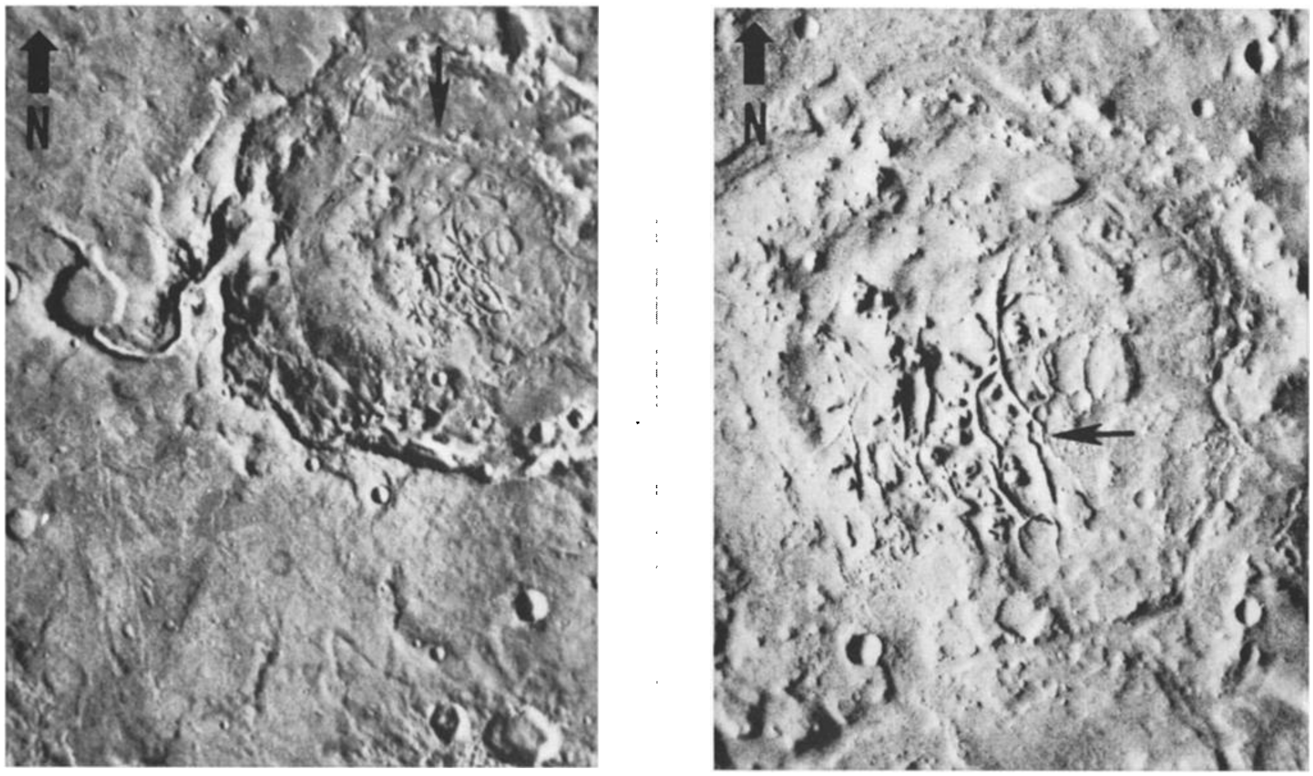

a b

Fig. 5. (*a*) Large (80 km diameter) crater containing narrow moat surrounding eroded floor (arrow). The western rim is breached by a sinuous channel. (*b*). Closer view reveals depressed central peak region containing knobby remnants criss-crossed by narrow ridges (arrow). The ridge system may represent exposed dikes related to an early stage of igneous intrusions. Viking frame 214A17 centered at 332°W, 28°N.

(Figure 7) and complex ridge systems (Figures 5 and 6*a*). The ridges may represent dike swarms related to an earlier phase of crater-controlled volcanism.

Figure 8 illustrates one further distinctive style of modification of two craters southeast of the Argyre basin in cratered plains material. The craters exhibit large differences in crater formation age but similar development of deep, arcuate depressions along the margin of the crater floor. In Figure 8*a* the arcuate moat breaks into elongate and subcircular depressions in the northeast quadrant, whereas the moat is discontinuous as two offset canyons in the southeast quadrant. Narrow radial fissures extend to the peripheral moat from an acentral irregular depression. A subtle dark ring encircles the structure and may be related to the formation of the moat. Where the moat is discontinuous, the crater floor exhibits little evidence for uplift. Therefore in contrast to lunar floor-fractured craters, the development of the moat resulted from collapse or removal of material. The time of moat development obviously postdates both the time of both crater formation and the time of crater inundation by smooth plains units.

The crater in Figure 8*b* is 150 km west of the example shown in Figure 8*a* and, in contrast, exhibits relatively well preserved ejecta deposits that superpose the surrounding plains. Within the crater, a deep arcuate moat cuts across the eastern floor margin, and in addition, a region of chaotic terrain has developed along the western floor margin.

The occurrence of similar styles of modification shown in Figure 8 in nearby craters exhibiting large differences in crater formation age further illustrates that the time of crater formation and crater modification are unrelated. Moreover, the relatively recent formation of the crater in Figure 8*b* indicates that the time of moat development was also relatively recent. The occurrence of such depressions in certain craters and not in others indicates that their development was localized by some selective process.

These common features suggest that modification of the craters is directly related to processes that are localized beneath certain crater floors but that generally are not related to the initial impact events. On the moon, such crater-controlled modification is interpreted as intrusions localized within the heavily brecciated zone beneath the crater floor [*Schultz*, 1976*b*]. A similar process is proposed for Mars, but the examples shown in Figures 2–7 also demonstrate the diverse styles of modification that appear to characterize specific regions. For example, a wide annular moat surrounding a central floor plateau and containing knobs or mesas typifies floor-fractured craters west of Deuteronilus Mensae (Figures 2*b*–4; see Figure 1). Several examples also exhibit plains material partly filling the moat. In contrast, a combination of tectonic processes and stripping of floor materials characterizes craters along the margins of the fretted terrains of Nylosyrtis Mensae (Figures 6 and 7).

The examples of martian floor-fractured craters shown in Figures 2–7 exhibit several common features. First, the modification process is typically restricted to the crater interior and commonly occurs within an annular zone between the floor margin and the crater rim. Second, modification occurs only in certain craters in a given region and affects impact structures ranging from highly degraded to well preserved. Third, floor-fractured craters typically occur in clusters. Fourth, they