Geophysical Research Abstracts
Vol. 19, EGU2017-12236, 2017
EGU General Assembly 2017

Constraining dike emplacement conditions from virtual outcrop modelling

Hans Jørgen Kjøll (1), Torgeir Andersen (1), and Christian Tegner (2)

(1) Center for Earth Evolution and Dynamics (CEED),University of Oslo, Oslo, Norway (h.j.kjoll@geo.uio.no), (2) Centre of Earth System Petrology (ESP), Aarhus University, Aarhus, Denmark

In the Late Neoproterozoic, the paleocontinents of Baltica and Laurentia rifted apart and sea-floor spreading into the Ordovician formed the Iapetus Ocean. The Iapetus later closed and the two continents collided forming the Caledonian orogen. Rocks related to the break-up and subsequent opening of the Iapetus, now reside as partly well-preserved tectonic lenses in thrust nappes within the Scandinavian Caledonides. The break-up architecture can be separated in two distinct domains, one hyperextended magma-poor segment in the SW, and one magma-rich part that comprise the Baltoscandian Dike Swarm (BDS), the main subject of this study. The magma-rich segment is exposed from c. Røros in the south, through Sweden and into Northern Norway, a distance of more than 900 kilometers. The magmatism of the BDS has been dated to c. 580-610 Ma and is now interpreted to represent a break-up related large igneous province (LIP). The BDS is generally well exposed in freshly glaciated outcrops and mountain cliffs. It intrudes proximal to distal marine, argillaceous, meta-sandstones and carbonates that locally display well-preserved extensional features, such as normal faults at both high and low angle. Partial melting of host rocks is observed at several localities, indicating relatively high temperatures during dike emplacement. Temperature estimates by previous workers indicate high-T (850°C) conditions during the break-up from the northernmost part of the dike swarm. Emplacement depths have not yet been accurately constrained, although some anomalous high pressure for an extensional environment (≈9Kbar) is indicated in the Corrovarre area. The spectacular exposure of the dike swarm provides the opportunity to evaluate the conditions during emplacement from dike geometries and morphologies. The several hundred meters high vertical cliff walls give excellent opportunities to assess the dike geometries over a range of host lithologies and across several km of stratigraphy (up to 3 km) in the, now tilted, cross-sections. The outcrops and mountain cliffs have been thoroughly photographed using a UAV and helicopter. 3-dimensional digital outcrop models have been prepared and interpreted together with outcrop observations. The new data give new insight into dike emplacement mechanisms, which in turn provide better constraints for the ambient conditions during emplacement of the dikes. Our regional observations support previous interpretations, that the BDS represented the distal parts of a magma-rich passive margin and the ocean-continent transition. Such tectonic domains are rarely exposed and available for direct observation and the study area in the North Scandinavian Caledonides, therefore represents a unique opportunity to better constrain the conditions during continental break-up as well as the infra-crustal dike emplacement mechanisms at divergent plate margins.