Accepted Manuscript

Normal fault growth in layered basaltic rocks: The role of strain rate in fault evolution

A. Bubeck, R.J. Walker, J. Imber, C.J. MacLeod

PII: S0191-8141(18)30085-3

DOI: 10.1016/j.jsg.2018.07.017

Reference: SG 3712

To appear in: *Journal of Structural Geology*

Received Date: 8 February 2018

Revised Date: 13 July 2018

Accepted Date: 20 July 2018

Please cite this article as: Bubeck, A., Walker, R.J., Imber, J., MacLeod, C.J., Normal fault growth in layered basaltic rocks: The role of strain rate in fault evolution, *Journal of Structural Geology* (2018), doi: 10.1016/j.jsg.2018.07.017.

Normal fault growth in layered basaltic rocks: the role of strain rate in fault evolution

A. Bubeck[1], R.J. Walker[1], J. Imber[2], C.J. MacLeod[3]

[1]*School of Geography, Geology, and the Environment, University of Leicester, University Road, Leicester, UK.*

[2]*Department of Earth Sciences, Durham University, Science Labs, Durham, UK.*

[3]*School of Earth and Ocean Science, Cardiff University, Park Place, Cardiff, UK*

[*]*Correspondence (ab753@le.ac.uk)*

ABSTRACT

Conceptual models for the evolution of dilatant faults in volcanic rift settings involve a step-wise growth pattern, involving upward propagation of subsurface faults, surface monocline formation, which are breached by subvertical, open faults. Immature, discontinuous normal faults are considered representative of the early stages of mature, linked faults that accommodate extensional strains. We consider the evolution of surface-breaking normal faults using a comparison of the distribution and geometry of normal faults from two volcanic rift zones: the Koa‘e fault system, Hawai‘i, and the Krafla fissure swarm, NE Iceland. Field mapping highlights similarities to current predicted geometries, but also prominent differences that are not reconciled by current models. Variable deformation styles record magma supply changes within the rift zones, which drive local strain rate gradients. Building on existing studies, we present a conceptual model of fault growth that accounts for spatial and temporal changes in strain rate within the deforming regions. We propose that faults in separate rift systems may not advance through the same stages of evolution and that faults within *individual* rift systems can show