Reviewed research article

Structure and tectonic position of the Eyjafjallajökull volcano, S-Iceland

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Abstract — *The Eyjafjallajökull volcano, one of the oldest active volcanoes in Iceland, is located in the volcanic flank zone of South Iceland, a few tens of kilometers south of the nearest branch of the mid-Atlantic plate boundary. It is an elongated, broad cone of about 1650 m height. A 100-200 m thick glacier covers the upper part of the volcano and its elliptical 2.5–km-wide summit crater or caldera. An E-W trending rift zone transects the volcano, but a few radial fissures are observed around the summit area. Eruptive fissures on the west flank are curved and tend to be aligned along the maximum gradient of the topography. The E-W orientation of the rift zone and the apparent correlation with the topography suggests strong influence of gravity. Dikes in the older parts of the volcano strike north-easterly and indicate a change in the stress orientation during the last 0.78 My. This change may be related to a southward propagation of the Eastern Volcanic Rift Zone of Iceland and the transfer of spreading from the Western to the Eastern Volcanic Rift Zone. We suggest that the anomalous orientation of the Eyjafjallajökull volcanic system is the result of preexisting topography and gravitational stresses when the volcanic edifice was built up unconformably on old oceanic crust. All known episodes of activity in Eyjafjallajökull have been accompanied by activity in the neighbouring volcano Katla. The most recent examples are the two thermal events, possibly subglacial eruptions, of 1999 and 2011 at Katla following the 1999 sill intrusion and 2010 eruption of Eyjafjallajökull. The coupling mechanism between the volcanoes remains enigmatic. One volcano may be triggered by the other by direct dike or sill injection. Furthermore, pressure perturbation in the mantle may affect the magma sources of both volcanoes.*

INTRODUCTION

The 2010 eruptive activity of the Eyjafjallajökull volcano in Iceland demonstrated the vulnerability of modern society. A relatively modest eruption of a moderately active volcano caused widespread disruption of everyday life in Europe for several weeks. The Eyjafjallajökull volcanic system is one of over 30 presently active volcanic systems in Iceland (Figure 1). The activity of these systems builds the Icelandic crust, partly to compensate for the divergence along the N-America – Eurasia plate boundary, and partly to contribute to the thickening of the crust above the Iceland hotspot. The plate boundary crosses the country from SW to NE and calculated from global models of plate motions (e.g. DeMets *et al.* 1994) the full spreading rate in the area is about 19 mm/year and the direction of spreading about 104°. The majority of the volcanic systems are located at the plate boundary and their activity is heavily influenced by the tectonic movements. Others are located off the boundary, in the so called flank zones (e.g. Saemundsson, 1978), and their activity is only affected slightly by the plate movements. Examples of these are Eyjafjallajökull and Vestmannaeyjar, including Surtsey and Heimaey eruptions (Figures 1 and 2). As a consequence of this varied tectonic environment Icelandic volcanoes display an unusually wide range of behaviour, both during eruptions and the preparation time of eruptions, i.e. the time from the initiation of recharge until eruptions break out (e.g. Thordarson and Hösk-