Fig. 11. Two 30-km-diameter floor-fractured craters in Mare Smythii on the moon near 4°E, 2°N. Summit of central peak in top example is near the elevation of the rim and suggests uplift, whereas central peak complex is missing or buried in bottom example. Mare basalts typically are emplaced within an annular moat, around the upraised central peak complex, or within the down-dropped central peak region. Vents for the basalts cannot be identified but are believed to occur along the concentric fractures. Lunar Orbiter I-8M.

ues from (5). If convection does not occur, the thawed zone may be confined below still-frozen floor materials. However, it is apparent from Figure 10 that craters larger than 20 km in diameter are even more likely to have the thawed zone restricted at depth.

Equation (1) permits estimation of the total time required for melting at different depths. Again, the results require bracketing by the range of possible specific heats. Near the intrusion (2 km from the center) with a superposed 10°C/km preexisting gradient, thawing times are of the order of 20,000–40,000 years. Farther from the intrusion (4 km from the center), these times rapidly increase to 200,000–400,000 years. Consequently, thawing from the heat of a deeply buried intrusion represents a gradual process.

## Possible Implications for Modified Martian Craters

The emplacement sequence of basalts in floor-fractured craters and larger multiringed basins on the moon provides significant clues for the probable escape routes of any hydrothermal products in martian craters. During early or arrested stages of development, floor-fracturing of lunar craters typically encompasses the crater floor at the base of or within the crater wall zone [*Schultz*, 1976*b*]. Surface volcanism expressed by dark-haloed vents occurs in a few examples, but commonly during the early stages of modification, surface eruptions have not occurred. With increased modification, peripheral floor fracturing becomes more extensive, and the old slumped wall material accumulates in a wide peripheral trough or moat. Other regions of modification at this stage may include fracturing around the central peak complex. Surface volcanism most commonly occurs along the floor margin, within the moat, or around the central peak region. During advanced stages of modification, structural modification is primarily ex-

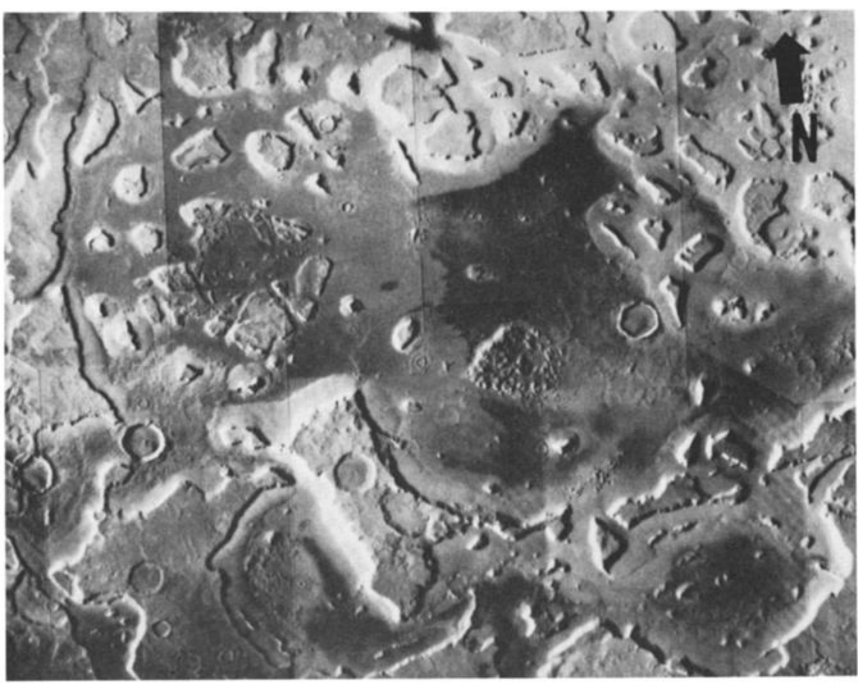

Fig. 12. Pair of large (>200-km-diameter) circular features in Deuteronilus Mensae. The structure at left (250 km in diameter) is defined by a broken scarp enclosing concentrically arranged mesas and hummocky inner zone. The feature at right (200 km in diameter) is more heavily degraded with only the outer scarp, isolated knobs, and inner hummocky zone remaining. These structures are interpreted as impact basins buried by plains units (basalts?) but reexposed by gradual thawing and deterioration of ice-bearing fill materials by intrusions. Viking frames 673B45-51 centered at 339°W, 43°N.