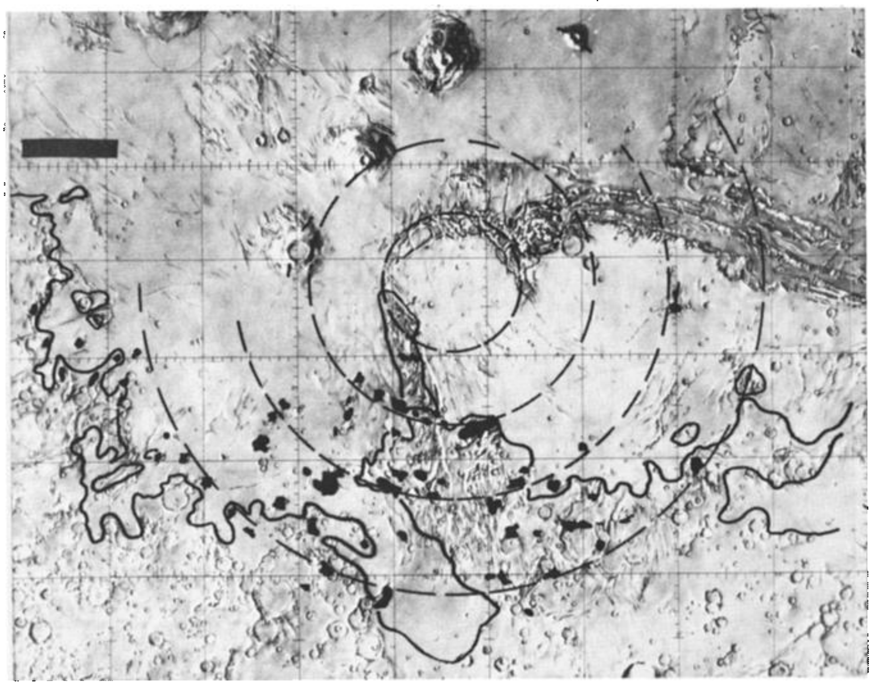

Fig. 19. Location of proposed Tharsis impact basin rings that partly control the pattern of Noctis Labyrithus. Solid regions represent massifs such as those illustrated in Figure 18. Outline indicates boundaries of plains regions. Bar scale represents 500 km.

less than 10 km in diameter to greater than 100 km in diameter; consequently, regional processes, such as isostasy, are not directly responsible for modification.

5. Modification affects a wide range of ages from ancient, extensively buried craters to relatively recent craters with well-preserved ejecta facies; this demonstrates that the modifying process is not a result of the impact but rather a result of subsequent events.

Theoretical estimates of the cooling history of a mafic sill near the base of the brecciated zone beneath the floor of an impact crater suggest that the time for cooling by conduction only is of the order of 10,000–100,000 years. Heat generated by intrusions at this depth may raise the temperature of overlying material above the fusion point of water, but only large (1 km thick) intrusions beneath craters smaller than approximately 20 km in diameter can thaw such material to near the surface. It should be noted, however, that any hydrothermal convection could significantly decrease the cooling time and affect frozen material over regions larger than those predicted from conduction alone. Thawed material in large craters (greater than 20 km in diameter) may remain in a mechanically unstable state beneath an impermeable cap until catastrophically released. Alternatively, the water may slowly percolate to the surface through concentric fractures related to floor uplift. Subsequently, the water either escapes to the atmosphere or creates a channel and carries away debris, thereby contributing to the destruction of the old crater form.

Floor-fracturing has occurred in craters of widely different formation ages. Numerous examples have been inundated or partly buried prior to floor fracturing, and this earlier stage of modification may reflect the early epoch of igneous activity suggested by *Wilhelms* [1974]. In several regions, gradual erosion of crater floor materials has revealed dikes which are perhaps related to this earlier epoch of volcanism.

The largest impact craters, the multiringed basins, established major topographic depressions that controlled the early emplacement of many plains units. Moreover, they established deep-seated crustal fractures that provided important pathways for igneous activity in a manner analogous to basaltic flooding of the lunar maria. This structural imprint is preserved along the borders of the fretted terrain and in the chaotic terrain. Intrusions controlled by this imprint may have greatly contributed to the development of these terrains in a mega-example of smaller martian floor-fractured craters. One of the largest examples may be a 2000-km-diameter impact basin centered at Syria Planum that has undergone extensive volcanic and structural modification but remains identifiable from basin-controlled faults, igneous activity, and remnant massifs.

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