THE AEOLIAN ENVIRONMENT ON VENUS; S. Bougan, Center for Earth and Planetary Studies, National Air and Space Museum, Smithsonian Institution, Washington, D.C., 20560; Ronald Greeley and John Marshall, Dept. of Geology, Arizona State University, Tempe, Arizona, 85287

Similarities between sediment transport on Earth by both air and water were recognized by Allen (1), who noted that current ripples and wind dunes might form by essentially the same process. Planetary exploration has provided natural laboratories for studying sediment transport under conditions unknown on Earth, such as the low-density atmosphere of Mars and the extremely dense atmosphere of Venus (2).

Aeolian processes on Venus have been considered for several years, with current research focusing on bedform morphology, size, classification, and comparison with terrestrial aeolian and subaqueous bedforms (3,4,5,6). Experiments using the Venus Wind Tunnel (VWT) show that transport in a high-density CO_2 atmosphere is similar in some respects to transport in water (2,7) and could provide insight into sediment transport in a variety of transporting media.

In the venusian simulations, the combined effect of varying wind speed and particle size gives rise to 3 major bedform types: longitudinal structures, transverse structures, and plane beds. These bedforms are described in detail in references 4 and 5. Each type occupies well-defined wind speed/particle-size regimes with boundaries corresponding primarily to the mode of particle transport. Longitudinal structures are associated with intermittent saltation and rolling particles; transverse structures with continuously saltating particles; and plane beds with particles in suspension.

The morphology of bedforms produced by water flow is controlled by many interdependent variables which have been described as the 'flow regime' concept (8). Experiments show that the main variables are grain size, flow speed, and flow depth (9). This same concept may be applicable to aeolian bedforms developed in dense atmospheres, although the effect of flow depth is difficult to analyze. However, Vanoni (10) demonstrated for water flow that 'depth' can be combined with velocity into a single variable, shear velocity, and that shear velocity and grain size satisfactorily separate current ripples from larger bedforms. This justifies the assumption that the initiation and formation of ripples and dunes does not depend on flow depth, although their subsequent size and crest geometry appear to be greatly influenced by depth.

Subaqueous flow invloves two regimes: the 'lower regime' (characterized by transverse bedforms) and the 'upper regime' (characterized by plane beds and antidunes). Boundaries separating these regimes correspond to thresholds of sediment movement: the lower flow regime is bounded below by the saltation threshold and above by the suspension threshold. Movement below the saltation threshold has not been characterized fully in the fluvial environment (11). Flume experiments also verify that ripples develop as soon as sediment movement begins on a surface (12).

The environment within VWT encompasses three regimes. No particles move below the rolling/intermittent saltation threshold. However, once this threshold is reached and particle movement begins, logitudinal bedforms evolve (Regime 1). In water, the first bedforms to develop are transverse to flow whereas in VWT, transverse bedforms do not develop until velocities high enough to achieve continuous saltation are reached (Regime 2). Plane beds develop once suspension is achieved in both VWT (Regime 3) and water.

Assignment of aeolian sedimentary bedforms to flow regime catagories allows comparative, although generalized, interpretation of the depositional flow environment. The regime classification is interpretively useful in any setting with unidirectional currents. Size and morphological variations of bedforms among these environments (aeolian or aqueous) appear to be a function of environment, including sediment supply, sorting, continuous or intermittent flow, and the density ratio between the particles and the transporting fluid.

Because the Venus case appears to lie midway between air and water, studies with VWT can provide insight into both transport environments. The similarity of microdunes to current ripples in water suggests that areas of windblown sand on Venus would resemble a river bed or marine basin, not necessarily a typical terrestrial sandy desert. Slope winds would tend to transport material downslope, much like a density or turbidity current. This sedimentary material ultimately would be deposited in protected lowlands such as grabens. Recent Soviet radar data from Veneras 15 and 16 show some of these grabens to be radar dark, indicative of smooth surfaces (ground resolution of 1-2 km). Basilevsky et al. (13) have suggested that these grabens could be sedimentary sinks. These low lying areas, at or below the datum line, appear to be the most likely areas for locating and identifying aeolian bedforms on Venus.

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