Variable features on Mars. II - Mariner 9 global results.

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50. The Furrowed Terrain of Mars. R. S. SAUNDERS, Jet Propulsion Laboratory, Pasadena, California. - Superposed on the ancient cratered terrain in the equatorial region of Mars are numerous sinuous furrows, in width 2 to at least 10 km and on the order of 100 to 1000 km in length. Some furrows radiate from large craters and in at least two cases the central crater appears to be a volcanic caldera. The furrows occur within a global band approximately 2000 km wide. The position of this band is most conveniently described as centered on the 15° S latitude parallel of a rotated global coordinate system in which the north pole is located at 110° W longitude and 75° N latitude with reference to the present areographic coordinate system. The underlying terrain has been modified by impact and local volcanic activity. The origin of the furrows is uncertain but may be related to volcanic activity either as lava channels or melted permafrost. The former case requires conditions in the crust favoring early volcanism in this restricted band; the latter case suggests, perhaps in addition, that in this region conditions permitted the existence of liquid water. It might be speculated that the coordinates of the pole to this band of furrowed terrain may represent the position of the ancient pre-Tharsis pole, if the furrowed terrain corresponds to a compositionally anomalous band of crust.

51. Significance of Martian Dune Features. J. A. CUTTS and R. S. U. SMITH, JPL - A complex of coalescing ridges and diverse marginal features in the Hellespontus region of Mars is identified as a dune mass. This implies a regime of eolian saltation on Mars, which has a number of meteorologic and geologic consequences. Saltation is sustained by the planetary wind systems on Mars, although it may be initiated by other means such as impact or mass movement. Eolian abrasion might explain many martian erosional features and provide a source of dust for the layered deposits of the polar regions. Saltation sorting can also account for albedo features on Mars. Individual dunes such as barchans and pyramidal dunes may exist peripheral to the Hellespontus dune mass. Pictures also suggest fine-scale dune-like structures in many other areas of the planet. Eolian features are, therefore, thought to be widespread, if not ubiquitous, on Mars. The hazards and scientific opportunities that they present should be carefully considered when planning spacecraft landings on the planet.

52. Salt Weathering on Mars? Michael C. Malin, California Institute of Technology. - Mariner 9 photographs of Mars indicate significant erosion has occurred on that planet. Although several erosional mechanisms have been proposed, common terrestrial weathering mechanisms cannot function in the Martian environment. One possible explanation is that erosion of unconsolidated material is responsible for the landforms observed. Another, more speculative hypothesis, is that salt weathering, a process ideally suited to the ultra-cold desert conditions on Mars, may have been, or may still be, active on the Martian surface. Volcanic salts are almost certainly available, with their association with water quite probable from both thermodynamic and geologic considerations. Thus, with high winds for removal of weathered material and the presence of salt solutions, the conditions necessary if not sufficient for salt weathering exist on Mars.

53. The Oxidation of the Martian Surface; R. Huguenin, T.B. McCord, MIT, J.B. Adams, FDU WIL, - The results of a laboratory experiment (Huguenin, R.L., J.G.R., in press) indicate that if the martian surface materials contain magnetite or other Fe(II)-bearing minerals and glasses, these ferrous materials will undergo photo-stimulated oxidation as a result of the exposure to solar ultraviolet radiation in the O_2-bearing martian atmosphere. Upon colliding with pairs of adjacent vacant adsorption sites on the grain surface, atmospheric O_2 dissociates into adsorbed O atoms. Illumination ($\lambda \leq .330\mu$) emits electrons from the Fe^{2+} which attach to the adsorbed O, forming chemisorbed O^{2-} and oxidizing the Fe^{2+} to Fe^{3+}. The O^{2-} then coordinate surface Fe^{3+} ions octahedrally. Adsorbed H_2O leaches Fe^{2+} ions from the substrate and deposits them on the grain surface, providing additional Fe^{2+} for photo-stimulated oxidation. H_2O adsorption also results in the partial substitution of OH ligands for O ligands. On Mars there is a daily alternation between intervals of H_2O adsorption and photo-stimulated oxidation, resulting in the formation of $Fe(O, OH)_6$ octahedra (goethite structure) rather than the hematite which was observed to form in the H_2O-free laboratory environment. The goethite grows by nucleation, forming mica-like scales that rupture from the grain surface. Adsorption of H_2O on these scales during their accumulation results in the formation of limonite. The daily H_2O adsorption intervals and abrasion make the oxidation rate orders of magnitude higher than predicted by the kinetic rate equation.

54. Variable Features on Mars: Mariner 9 Global Results. C. SAGAN, J. VEVERKA, P. FOX, R. FRENCH, R. DUBISCH, P. GIERASCH, Cornell University, and L. QUAM, J. LEDERBERG, E. LEVINTHAL, R. TUCKER, B. EROSS, Stanford University, and J. POLLACK, Ames Research Center. - Systematic Mariner 9 monitoring of the space and time distribution of Martian bright and dark markings--the streaks and splotches--indicate a range of global correlations. The time-variable classical dark markings owe their configurations and variability to their constituent streaks and splotches, produced by windblown dust. Streaks and splotches are consistent wind direction indicators. Correlation of global streak patterns with general circulation models shows that velocities ~50-90 m/s above the boundary layer are necessary to initiate grain motion on the surface and to produce streaks and splotches. The generation of streaks and the progressive albedo changes observed require only threshold velocities at the grain surface ~2 m/s for ~1 day. We propose that the dark collar observed following the North polar cap in its retreat is produced by the scouring of bright overlying dust from the polar peripheral ground by winds driven by the temperature differences between frosted and unfrosted terrain.

55. Variable Features on Mars: Mariner 9 Observations of Promethei Sinus. C. SAGAN, J. VEVERKA, P. FOX, R. FRENCH, R. DUBISCH, P. GIERASCH, Cornell University, L. QUAM, J. LEDERBERG, E. LEVINTHAL, R. TUCKER, B. EROSS, Stanford University, and J. POLLACK, Ames Research Center. - Mariner 9 observations of changes in the configuration and albedo of bright and dark markings are discussed for Promethei Sinus; and also for Syrtis Major, and Lunae Palus. These changes are generally consistent with removal of bright sand and dust and uncovering of darker underlying