered as well.

But sometime since, perhaps about a billion years ago, Ganymede seems to have gotten a shot of heat that reignited its core magnetic dynamo and expanded its nascent ocean toward the surface, says Stevenson. This rejuvenation could have happened if Ganymede temporarily stepped into the orbital "dance of the satellites" that fueled the recent resurfacing of Europa, he adds.

As Ganymede drifted away from Jupiter, it may have passed through an orbital arrangement with other Galilean satellites that distorted its orbit into an ellipse. The resulting tidal flexing of its rock and ice—enhanced by



Familial resemblance. This 26-kilometer-wide striated lane on Ganymede formed by crustal spreading, as happens on Europa.

CREDITS: JPL/NASA

even a thin ocean—would have temporarily heated its interior, expanded the ocean, and flexed a weakened crust. That flexing and the warmth of the ocean could have renewed and brightened the surface, or, as luck would have it, only half of it. Once beyond the resonance, Ganymede would have cooled again, stuck in its two-faced look. –RICHARD A. KERR

EMBRYO RESEARCH

British Parliament Approves New Rules

The British House of Commons has overwhelmingly approved new rules governing research on embryos in the United Kingdom. If the regulation passes the House of Lords, it would allow British scientists to derive and use stem cells from human embryos and to conduct nuclear transfer experiments—the same technology that produced Dolly the sheep—with human cells.

Opponents in Britain and elsewhere in Europe have called the 19 December vote a step down a slippery slope toward human cloning. But supporters deny that, claiming that the new rules ensure strict ethical oversight of this research, which could eventually help treat or even cure such devastating diseases as Parkinson's or diabetes.

The measure passed by 366 to 174 in a "free" vote, in which members were allowed to vote their consciences rather than adhere to a party line. "We had no idea" how the vote would fall, says Robin Lovell-Badge, a developmental geneticist at the National Institute for Medical Research in London who works with mouse embryonic stem cells. "We were very surprised at how strong the support was." The House of Lords is expected to vote on the measure in mid-January.

Current British law, passed in 1990, allows researchers in the United Kingdom to conduct experiments with embryos up to 14 days old, but only for research into infertility, the causes of miscarriage, genetic or congenital diseases, or new methods of contraception. The new regulation would permit research aimed at developing treatments for disease as well.

All such work will be regulated by the Human Fertilisation and Embryology Authority (HFEA), which oversees fertility treatments and also reviews research proposals for scientific and ethical merit before issuing licenses to work with human embryos. Unlike in the United States, where embryo research conducted by private companies is not regulated by the federal government, British researchers who attempt to do embryo research without a license would face criminal penalties, including prison.

The HFEA has already granted several licenses for the derivation of stem cells from embryos, says developmental biologist Anne McLaren of the Wellcome/CRC Institute in Cambridge, U.K. The scientists granted these licenses specified that the cells would be used to study blastocyst quality to better understand infertility.

CREDIT: JEFF MILLER/UNIVERSITY OF WISCONSIN, MADISON

New rules. The British House of Commons passed a measure allowing scientists to derive human embryonic stem cells for potential disease treatments.

Some opponents of the new regulation wanted a ban on research involving nuclear transfer techniques in human cells. Such work would attempt to create human embryonic cells with the same nuclear DNA as a patient. Those cells could then be used to derive genetically matched stem cells that might be coaxed to produce specific types of cells for treating disease. Last year, a U.K. government panel said that nuclear transfer experiments could be ethically justified if they were used to produce cells for disease treatment (*Science*, 25 August 2000, p. 1269), but opponents have argued that the work could lead to human cloning. "I fear that if we proceed as we are doing, we will open the floodgates," said Edward Leigh (C–Gainsborough) during the parliamentary debate.

German leaders have also expressed dismay about the vote. Minister for research Edelgard Bulmahn told the newspaper *Frankfurter Allegemeine Zeitung* that allowing nuclear transfer experiments in human cells was "breaking an ethical border." German research should focus on exploring alternatives to the cloning of human embryos, Bulmahn said, such as stem cells derived from adult tissues. Health Minister Andrea Fischer agreed. Chancellor Gerhard Schroeder also expressed reservations. He wrote in a statement that Germany "should not yield to calls to relax the ban on the use of embryo stem cells until the potential of adult stem cells in medicine has been properly investigated." –GRETCHEN VOGEL

With reporting by Ohad Parnes in Berlin.

GERMANY

Chipping Away at Feudal Vestiges in Academe

BERLIN—Any young German scientist hoping to carve out an academic career faces a daunting barrier: the notorious post-Ph.D. Habilitation requirement. To be eligible for tenure, young scholars are required to work for 6 years or more as a kind of academic apprentice, dependent on a senior professor for support. Now, this centuries-old academic peculiarity may finally be on the way out.

Last week, the DFG, Germany's central research foundation, announced a new program of "junior professorships" that will provide independent support for young researchers. Beginning in the next few months, young scientists will be able to apply for 3-year support for their own research or group projects they head. At the same time, the German Donor's Association—the country's major private science-funding body—announced that it is starting a program of "research professorships." These will fund university positions for researchers under age 35, with 150,000 DM (about $72,000) annually for a period of 4 years, for independent studies. Priority will be given to new and interdisciplinary areas of research.

Both these new programs present a direct challenge to the hegemony of senior professors, and they are being viewed as key steps in the eventual elimination of the Habilitation requirement. A blue-ribbon committee of scientists and government of-