Evolution of silicic magmas at Icelandic central volcanoes during rift relocations

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The Iceland hot spot has been linked with the Mid-Atlantic Ridge (MAR) for about 25 Ma, which has had direct consequences for the magmatic and tectonic evolution of the island of Iceland. The MAR axis moves northwest about 1-3 cm/yr, resulting in the surface expression of the Iceland plume moving first under the MAR axis and then progressively east of it (Lawyer and Müller 1994). However, the plume periodically recaptures the terrestrial rift on Iceland by instigating rift relocation, which effectively moves the rift eastward (Jóhannesson 1980; Hardarson et al. 2008; Hey et al. 2010). Rift jumps have occurred several times throughout Iceland's history. One of the most notable features of Icelandic rift zones is the development of volcanic complexes consisting of a central volcano and associated fissure swarms (e.g., Carmichael 1964). Central volcanoes are the only places in Iceland with exposed silicic rocks, which compose about 10 percent of the exposed rock in Iceland (e.g., Walker 1966). Previous research at several silicic centers (e.g., Sigmarsson et al. 1991; Jónasson et al. 1992; Jónasson 2007; Martin and Sigmarsson 2010; Carley et al. 2011; Martin et al. 2011; Padilla et al. 2012) has indicated the common occurrence of the mineral zircon. However, no studies have been conducted that use zircon to obtain precise U-Pb ages or detail geochemical changes in central volcano magmas as they–and their host rift systems–evolve. Our work compares the evolution of three magmatic systems at different rift axes in the Westfjords and along the west coast of Iceland. The Árnes caldera formed at the Fenrir rift zone (Benediktsdóttir 2012) potentially as early as 13-15 Ma (Jordan et al. 2008; Hey et al. 2010) while the rift was juvenile. This area has well-documented, abundant silicic rocks, but they have undergone little petrologic or geochemical examination. The Nónfjall caldera was also formed during the Fenrir rift propagation around 10 Ma, but is undescribed in the petrologic literature. The Hafnarfjall-Skardsheidi central volcano in west-central Iceland was mapped in detail and examined by Franzson (1978), but emphasis was on the origin of the mafic rocks and not on the petrogenesis of the prominent felsic volcanic and intrusive units. This volcanic system–active from roughly 6-4 Ma (e.g. Moorbath et al. 1968) during the A-A′ rift jump (Hey et al. 2010)–formed from the juvenile Reykjanes-Langjökull rift axis. Since all central volcanoes in Iceland dated thus far appear to have lifespans of roughly 2 Myr, a comparison of the geochemical changes in each system over its lifetime will elucidate: a) the timing and diversity of silicic magma development; b) the processes active in facilitating these changes; and, c) the role that rift evolution and relocation plays on silicic magma genesis. Here we present preliminary findings from fieldwork and initial analytical results.