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## Mechanical Modeling of Dike Propagation: Methods, Recent Results and Links to Geophysics

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Magma is transported in brittle rock by diking. Diking plays a key role in tectonic phenomena such as continental rifting and plate divergence at mid-ocean ridges. In spite of the importance of understanding how magma is transported from deep magma melting zones to the Earth's surface, the physics of diking is still poorly understood. Physics-based models of propagating dikes usually involve coupled transport of a viscous fluid with rock deformation and fracture. But the behavior of dikes is also affected by the exchange of heat with the surroundings and by the interaction with rock layering, pre-existing cracks, and the external stress field, among other factors. This complexity explains why existing models of propagating dikes are still relatively rudimentary: they are

mainly 2D, and generally include only a subset of the factors described above. In this contribution, I will review numerical models on dike propagation focusing on the most recent studies (from the last 15 to 20 years). I will compare two main philosophies, one in which fluid dynamics is taken to control the behavior and the other which focuses on rock fracturing, and how they can be combined to obtain a more comprehensive approach. I will also show how simplifying the problem is necessary to address questions such as what pathway the magma will take through the crust in different conditions. I will illustrate some recent case of dike intrusion monitored by modern geophysical instruments and show what we have learnt from such observations on the mechanics of dikes.

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