

Morphometric and magmatic evolution at the Boset-Bericha Volcanic Complex in the Main Ethiopian Rift

Melanie Siegburg (1), Thomas Gernon (1), Jonathan Bull (1), Derek Keir (1), Rex Taylor (1), Casey Nixon (2), Bekele Abebe (3), and Atalay Ayele (3)

(1) Ocean and Earth Science, University of Southampton, Southampton, United Kingdom (ms1f14@soton.ac.uk), (2) Department of Earth Science, University of Bergen, Bergen, Norway, (3) Department of Earth Science, Addis Ababa University, Addis Ababa, Ethiopia

Tectono-magmatic interactions are an intrinsic feature of continental rifting and break up in the Main Ethiopian Rift (MER). The Boset-Bericha volcanic complex (BBVC) is one of the largest stratovolcanoes in the MER (with a total area of $\sim 870 \text{ km}^2$), with volcanism largely occurring over the last $\sim 2 \text{ Myr}$. Despite the fact that 4 million people live within 100 km of the volcano, little is known about its eruptive history and how the volcanic system interacts with rift valley tectonics. Here, we present a detailed relative eruption chronology combined with morphometric analyses of different elements of the volcanic complex and petrological analyses to constrain morphometric and magmatic evolution at the BBVC. Additionally, tectonic activity has been characterised around the BBVC, all based on field observations and mapping using high-resolution digital elevation data. The BBVC consists of the Gudda Volcano and the younger Bericha Volcano, two silicic eruption centres located along the NNE-SSW trending rift axis. The fault population predominantly comprises distributed extensional faults parallel to the rift axis, as well as localised discrete faults with displacements of up to 50 m in the rift centre, and up to 200 m in the NE-SW trending border fault system. Multiple cones, craters and fissure systems are also oriented parallel to the rift axis, i.e. perpendicular to the minimum compressive stress. The eruption history of BBVC can be differentiated into 5 main eruption stages, subdivided into at least 12 eruptive phases with a total of 128 mappable lava flows. Crosscutting relationships of lava flows provide a relative chronology of the eruptive history of the BBVC, starting with pre-BBVC rift floor basalts, pre-caldera and caldera activity, three post-caldera phases at the Gudda Volcano and two phases forming the Bericha Volcano. At least four fissure eruption phases occurred along the rift axis temporally in between the main eruptive phases. Morphometric analyses indicate a total corrected volume of eruptive material at the BBVC of $\sim 36 \text{ km}^3$. The magmatic and morphometric evolution of the BBVC is spatially and temporally complex, showing a bimodal distribution of effusive basalts towards explosive peralkaline trachytic and rhyolitic lavas for the Gudda and Bericha Volcano, respectively, with rare intermediate lavas from fissure eruptions. Preliminary geochemical data suggest that fractional crystallisation may have played an important role in driving magmatic evolution the BBVC. This study emphasises the important role of tectono-magmatic interactions in the evolution of a continental rift system.