DISTRIBUTION AND ORIENTATION OF ALLUVIAL FANS IN MARTIAN CRATERS. E. R. Kraal[1], J.M. Moore[2], A. D. Howard[3], E. I. Asphaug[1] [1](Department of Earth Sciences, University of California Santa Cruz, 1156 High Street, Santa Cruz, California, 95064, ekraal@es.ucsc.edu, asphaug@es.ucsc.edu), [2](NASA Ames Research Center, MS 245-3, Moffet Field, CA 94035-1000, jeff.moore@nasa.gov), [3](Department of Environmental Sciences, University of Virginia, 291 McCormick Rd., PO Box 400123, Charlottesville, VA 22904-4123, alanh@virginia.edu).

Overview: We present the results of the complete survey of Martian alluvial fans from 0-30° S, initiated by Moore and Howard [1]. Nineteen impact craters contain alluvial fans. They are regionally grouped into three distinct areas. We present our initial results regarding their distribution and orientation in order to understand what controls their formation. Since alluvial fans are formed by water transport of sediment, these features record 'wetter' episodes of Martian climate. In addition, their enigmatic distribution (in regional groups and in some craters, but not similar adjacent ones) needs to be understood, to see how regional geology, topographic characteristics, and/or climate influence their formation and distribution.

Alluvial Fans: Fan deposits are formed by the deposition of sediment from a shifting source (such as a stream migrating over the deposit) and are recognized by their cone-shape morphology. Fans are well studied on Earth and form in many conditions from large underwater deposits at the mouths of rivers to sub-aerial gravity driven flows. This continuum of formation processes produces slight variations in morphology (such as slope, area, and basin size) that can be used to distinguish the formation process as well as information about the sedimentary system (for review see[2]).

Features in some craters on Mars, discovered in THEMIS daytime IR images and MOLA topography, have the same cone shape as terrestrial alluvial fan deposits. Comparison of fan statistics such as fan gradient, fan area, and basin area to statistics of terrestrials fans indicates that Martian fans follow the same approximate trends and compare well to very large terrestrial alluvial fans with possibly finer sediment size and lower sediment concentrations [1].

Fans in Martian Craters: Alluvial fans form because of the abrupt transitions from steep, eroding catchments to low gradient, depositional basins. Over the abrupt transition, the stream power drops significantly and causes deposition of the stream bed load [2]. Impact craters provide the ideal topographic setting for the formation of alluvial fans. There is an abrupt change in slope from the high, steep rims to the shallow, low crater bowls. We have searched for alluvial fan in other areas on Mars, such as Valles Marineris, and have not yet identified any candidate deposits. To date, the only alluvial fans on Mars have been identified in crater rims.

Distribution: Our completed survey results confirm the initial results of Moore and Howard[1]. All alluvial fans are located in craters south of 18° and from -40° to 85° E. Within this large group, there are three distinct regional groups of craters containing alluvial fans, the southern portion of Margaritifer Terra , Southwestern Terra Sabaea, and Tyrrhena Terra.

Orientation: In an effort to understand the factors controlling the formation of these fans, we examine the orientation of the fans from crater rims. Figure 1 shows the orientation of fans in the three regional groups. Though the average fan emerges from the northwest rim of the crater, there is a great deal of spread in the data. Some areas, such as Figure 1A (Margaritifer Terra) have a more distinct orientation pattern. While others, such as Figure 1B (Terra Sabaea) have a wider spread in the orientation. In the case of the craters in Terra Sabaea, the orientations are dominated by a crater system of fans spilling into three a joining craters. The majority rest of the fans in the Terra Sabaea region are below MOLA topographic resolution, and therefore, are not included in the orientation statistics.

Continuing Research: We are in the process of completing a global survey. In addition, we are collecting more data on the crater statistics, regional geologic setting, and orientation patterns to understand the mechanisms controlling alluvial fan formation. The formation of alluvial fans on earth is controlled by tectonic, climatic, and geologic conditions. The same is likely true on Mars. Therefore, by understanding their formation, we will gain insight into the climate history of Mars.

References: [1] Moore, J. M. and A. D. Howard (2005). "Large alluvial fans on Mars." Journal of Geophysical Research (Planets) **110**(E4): E04005 dio: 10.1029/2004JE002352. [2] Harvey, A. M. (1997). The role of alluvial fans in arid zone fluvial systems. Arid Zone Geomorphology: Process, Form, and Change in Drylands.

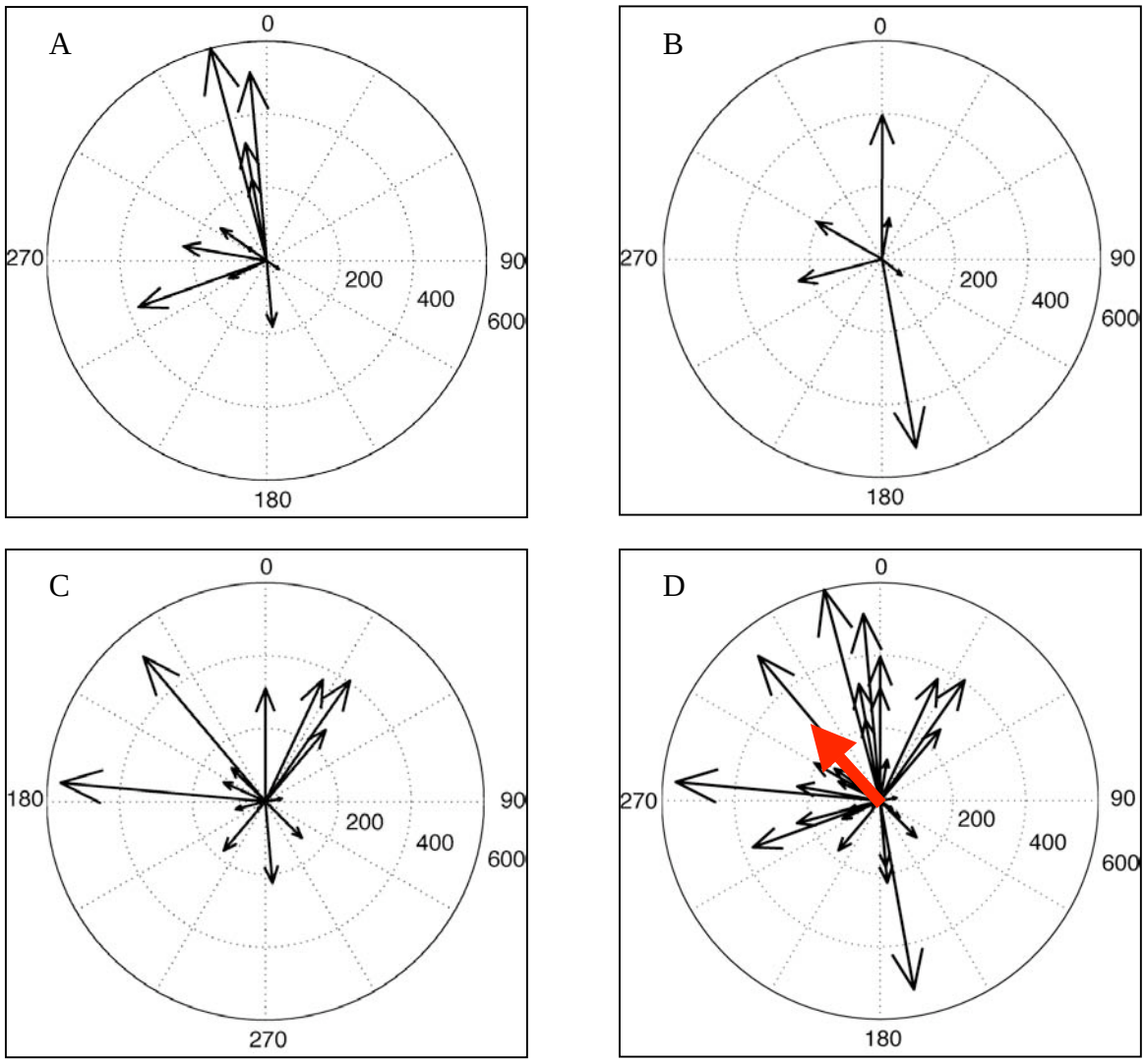

Figure 1: Fan Orientation of Alluvial Fans in Martian Craters.
Arrows point to the direction of emergence of the fan from the crater rim. Their length scales with area of the fan apron. North is up in all cases and area of fan is in km. The only fans included are those above MOLA topographic resolution (see Moore and Howard, 2005). The fans are plotted according to their regional groups. Figure 1A is in located in Southern Margaritifer Terra. Figure 1B is located in Southwestern Terra Sabaea; the extreme variation in this data is because there is only one set of fans above MOLA resolution. It is a system of fans in three ajoining craters. Figure 1C located in Tyrrhena Terra, just north of the Hellas Basin. Figure 1D show the complied data. Average fan is indicated in red. The average fan is 250 km^2 and originates from the northwest rim of the crater (300°).