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Syntectonic granitic veins. Rheological insights from vein - host rock structural patterns

E. Druguet (1), J. Carreras (1), D.M. Czeck (2) and L.M. Castaño (1)

(1) Departament de Geologia, Universitat Autònoma de Barcelona, 08193 Bellaterra, Barcelona, Spain (elena.druguet@uab.es / Phone: +34-5811163), (2) Department of Geosciences, University of Wisconsin, Milwaukee, P.O. Box 413, WI 53201, USA

Dyking is a common process at different crustal domains throughout many orogenic belts. During emplacement, deformation tends to localize around syntectonic veins, giving rise to different and contrasting structures for magmatic and for solid state stages. Rheological properties of granitic magmas have been studied theoretically and experimentally. However, the role of rheology in localization and development of vein-related structures has been less explored. This study particularly focusses on the deformation patterns which can arise from vein-host rock interaction during emplacement. This has been made by means of two complementary approaches: analysis of field structures and analogue modelling. We present examples of syntectonic veins and dykes from the Rainy Lake District of the Superior Province (Canada) and from the Cap de Creus tectonometamorphic belt (Spain). In both sites, complex structural patterns are displayed, denoting that rheology contrast between vein and host rock strongly influences vein emplacement and subsequent deformation. Thus, from the observed field structures we can infer some rheological aspects such as the relative viscosity change of the crystallizing veins and the variable nature of the host rock in which the veins intrude. To test the effect of rheology changes on the developing deformation structures, analogue experiments were performed using the experimental device BCN-Stage (Department of Geology, UAB). We deformed models of plasticine as viscous host-rock analogue and chocolate as the crystallizing veins. Crystallization implies a rapid increase in effective viscosity with a rheological threshold marked by the reversal of competence contrast between partial melt and host rock. During the whole process, deformation localizes around crystallizing veins, giving rise to a range of particular structures which can be associated to different rheological conditions.