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Comparison of cross-bedding in eolian dunes in the Namib Desert and the eolian Stimson sandstone in Gale crater, Mars

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The dynamics and structure of linear dunes in the Namib Desert has puzzled sedimentologists for a half-century. Bagnold's [1] observations of reversing dynamics of linear dunes in other deserts led him to predict that internal cross-strata should preserve opposing flanks of linear dunes, and McKee [2] suggested that shallow pits in Namib dunes displayed this stratification. In contrast, Besler's [3] observations of movement of a Namib dune led Rubin and Hunter [4] to argue that the Namib dunes are migrating laterally, thereby preserving cross-beds on only the advancing flanks of the dunes, while the trailing flanks undergo erosion. Rubin and Hunter hypothesized that in such cases, cross-beds on the advancing flanks should include sets deposited by superimposed bedforms migrating parallel to the crests of the main dunes. Recent ground-penetrating-radar observations of Namib dunes [5] demonstrated that these predictions were correct.

Stratification in the eolian Stimson sandstone was recently observed by the rover, *Curiosity*, in Gale crater, Mars. The Stimson cross-stratification includes structures in common with Namib dunes. Both contain compound sets deposited by small bedforms migrating over larger bedforms. We have not yet fully reconstructed the morphology of the bedform assemblages or determined whether the dunes were transverse, oblique, or longitudinal, but the Stimson sandstone does, in fact, contain examples of structures like Bagnold predicted for linear dunes: sets of cross-beds that that meet in interfingering zig-zags and dip toward opposing directions. Compound cross-stratification in the Namib dunes and Stimson sandstone, however, differ notably in scale. The thickest sets recognized in the Stimson are comparable to the subsets deposited by Namib superimposed dunes.

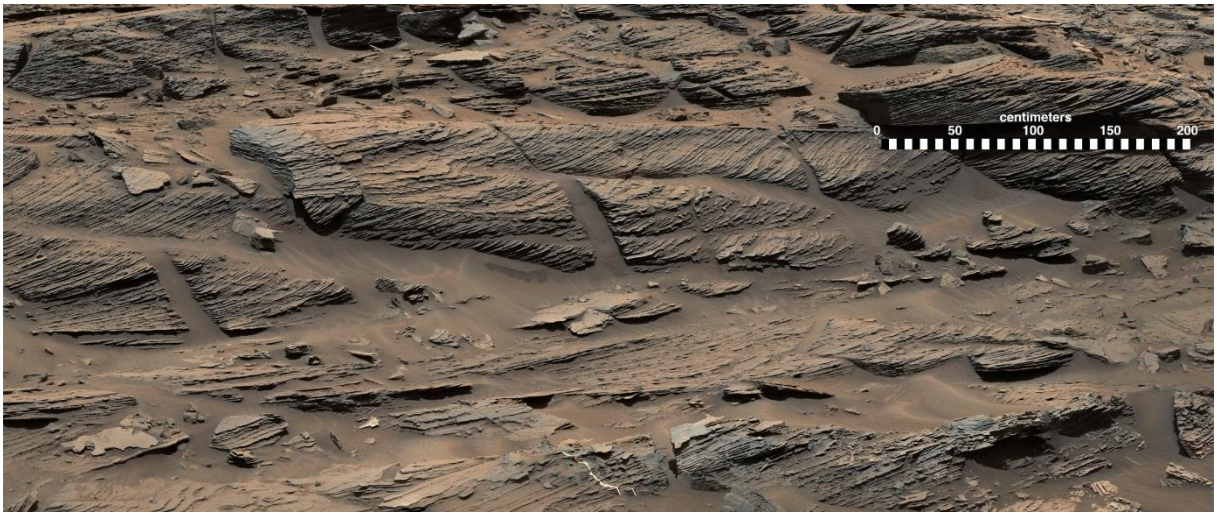

Figure 1: Eolian cross-stratification in the Stimson sandstone. Image credit: NASA/JPL-Caltech/MSSS.

References:

[1] Bagnold RA (1941) *The Physics of Blown Sand and Desert Dunes*: Methuen, London 265 p

[2] McKee ED (1982) Special Paper of the Geological Society of America, 188, 64 p

[3] Besler H (1975) Wurzburger Geographische Arbeiten 43: 135-147

[4] Rubin DM and Hunter RE (1985) Sedimentology 32: 147-157

[5] Bristow, CS, Duller GAT and Lancaster N (2007) Geology 35.6: 555-558