Revised Galileo results pose Jovian puzzle

Some 4.5 billion years ago, a sizable fraction of the gas and dust that cloaked the infant sun assembled into a solid core 10 times as massive as Earth. This solid body then grabbed nearly 30 times its weight in hydrogen and helium from the solar nebula, forming the biggest planet in the solar system.

On that, planetary scientists generally agree. But a new analysis of data gathered by the Galileo probe, which parachuted into Jupiter last December (SN: 12/23&30/95, p. 420), has thrown detailed theories about the giant planet's origin into disarray.

Jupiter's atmosphere—at least the region explored by the Galileo probe—appears unusually dry, containing only one-fifth the abundance of water scientists had predicted. They used as a benchmark the sun's oxygen-to-hydrogen ratio because Jupiter originated from material that swaddled the sun. Donald M. Hunten of the University of Arizona in Tucson reported the latest analysis last week at the annual Lunar and Planetary Science Conference in Houston.

The new report contains the second revision of the scientists' estimate of Jupiter's water supply, which they derive from data recorded by the probe's mass spectrometer. The current value, announced after researchers carefully calibrated a duplicate of the spectrometer sent to Jupiter, is nearly the same as the original value reported by SCIENCE NEWS last December and one-fifth that calculated in January (SN: 1/27/96, p. 55).

Other detectors on the probe also found evidence of a dry Jupiter. The absence of water clouds, the relative rarity of lightning, and the infrared emission that water would have blocked all suggest that the probe encountered little water vapor. "It's overwhelming," declared atmospheric scientist Andrew P. Ingersoll of the California Institute of Technology in Pasadena at the conference.

The finding, he adds, leaves open three possibilities, none of which seems appealing.

In the first scenario, the probe may simply have entered an anomalously dry region that bears little resemblance to the rest of the atmosphere. Indeed, Earth-based observations indicated that the outer portion of the entry site has little water.

Arguing against that scenario are Jupiter's persistent winds, which would be expected to have thoroughly mixed water vapor throughout the atmosphere. Ingersoll is exploring a specialized model in which the Jovian winds blow only from west to east and somehow don't mix adjacent layers of the atmosphere.

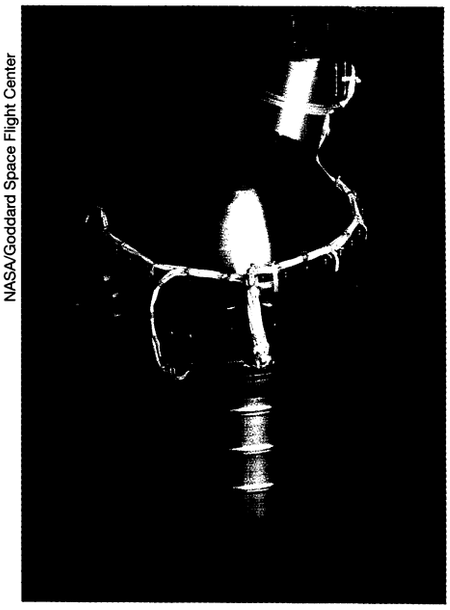
In another scenario, Jupiter contains plenty of water, but it remains locked as ice in the planet's core, far below the atmosphere plumbed by the probe.

Finally, Hunten suggests that Jupiter truly is dry and its core was built from a class of primitive meteorites, carbonaceous chondrites, that contain little water. This contrasts with the popular idea that water-bearing comets provided much of the core material. Hunten's model would explain both the lack of water and the surprisingly high ratio of carbon to oxygen that the spectrometer detected.

Hunten notes that even in the chilly outer solar system, rocky debris rich in carbon may be surprisingly plentiful. Moreover, the distinction between comets and meteorites may not be clear-cut. Some material now classified as comets may resemble rocky meteorites rather than water-bearing "dirty snowballs," as comets are often described, he says. Hunten's theory may explain the rocky compostion of Pluto and Neptune's moon Triton farther out in the solar system.

"With only one probe, anyone could be right about the water," says John A. Haberman at NASA's Goddard Space Flight Center in Greenbelt, Md.

"I always say that good science raises more questions than it answers, and this mission certainly qualifies." —*R. Cowen*



NASA/Goddard Space Flight Center

Duplicate of mass spectrometer, 0.4 meter tall, that plunged into Jupiter last December.

Peptides direct traffic in the body

Almost every home or business displays an address, often in simple black numerals, to distinguish itself from the other buildings on the street. Similarly, some organs of the body appear to bear molecular labels that enable cells, such as those of the immune system, to recognize them.

Cancers also seem to take note of addresses. Prostate cancer almost always spreads to bone. The cells of certain lung cancers usually colonize the brain. "Some tumors have a very strong predilection to go certain places," says Erkki Ruoslahti of the Burnham Institute in La Jolla, Calif.

How do these cells know where to go? In the March 28 NATURE, Ruoslahti and his colleague Renata Pasqualini describe their use of viruses to find protein fragments, or peptides, that preferentially latch onto the blood vessels within the kidney or the brain.

"I think it's a very elegant strategy for discovering new molecules on the surfaces of the endothelial cells that line blood vessels. [It also] offers compelling evidence for the differences in the endothelial cells of different organs," says Judah M. Folkman of Children's Hospital in Boston.

Peptides that home in on distinct areas of the body could help investigators deliver genes, cells, or drugs. "The peptides could take a payload to the targeted organ," Ruoslahti says.

To find such peptides, Ruoslahti and Pasqualini worked with phages, viruses that normally infect bacteria. The investigators linked a large variety of DNA sequences, each coding for a different peptide, to a gene that produces a protein on the surface of phages. As a result, they created a library of phages, each with a different peptide exposed on its surface.

The researchers injected this library into mice. After 1 to 4 minutes, they harvested various organs, collected the phages sticking to the organs' blood vessels, and injected those phage strains into other mice. After repeating this procedure a few times, the investigators isolated phages that aim for blood vessels of the kidney or the brain and identified the peptides that provide this guidance. The endothelial molecules to which the peptides bind remain unknown, says Ruoslahti.

To confirm the peptides' targeting powers, the investigators coated red blood cells with one of the brain-targeting peptides. When injected into mice, almost all the coated cells accumulated in blood vessels in the brain.

In the future, the phage library strategy may identify unique molecules on blood vessels that supply growing tumors. Physicians could then direct toxic substances to those vessels. "If you can destroy the vasculature of the tumor, then you can do away with the tumor," says Ruoslahti. —*J. Travis*