Shallow dynamics of magma chambers/dikes and eruptions

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Dike intrusions significantly decrease lithospheric strength ➞ rift focusing

Buck 2004
Models and Observations

Rubin 1995

Grandin et al., 2009

Rubin & Pollard 1988
Time and length scales of dike intrusions

Location (s), size and shape of magma feeder zone (s) during discrete rifting episode

How is seismic energy release distributed during dike intrusions?

Where and when during a dike intrusion certain types of faulting mechanisms occur?

What portion of plate divergence occurs seismically and variation with rifting stage?
Afar rifting episode

Belachew et al., 2011

Mid-segment feeding

Krafla rifting episode

Buck et al., 2006
Level of Tectonic stress vs Fracturing/faulting

**Southward propagation**

- Slower propagation rates
- Less post-diking seismicity
- Longer propagation duration (up to 44 hr)

**Northward propagation**

- Faster propagation rates
- High-level of post-diking seismicity
- Shorter duration (~ 8 hr)
**Seismic Moment Distribution**

- **AFAR** - The seismic Mo < 3% of the geodetic moment estimates.
- **NATRON** - 65% of opening accommodated aseismically
  - ✓ seismic Mo << geodetic moment
  - ✓ dike opening occurs ‘aseismically’

- ~80% of seismic energy is released during the propagation phase for each dike
Modified from Ebinger et al., 2008
Future directions

✓ Dense seismic and GPS stations to better determine the time and length scales of dike intrusions

✓ Image magma chamber size, shape and depth

✓ Define empirical scaling relations for fault characteristics applicable for magmatic rifts

✓ Better modeling of deeper dikes that are usually missed using geodetic techniques but seismically

✓ Partitioning of strain at different stage of rifting