



Fig. 5. The Raditladi basin, ~250 km in diameter. (A) This NAC image mosaic of the basin shows the central peak ring and floor. Mosaic of MDIS NAC images EN0108826722M, EN0108826727M, EN0108826732M, EN0108826787M, EN0108826792M, and EN0108826797M. (B) This close-up (see box in A) shows the generally concentric graben structures, centered on the crater center defined by the rim crest, but slightly offset to the southeast from the center of the peak ring. Mosaic of MDIS NAC images EN0108826727M and EN0108826792M. (C) Sketch map of area in (B), showing the peak ring, the generally concentric graben system, the large superposed impact crater, and two elongate craters that may be vents for the dark material on the crater floor.

New MESSENGER data such as altimetry of the Raditladi basin as well as the search for other similar basins elsewhere on Mercury will help in formulating and constraining such models.

4. Radial graben swarm: Pantheon Fossae

One of the most striking features observed in images from MESSENGER's first Mercury flyby is the radial graben structure Pantheon Fossae, centered in the Caloris basin (Figs. 6–8) (Head et al., 2008; Murchie et al., 2008; Watters et al., 2009a-this issue). Its location central to the Caloris basin interior, its numerous graben radiating away from a nexus, or central core, and its geographic association with Apollodorus crater have led to a range of hypotheses for its origin. These include: (1) uplift and radial fracturing of the center of Caloris following volcanic infill of the basin floor (Murchie et al., 2008; Watters et al., 2009a,b-this issue); (2) stress release and fracturing triggered by the Apollodorus impact (Freed et al., 2009-this issue); and (3) radial dike emplacement from a shallow magma reservoir (Head et al., 2008). Here we further explore the radial dike emplacement interpretation and the possibility that these features might mark the presence of a magma reservoir in the center of the Caloris basin (Fig. 6).

As described by Murchie et al. (2008), Head et al. (2008), and Watters et al. (2009a,b-this issue), the Pantheon Fossae complex is centrally located in the Caloris basin and consists of over 230 linear troughs or graben that radiate away from a common center (Fig. 7). Detailed analysis of individual portions of Pantheon Fossae reveals the following characteristics:

- (1) *General characteristics of graben:* The lengths of individual graben segments range from ~5 km up to ~110 km, and widths range from 1 to 8 km.
- (2) *Central arcuate and polygonal patterns:* In the nexus, troughs (graben) crosscut one another and produce a local polygonal pattern (Figs. 7 and 8A). Others curve away from the center as the nexus is approached (Fig. 8H, upper left).
- (3) *Two populations of graben length:* The radius of the dense radially symmetric plexus of graben is ~175 km, and a few graben extend to greater radial distances to the north and southwest (Fig. 7A–C), out to distances that intersect with a ring of generally concentric graben around the outer basin floor.
- (4) *Two scales of graben width:* In the central region, just south of Apollodorus crater (Figs. 7 and 8A), a large graben about 8 km wide emerges from beneath Apollodorus crater ejecta, extends radially away from the central region for about 35 km, changes strike for about 20 km, and then again changes strike, extending about 45 km before becoming obscured beneath a superposed impact crater (Fig. 7). Toward the nexus, the width is more than twice that of the smaller graben population. The large graben decreases in width radially from the nexus; this feature appears to crosscut smaller radial graben. Two additional larger features that could be large troughs radiate to the northwest and to the southeast (Figs. 7A and 8C, H).
- (5) *Cusped walls and crater-chain-like structures:* Some of the graben walls appear cusped, with convex-outward wall segments that resemble crater chain segments (Fig. 8B, E–G). Similar pits and chains are often seen associated with graben on the Moon and Mars. One crater chain with distinctive raised rims parallels nearby graben (Fig. 8F, lower center).
- (6) *En echelon graben:* Locally, some graben appear in *en echelon* patterns (Fig. 8D, center).
- (7) *Superposed (cross-cutting) graben:* In addition to the large graben mentioned above, smaller graben sometimes show cross-cutting (superposition) relationships (Fig. 8E, center; H).
- (8) *Possibly embayed graben:* The laterally discontinuous nature of many graben (Fig. 8D), and the manner in which the graben