SEISMIC ACTIVITY AND RIFTING IN THE KRAFLA FAULT SWARM IN NE-ICELAND

by
BRYNDÍS BRANDSDÓTTIR
and
PÁLL EINARSSON
Science Institute, University of Iceland,
Dunhaga 3, Reykjavík

ABSTRACT

The Krafla volcano in the rift zone of NE-Iceland has been going through a series of inflation-deflation cycles since 1975. Magma accumulates beneath the volcano during slow inflation periods and is injected laterally into the Krafla fault swarm during deflation events. Each deflation event has a characteristic pattern of seismic activity. It typically begins with continuous volcanic tremor and the tremor amplitude is dependent on the rate of deflation. Earthquake activity increases shortly after the deflation starts and the epicentral area is soon extended from the caldera region, along the fault swarm to the north, the south or both. The propagation speed of the seismic activity is highest in the beginning, but decreases with decreasing deflation rate and increasing length of the epicen-

tral zone. Typical speed is 0.5 m/s, but may reach values as high as 1.2 m/s.

Although the hypocentral zones of the different deflation events often overlap, the largest earthquakes are located within a well defined, but each time different section of the fault swarm. The earthquakes occur in the uppermost 10 km of the crust, but the depth range is different for different deflation events.

The earthquake activity culminates after the maximum of deflation rate and tremor amplitude is reached, with earthquakes typically reaching magnitude 4. Extensive faul movements and fissuring usually occur in the area of maximum earthquake activity.

The seismological data strongly support a model where the present events are assumed to be the result of interaction between magma pressure under the Krafla volcano and rifting of the plate boundary. The rifting is triggered by increasing magma pressure in the reservoir and a fluid filled extensional crack propagates laterally along the Krafla fault swarm. The driving force of this process is the tectonic stress at the plate boundary, but the mode of strain release is modified by the presence of fluid.