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The structure and evolution of magmatic complexes in fold-and-thrust belts – a case study of Cerro Negro, Neuquén Province, Argentina

D. Gürer (1,2), O. Galland (1), H.A. Leanza (3), C. Sassier (4), P.R. Cobbold (5), E.A. Rossello (3,6)

(1) Physics of Geological Processes, University of Oslo, P.O. Box 1048, Blindern, Oslo, Norway (Derya.Guerer@gmail.com), (2) Steinmann Institut für Geologie, Mineralogie und Paläontologie, Rheinische Friedrich-Wilhelms-Universität Bonn, Poppelsdorfer Schloss, 53115 Bonn, Germany, (3) SEGEMAR & CONICET, Av. Julio A. Roca 651, 10° piso, 1322 Buenos Aires, Argentina, (4) Department of Geosciences, University of Oslo, P.O. Box 1047, Blindern, 0316 Oslo, Norway, (5) Géosciences-Rennes (UMR6118), CNRS et Université de Rennes 1, 35042 Rennes, France, (6) CONICET and Departamento de Ciencias Geológicas, Universidad de Buenos Aires, Buenos Aires, Argentina

In contrast to the classical concept of magma ascent in extensional settings, recent studies show that volcanism also occurs in compressional settings. The nature of the interplay between magmatism and tectonics in fold-and-thrust belts however, remains a major question, notably in active margins. The mechanisms of magma transport in such settings and whether magmatism affects tectonic deformation need to be addressed.
Therefore, we carried out detailed structural mapping and sampling of an intrusive complex: the Cerro Negro of Tricao Malal, Neuquén Province, Argentina. This intrusive system belongs to a magmatic province that intruded into the intensely deformed Agrio fold-and-thrust belt, located between 37°S and 38°S in the Argentinean foothills of the Andes. The fold-and-thrust belt has resulted from intense E-W shortening, and contains tight folds and thrusts, trending N-S. The intrusive complex crops out as a network of sills and dykes around a main intrusion, all of which are of andesitic composition.
The plumbing system of Cerro Negro is well exposed so that the structural relations between the intrusions and the tectonic structures can be studied. We have identified at least two generations of intrusions: two thick sills that predate or are coeval with deformation, and numerous sub-vertical dykes that strike N-S, i.e. perpendicular to the shortening.
We observed that the main intrusive body and the dykes have formed in a central anticline, the dykes being close to the hinge. Furthermore, the dykes crosscut folded sills, postdating all visible deformation.
From the structural and temporal relationships between the anticline and the dykes, we infer that local stresses controlled the formation of the dykes during outer-arc stretching. This illustrates how tectonic deformation may control magma emplacement. Conversely, the traces of the main tectonic structures curve around the intrusive complex, suggesting that the latter influenced the tectonic deformation.