

Rift-zone volcanic systems: their initiation, evolution, and extinction

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Project Description:

Rift-zone volcanic systems are elongated swarms of tectonic fractures (tension fractures, normal faults) and volcanic fissures (and dykes below the surface) with, normally, a major volcano, a central volcano (stratovolcano or a collapse caldera) somewhere near the centre. These systems are commonly 10-20 km wide and 50-200 km long. They are normally fed by double magma chambers, that is, a deep-seated reservoir beneath much of the system supplies magma to a shallow chamber beneath the central volcano itself. The reservoir is normally very large and can supply magma to eruptions of tens of cubic km, whereas the chambers are small and produce eruptive volumes that are normally (except during caldera collapses) fraction of a cubic km.

The aims of this project are:

- a. Explain how rift-zone volcanic systems form. Which comes first, the fissure swarm or the central volcano. Why are the chambers normally so much smaller than the reservoirs.
- b. Correlate the lifetime (the time the system is active) of a volcanic system with its tectonic environment, in particular (for divergent plate boundaries) with the spreading rate and location in relation to a mantle plume (here the case of Iceland is relevant).
- c. Explain how (i) the reservoirs and the magma chambers form and (ii) how they become extinct.
- d. Provide a volcano-tectonic model of the general evolution of a rift-zone volcanic system.

References:

Gudmundsson, A., 2014. Energy release in great earthquakes and eruptions. *Front. Earth Science* 2:10. doi: 10.3389/feart.2014.00010

Gudmundsson, A. 2012. Magma chambers: formation, local stresses, excess pressures, and compartments. *J. Volcanol. Geotherm. Res.*, 237-238 (2012) 19–41 .

Gudmundsson, A., 2011. Deflection of dykes into sills at discontinuities and magma-chamber formation. *Tectonophysics*, 500, 50-64.

Andrew, R.E.B., Gudmundsson, A., 2008. Volcanoes as elastic inclusions: Their effects on the propagation of dykes, volcanic fissures, and volcanic zones in Iceland. *J. Volcanol. Geotherm. Res.*, 177, 1045-1054.

Gudmundsson, A., 2006. How local stresses control magma-chamber ruptures, dyke injections, and eruptions in composite volcanoes. *Earth-Sci. Reviews* 79, 1-31.

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Applicants are requested to send an additional copy of their CV directly to the lead supervisor of the project in which they are interested. Please also contact the supervisor if you have any questions about the project itself