NEPTUNE'S SATELLITES: IMPLICATIONS FROM IMPACT CRATER MORPHOLOGY

(*Letter to the Editor*)

KENT D. TREGO
Planetology Research Institute, Palo Alto, California, U.S.A.

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Abstract. The presence of central peak craters and the absence of central pit craters on Triton implies a surface rigidity similar to the Saturnian and Uranian satellites and stronger than that of the Jupiter satellites Ganymede and Callisto. Tectonically degraded terrain may exist at the antipode of the large impact structure on 1989N1. Dome craters on Triton may represent a form of solid state volcanism.

The geology of the Neptunian satellites as revealed by Voyager 2 images was reported by Smith *et al.* (1989). Triton has a modest population of impact craters up to 27 km in diameter. Bowl-shaped, flat-floored, and central peak craters were found on Triton. Smith *et al.* (1989) also reported that a large impact structure was found on 1989N1. The crater is approximately 150 km in diameter.

In addition to the presence of central peak craters on Triton (Figure 1), there is an absence of central pit craters which are result of crater floor subsidence. The Jupiter satellites Ganymede and Callisto do not have representative populations of central peak craters, which are result of crater floor rebound during the late stages of crater formation, and do have large populations of central pit craters implying surface rigidity weaker than that of the Saturnian and Uranian satellites (with the exception of Miranda) which do have central peak craters and no central pit craters (Trego, 1986; 1987a; 1987b). The presence of central peak craters and absence of central pit craters on Triton implies the surface rigidity of Triton is similar to that of the Saturnian and Uranian satellites and stronger than the rigidity of Ganymede and Callisto.

The large impact structure on 1989N1 (Figures 2 and 3) is proportionally similar to the craters Herschel (130 km in diameter) on the Saturnian satellite Mimas and Odysseus (400 km in diameter) on the Saturnian satellite Tethys. The crater on 1989N1 is approximately 37.5% of the diameter of 1989N1 (400 km in diameter) while Herschel is 33% of the diameter of Mimas (390 km in diameter) and Odysseus is 38% of the diameter of Tethys (1050 km in diameter). Tectonically altered antipodal terrains to large impacts formed from those large impacts occur on Mercury and the Moon (Schultz and Gault, 1975). No conclusive evidence of these antipodal terrains occurs on Mimas or Tethys. The possibility exists that a tectonically altered antipodal terrain occurs on 1989N1.

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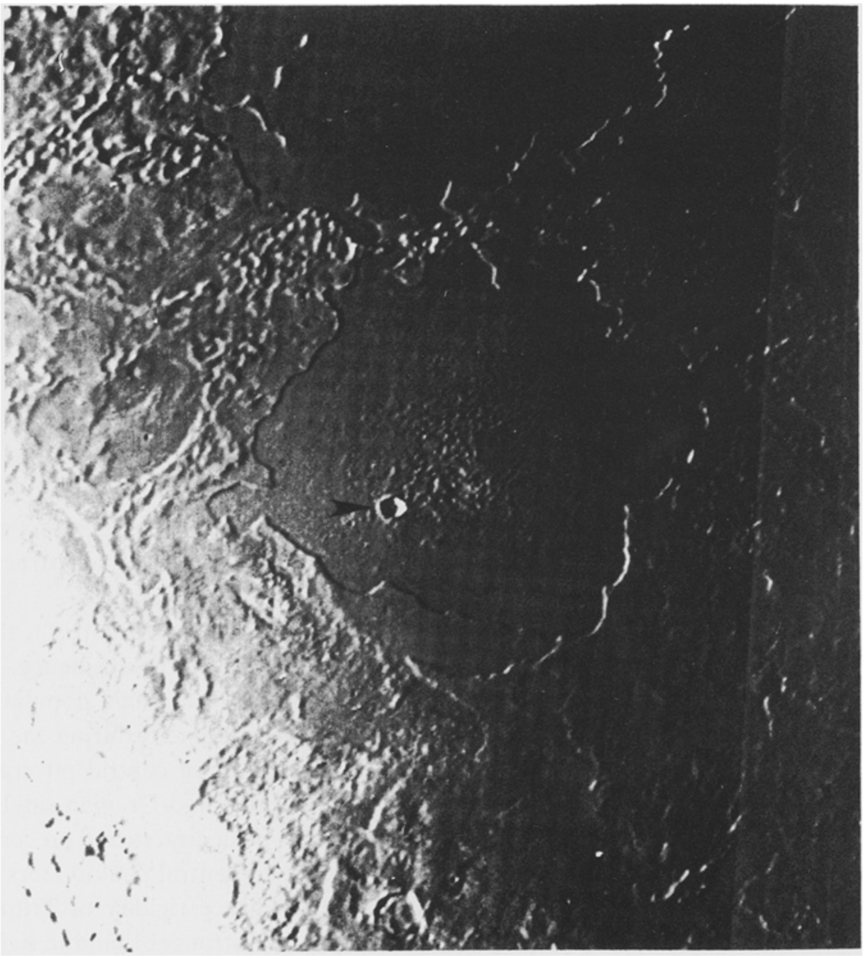

Fig. 1. A central peak crater on Triton (15 km in diameter). The crater is indicated by an arrow.

Dome craters, whose floors have significant positive relief (Figure 4), have been found on Ganymede (Moore and Malin, 1988). These impact craters may represent a mere floor uplift or the intrusion of endogenic material. Dome craters exist on Triton (Figures 5, 6, and 7). These dome craters may represent a form of solid state volcanism which has been reported on Triton by Smith *et al.* (1989).

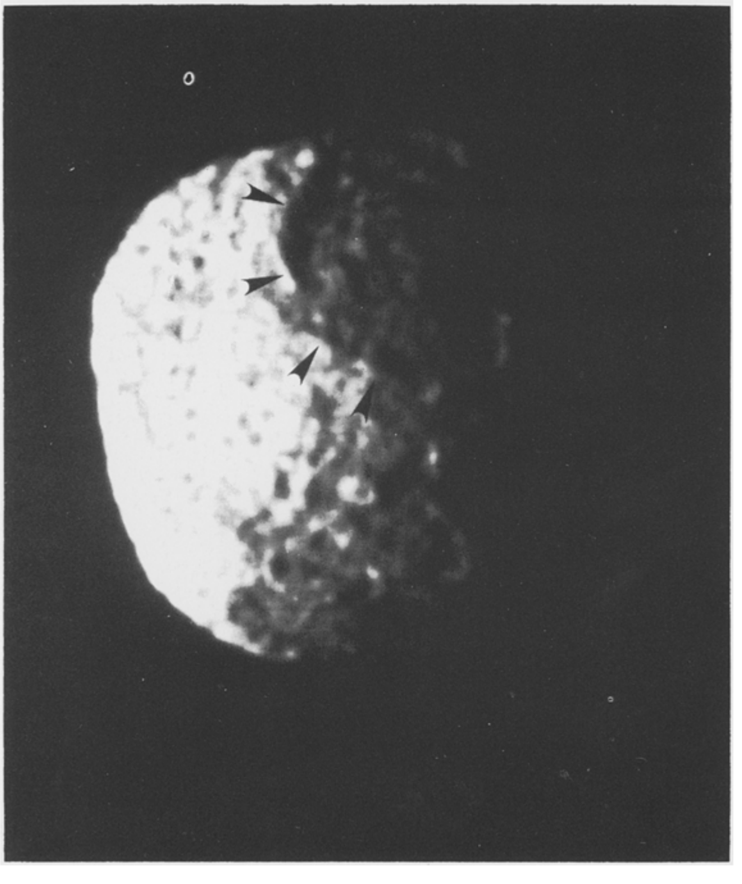

Fig. 2. The satellite 1989N1. Arrows indicate the rim of the large impact crater (150 km in diameter).

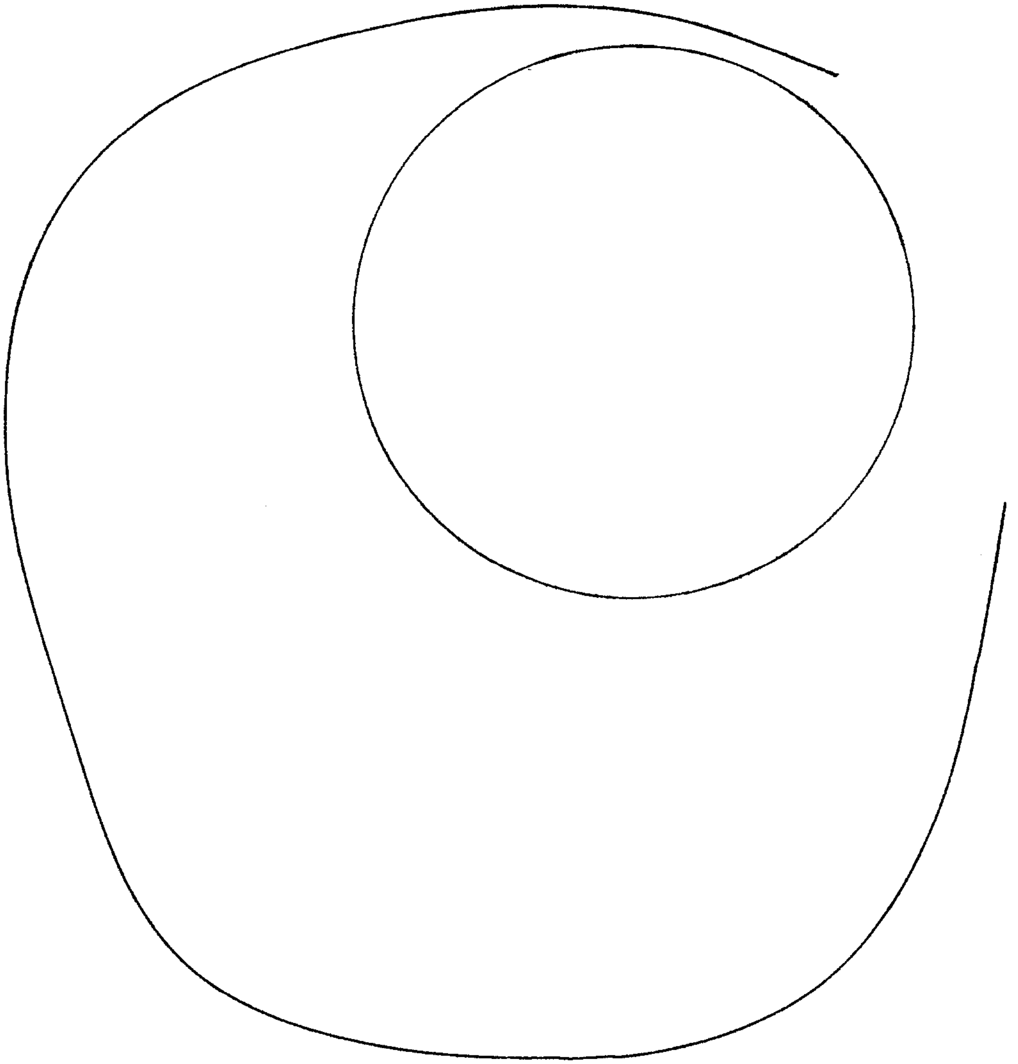

Fig. 3. Diagram of the satellite 1989N1 showing the position of the large impact crater.

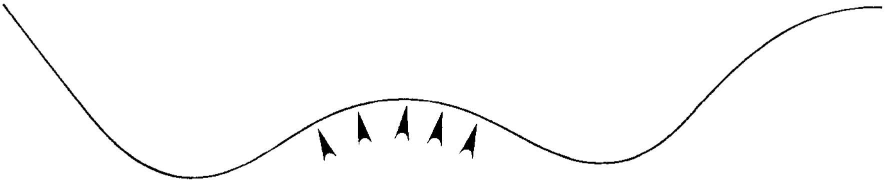

Fig. 4. Diagram of a dome crater. Arrows indicate the direction of the positive floor relief.

Fig. 5. Southern hemisphere of Triton showing positions of two dome craters at the south polar cap boundary (indicated by arrows) and location of cantaloupe terrain (CT) where other possible dome craters exist.

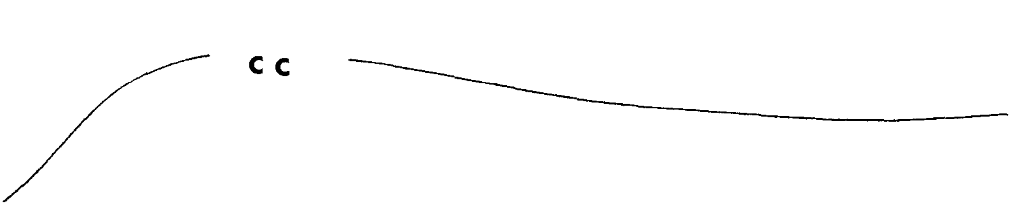

Fig. 6. Diagram showing the positions of two dome craters (C) along the boundary of the south polar cap.

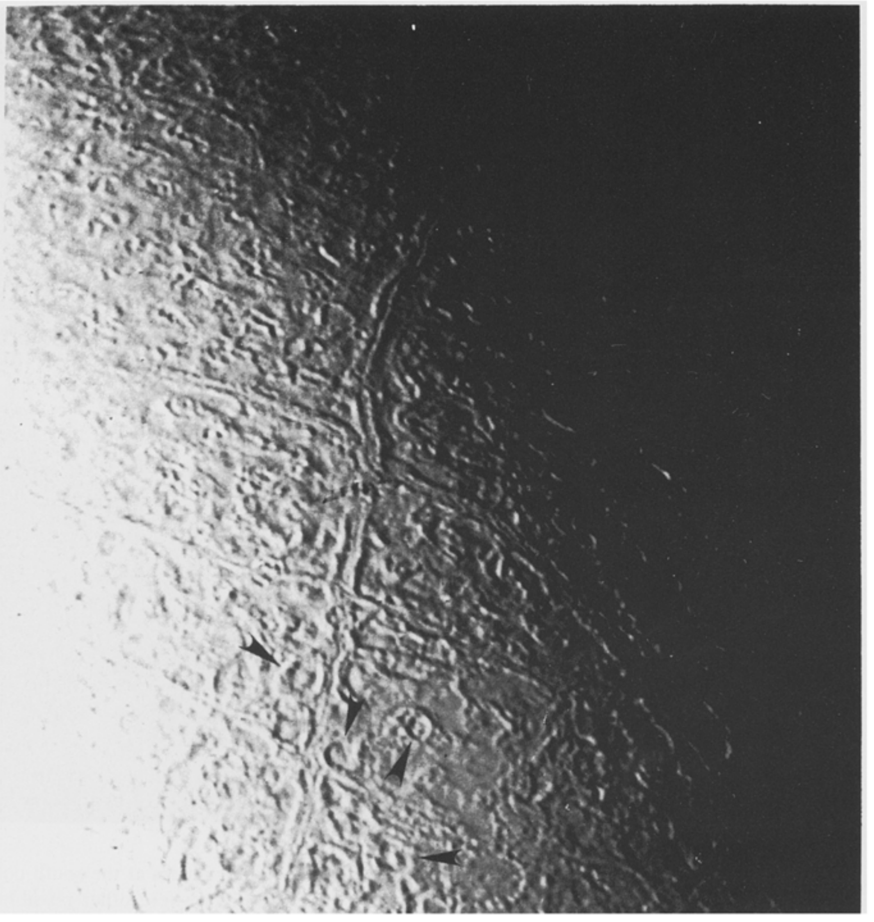

Fig. 7. Possible dome craters in the cantaloupe terrain (indicated by arrows).

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