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Why do lab-scale experiments ever resemble geological scale patterning? BEHROOZ FERDOWSI, Department of Geosciences, Princeton University, BRANDON C. JONES, JEREMY L. STEIN, TROY SHINBROT, Department of Biomedical Engineering, Rutgers, The State University of New Jersey — The Earth and other planets are abundant with curious and poorly understood surface patterns. Examples include sand dunes, periodic and aperiodic ridges and valleys, and networks of river and submarine channels. We make the minimalist proposition that the dominant mechanism governing these varied patterns is mass conservation: notwithstanding detailed particulars, the universal rule is mass conservation and there are only a finite number of surface patterns that can result from this process. To test this minimalist proposition, we perform experiments in a vertically vibrated bed of fine grains, and we show that every one of a wide variety of patterns seen in the laboratory is also seen in recorded geomorphologies. We explore a range of experimental driving frequencies and amplitudes, and we complement these experimental results with a non-local cellular automata model that reproduces the surface patterns seen using a minimalist approach that allows a free surface to deform subject to mass conservation and simple known forces such as gravity. These results suggest a common cause for the effectiveness of lab-scale models for geological scale patterning that otherwise ought to have no reasonable correspondence.

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