MAGELLAN: OVERVIEW OF VENUS SURFACE MODIFICATION; R.E. Arvidson, McDonnell Center for the Space Sciences. Earth and Planetary Sciences Department, Washington University, St. Louis, MO 63130, V.R. Baker, Department of Geosciences, University of Arizona, Tucson, AZ 85721, C. Elachi and R.S. Saunders, Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91109, J.A. Wood, Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge, MA 02139

Pre-Magellan observations of Venus demonstrate that volcanic and tectonic landforms dominate the surface of that planet. However, the nature and extent of landform modification by such processes as mass wasting, chemical and mechanical weathering, and aeolian (i.e., wind) erosion and deposition, have remained unclear. The reason is that these observations had a best spatial resolution of several kilometers and would miss most fine-scale landforms and features produced by surficial processes. Thus, one of the scientific objectives of the Magellan Mission is to image the surface at high enough spatial resolution to be able to see features diagnostic of weathering, erosion, and deposition. In this abstract we report analyses of initial Magellan observations (~150 m best spatial resolution) that pertain to understanding the nature, rate, and history of surface modification by atmosphere-surface interactions and other surficial processes. We focus on radar imaging, although we also include initial results from radiometry and altimetry observations. Data included in the analyses extend in longitude from approximately 330°E to the prime meridian.

Initial Magellan observations show that the volcanic and tectonic landforms dominating the venusian surface have, in fact, been modified by surficial processes, as follows:

(1) The surfaces of slopes associated with relatively high mountainous terrains (Danu Montes, Maxwell Montes, Sif and Gula Mons) consist of materials with high dielectric constants, probably because enhanced mass wasting and wind erosion expose these materials at a faster rate than they can be chemically altered by reactions with the atmosphere. Candidate minerals include pyrite, magnetite, and ilmenite.

(2) Several impact craters are associated with low emissivity surfaces that extend westward for up to 1000 km in streak-like, paraboloidal forms. These streaks are probably ejecta blown westward by high altitude winds during the cratering events. The streaks may thus provide time stratigraphic markers. For example, we have found low emissivity streak material superimposed on lava flows on the eastern flank of Gula Mons. We are currently analyzing the ensemble of Magellan data to determine if there are regions where volcanic or tectonic features are superimposed on streak deposits, i.e. features young enough to have buried streak materials. None have been found so far.

(3) For the likely assumption that only the youngest craters (<20 Ma) retain paraboloidal streaks, we estimate that the materials that comprise the streaks are reworked by weathering and aeolian redistribution at a rate of approximately 10^{-1} µm/yr.

(4) Much smaller (10's kms long) aeolian streaks are associated with domes located in the 25 to 30°N. latitude region, where volcanic materials mantle older plains, and at 25 to 30°S. latitude, where crater ejecta deposits are available for reworking. A probable dune field is also found within an elongate crater ejecta deposit at 25°S. latitude. Surface winds inferred from the streaks and dunes are dominantly equatorward and westward, with modulation by topography.

(5) The rate of reworking of plains surfaces by weathering, mass movements, and aeolian processes seems to be high enough to produce homogeneous radar and emissivity signatures over the approximately ~400 ma typical plains age inferred from impact crater abundances. The rate has been insufficient to alter landforms significantly. In fact, the extent of signature homogenization may be a powerful tool for relative age dating of plains units. Higher reworking rates occur in the tesserae as a result of the addition of enhanced mass wasting of tectonically disrupted materials.

(6) Finally, we do not see surface features whose origin would require that Venus had a different climate during the past ~400 ma years of time recorded by the landforms evident in Magellan data. Unequivocal evidence of fluvial, lacustrine, or marine landforms and deposits has not been observed over areas covered so far. Rather, we suggest that processes similar to those that occur under the present ambient conditions are capable of shaping the surface being unveiled by Magellan.