

What is sand dilatancy?

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Figure 1. Demonstration of the dilatancy phenomenon, which can be commonly observed when walking on a horizon of saturated sand at depth

Have you noticed anything strange when you walk on the beach, in the saturated fringe? Strangely enough, when you put your foot on the ground, the sand dries up around your foot. This is due to the *dilatant* properties of the sand, described by the Irish physicist Osborne Reynolds (1842 - 1912) at the end of the 19th century. What is it about? When a granular material is sheared, its volume (generally) tends to increase; this means that the volume of voids between the grains of the skeleton increases. This is a very remarkable property, and it is this property that you activate when you put your foot on the ground. Under the effect of your weight, the ground sinks, creating a *shear* in the sand in the vertical direction. The increase in the volume of the voids induces a drop in pressure and therefore a migration of the liquid from the surface to this region to a depth of a few centimetres (Figure).

This property of *dilatancy* is found in many examples of everyday life, involving granular materials other than sand.