

## **In Search of High Flux Magma Conduits: 3D Photogrammetry, Analyzing Emplacement Mechanisms of Mafic Intrusion Networks**

Gregory Dering,<sup>1\*</sup> Steven Micklethwaite,<sup>1,3</sup> Marco Fiorentini,<sup>1</sup> Stephen Barnes,<sup>2</sup>  
and Alexander Cruden<sup>3</sup>

<sup>1</sup>Centre for Exploration Targeting, University of Western Australia, ARC Centre of Excellence for Core to Crust Fluid Systems, Crawley, Western Australia 6009

<sup>2</sup>Mineral Resources Flagship, CSIRO, Kensington, Western Australia, 6151

<sup>3</sup>School of Earth, Atmosphere, and Environment, Monash University, Clayton, Victoria, Australia 3800

\*E-mail, [gregory.dering@research.uwa.edu.au](mailto:gregory.dering@research.uwa.edu.au)

Research on Ni-Cu-PGE sulfide mineralization has mainly addressed the petrology and geochemistry of ore deposits as well as the lithosphere-scale controls on the localization of Ni-sulfide camps. Better understanding is required of the physical mechanisms by which magma-carrying fracture networks develop and propagate, in order to develop predictive hypotheses about the location of high-flux conduits and associated mineralization within large intrusion networks. We employ an innovative technique, using unmanned aerial vehicles (UAVs) and photogrammetry to map, georeferenced, and structurally analyze mafic intrusion networks in 3D, at high resolutions (1 cm–1 pixel, or finer). The technique allows analysis of the structural development and scaling relationships of dolerite intrusions emplaced in Proterozoic granitic rocks along the south coast of Western Australia.

Dike swarms, sills, and adjoining host rocks are essentially nondeformed since intrusion emplacement and are well exposed in wave-polished coastal outcrops. Structural features are preserved both within the intrusions and adjacent host rocks, allowing measurement of fracture networks, intrusion spacing, and displacement vectors of intrusion walls. Though not mineralized, structural analysis of these exceptionally well exposed mafic intrusions is a first step toward understanding the mechanisms and dynamics of magma transport leading to the development of high-flux conduits. Such conduits have been recognized as favorable settings for magmatic Ni-Cu-PGE deposits, including those at Noril'sk-Talnakh, Russia, and Nebo Babel, Western Australia.