CRATER COUNTING AS A TOOL TO DERIVE THE TIMING OF PALEO-LAKES IN CENTRAL PIT CRATERS ON MARS. S. E. Peel[1] and D. M. Burr[1], [1]University of Tennessee, Knoxville (speel1@vols.utk.edu).

Introduction and Background: Central pit craters are craters that contain an approximately circular depression centered on the crater floor or in the central peak [e.g., 1 and 2]. These craters have been identified on many planetary bodies including Mars [e.g., 2-7]. The mechanism of their formation is still under debate, but most of the proposed formation mechanisms include interaction with water-rich materials in the impact target [5, 8-12].

Recent work identified 96 central pit craters, in Mars Reconnaissance Orbiter Context Camera (CTX) [13] and High Resolution Stereo Camera (HRSC) [14] imagery, that contain interior valley networks, many of which terminate into the central pits (Fig. 1) [15]. Of these craters, five were analyzed and found to contain outlet channels that drained the central pits (formed into the floors of the craters) out onto local lows in the crater floor and/or contain sedimentary fans that may be deltaic. Recently, the authors of this abstract have identified 59 of the 96 central pit craters as having well-preserved valley networks, many of which contain sedimentary fans that were not identified in [15] (e.g., Fig. 2).

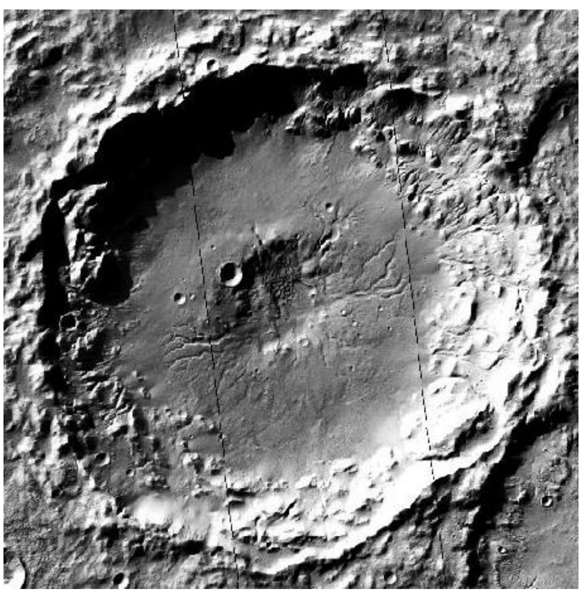

Fig. 1: Central pit crater (36°19’S, 158°12.5'E; diam. ~40 km) that contains well-defined pit valleys. (CTX images B18_016770_1429, B19_017192_1443, and B19_016981_1432; north is up)

Hypothesis: The hypothesis being tested through this project is that some central pits are paleo-lacustrine in nature. A necessary component of this work is to place these features into context within the history of previously identified water-related features on Mars. This abstract first briefly outlines the methods being used to test the paleo-lake hypothesis, and then describes the critical task of age-dating these features.

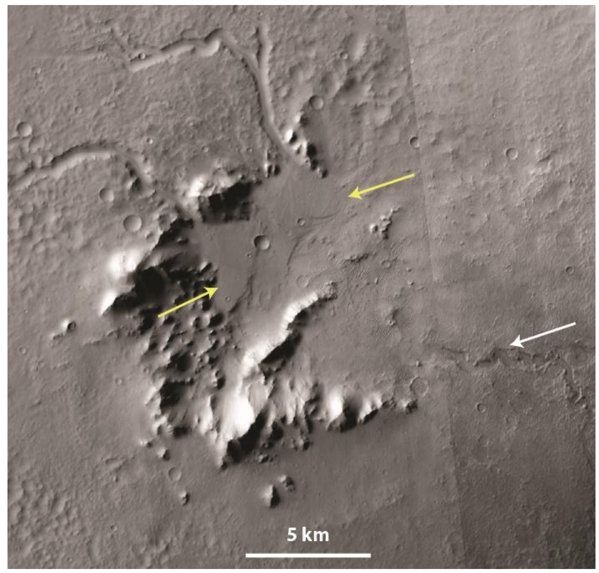

Fig. 2: Central pit with three clearly preserved valley networks, two of which terminate in the formation of sedimentary fans (yellow arrows). One valley to the SE (white arrow) does not form a distinct fan-shaped deposit at its terminus. (GoogleEarth imagery at 19° 8'S, 36° 2.3'E; NASA/USGS; north is up)

Testing of Potential Paleo-Lacustrine Features: We are basing any identifications of paleo-lakes off of a suite of morphologic evidence. Our analyses include (1) the measurement of radial profiles of sedimentary fans within the central pits, (2) the measurement of the orientations of the slopes of potential outlet channels, and (3) the checking for diagnostic sedimentary structures associated with a lake depositional system.

Intended Age-Dating Methods: The methods to be employed for the age-dating of these features are in two main stages, both of which will be conducted in ArcGIS using the CraterTools program [21] with the Neukum Production Function [22]. The first stage is to identify the ages of the craters within which the central pits (and their potential paleo-lakes) formed.

Identification of maximum crater ages will be accomplished in two ways. The first is by identifying the ages of the geologic unit in which the craters formed. These ages will be taken from the Tanaka et al. [16] geologic map of Mars. The second method for the age-dating of these craters is through crater counting on the host crater layered ejecta deposits [e.g., 17], where preserved [15]. The above methods will define a maximum age for the fluvial and potential paleo-lake features. These counts will be conducted in CTX imagery to allow for maximum coverage of the ejecta deposits.

The second age-dating method to be employed for the paleo-lakes is through crater counting on the fluvial and sedimentary deposits associated with the paleo-lakes. Where the deposits show clear signs of erosion, careful consideration will be taken to assure the crater counting is limited to the uppremost continuous surface, thus preventing contamination of counts from older surfaces. High Resolution Science Experiment (HiRISE) [20] imagery will be used to assure the highest possible crater population is utilized.

Because these areas are small, the counts for individual fluvial and pit fan deposits (which should have formed near in time if not concurrently) within a crater will be combined in order to get a statistically robust age estimate for each crater [18 and 19]. An important question that needs to be ascertained is *How robust will these small area age estimates be?* It is my goal at this meeting to learn how to go about answering this question and I look forward to any input and recommendations from the impact cratering communittee on any of the age-dating methods I have listed.

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