SOME COMPARISONS OF EOLIAN FEATURES ON EARTH AND MARS. Farouk El-Baz National Air & Space Museum, Smithsonian Institution, Washington D.C. 20560.

Windblown features are common in the deserts of both Earth and Mars. Although atmospheric pressure, wind velocities, and probably the grain size of transported particles differ on the two planets, many of the eolian landforms on both are analogous (e.g., 1, 2, 3). This paper reports on a few examples that are revealed in Mariner and Viking images on the one hand and Apollo-Soyuz and Landsat data on the other.

Mariner 9's narrow-angle camera provided the first view of dunelike features on Mars (fig. 1a). The photographed field measuring 30 X 60 km lies on the floor of Proctor crater (47.5°S, 330°W) in the Hellespontus region, an area for which Arvidson predicted "frequent and intense directional winds" (3). This dune field was described as a complex of diverse marginal features and prominent subparallel ridges (trending N15°W to N35°W) crossed by narrow sharp-crested ridges trending N and NE (1). The prominent ridges have similar slopes on either side of their rounded crests, where mean wavelength is 0.92 km (4). These ridges are aligned roughly normal to the prevailing wind direction, with superposed smaller sharp-crested ridges parallel to the wind. This pattern was compared to that of the Algodones dunes of southern California (1), and the Kara Kum Desert and Badan-Jiling sand sea of central Asia (2).

The Apollo-Soyuz mission photographed two analogous dune fields (5) near the towns of Vallecito and Marayes in the San Juan Province of Argentina (fig. 1b and c). The two fields are enclosed in a depression, a setting that is similar to that of the Proctor crater dunes. The larger of the two fields, here called Vallecito, is equal in size to the Proctor dunes, being 35 X 55 km. It displays a fishscale pattern composed of numerous irregular crescentic dunes and linear sand ridges. To the north, it roughly follows the contour of the Sierra Pie de Palo. In the southern part, linear ridges trending N30° to 35°W display steep western flanks, and gentle eastern sides. The distance from crest to crest is 1 to 2.3 km, with superposed smaller linear dunes trending N60° to 70°W aligned diagonally across the eastern slopes. The smaller of the two, called here the Marayes field, is 10 X 20 km. It is rectangular in shape and appears to be strongly influenced by bordering topographic highs; its eastern margin roughly parallels the 1000 m contour, and its northern edge is bounded by drainage channels of the NS trending Sierra de la Huerta. This field is composed of a complex network of transverse and longitudinal dunes, including crescentic ridges trending N15°W that are crossed by narrow EW-trending ridges.

The gross morphological and orientational similarities between these dune fields are readily apparent (fig. 1). However, the parameters governing the movement of sand by wind and the development of bedforms on Earth differ greatly in magnitude from those on Mars. For example, McCauley estimated that saltating particles on Mars should have 10 times greater momentum and 100 times greater Kinetic energy than an Earth (6). If this is true then the Hellespontus dunes would form in the same manner as terrestrial eolian ripples.

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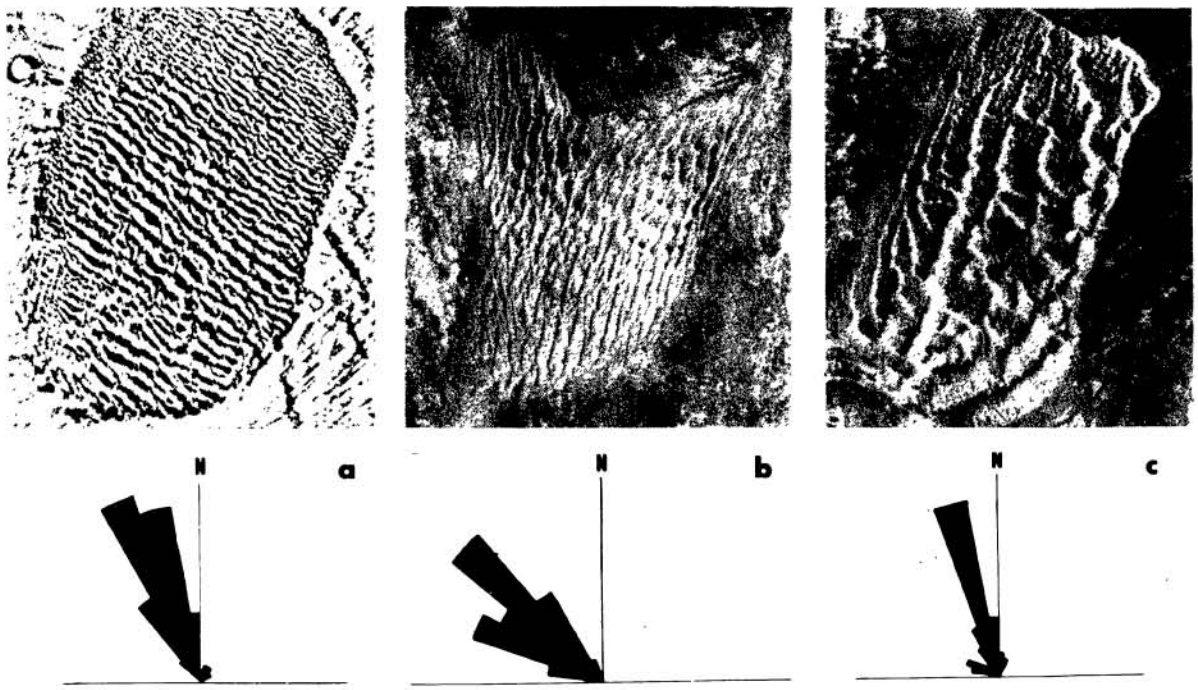

Figure 1. Dunes and their orientation within Proctor crater on Mars (a), and near Vallecito (b) and Marayes (c) both in Argentina.

Another area that includes several analogs to eolian features on Mars is the Oweinat region at the boundary between Egypt, Libya, and Sudan. Here the primary pattern is that of circular mountain rings around which the sand flows (fig. 2a). The setting is similar to the circular crater rims on Mars that affect the path of streaks. In the Oweinat region, both light and dark streaks are present, and their location an orientation are controlled by local variations in the topography. Dark sand-free areas in the lee of mountains, particularly Hagar El Garda (fig. 2b), are similar to dark zones in the lee of Martian craters. As shown in figure 2c, craters with low rims in the area are nearly completely buried by bright sand streaks, as in the case of lowlands on Mars.

Orientation of sand streaks in southwestern Egypt (7), and of those associated with craters on Mars (8) have been successfully used to model global wind circulation patterns. The relationship between the wind regime and resulting landforms has also been successfully modeled in wind-tunnel experiments (9). From these results and based on this preliminary photogeologic study, it is believed that analog correlations of windblown features on Earth and Mars will lead to a better understanding of eolian regimes and the history of their development on both planets.

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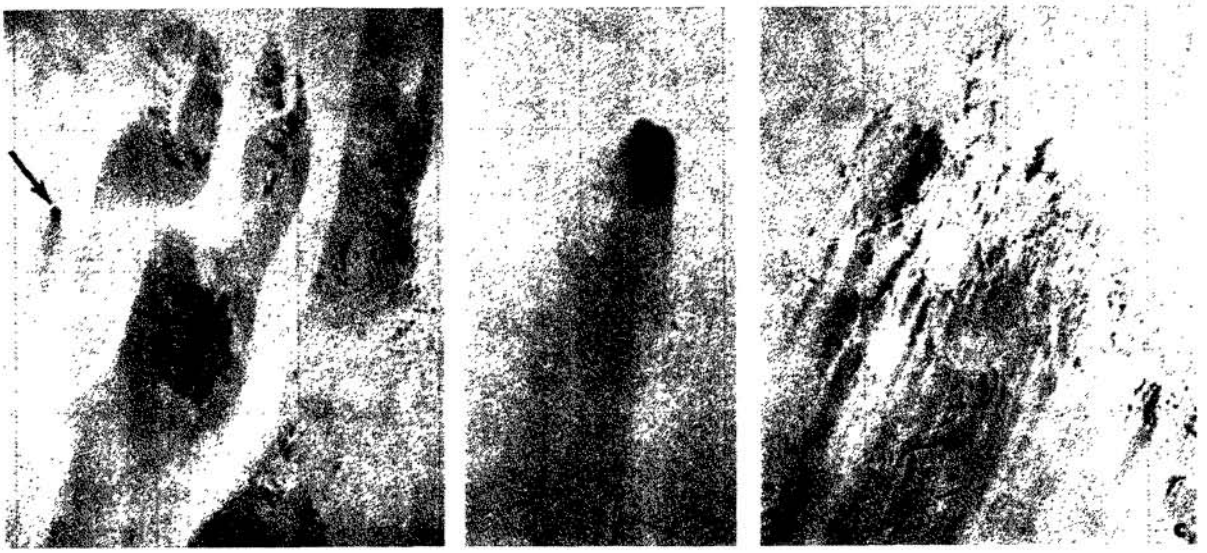

Figure 2. Bright sand streaks in Libya (a); arrow points to hill with dark lee (b); and partly buried complex craters in Egypt (c).

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