Martian pit craters - Relation between pit diameter and crater diameter

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Among Martian complex craters, there are craters having interior features such as floor pits and summit pits. While these craters exist ubiquitous on icy satellites, they are uniquely conspicuous on Mars and rare on other terrestrial planets. The presence of pits has been attributed to interaction of the crater-forming process with a volatile component. However, the detailed process of pit formation has not been understood yet.

Through a research of Ganymede and Callisto, it was found that the pits diameter generally increases with crater diameter. A relation between the pit diameter D_pit and the crater diameter D for Ganymede (Passey and Shoemaker, 1982) is given;

$$D_{pit} = 1.9 \exp(0.023 D) ,$$

and for Callisto;

$$D_{pit} = 1.45 \exp(0.028 D) ,$$

where D_pit and D are both in kilometers.

Based on the result of analyses on Viking data by Wood et al. (1978), we derived a similar relation between D_pit and D for Martian pit craters;

$$D_{pit}(Mars) = (1.099 \pm 0.122)\exp\{(0.0348 \pm 0.0052)D\} .$$

The similar relation may indicate that the morphology of the pit craters, that is, the ratio of the pit diameter to the crater diameter, is related to the subsurface volatile content.

However, the part of Martian surface analysed by Wood et al. (1978) was limited and the number of the available data is not enough for further discussion. We report a result of our analyses on the data of Mars Global Surveyor to derive better relation between D_pit and D for Martian pit craters and to investigate the relation between the morphology of the pit craters and the subsurface volatile content.