First-Look Maps of Saturn's Moons

Almost nothing was known about Jupiter's Galilean satellites — Io, Europa, Ganymede and Callisto — before the Voyager 1 spacecraft visited them in March of 1979, even though they are so big that Galileo himself discovered them (hence the name) through his primitive telescope in the early 17th century. The moons of Saturn are nearly twice as far from earth, and, with the exception of Titan, far smaller than any of the Galileans, so it is hardly surprising that still less information existed about them in the astronomical record.

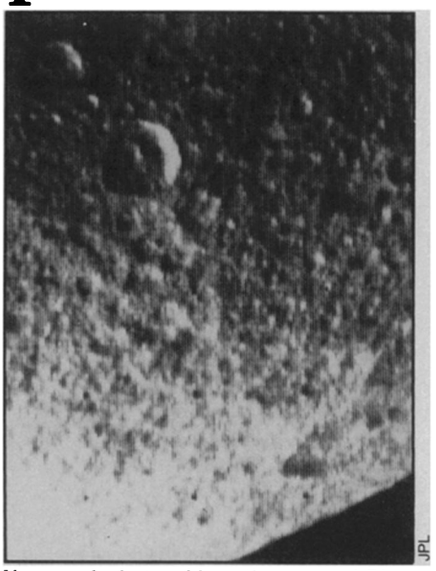
Last November, Voyager 1 flew through the Saturnian system to begin setting the record straight, a task that will continue when Voyager 2 flashes by late this coming August. Voyager 1's cameras were frustrated by the dense atmosphere of Titan, but revealed the strangely varied crater sizes of Rhea, widespread wispy streaks on Dione, a vast crack extending a fourth of the way around Tethys, one of the deepest known craters in the solar system on little Mimas, and more.

Now many of the photos have been used to prepare maps of the above four moons, just as was done for the Galilean satellites (see SN 117:251, 283, 315, 345). Drawn by artists at the U.S. Geological Survey's Branch of Astrogeologic Studies in Flagstaff, Ariz., they attempt to present the satellite surfaces free from camera-angle distortions, shadow effects and other potentially misleading influences. The maps are still preliminary — precise positions of surface features are still being refined, names for them have not yet been approved by the International Astronomical Union, and Voyager 2's additional photo-coverage is months away — but they provide the first near-global looks at the solar system's most recently explored members.

They were drawn by airbrush, freehand, working directly from the Voyager 1 photos. Where the photos seem blurrier or lower in resolution, the maps have deliberately been rendered the same way in order to prevent possibly erroneous extrapolations with the exotic terrain. Planetary cartography chief Ray Batson pointedly prefers non-geologists as his artists, in fact, to minimize any possible tendency to make the alien landforms look like more familiar features on earth.

The map of Rhea — or at least of all the parts that were photographed with sufficient resolution (the cutoff point was about 40 kilometers per line pair) — appears on pages 108-109 and the cover of this issue of SCIENCE NEWS. Dione, Tethys and Mimas will appear in upcoming issues.

"Callisto," one researcher observed after seeing the first Galilean-satellite photos, "may well turn out to be the most heavily cratered body in the solar system." Indeed, it showed virtually nothing else — no mountains, no crevasses, just craters, shoulder to shoulder. But Rhea seems to be more crater-ridden still, with the characteristic ring-walls sometimes cutting across one another as though there was simply not enough room for all the meteorites, large and small, that struck it.



Voyager 1 photo of heavily cratered Rhea was used in mapping the satellite's surface.

Strangely, according to Laurence Soderblom of the USGS, parts of Rhea look as though the largest chunks were missing from the meteorite mix that hit everywhere else (SN: 11/22/80, p. 325). One interpretation of this, he says, could be that those parts were smoothed over by internal activity following the great meteorite bombardment believed to have done most of the solar system's cratering some four billion years ago, so that the smooth areas now preserve evidence of a later bombardment by a different batch of objects that lacked the biggest pieces.

Soderblom's view is not unanimous among the Voyager scientists, and it raises the question of what would produce the heat necessary for internal activity in a body that is mostly ice and less than half the size of earth's moon. There are also a few large, smooth areas still visible on Rhea (one is centered at about 5°N by 30° on the map), not unlike the lava-filled maria on earth's moon, though it has been suggested that solid ice could, over time, simply have "flowed" back to fill them in.

Voyager 2 will not add a great deal to the existing Rhea photo-coverage, since it will pass nearly nine times as far from the satellite as did Voyager 1. But even the photos now in hand, barely three months old, will, like the map, yield more information as researchers spend more time studying their latest planetary horizons.

Next: Dione. □

Council turns down Peru quake forecast

In its first major action, the year-old National Earthquake Prediction Evaluation Council has rejected a prediction by two U.S. government scientists that a series of large earthquakes will occur in Peru beginning in June 1981.

The evaluation, completed following a meeting of the two scientists and the 12-member council held Jan. 26 to 27, came at the request of the Peruvian government. According to reports received at the U.S. Geological Survey in Reston Va., when news of the prediction was made public in Peru last year, there was general alarm and a scramble to make airline reservations to leave the country. The episode points out the delicacy required in issuing earthquake predictions and raises questions about the responsibility of scientists making such forecasts.

Brian Brady of the U.S. Bureau of Mines and William Spence of the U.S. Geological Survey, both in Denver, Colo., outlined their forecast at a meeting on earthquake prediction held in San Juan, Argentina, on Oct. 20. The scientists could not be reached for comment, but earlier news accounts reported that the predictions were based on a method called the "inclusion collapse theory." According to this theory, inclusions are areas of deeply buried rock that have become weakened by cracking and that eventually give way in an earthquake. The scientists believe that such inclusions have developed in the oceanic plate that descends along the coast of Peru, and that a precursory pattern of tremors has occurred in the region. Because of the size and position of the proposed inclusions, Brady and Spence forecast that a magnitude 7.5 to 8.0 event would occur on or about June 28, a magnitude 9.2 quake about Aug. 10 and a magnitude 9.9 event about Sept. 16. (The scientists used the Kanamori scale, which includes the energy released in low-frequency tremors. A major 1960 quake in Chile measured 8.3 on the Richter scale, 9.6 on the Kanamori.) The predicted epicenters are all near Lima.

The council, which was created by law in 1977 and met for the first time last year (SN: 3/1/80, p. 136), responded, "...nothing in the observed seismicity data, or in the