**CENTRAL PIT CRATERS IN THE SOUTHERN HEMISPHERE OF MARS.** R. J. DeVries and N. G. Barlow, Dept. Physics and Astronomy, NAU Box 6010, Northern Arizona University, Flagstaff, AZ 86011-6010. rjd43@nau.edu; Nadine.Barlow@nau.edu.

**Introduction:** Central pit craters are craters with a central depression either on the floor of the crater or on a central uplift. Central pit craters are found only on bodies with volatile-rich crusts, specifically Mars, Ganymede, and Callisto, and thus target volatiles are proposed to produce these features. The main focus of this study is to determine the characteristics and distributions of central pit craters on Mars in order to constrain the possible central pit formation mechanisms. Several models have been proposed for the formation of central pits: (1) vaporization of target volatiles during crater formation and release of the resulting gases [1, 2, 3], (2) collapse of a central peak in a weak icy crust [4], and (3) excavation into a subsurface liquid reservoir [5, 6]. Results of this study for Mars are being combined with our on-going studies of central pit craters on Ganymede [7] and Callisto to define the environmental conditions under which central pits form and constrain the possible formation mechanism(s).

**Central Pit Craters in the Northern Hemisphere of Mars:** We have completed our survey of central pit craters in the northern hemisphere of Mars [8]. Central pit craters on Mars display two distinct morphologies: pits which occur directly on the floor of the crater ("floor pits") (Fig. 1) and those which occur on a central uplift or central peak ("summit pits") (Fig. 2). Floor pits are further subdivided into symmetric or asymmetric pits based on the planform of the pit. We identified 842 central pit craters in the northern hemisphere, constituting 6% of the 13,996 craters cataloged in this region. Symmetric floor pits constitute 60% of all central pit craters in the northern hemisphere, asymmetric floor pits are 4%, and summit pits are 36%. Although the study only included craters down to 5 km in diameter, smaller central pit craters were also seen. The upper diameter limit is 125.4 km. Central pit craters are seen from the equator up to 70°N latitude. Central pit craters display a range of preservational states, from very degraded to pristine, and are most commonly associated with the multiple layer ejecta morphology.

**Central Pit Craters in the Southern Hemisphere of Mars:** We are currently extending our study of central pit craters to the southern hemisphere of Mars. To date, we have identified 250 central pit craters using THEMIS daytime IR and visible imagery. We have measured the crater diameter and pit diameter using the software program JMARS [9]. JMARS is also used to determine the topographic profile across the crater, helping us determine whether the floor of the pit lies above or below the crater floor. If the pit floor lies above the crater floor, the central pit is classified as a summit pit. If it lies below the crater floor, it is classified as a floor pit. Cataloged information about each crater includes its latitude, longitude, crater diameter, pit diameter, type of pit (floor versus summit), and geologic unit.

Based on the analysis of the 250 central pit craters thus far identified in the southern hemisphere, we find that central pits occur in craters ranging from 10 to 44.3 km in diameter, well within the 5 to 60 km diameter size range previously reported in an incomplete study for all of Mars [10].

The ratio of the pit diameter ($D_p$) to the crater diameter ($D_c$) may provide insights into the concentrations of target ice involved in the production of central pits. For the 250 central pit craters thus far measured, the range in $D_p/D_c$ is 0.045 to 0.198 with an average of 0.0998 (standard deviation of 0.054). $D_p/D_c$ values for martian central pit craters tend to be smaller than the corresponding values for central pit craters on Ganymede [7], probably due to the lower ice concentration in the crust of Mars.

Table 1 shows example data for five floor pit craters in the southern hemisphere of Mars. Table 2 shows the same data for five example summit pit craters. Data for the 250 central pit craters is summaried in Table 3.

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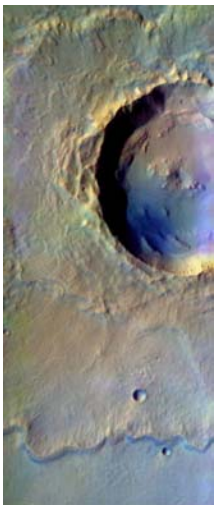

**Figure 1.** Example of a floor pit crater which is located at 319.2 E 28.4 N. The diameter of the crater is 15.76 km and the diameter of the pit is 1.17 km.

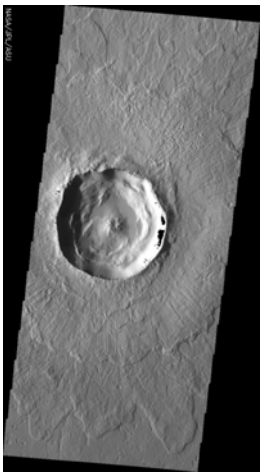

**Figure 2:** Example of a summit pit crater located at 190.7 E and 54.7 N has a crater diameter of 11.3 km and a pit diameter of .5 km.

**Table 1: Characteristics of Example Floor Pit Craters**

| | Crater 1 | Crater 2 | Crater 3 | Crater 4 | Crater 5 |
|---|---|---|---|---|---|
| Latitude (S) | 35.05 | 3.57 | 9.38 | 9.27 | 18.45 |
| Longitude (E) | 317.34 | 322.4 | 347.22 | 337.18 | 185.91 |
| Crater Diameter (km) | 29.0 | 15.2 | 20.9 | 20.5 | 39.9 |
| Pit Diameter (km) | 2.8 | 2.9 | 2.8 | 3.3 | 3.1 |

**Table 2: Characteristics of Example Summit Pit Craters**

| | Crater 1 | Crater 2 | Crater 3 | Crater 4 | Crater 5 |
|---|---|---|---|---|---|
| Latitude (S) | 16.42 | 10.27 | 4.80 | 1.09 | 16.43 |
| Longitude (E) | 202.18 | 204.45 | 193.70 | 293.44 | 202.18 |
| Crater Diameter (km) | 19.4 | 27.8 | 31.3 | 26.8 | 19.2 |
| Pit Diameter (km) | 1.4 | 1.8 | 2.3 | 2.1 | 2.3 |

**Table 3: Summary of Central Pit Crater Data**

| | Crater Diameter (km) | Pit Diameter (km) |
|---|---|---|
| Smallest | 10.3 | 0.5 |
| Largest | 44.3 | 7.3 |
| Average | 22.9 | 2.4 |