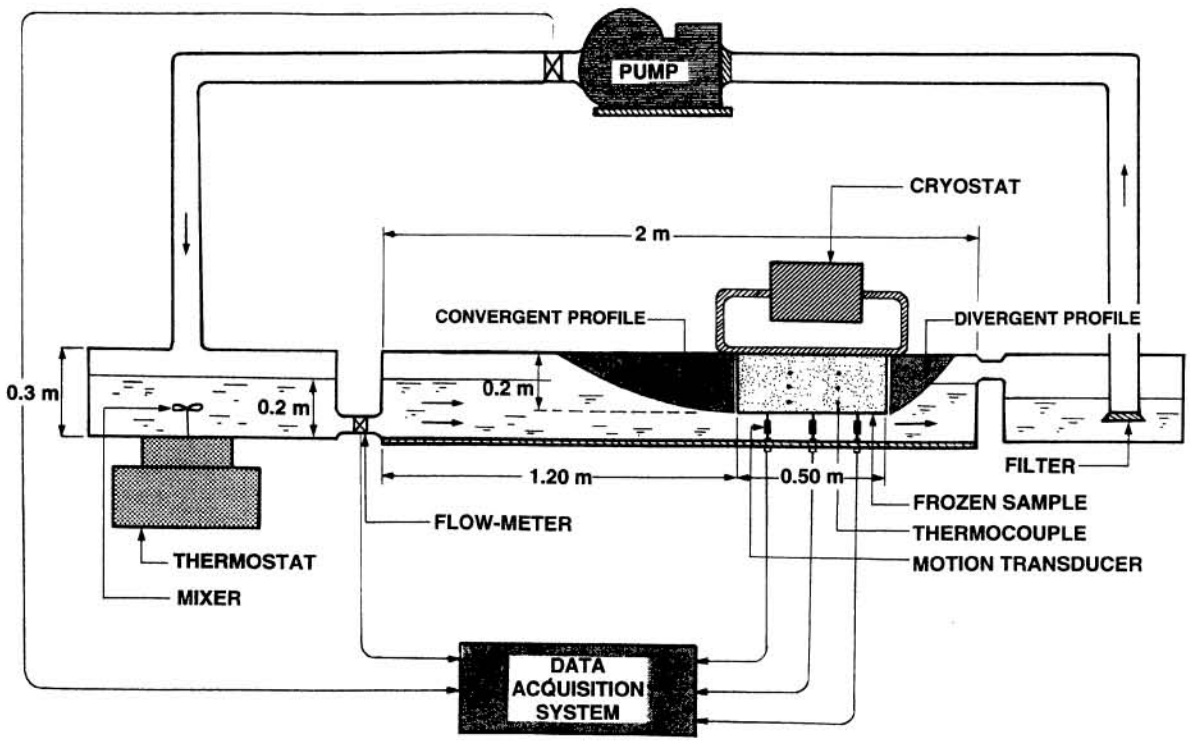
MARTIAN FLUVIO-THERMAL EROSION: EXPERIMENTAL PROJECT. **J. Aguirre-Puente, F. Costard and N. Makhloufi. Centre de Géomorphologie, CNRS, rue des Tilleuls, 14000 Caen, France.**

Introduction: Fluvio-thermal erosion on Mars has been proposed by F. Costard (1), based on a comparison between Martian outflow channels and fluvial outbursts in Siberia. These analogies leads to the hypothesis that Martian outflow channels were eroded by the action of liquid water against a ground ice. The dynamics of these flows under cold climate induces the propagation of a thawing line in the ground ice and a fast bank recession (~25m/year) with removal of sediments (2). Our research program has been essentially focused on the modeling of some periglacial processes in a Martian environment. Generally, the modeling of an erosional process is difficult because it is the result of an interaction of several elementary phenomena. An ablation model with immediate removal of sediments has been first proposed (3,4,5). An experimental study must complete our theoretical approach. Despite the limits of the preliminary tests, the study of the thermal erosion will allow to better understand both, the Martian thermokarst and outflow channel formations. This paper presents the designed experimental device.

Conception of the experimental setup: The purpose of the experimental study is to measure the propagation of the thawing line in a simulated Martian ground ice and the thermal erosion rate. A general overview of the experimental configuration is presented in the included figure. To test our theoretical fluvio-thermal modelisation (ablation model), we propose to built a hydraulic channel in a small scale. The flow must erode a frozen rectangular block (about 0.5x0.3x0.2 m) supported by a mechanical framework. The frozen sample, in thermal contact with the water during the experimentation undergoes a strong thermal action. The channel discharge has been calculated to be enough to produce a turbulent regime and to insure the immediate removal of the thawed sediments. The velocity near the ground ice sample is about 0.8 $m.s^{-1}$. To obtain these conditions, the upstream comes from a water thermostated tank. A pump insures the recycling of the water. Temperature measurements will be done with regularly spaced thermocouples. A data acquisition system will insure the information acquisition and the control of the experiment. The hydraulic channel will be located in the freezer hall facility (18 x8x5 m) in view to conduct the experiment under controlled conditions (mean air temperature: about -10°C). We plan to perform this experiment with a ground ice temperature of -5°C; later, more various temperatures and sophisticated compositions and porosities will be introduced. A water temperature of 1°C and 5°C will be used.

Conclusion: This paper presents the thermo-mechanical study necessary to conduct a fluvio-thermal simulation. Measurements will be confronted with our previous ablation model and with terrestrial measurements in Arctic regions. If this first experimental study agrees with theory, the estimations of thermal erosion rate for Martian outflow channels will be reliable. The experimentation will give us necessary elements to refine the studies and to conduct the experimental study in a simulated Martian environment (6) - DLR Space Simulator, Germany -. Our recent insertion in the Martian Simulation Group (with German and Russian scientists) allows us to consider this type of experimentation.

This work is supported by Programme National de Planétologie de l'Institut National des Sciences de l'Univers (CNRS, France).



General overview of the experimental study.

Water temperature : T= 5°C and T = 1°C
Ground ice temperature : t = -5°C
Channel cross section : 0.3 m
Channel discharge : Q = 24 l s^{-1}
Water velocity in the channel : v = 0.4 ms^{-1}
Water velocity beneath the frozen sample: v = 0.8 ms^{-1}
Reynolds number: Re = 3 10^5

References : (1) Costard F. (1989) LPSC XX, 189. (2) Are F.E. (1983) Proc. 4th Int. Conf. on Permafrost, 24. (3) Aguirre-Puente J., Costard F. and Posado-Cano R. (1990) LPSC XXI, 7. (4) Aguirre-Puente J., Costard F. and Posado-Cano R. (1993) LPSC XXIV, 5. (5) Aguirre-Puente J., Costard F. and Posado-Cano R. (1994) submitted to Icarus. (6) Möhlmann D. and Kochan H. (1993) Workshop on the Int. Coord. of the Expl. of Mars, IACG, Wiesbaden, 29.