MARS: PRELIMINARY ESTIMATES OF RATES OF WIND EROSION BASED ON LABORATORY SIMULATIONS. *R. Greeley and S.H. Williams, Department of Geology and Center for Meteorite Studies, Arizona State University, Tempe, AZ 85281.*

Ample evidence exists for aeolian erosion and deposition on Mars. Prior to Viking, relatively high rates of erosion by windblown particles had been predicted (1), based partly on the observations of frequent dust storms and the fact that the particles should be highly energetic because they would be driven at high velocities by the order-of-magnitude stronger winds required to set them into motion. Furthermore, the decrease in possible atmospheric "cushioning" in the low density atmosphere of Mars might enhance the rate of erosion (2). However, one of the surprises from the Viking Mission was the apparent low rate of wind erosion evidenced at the Viking landing sites (3). A recent estimate (4) suggests a rate on the order of a millimeter per million years based on preservation of surface features and ages derived from impact crater statistics.

In order to determine rates of aeolian erosion on Mars, three general parameters must be known: 1) erosive effectiveness of windblown particles under martian conditions, 2) material properties of martian rocks and minerals as related to resistance to aeolian erosion, and 3) near-surface meteorological conditions on Mars (wind speeds, duration, etc.). The first two general parameters can be investigated in wind tunnels and through other laboratory simulations; the latter parameter can be obtained from the Viking meteorology experiments, at least for the areas around the landing sites. In this report, we present preliminary data from laboratory simulations of aeolian erosion on Mars and combine the results with early Viking meteorology data to estimate a rate of erosion.

The **Rotating Arm Mars Erosion Device** (RAMED) consists of a holder for various rock samples at the end of a rotating arm and a sand hopper from which sand can be dropped into the path of the target (fig. 1). Atmospheric pressure and composition, impact particle size and quantity, target composition, and impact velocity can all be controlled. The sample is weighed before and after each run, the data being plotted as target mass lost per impacting mass, a unitless parameter, as a function of impact velocity and rock type. Quartz sand was used as the impacting material. Its size range was 120-180 microns, the size most easily moved by martian winds (5). RAMED results for a variety of rock types are shown in fig. 2; as expected, different rocks have different resistences to erosion, reflecting grain and crystal size, bonding, composition, etc., with rhyolite and obsidian being relatively resistant, and sandstone being relatively susceptible to erosion. For particles in the 120-180 micron size range impacting at relatively low velocities ($\sim$10m/s), the mass lost from the target rock is on the order of 10^{-4} of the impacting mass and 10^{-6} of the impacting kinetic energy. An approximate erosion rate can now be calculated using the equations presented by Sagan (1). However, several values must be changed to reflect Viking data and the laboratory simulations. The frequency of winds of sufficient speed to cause particle saltation is several orders of magnitude smaller than that used by Sagan (6). In addition, the mass lost from the target per unit impacting KE is on the order of 10^{-6}, rather than 10^{-4}. A preliminary determination of flux for a saltating cloud was obtained at the MARSWIT facility in 1977 (7). When the results are scaled to Mars, the number density of particles becomes approximately 10^{-5} particles cm^{-3}. With these refined values, the rate of erosion is found to be about a millimeter per million years and is in general agreement with the estimate of Arvidson *et al* (4), based on a completely different technique.

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The result presented here is preliminary. Additional experiments are in progress to refine these data; it is also hoped that additional meteorological data will become available regarding wind strengths and frequencies.

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(7) The Martian Surface Wind Tunnel (MARSWIT) is a facility at NASA-Ames Research Center capable of operating in the wind velocity range and atmospheric pressures comparable to Mars. Saltating flux experiments were conducted at one atmospheric pressures by J. Burt in 1977.

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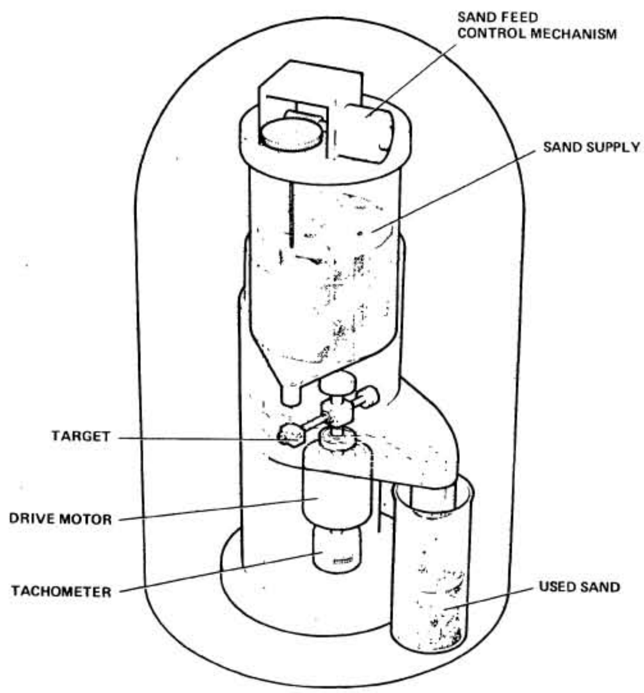

Figure 1 RAMED (Rotating Arm Martian Erosion Device) used for simulation of aeolian erosion on Mars. Device is about 0.5 m high and is placed in a bell jar (as depicted) for experiments run at low pressure and in a CO_2 atmosphere. Target (rock sample) rotates to impact sand grain at a controlled velocity.

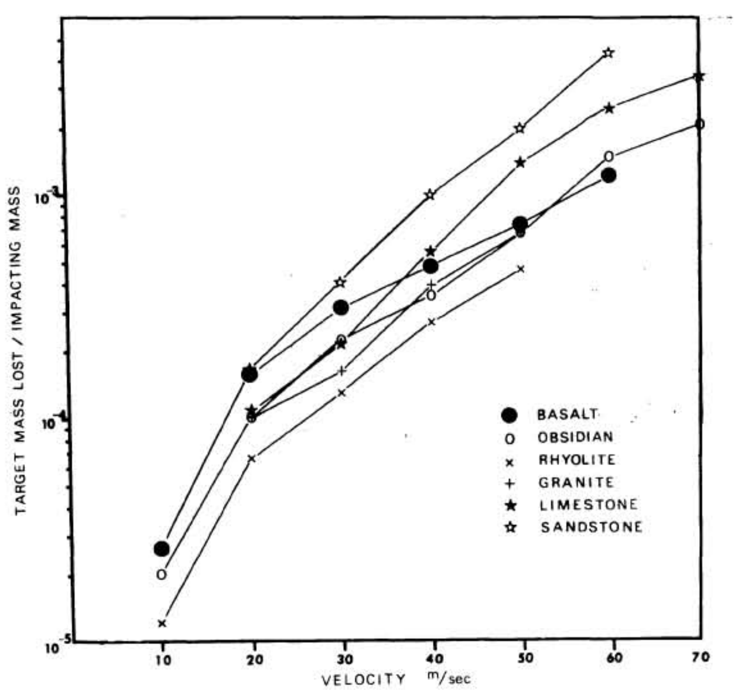

Figure 2 Erosion of 6 rock types as a function of simulated aeolian abrasion. Tests were done at martian pressure (~ 3mb). The impactors were quartz sand in the 120-180 micron diameter range.