TETHYS AND DIONE: NEW GEOLOGICAL INTERPRETATIONS. P. J. Stooke[1], [1]Department of Geography, University of Western Ontario, London, Ontario, Canada N6A 5C2; pjstooke@uwo.ca; http://www.uwo.ca/geog/faculty/stooke.htm

Introduction: The Voyager images of Tethys and Dione have been reprocessed using new methods including super-resolution (applied to multispectral sequences) to enable new geological interpretations of both satellites. This follows similar work on Mimas and Enceladus [1]. A variety of features are revealed for the first time, or seen more clearly than before, to support new geological interpretations prior to Cassini's arrival. New tectonic features, impact basins and albedo markings are described. The poster includes global photomosaics which fill blanks in USGS maps.

Tethys: Tethys shows broad low albedo swaths superimposed on a cratered background, with smooth plains, impact basins and large fracture systems [2]. The newly reprocessed images provide new information on all these feature types.

Albedo features: A diffuse N-S dark stripe runs down the 270° meridian, a location suggesting rotational or orbital dynamic control. More difficult to explain this way is the sharp-edged E-W low albedo stripe running along the equator between longitudes 0° and 160°. It widens from about 200 km at 0° longitude to 400 km through most of its length, has a faint bright central line, and ends abruptly, not diffusely, southwest of Odysseus (Fig. 1). Within the long. 270° stripe there are other complexities. All large craters (Penelope, Polyphemus etc.) on both edges of the stripe have dark albedo material on walls facing 270° longitude, and bright material on walls facing away from 270° (Fig. 2). This produces curious 'lighting reversal' effects as the craters rotate across the disk. Two prominent dark spots [3] are observed in medium resolution images of the 270° region (Fig. 3). They lie northwest of Penelope, are each about 10 km across, and lie in an area of small craters, but their topographic expression is not certain. Other subtle dark spots and streaks are visible in bright terrain between Penelope and Odysseus. These observations suggest that low albedo material is distributed in complex ways, governed more by local conditions or events than orbital or rotational dynamics. The equatorial dark stripe could be a cryovolcanic plume deposit erupted from faults bounding the deepest section of Ithaca Chasma and smeared westward by rotation. The patterns observed on crater walls near 270° longitude suggest emplacement radiating from a central vent, and the small dark spots might be crater ejecta derived from a 'cryptomare' type buried dark deposit, or small vents from the last phase of cryovolcanism. Cassini images should be targeted to examine the dark spots at the highest possible resolution, and to perform global low-phase multispectral mapping of albedo markings.

Impact basins: The basin Odysseus is well known, but two other impact basins are revealed in these images (Fig. 4). One, centred at 35° S, 345° W [3] is 330 km in diameter and has a faint inner ring structure. The other is at 45° N, 20° W, is about 220 km across and appears to have a central dome-like structure. A third candidate lies just northwest of Odysseus. Modelling the relaxation of these basins may help elucidate the interior structure and thermal history of Tethys.

Tectonics: Figure 4 also shows a series of previously unmapped tectonic features (TF) southeast of the double-ring basin described above. They extend from the south pole to 30° S, 330° W, cutting through the basin rings. They suggest that large new tectonic structures may await discovery in the poorly-seen south polar area, another worthwhile target for Cassini.

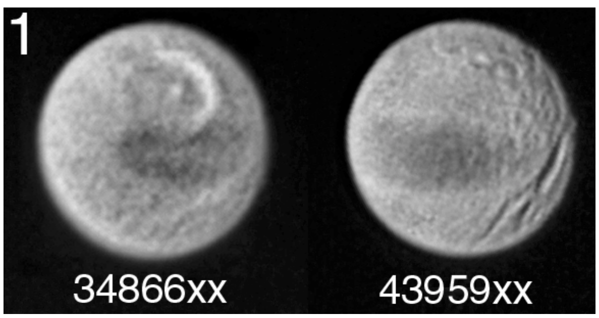
Dione: Dione has a complex structure with smooth plains, tectonic structures and dramatic albedo variations [4,5]. The newly reprocessed images fill blank areas in USGS maps and permit the identification of new tectonic structures, smooth plains areas and albedo markings, as well as a possible large impact basin.

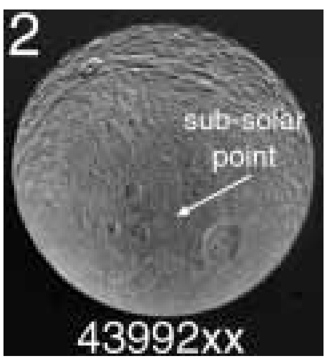
Albedo features: The global pattern of albedo was well documented by Voyager 1, but Voyager 2 images extend those observations towards the north pole near long. 270° (Fig. 5). Whispy bright markings extend almost to the pole. Early Voyager 1 images show albedo variations near 120° long., including bright patches which may be fresh crater ejecta and faint dark patches. Cassini should show these features more clearly. The bright areas of these satellites are not bland, and high resolution multispectral sequences at low phase angle should be taken whenever possible.

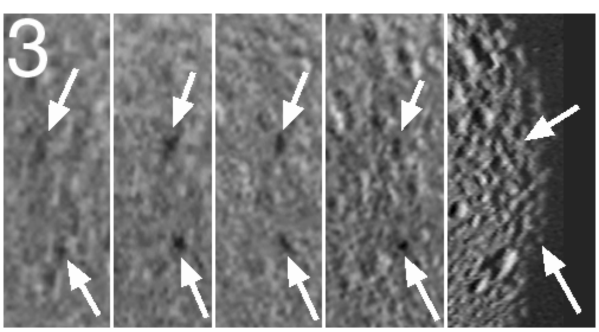
Impact basin: Dione does not have as many impact basins as Tethys or Rhea, the enigmatic Amata structure [5] being the only obvious candidate. Amata's impact origin is not certain, however, due of the lack of near-terminator images. A new candidate basin is identified at roughly 70° S, 160° W, with a diameter of 300 km and hints of a concentric inner ring (Fig. 6). If confirmed by Cassini this may be the only large impact basin on Dione, or the second after Amata.

Tectonic features: High albedo streaks on Dione are probably associated with faults, but this is rarely seen clearly except at Palatine Chasma/Palatine Linea. Winding valley structures such as Latium Chasmata show no relationship with albedo. This study reveal new structures, notably a series of large north-south ridges and valleys at 65° S, 300° W (Fig. 7). The Voyager 1 transit sequence produces a super-resolution composite (Fig. 8) which reveals tectonic fabrics with different orientations. At 10° N, 180° W the lineaments run SW-NE over an area 1000 km across, while at 50° N, 130° W and 45° S, 160° W the trend is N-S. These patterns appear in adjacent image sequences, showing they are not artifacts. The smooth plains mapped in high resolution images at 60° W appear to extend along the equator to roughly 180° W. Dione appears to be a complex tectonic patchwork.

References: [1] Stooke P.J. (2001) *LPS XXXII*, on CD-ROM. [2] Moore J.M., Ahern, J.L. (1983) *JGR., 88,* A577-A584. [3] Stooke P.J. (1989) *LPS XX*, 1071–1072. [4] Plescia, J.B. (1983) *Icarus 56*, 255-277. [5] Moore, J.M. (1984) *Icarus 59*, 205-220. [6]







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