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Wet sand flows better than dry sand

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Wet sand that does not contain too much water is known to be stiff enough to build sand castles or in physical words has a significant yield stress. However, we could recently show that there are quite a few conditions under which such wet sand opposes less resistant to flow than its dry counterpart. This effect might have been already known to the old Egyptians: The Ancient painting of El Bersheh at the tomb of Tehutihetep shows that there was liquid poured in front of the sledge that was used to transport heavy weight stones and statues. While archeologist have attributed this to a sacral ceremony, our data clearly show that wetting the sand ground drastically decreases the effective sliding friction coefficient. We first study the stress-strain behavior of sand with and without small amounts of liquid under steady and oscillatory shear. Using a technique to quasistatically push the sand through a tube with an enforced parabolic (Poiseuille-like) profile, we minimize the effect of avalanches and shear localization. We observe that the resistance against deformation of the wet (partially saturated) sand is much smaller than that of the dry sand, and that the latter dissipates more energy under flow. Second we show experimentally that the sliding friction on sand is greatly reduced by the addition of some—but not too much—water. The formation of capillary water bridges increases the shear modulus of the sand, which facilitates the sliding.