

The volcanotectonics of the Askja volcanic system, Iceland

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Background

Askja volcano forms part of the Askja volcanic system on the Northern Volcanic Volcanic (NVZ) on the Icelandic rift. Askja's last major eruption was in March 1875. The eruption blasted out the Öskjuvatn caldera and formed several lava flows and fissure eruptions. The formation of the Öskjuvatn was caused by the collapse of the caldera during the March 1875 eruption. The eruption is linked with the formation of the Nyjahraun lava flow, which was formed by fissures along the Sveinagja graben between February and October 1875. The Öskjuvatn caldera formation was associated with the explosive, rhyolitic, plinian-phreatoplinian eruption at Askja on March 28th-29th 1875, which is considered to be a major part of the 1874-1876 volcanotectonic episode at Askja. It is thought that the Askja eruption is linked to the formation of the Nyjahraun lava field with caldera collapse with stimulated by removal of magma via injection of lateral dykes between the volcano and the Sveinagja graben. Later eruptions include Vikrahraun, Myvetningahraun and Thorvaldshraun. The Thorvaldshraun eruption was a fissure eruption which has similarities with the Krafla 1975-1984 fissure eruption and propagated to the south the Öskjuvatn crater.

Research problem

There are a number of interesting issues to address, which will be addressed over the course of the PhD project and during the resulting PhD thesis itself. There has been little work done on a number of problems related to the volcanotectonism of volcanoes in Iceland and as well as those worldwide. A key issue that has received little attention in Iceland is constraining the depth of the magma chambers of its volcanic systems. The evolution of the magma chamber, in terms of its depth and shape, over time has not been studied at many volcanoes worldwide. The physics and tectonic evolution of the Askja magma chamber is poorly constrained as are the internal structural development and properties. In addition, the mechanical and chemical properties of the magma chamber at Askja are yet to be studied in detail.

Research aims

1. Determine the depth and shape of the Askja magma chamber as well as the volcanic plumbing of the Askja volcanic system
2. Establish how the Askja magma chamber's shape and depth evolved over time
3. Constrain the physical and tectonic evolution of the Askja magma chamber

4. Define the internal structural development and properties of the Askja magma chamber
5. Determine the mechanical and chemical properties of the magma chamber
6. Establish how lateral dyke injection could have caused the formation of the Öskjuvatn caldera using modelling techniques
7. Investigate the role of crustal rheology in the modification of the style of active deformation in active rift zones
8. Establish whether the volume of the 1875 caldera collapse at Öskjuvatn is due to tectonically induced subsidence
9. Constrain different tectonic events at Askja with determination of the petrology and petrography of the eruptive products associated with these events

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