VENUS: COMPOSITIONAL AND MECHANICAL EFFECTS FROM WINDBLOWN GRAINS; ***R. Greeley, J.R. Marshall**, Department of Geology, Arizona State University, Tempe, Arizona 85287, and **J.B. Pollack**, NASA-Ames Research Center, Moffett Field, CA 94035.*

Several investigators have speculated on the possibility of wind erosion on Venus (1). Although winds of sufficient strength to move particles are documented (2) and many investigators suggest active aeolian processes (3), the style and efficiency of erosion are open to question. In order to address this problem, the Venus Simulator was fabricated (4); it is capable of simulating abrasion of materials by windblown particles under the full range of venusian conditions of atmospheric temperature, pressure, and composition. The Venus Simulator propels sand or pebble-sized particles with controlled velocity and periodicity against rock targets in a carbon dioxide atmosphere at temperatures up to 770 K and pressures up to 114 bar. These conditions are achieved in a pressure vessel which has an internal volume of 0.05 m^3. The vessel contains a 7-cm diameter, 75-cm long, tubular furnace which provides an electrically-heated gas reservoir. An abrasion device is inserted through the center of one of the end flanges into the reservoir and is viewed through a 5-cm thick quartz window. Illumination of the device is through a light pipe at the opposite end of the pressure vessel. A gas-pulsing system produces rapid-cycle release of internal pressure, and in so doing causes gas to be drawn into the reservoir through a 2-cm long gas gun in the abrasion device. This flow propels particles at a rock target situated directly in the gas chamber. Pressure in the vessel is maintained by a gas-intensifer system. The flowing gas is at the same temperature as the impactor and the target.

A preliminary series of test was run (Table 1) in which basalt and olivine grains 3-mm in diameter were blown at velocities of 0.5-0.7 m/s against a basalt target under atmospheric pressures ranging from 20 to 62 bars. These conditions are appropriate for particle motion by gentle venusian winds at elevations ranging from the mid-level plains to the summits of mountains on Venus. Experiments were also run using the same materials at near-terrestrial conditions for comparison. The surfaces of both the impactors and the rock targets were analyzed via SEM after each run; compositional effects were assessed using a Kevex multichannel x-ray analyzer attached to the SEM. The surface of the target was assessed using a Tencore Alpha-step 200 profilometer. This device traverses the surface with a diamond stylus and converts vertical stylus motion into an electronic signal used to derive the profile with a vertical resolution of 5 nm.

Preliminary results show that particles are abraded even at the very low impact velocities likely to occur on Venus. However, the same particles do not produce abrasion of target rock surfaces at impact velocities of less than 1 m/s. Instead, comminuted debris from the particles is transferred to the rock surfaces to form an accretionary layer of material several microns thick. The lack of rock abrasion is interpreted to be a function of low-impact velocity and the development of the accretionary layers is considered to be partly a function of the high temperatures found on Venus. It is concluded that rolling or low-velocity saltation of pebble-sized material on Venus will lead to gentle attrition of the moving material, but that rock surfaces encountered during transport will bear the traces of impact in the form of friable surface deposits. Thus, there is a transfer of material from the windblown grains to the rocks exposed on the surface which may act as mechanical or chemical buffers to weathering processes. Moreover, caution must be exercised in using measurements of surface compositions which may involve a mixture of "bedrock" and accretionary layers resulting from the impact of windblown material of possibly different composition.

REFERENCES

1. Barsukov, V.L., Khodakovsky, I.L., Volkov, V.P., and Florensky, K.P., 1980, The geochemical model of the troposphere and lithosphere of Venus based on new data, *COSPAR Space Res.*, *20*, 197-208.
2. Antsibor, N.M. et al., 1976, Estimates of wind velocity and turbulence from relayed Doppler measurements of the velocity of instruments dropped from Venera 9 and Venera 10. Translated from *Kosmicheskie*

VENUS: EFFECTS FROM WINDBLOWN GRAINS
Greeley, R. et al.

Issledovaniya, 14, 714-721; Avduevskii, V.S. et al., 1976, Measurement of wind velocity on the surface of Venus during the operation of stations Venera 9 and Venera 10. Translated from *Kosmicheskie Issledovaniya, 14,* 710-713; Counselman III, C.C., Gourevitch, S.A., King, R.W., Loriot, G.B., and Prinn, R.G., 1979, Venus winds are zonal and retrograde below the clouds, *Science, 205,* 85-87; Kerzhanovich, V.V. et al., 1979, An estimate of the wind velocity and turbulence in the atmosphere of Venus on the basis of reciprocal Doppler measurements by the Venera 11 and Venera 12 spacecraft. Translated from *Kosmicheskie Issledovaniya, 17,* 690-696.

3. Greeley, R., Iversen, J., Leach, R., Marshall, J., White, B., and Williams, S., 1984, Windblown sand on Venus: Preliminary results of laboratory simulations, *Icarus, 57,* 112-124; Iversen, J.D., Greeley, R., and Pollack, J.B., 1976, Windblown dust on Earth, Mars, and Venus, *J. Atmos. Sci., 33,* 2425-2429.
4. Marshall, J.R., Greeley, R., and Tucker, D.W., 1986, Aeolian-induced surface accretions on venusian rocks: Preliminary laboratory simulations, *Trans. Amer. Geophys. Union, 67,* no. 44, 1078.

Table 1. Preliminary experiments in the Venus Simulator

Run #	Target	Impactor	Temp. (K)	Press. (bar)	# of impacts	Impact velocity (m/s)
004	basalt	basalt	737	20	10^5	0.7
005	basalt	olivine	737	20	10^5	0.7
006	basalt	basalt	737	40	10^5	0.5
007	basalt	basalt	737	62	10^5	0.5
008	basalt	basalt	290	6	10^5	0.6