Inside Jupiter: Probe's Early Results

Astronomers have for the first time explored the hidden depths of the largest planet in our solar system. The data recently gathered by a robotic probe may shed light on Jupiter's past as well as its present.

On Dec. 7, the small, instrument-laden emissary from Earth plunged through the Jovian cloud tops. For 57 minutes before it burned up in the furnace of Jupiter's lower atmosphere, the probe transferred precious information on wind speeds, chemical composition, cloud structure, and the prevalence of lightning to its mother craft, Galileo (SN: 12/2/95, p.375). In mid-December, Galileo slowly beamed most of the data to Earth, and planetary scientists began analyzing the mother lode of information about a strange, gaseous world.

"The amount of data in just 57 minutes is overwhelming," says Hasso B. Niemann of NASA's Goddard Space Flight Center in Greenbelt, Md. "We are still working like crazy to make sense of it."

Niemann should know. He designed one of the probe's six measuring tools, a mass spectrometer that has identified in Jupiter's atmosphere a smorgasbord of compounds—neon, argon, hydrogen sulfide, and organic compounds including hydrocarbons, ammonia, and methane.

After only a few days of analysis, the findings remain highly preliminary, emphasize Niemann and coinvestigator Donald M. Hunten of the University of Arizona in Tucson. But Hunten finds two early results particularly intriguing: a lower than expected abundance of water vapor and an apparent enrichment with two heavy inert gases—krypton and xenon.

Even though astronomers have so far detected only trace concentrations of water in the upper reaches of Jupiter's atmosphere, they had several compelling reasons for believing that the probe would find more water at greater depths, explains Gordon L. Bjoraker of Goddard. Jupiter, like the other planets, formed from gas and dust that cloaked the infant sun. At Jupiter's chilly location, 778 million kilometers from the sun, any oxygen would have combined readily with hydrogen to form ice. Therefore, scientists reasoned, the concentration of water in Jupiter must be at least as high as the concentration of oxygen on the sun.

Moreover, several large Jovian moons, including Callisto, Europa, and Ganymede, have icy surfaces, and models suggest that icy materials account for half the interiors of these moons.

Finally, to explain the propagation of atmospheric ripples observed after Comet Shoemaker-Levy struck Jupiter last year, Andrew P. Ingersoll of the California Institute of Technology in Pasadena hypothesized that the giant planet may contain 10 times as much water as the sun's oxygen abundance indicates. He even bet Bjoraker and other colleagues $10 that Jupiter has at least five times the solar abundance of water—about 7,500 parts per million.

In plumbing Jupiter's atmosphere, the mass spectrometer on the probe detected water vapor at only about one-tenth that of the solar baseline, Hunten says. "Any abundance below the solar abundance is truly amazing," says Bjoraker. "I guess I get my $10."

"No one has any idea where Jupiter is hiding 90 percent of its water [and oxygen]," says Hunten. He expects the team to investigate whether some water may have been overlooked because it stuck to tubing in the spectrometer's vacuum system. Hunten deems this explanation unlikely, "but when you get a result this puzzling, you want to check every possibility," he says.

The apparent excess of krypton and xenon, in contrast, may have a straightforward explanation, Hunten adds. During the early history of the solar system, astronomers think, comets plunged into Jupiter much more frequently than they do now. Laboratory experiments show that water ice—the main constituent of comets—traps xenon and krypton more easily than it does lower-mass noble gases, notes Tobias C. Owen of the University of Hawaii in Honolulu. The relatively high concentration of krypton and xenon detected by the spectrometer may thus attest to the importance of comets in determining the chemical evolution of planetary atmospheres.

Owen says it's too soon to tell whether the data definitively show enrichment with xenon and krypton. "Check back with us in January," he says.

At press time, a partial government furlough forced NASA to postpone until early January a briefing on the probe's findings initially scheduled for Dec. 19.

— R. Cowen

Team nabs second breast cancer gene

Last year, when an international team ended a 4-year quest for the gene responsible for inherited breast cancer, the researchers announced that they and another team, working together, had discovered a second breast cancer gene somewhere on the long arm of chromosome 13.

Now, that second team, headed by Michael R. Stratton, has the additional gene in hand. Approximately 90 percent of all inherited cases of breast cancer can be attributed to mutations in either of the two genes.

"We don't have all of [the second gene] because it is quite large," says Stratton, of the Institute of Cancer Research in Sutton, England. "But we do have the abnormalities which are responsible for breast cancer risk."

In 1990, Mary-Claire King, now of the University of Washington in Seattle, reported that a breast cancer susceptibility gene dubbed *BRCA* resides on chromosome 17 and may cause the 5 to 10 percent of breast cancers that are inherited. Last year, a team headed by Mark H. Skolnick of the University of Utah School of Medicine in Salt Lake City isolated the chromosome 17 gene and called it *BRCA1*.

At the same time, Skolnick and Stratton had acquired evidence of another gene, on chromosome 13, that they called *BRCA2* (SN: 9/24/94, p.197).

Stratton and his group studied six families with a history of breast cancer linked to chromosome 13. In the Dec. 21/28 NATURE, they report that each of those families harbors one of five mutations that truncate the protein produced from *BRCA2*'s instructions.

Currently, Stratton's team has identified 7,000 of the gene's base pairs. The researchers suspect, however, that the entire *BRCA2* gene could include as many as 12,000 base pairs. While *BRCA2* bears only a slight resemblance to *BRCA1*, early evidence indicates that it, like *BRCA1*, provides the blueprint for a tumor suppressor that puts a brake on cell growth.

Inheriting mutations in either *BRCA1* or *BRCA2* gives a woman an 85 percent chance of developing breast cancer. Both genes also increase a woman's risk of ovarian cancer, compared to the general population. *BRCA1* confers a greater risk than *BRCA2*; however, *BRCA2* mutations are responsible for some male breast cancers, whereas *BRCA1* mutations are not.

Stratton notes that isolating *BRCA2* now allows researchers to explore the differences between the breast cancer genes.

— L. Seachrist