Geophysical Research Abstracts, Vol. 8, 02948, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02948

Possible origins for fluidized ejecta on Mars: Implications for water and climate on Mars.

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Unlike many craters on the terrestrial planets, those on Mars possess ejecta that travel along the surface as a ground hugging flows. Three possible hypothesis have been proposed to explain the origin of such fluidized ejecta. We will review them, focusing in particular on the granular flow origin. Which thesis truly explains their origin still remains in question. We will also discuss the implications of each one of these models for the presence of water and climatic change on Mars.

Of the three possible hypotheses that exist for the formation of fluidized ejecta on Mars, the first two have been discussed extensively in the literature and are only briefly reviewed here. They include impacts into a volatile rich-target, or entrainment and deposition of ejecta by the martian atmosphere. In both cases ground hugging flows are ultimately generated resembling either a water-laden debris flow in the case of the volatile model, or a gravity current in the case of the atmospheric model.

A granular flow model is a third possibility. In this intriguing model, ejecta are excavated and emplaced ballistically, but then slide as a dry granular flow. Such granular flows describe well the behavior of many massive landslides, which, because of the presence of cobbles and boulders, do not retain water or air. A simple 3-D Distinct Element Model shows that flow occurs when the target surface is either smooth or slightly erodible, or when the friction coefficient between grains is small. The properties of the target surface is a factor that has not been considered previously, and could explain the difference between craters on Mercury and the Moon, and Mars.

All these models have important implications for climate change and the past presence of water on Mars. For instance, the granular flow model could indicate differences in

the target surface properties on Mars which are heavily influenced by sedimentary processes that result from past climatic and fluvial processes.