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Penetration and blown-air effect in sand

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Sand is known to show a variety of uncommon physical features that do not fit the behavior of liquid or solid state. A good example of the inherent difficulties encountered when trying to describe collective grains behavior is the penetration of an intruding object into a granular medium. Such problems involve large coordination numbers, and the medium response dramatically depends on the volume fraction. On the fringe of these studies, we consider here the penetration of a cylindrical shell (typically an upside down glass) into dry sand, and report what we called the "blown-air effect". The air initially trapped escapes when the shell is pushed into sand, flowing through the granular medium. This flow dilates the sand and considerably eases the penetration of the shell. This is very different from what happens in liquids: when pushing a top-closed shell into a liquid, the trapped air increases the buoyancy and opposes the penetration. We show that the air flow does not change the general dynamics of penetration, suggesting that fluidization only involves an effective smaller volume fraction. Despite its simplicity (only a glass and some sand are needed to observe the effect), this experiment nicely illustrates the sometimes counter-intuitive behavior of granular media. Penetration in sand is also a critical issue in industry, and this work may help improving burying methods.

Ref:
Penetration and blown air effect in granular media
R. Clément, S. Courrech du Pont, M. Ould-Hamouda, D. Duveau, and S. Douady
Phys. Rev. Lett. 2011

Science News:
http://news.sciencemag.org/sciencenow/2011/02/convince-your-friends-youre-a-ge.html