Hexagon found around Saturn's north pole

The bands, whorls and wavy lines decorating the atmosphere of Saturn have fascinated planetary scientists since the Voyager 1 and 2 spacecraft flew by in 1980 and 1981. Even now, study of the photos they took continues to reveal surprises. One striking example is a gigantic hexagon, about a fourth the diameter of Saturn itself, on the clouds around the planet's north pole.

Neither Voyager craft flew over the pole, so their photos were not taken from a down-looking viewpoint that would reveal the hexagon at a glance. Instead, the cameras faced Saturn's lower latitudes, where the hexagon was not immediately apparent. "A full view of the complete polar region was obtained by making projections of several images taken as the planet rotated and mosaicking them together," reports David Alan Godfrey of the National Optical Astronomy Observatories in Tucson, Ariz.

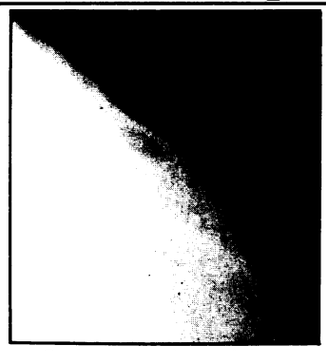
Strictly speaking, Godfrey notes in the November ICARUS, it is not so much a hexagon as an atmospheric feature consisting of a wave pattern that is repeated six times around the planet, ranging between a few degrees above and below 76°N latitude.

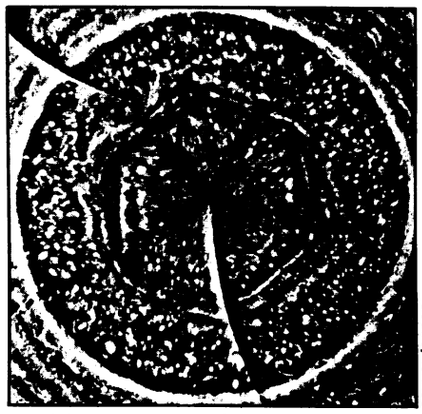
A number of researchers have shown interest in the feature. "It's got to be high in the atmosphere, a pattern that forms from a coupling between circulation and rotation," says Reta Beebe of New Mexico State University in Las Cruces. "It appears to be in a region of stratus cloud – above the region where there is upward mixing."

"Earth has a similar wave pattern with three cycles in it instead of six," notes Michael Allison of the Goddard Institute for Space Studies in New York City. "But because the waves diffuse so rapidly to the north and south, there is not the appearance of a pole-centered triangle. Those disturbances develop into our major weather patterns."

The meteorology is complex, Allison says, but its implications are significant. "The hexagonal cloud feature may exist as a 'stationary wave,' driven by the perturbation caused by the anticyclonic oval which resides at the same latitude [see left photo]." The hexagon, he suggests, may be "a planet-encircling wave, maintained by the sharp latitudinal variation in the 100-meter-per-second eastward jet in which it is embedded. With a longitudinal scale corresponding to a pattern of six repetitions – which is what we see – we calculate that the wave has a westward drift relative to the eastward flow of the background wind, thereby holding the hexagon in a fixed longitudinal position on the planet."

That the hexagon remains at a fixed longitude also means it rotates at about the same rate as Saturn itself, as defined by the rotation of the planet's radio emissions, although the connection between the two phenomena is unclear. "Although several uncertainties remain," Allison says, "the clearly defined horizontal scale and the implication of the hexagon's longitudinally fixed position make it a wonderful template for understanding the vertical structure of the atmosphere beneath it." – *J. Eberhart*





Godfrey/ICARUS

Voyager 2 photomosaic at right shows hexagonal feature around Saturn's north polar region. Dark, starfish-like lines are processing artifacts – boundaries of the individual photos used in the mosaic, similar to the photo at left.

DNA rides along as asbestos enters cells

Scientists have long sought to understand how asbestos causes cancer. Now they have identified a molecular mechanism that may underlie the process. "Asbestos can carry DNA into cells. What we have provided is a potential mechanism of mutagenesis in cells," says Edward M. Johnson of the Mount Sinai School of Medicine in New York City.

Measurable concentrations of DNA normally are present in fluid surrounding cells. In the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.85, No.20), Johnson, Jill D. Appel, Thomas M. Fasy and their colleagues suggest asbestos can carry pieces of this "exogenous" DNA into a cell, where genes on the DNA segments are later expressed. The research team took a common commercial form of asbestos, called chrysotile or "white" asbestos, and observed the DNA interaction using an electron microscope. The researchers found that the positively charged chrysotile surface attracted the negatively charged DNA.

They then found that the DNA-bound asbestos pierced the cell membrane. To illustrate this, they incubated monkey cells with marker DNA that conferred resistance to an antibiotic called neomycin. Cells still alive after researchers added neomycin were those that had taken up the resistant DNA.

Once inside the cell, exogenous DNA might create havoc in any of a number of ways, explains Appel. One possibility is that the DNA disrupts or shuts off genes that control the cell's normal growth. Alternatively, the DNA may carry a cancer-causing gene that is activated inside the cell; activate a cancer-causing gene that has remained quiescent in the host cell; or trigger the cell's repair enzymes, which copy DNA but can make mistakes that lead to mutations.

Geneticist George Dubes, at the University of Nebraska in Omaha, says the work has "great theoretical significance." Dubes and his colleagues had shown that silicate minerals similar to asbestos can enhance the uptake of viral RNA into cells, which prompted the Mount Sinai group's study.

The new research may help explain why asbestos exposure greatly increases a smoker's risk of lung cancer, Appel says. Modern cancer theory says a number of "insults" are needed before cancer develops – and asbestos exposure may tip the balance for some smokers. Genetics also plays a role in the development of the disease; some people resist cancer even though they are exposed to more than one carcinogen, Appel notes.

Appel says the findings also may guide the development of safe alternatives to asbestos. With the knowledge that chrysotile asbestos carries a net positive charge, researchers might look for insulating materials that do not bind DNA.

Asbestos was widely used for several decades after World War II to insulate and fireproof buildings. The material's heyday was cut short by reports linking it to cancer. A landmark study led by another Mount Sinai researcher, Irving Selikoff, showed during the 1960s that insulation workers who handled asbestos died of cancer at high rates.

– *K. Fackelmann*