THE ALLUVIAL FANS OF SAHEKI CRATER.

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Introduction: Alluvial fans are one of the few depositional (as opposed to erosional) fluvial features on the Martian surface and as such have the potential to provide key insights to our understanding of Mars' water history. Numerous fans have been identified, ranging in length from sub kilometer [1] to tens of kilometers [2,3]. We conducted an intensive study of the large fans in Saheki crater, located within the southwestern Tyrhenna Terra. Recent high-resolution data has allowed for new insights into the details of these fans. We use CTX and HiRISE stereo coverage, along with MOLA and THEMIS IR data to map, crater-date, and estimate the prevalent hydrology present during fan formation.

Morphology: There are two prominent fans in Saheki crater, which we have labeled K1 and K2. K1 is on the north side of the crater and covers 714 km^2 . K2, located on the western side of the crater, covers 722 km^2 and is considerably more wind-eroded than K1. Stratigraphic relations between the two fans suggest that they formed concurrently. Both fans are completely imaged by CTX. In addition there are three stereo-pair HiRISE images, from which we have made digital elevation models (DEMs). The fans are covered with narrow, gently sloping ridges, which we interpret as exposed relatively coarser channel-bed sediments left behind after wind has removed the surrounding finer and more friable overbank sediments .

The K2 fan has some of the best-preserved inverted channels of any fan in the Tyrhenna Terra region. We mapped the K2 fan into several distinct units based on inverted channel continuity, relative elevations of channel ridges, and the amount of aeolian degradation. A simplified version of this map is provided as [Fig. 1]. Although they are distinct from one another, the K2 units are not as clearly defined as lobes on smaller fans on Mars. The K1 fan does not have the inverted channels seen on K2 and cannot be mapped in such detail.

Some sections of channels have been removed by wind erosion, implying that bedload material was fine grained. In addition, there is no evidence of boulders from HiRISE images, leading us to the conclusion that the channel beds are predominately fine-grained (sand to granule) sediment..

Crater Statistics: Using a CTX basemap (resolution of ~6 meters/pixel),we counted all craters larger than 50 meters in ArcGIS on the two fans to acquire both relative ages between fan units and absolute ages of the fans themselves. Absolute ages were obtained with [4] software, using the chronology function of [5] and the production function of [6].

The K1 surface appears to be pristine enough that crater counts can be used to acquire an approximate absolute age of fan formation. Craters indicate that the fan formed in the late Hesperian to early Amazonian, which is comparable to ages obtained by [7] for alluvial features near Holden Crater, but inconsistent with the late Noachian ages derived by [8] in Harris Crater, located 250 km to the west of Saheki. Plots for the K1 and K2 fans are included as [Fig. 2]. We will be conducting crater analysis of other nearby fan systems in order to determine patterns of formation time. The extensive erosion that has taken place on the K2 fan has erased much of the cratering record. Craters that do remain are localized on the less-eroded ridges.

Hydrologic Modeling: We mapped numerous stretches of inverted channels on the K2 fan, ranging in width from 7-180 m with an average of 41m and a standard deviation of 29m. Rather than using these to calculate paleoflows, we identified three separate channel reaches with what appears to be natural levees [Fig. 3]. These should provide a good estimate of paleochannel width since they represent locations where the channel has not laterally migrated significantly or been significantly wind-eroded. These range in width from 15-30m. Channel depth is calculated based on slope and an assumed sand grain size. Slopes were obtained from our HiRISE and CTX-derived DEMs (where available) or MOLA data. As outlined in [9], we use both the Manning and Darcy-Weisbach relations to get discharge values. We calculate discharges ranging between 2-6 m^3/s, which are comparable with values obtained for similarly sized fans in the Atacama Desert, Chile [10]. These will provide starting points for our subsequent computer modeling of fan formation.

Conclusions: We use stratigraphic relationships along with the continuity of similar landforms to map out the alluvial fans in Saheki crater. Crater statistics give an age in the early Amazonian, which is in line with estimates made on other fan systems on Mars. Basic hydrologic modeling gives estimates of discharge that will be used for landform modeling.

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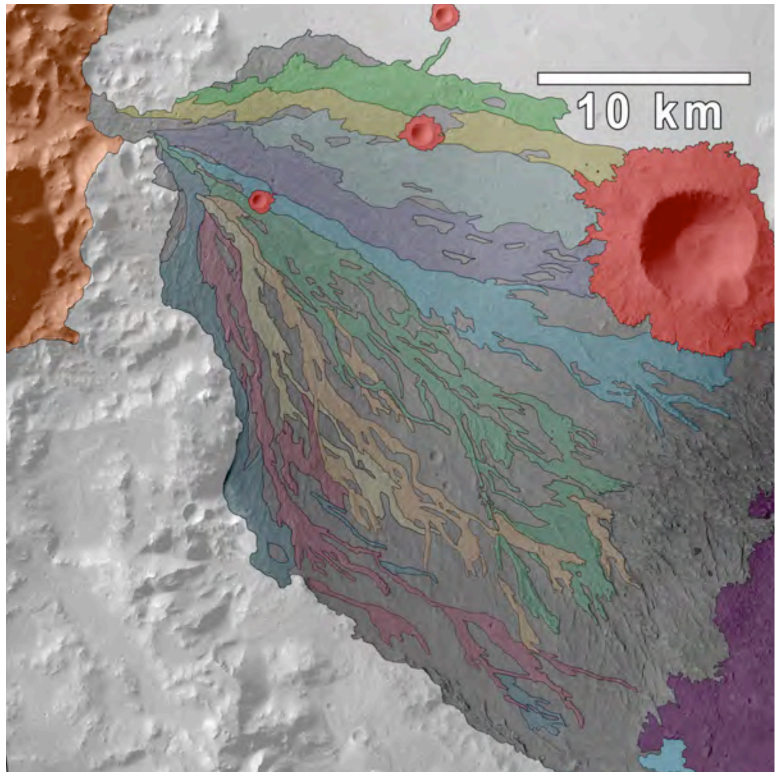

Fig. 1 (top): Geomorphic map of fan K2 in Saheki Crater. Colors show distributaries of related age as inferred from branching pattern and relative elevations. Light orange (to left) is the source basin, red shading shows superimposed crater ejecta, white is undifferentiated units (uncertain relative ages and relationships), blue (at bottom right) is the crater floor, and uncolored areas are unmapped. Base map is CTX mosaic.

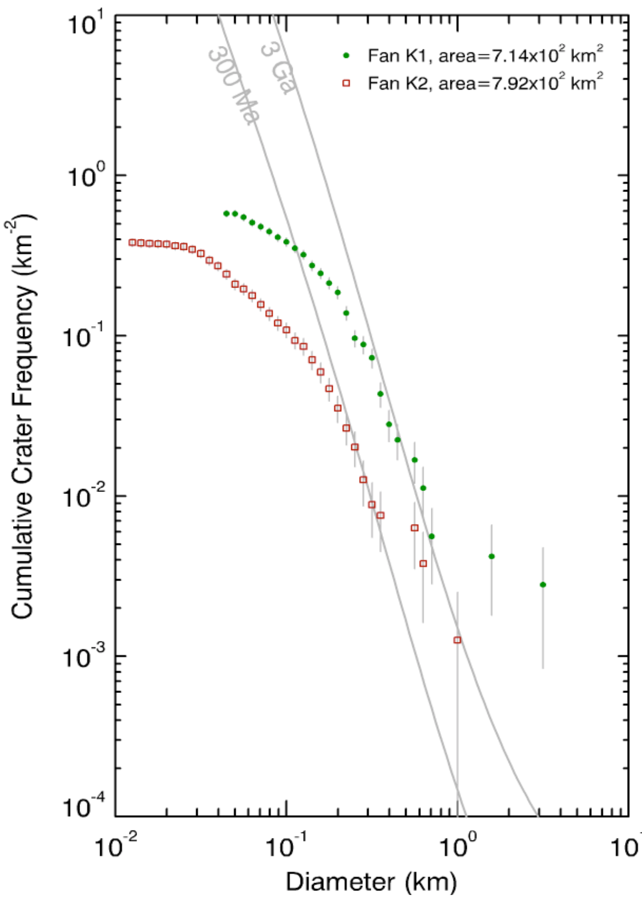

Fig. 2 (right): Crater counts for Saheki Crater fans. 3GA and 300Ma isochrons superimposed for reference.

Fig. 3 (below): CTX image of paleochannels on the K2 fan, Saheki crater. Note 40 meter wide natural levee trending from top left to bottom right.