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# Overturned to recumbent thrust sheets in the Northern Calcareous Alps (NCA) – the role of inflated salt on fold-and-thrust belt structural styles

Klaus Pelz (1), Pablo Granado (2), Philipp Strauss (1), Eduard Roca (2), Michael König (1), Wolfgang Thöny (1), Herwig Peresson (1), and Josep Anton Muñoz (2)

(1) OMV Exploration and Production GmbH, Trabrennstrasse 6-8, 1020, Vienna, Austria, (2) Institut de Recerca Geomodels, Departament de Dinàmica de la Terra i de l'Oceà, Universitat de Barcelona, Martí i Franque`s s/n 08028, Barcelona, Spain

The NCA is a multiply deformed salt-detached fold-and-thrust belt of the Austroalpine orogenic wedge. The Permo-Mesozoic sedimentary succession involved in the fold-and-thrust belt is dominated by thick non-metamorphic Triassic platform carbonates, underlain by a Permian layered evaporitic sequence (i.e. Haselgebirge Fm.) and covered by Upper Cretaceous to Miocene syn-orogenic deposits.

One of the most relevant (and controversial!) features of the NCA fold-and-thrust belt is the presence of large panels of inverted stratigraphy (i.e. structurally overturned). These panels may be as long as 10 km across strike of fully overturned, but systematically thin stratigraphy. In addition, no evidence for metamorphic conditions during folding has ever been found. Published cross-sections either show (1) isoclinal folds with such long overturned limbs, or (2) typical Rocky-Mountain style layer-cake thrust sheets affected by thrust-related folds, which avoid the 'eye-catching' overturned panels. In addition, many of the geological contacts between different units are mapped as thrusts, but in fact, are substractive contacts.

Both ways of drawing cross-sections over the NCA miss (a) the relationship between structural units showing significant changes in thickness and facies across geological contacts and (b) the kinematical and mechanical understanding of both the substractive contacts as well as the development of the overturned and non-metamorphic panels.

During recent field work, the extent of these megaflaps has been critically examined. Coherent panels of overturned stratigraphy have a typical to maximum extent of 2 to 3 km. These panels are separated from more extensive thrust sheets by steeply-dipping faults, which have been previously interpreted as late strike-slip faults that dissected a formerly coherent overturned panel. From our field work and cross-sections, we found that (i) remnants of Permian salt usually mark the trace of these contacts between different units; (ii) that stratigraphic thicknesses of the overturned panels are systematically reduced when compared to neighboring thrust sheets with normal stratigraphic polarity; and (iii), that the significant variations in thickness and facies between neighboring structural units take place across these salt-bearing contacts.

We interpret these mechanical contacts as secondary welds (i.e. thrust welds) between former salt-withdrawal minibasins developed on the Neo-Tethys rifted margin, whereas the stratigraphically thin panels were deposited in between the minibasins, on top of formerly inflated salt.

An initial rotation of these thin overturned panels would have been related to salt evacuation on the continental margin stage, and later during early shortening. The lateral extent of the megaflaps would have been controlled by the original amount of Permian salt, and the width of inflated salt structures. Orogenic shortening would have led to the squeezing of inflated salt structures (i.e. walls and diapirs), and the rotation of the thinned stratigraphy to produce the overturned panels or megaflaps.