Geophysical Research Abstracts
Vol. 16, EGU2014-16841, 2014
EGU General Assembly 2014

Mechanisms and Timescales of Fluvial Activity at Mojave and other Young Martian Craters

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Mojave crater, and five other relatively young Late Hesperian to Amazonian-age martian craters exhibit channelized alluvial fans that are sourced from bedrock-eroded catchments. These catchments emerge from the crests of sloping surfaces, suggesting a formation mechanism that involved precipitation. The evidence for fluvial activity at all six craters is restricted to their interiors and the immediate surrounding regions. Detailed mapping at Mojave reveals the highest density of channels, catchments and fans interior to the crater. Similar landforms are identified outside of the crater, but not beyond $\sim$200 km from the rim. Irregular pits on the floor of Mojave, interpreted as degassing structures from hot impact melt, directly superpose several fan surfaces, and partly destroy the fan toes. This suggests that sediment was mobilized immediately after crater formation, while the crater was still hot. Based on the patterns and timing of channel-fan development at all six craters we favor several hypotheses for the precipitation mechanism: (1) snowfall and melt on young, hot impact craters, (2) impact plume precipitation, and (3) degassing of volatiles from impact melt terrain. Scenario (1) suggests a different global or regional climate relative to modern conditions, requiring equatorial and mid-latitude snowfall accumulation. Scenarios (2) and (3) do not necessarily require unique climate conditions, as water may have been mobilized from the target or the impactor.