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Compiled by
Henry E. Holt
NASA Office of Space Science
Washington, D.C.
DEFORMED IMPACT CRaters ON MARS.
Constance G. Andre and Farouk El-Baz, National Air and Space Museum,
Smithsonian Institution, Washington, D.C. 20560.

Deformation of fairly predictable geometric forms, like fresh impact
features, provides valuable information about the nature of Martian
surface and subsurface material and the forces that modify topography,
such as volcanism, tectonics, impact cratering and erosion. Several
types of crater deformation were observed in Viking I and II images. The
initial crater shape may be disfigured by meteoroid impacts, fissions,
faults, collapse, irregular slumping, differential fluid erosion,
differential eolian erosion, partial exhuming by wind or water, and lava
encroachment.

Crater deformation by fissures is common in the Claritas Fossae
region in the southern hemisphere of Mars. Numerous subparallel
fractures cross several generations of craters in these ancient uplands
south of Syria Planum (Fig. 1). The tensional fractures often dissect
the crater floors, limbs and ejecta. The most severely fractured craters are
elongated perpendicular to the trend of the fractures. Despite the
extreme linear segmentation, the impact structures remain. This suggests
an unusually strong and cohesive crustal material.

Deformation of crater interiors on Mars may be caused by substrate
processes. Figure 2 is an example of crustal conditions that cause the
interior of an impact crater to be most susceptible to mechanical
destruction. The floor of the crater is a disordered heap of angular
blocks characteristic of the chaotic terrain, which occurs mainly in the
equatorial areas of Mars between 10° and 50° longitude. Chaotic terrain
is believed to be caused by melting of subsurface ice and the collapse
of the surface layer (Sharp, 1973; Schultz and Flicken, 1979). It often
forms within impact craters. The deformed crater in Figure 2 shows that
with the exception of a few linear extensions, the chaotic material is
confined to the crater floor. If the breccia lens created below the
crater during impact directly overlies a weak subsurface layer, like
ice, it would destabilize the crater floor relative to the more competent
surrounding lithology.

A different form of deformation occurs within craters near canyon
walls. Figure 3 illustrates such a crater that is the locus of headward
erosion. The crater has been partially destroyed by mass wasting and
crater retreat. Craters like this one are not uncommon in the ridged
plains which resemble the flood basalts of lunar maria (McCauley, 1978).
Preferential deterioration of craters like this one may be a useful
indication of a less consolidated older surface surrounded by a more
coherent volcanic veneer that slows erosional processes.

Effects of differential eolian erosion are evident in the dissected
plateau of Acidalia Planitia (Fig. 4). The ejecta of impact craters are
only visible on the high ground in the center of the image. Ejecta
contours around craters on the plateau end abruptly at the edges of
scars. The importance of wind in the shaping of this landscape is
indicated by white streaks in the lee of craters in the low areas
(El-Baz and Maxwell, 1979). In addition, dark patches of irregular
Impact craters on Mars deformed by: (1) fissures; (2) undermining and collapse; (3) headward erosion; (4) differential eolian erosion.
shape which are usually accumulations of dunes (Mutch et al., 1976), are confined to low-lying areas on the wind side of scarps on the floor of the largest crater. The image also illustrates that unlike the cases in figure 2 and 3, the impact craters here are particularly resistant to the forces of eolian erosion prevalent in this area.

All types of crater deformation observed on Mars are highly dependent on geographic location. None of the types discussed occur on the Moon. For this reason, distorted impact crater forms contain important information. Although impact craters are common to all terrestrial planetary bodies in the solar system, modifications to crater morphology are likely to be a function of the nature of each planet, moon or asteroid.

References