Science Societies

3D printer creates sand packs for gas flow experiments

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Generation of a heterogeneous sand pack using a modified 3D printer

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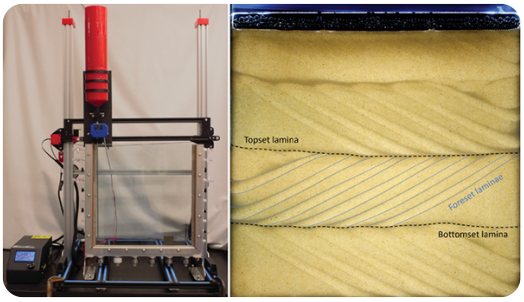
Gas flow in unconsolidated sediments plays a role in a variety of subsurface applications, including carbon capture, leaky natural gas wells, and underground hydrogen storage. Understanding the fate of gas is important for assessing potential impacts to groundwater resources and releases to the atmosphere. Gas can migrate through various geological settings, subject to multiple scales of heterogeneity that build upon one another to form the setting as a whole. However, despite the prevalence of heterogeneity in the subsurface, laboratory studies of gas migration commonly use simplified, more homogeneous settings.



Left: A Queen's University research team modified this 3D printer so that it could dispense sand. Right: An example of a heterogeneous sand pack created by the modified 3D printer. Photos by Mitchell Davidson.

In a recent article in *Vadose Zone Journal*, researchers present a more accessible way to generate geologically realistic microheterogeneous structures for use in quasi-two-dimensional flow cell experiments to study gas migration. The team modified a 3D printer to accommodate a sand-filled hopper that could automatically and repeatably dispense a mixture of sand to create herringbone cross-beds. By injecting methane gas into replicate sand packs and tracking that gas using light transmission, the researchers were able to reproduce key macroscopic features of the sand packs and gas distributions.

This novel approach opens the door for others to investigate multiphase flow using similar heterogeneous sand packs that can be repeated across time and space.

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Davidson, M.A., Mumford, K.G., Mullins, N., & Calvert, M. M. (2022). Modification of a 3D printer to create geologically realistic heterogeneous sand packs. *Vadose Zone Journal*, e20216. **https://doi.org/10.1002/vzj2.20216**

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