

**MARTIAN OUTFLOW CHANNEL FORMATION BY WATER EROSION
UNDER NONEQUILIBRIUM CONDITIONS**

K.A. McGeehan, Dept. of Geology, Southern Illinois University, Carbondale, IL 62903
S.A. Schumn, Dept. of Earth Resources, Colorado State University, Fort Collins, CO 80523
R.S. Robinson, Dept. of Physics, Colorado State University, Fort Collins, CO 80523

An experimental study was carried out in a 2.4m by 4.9m cylindrical vacuum chamber in order to investigate the possibility that martian outflow channels were formed by the melting of ground ice. Frozen soils that were subjected to an increased geothermal gradient at temperatures about 273K and at an average pressure of 8.38 mbar, melted and formed water-filled depressions and outflow channels. The depressions formed as a subsurface ice layer thawed. Water initially appeared at the surface either during gradual collapse of the surface material or as geysers. The mode of appearance of water at the surface was a function primarily of the strength of the ice and the temperature of the water vapor.

Geysers occurred when pressure built up in the subsurface due to phase changes of water from solid to liquid and vapor. No channels formed during experiments with initial geyser events because most of the available water was expended during geysering. The morphology of the resulting landform was similar to pseudocrater morphology on Mars. Geyser-like occurrences, therefore, may explain the presence of some pseudocraters on Mars.

Water usually appeared as a moist area which gradually expanded. Small holes formed and gradually coalesced until one large water-filled depression existed. Water eventually spilled over the side of the depression and flowed downslope, carving a channel into the pure ice layer.

Comparisons of the morphologic characteristics of the experimental channels to martian outflow channels show many similarities. Like the martian channels, the experimental channels were broader and deeper near the source, becoming shallower downstream. No obvious deposition of eroded material was observed.

Results of experiments to simulate the formation of martian outflow channels indicate that the channels could have formed under current martian climatic conditions. Water could have been derived from the melting of ground ice by heat emitted from a magma intrusion (1).

Some authors have suggested the necessity of some protection of the flowing water, such as an ice layer (2) or an ice fog (1). Although nonequilibrium conditions existed, channels were carved into the surface material. No ice formed over the water flowing in the experimental channels. The processes observed in the vacuum chamber may also have occurred on Mars.

References

1. Masursky, Harold, J.M. Boyce, A.L. Dial, G.G. Schaber, and M.E. Strobell (1977), JGR 82:4016-4038.
2. Wallace, David, and Carl Sagan (1979), Icarus 39:385-400.