Geophysical Research Abstracts
Vol. 21, EGU2019-4577-1, 2019
EGU General Assembly 2019

Dyke propagation and linkage: Insights from high resolution aperture data captured by drone

Steven Micklethwaite (1), Gregory Dering (2), and Alexander Cruden (3)

(1) Drone Discovery Platform, Earth, Atmosphere and Environment, Monash University, Melbourne, Australia (steven.micklethwaite@monash.edu), (2) CET, The University of Western Australia, Perth, Australia (gregory.dering@research.uwa.edu.au), (3) Earth, Atmosphere and Environment, Monash University, Melbourne, Australia (sandy.cruden@monash.edu)

Outstanding exposures of dyke networks are preserved from the Independence Dyke Swarm in the Sierra Nevada batholith, eastern California. Using drone-based Structure-from-Motion photogrammetry >60 outcropping dykes were mapped in 3D at exceptionally high resolution (3-5 mm per pixel) over strike distances up to $\sim$100 m. A semi-automated digital method, that corrects for outcrop topography, yielded 20,000 aperture measurements along 40 discrete dyke segments, at 1 cm intervals. This approach revealed that smaller dykes have tapered length-aperture profiles (short-and-fat) but the larger dykes comprise multiple segments and have flat-topped length-aperture profiles (long-and-thin). The tips of individual dyke segments are typically blunt, with extremely steep aperture gradients. The accuracy inherent to our method enables us to demonstrate for the first time that dyke apertures have a second order oscillation, with amplitudes of 20–40 cm along strike. These results together with other field observations lead to the ‘breakout’ model, where lateral dyke growth and linkage are influenced by multiple episodes of magma influx, internal crystallization, the stalling of propagating fracture tips and inflation until catastrophic linkage occurs between segments. This model potentially explains vertical channels of seismicity observed around laterally intruding dykes and the scaling characteristics of dyke length-aperture populations.