SCIENCE NEWS

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THIS WEEK

RESEARCH NOTES

ARTICLES

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COVER: Giant clams, *Calyptogena magnifica*, are arrayed near fissures where hot, mineral-rich water streams from vents on the Pacific seafloor. The vent field, called "Clam Acres," is the focus of a multi-disciplinary study of the biological communities along the East Pacific Rise, 21° North of the equator. See p. 410. (Photo: Robert Hessler/Scripps Institution of Oceanography)

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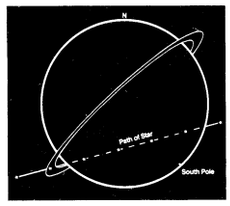
SCIENCE NEWS OF THE WEEK

Neptune Rings: An Occultation Story



For centuries Saturn was unique in the solar system. Its rings were its trademark, easily visible in small telescopes. Saturn is no longer unique. In recent years rings, though hardly visible, have been found around Jupiter and Uranus. Now, Neptune began to seem unique; it was the only Jovian planet without rings. But at the meeting of the American Astronomical Society in Troy, N.Y., last week, "evidence for a ring system of Neptune" was presented by Edward F. Guinan, Craig C. Harris and Frank P. Maloney of Villanova University in Villanova, Pa.

The presentation got a good deal more attention than its authors expected. That included TV cameras, articles in metropolitan newspapers and banner headlines in the local papers. The authors stressed that they were not presenting any definitive conclusion, but a single piece of evidence ("unconfirmed," they said) by which they hope to stimulate further investigations. There will be several favorable opportunities in the next few years, including a Voyager spaceprobe visit to Neptune's neighborhood.

The evidence comes from data taken during an occultation, the passage of Neptune in front of a star, on April 7, 1968, from the Mount John Observatory in New Zealand. The star was BD −17°4388, which at 7.8 magnitudes is about as bright as Neptune itself. The equivalence in brightness meant that when the star went behind the planet, the drop in total recorded light would be about 50 percent. In that kind of contrast interesting information might show up that would not be available in a lower-contrast occultation.

In 1968 the main interest was in the composition and density of Neptune's atmosphere. For two very brief moments — just as the star went behind Neptune and just as it emerged — the star's light would be coming through the planet's atmosphere, and analysis of the transmitted light could give the desired information about the atmosphere. Data were recorded on a strip chart and on punch cards. The strip chart took data at a fast enough rate to get something interesting during the two brief flashes when the star passed behind Neptune's atmosphere. The punch cards did not have that kind of time resolution, and were regarded as a back-up.

Guinan returned to the United States by way of the Soviet Union. Sometime between his entry into that country and his departure from there, the strip chart disappeared "along with a copy of *Time* magazine." He makes no accusations. With the main records of the occultation gone, people interested in Neptune's atmosphere didn't bother to reduce the data on the punch cards, believing that the effort would bring no reward. The punch cards were put aside, however; one does not just throw such things away.

Fourteen years later came a senior undergraduate student, Harris, looking for a thesis subject. It was suggested that he should reduce the data on these old punch cards. In the time since the data had been taken, several previously unsuspected rings and satellites of Jovian planets had been found, and it was now plausible that something interesting could be in the old data.

Harris did the reduction during the autumn of 1981. It was mechanically tedious. The cards had gotten wet on the way back from New Zealand and were warped. They had to be fed into the reading machine one by one and some had to be repunched. Nevertheless, the data came out. They show the expected sharp regular drop in brightness due to the planet's cutting off the starlight, and near to that they show an irregular drop of about 30 percent in brightness. A satellite would have made a sharp regular drop similar to the one made by the planet. The irregular drop is characteristic of the combination of transmission and obscuration provided by rings. If the drop represents rings, they lie in the planet's equatorial plane, and they lie quite close. Their inner edge would be about 3,600 kilometers from the surface, their outer edge about 7,900 km away.

There are certain complications. An analysis of some other Neptune occultations published in the Dec. 10, 1981 NATURE by J.L. Elliot et al. of Massachusetts Institute of Technology shows no evidence of rings. It could be that the occultations reviewed by Elliot et al. all missed the rings; each occultation has its own trajectory. To make the geometry come out right for that, Guinan, Harris and Maloney have to shift the orientation of Neptune's rotation axis by a few degrees from what it is commonly taken to be. There is a lot of uncertainty in the determination of the axis, and the shift they want to make falls within that uncertainty, but it still leaves some other astronomers expressing confusion — as well as surprise and interest — over just what is intended.

Guinan, Harris and Maloney hope the interest will lead others to take another look. Observing equipment has improved since 1968, and so occultations of fainter stars can be used. Favorable opportunities will occur on June 15, 1983 and July 22, 1984, they say. And then in a few more years, there's Voyager 2's Neptune encounter.

—*D.E. Thomsen*