What This Is About:
Distinguishing aeolian megaripple deposits from fluvial deposits on Mars is important, because legitimate fluvial deposits are mission drivers for rovers and landers. We present distinguishing features of aeolian megaripple deposits to inform analyses of sedimentary rocks on Mars.

2. Wind Tunnel Experiments

The Arizona State University Planetary Aeolian Laboratory was utilized. Sorting was investigated using 250 µm sand, saltating against 600-3800 µm grains divided into nine equal (by mass) size fractions. At 12 m/s, megaripples developed spontaneously, having crests with mostly 1000-1700 µm grains. Finer grains were present at crests as well, but only transversely, and coarser grains were left behind, upwind. From a well-graded coarse sand supply, megaripples rapidly developed crests with a sharply-defined maximum coarse grain size.

Other experiments showed that saltation-driven creep rates of individual coarser grains decline exponentially with increasing coarse grain size. This helps explain why megaripple migration, involving saltation-driven creep, is a very effective coarse grain sorting mechanism.

3. Field Investigations of Ancient Deposits

Megaripples are easier to recognize in ancient deposits if whole bedforms are preserved, as within Permian sandstones on the Isles of Arran [11], where megaripples can be identified in cross-section.

Very coarse sand horizons within aeolian sandstones in eastern UT (e.g., 12-13) were imaged and measured for grain size-frequency. Similar to the wind tunnel results, sorting involved narrow coarse modes (1000-1180 µm White Rim 55, 1720-2000 µm at Buckhorn Wash). We interpret these sorted, very coarse sand horizons as products of saltation-driven creep during megaripple migration.

4. Summary

Poorly sorted sandstones on Mars are not necessarily fluvial/alluvial. Aeolian megaripples, which should be expected in the martian sedimentary record, produce bimodal sediments. Bimodal sandstones in which the coarser mode has a sharply defined maximum could be aeolian, or could reflect aeolian influences on source sorting even if deposited ultimately by other mechanisms. Other indicators of potential aeolian origin include megaripple structures preserved within finer grain deposits.