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A Neogene caldera cluster in Eastern Iceland – remnants of unusually strong felsic magmatic activity

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Abstract

Key words: Eastern Iceland, central volcano, rift zone volcanism, collapse caldera, flood basalt volcanism, Iceland plume

The interaction between the mantle anomaly beneath Iceland (Iceland plume) and spreading at the Mid-Atlantic ridge (MAR) has produced a variety of tectono-magmatic phenomena, among them the Iceland plateau with an anomalously thick crust, magmatic and tectonic activity in rift zones and flank zones with distinct characteristics, as well as the generation of felsic rocks in amounts unusual for the setting. The extinct volcanoes of Eastern Iceland have been the subject of investigations on the architecture of rift zones, as they represent fossil evidence of the tectono-magmatic evolution of Iceland through time. However, the central volcanoes of the northernmost part of this area have received comparatively little attention, despite the wealth of geological phenomena, not the least the multitude of felsic rocks. Here we present and discuss the findings of more than three decades of field observations in the Borgarfjörður Eystri area and place them in light of prevailing and emerging crustal accretion models.

The area hosts a cluster of Neogene central volcanoes that experienced a phase of violent explosive eruptions between about 13.5 and 12.2 Ma (Berg et al., 2015; Burchardt et al., 2011; Gustafsson et al., 1989). Several collapse calderas, subvolcanic intrusions, large amounts of effusive rhyolitic rocks and ignimbrites are exposed between voluminous flood basalts that have been suggested to reflect a more pronounced and widespread activity of the Iceland plume (Óskarsson and Riishuus, 2013; 2014). Field relationships, geochronology, and petrographic relationships suggest that this cluster of central volcanoes formed in a flank volcanic zone/propagating rift setting to the east of the mature rift at the time. Mapping of zeolite facies indicates that the Borgarfjörður Eystri area escaped extensive burial and alteration in comparison to areas of same age to the south. This implies asymmetry in crustal accretion from the ridge, and possibly indicates a southwestward migration and withdrawal of the declining mantle anomaly.