Geophysical Research Abstracts
Vol. 19, EGU2017-10245, 2017
EGU General Assembly 2017

Amphibolite boudins in marble on Naxos, Greece: 3D analysis of multiphase deformation on a retrograde P-T path

Simon Virgo, Christoph von Hagke, and Janos L. Urai
RWTH Aachen University, Geologie - Endogene Dynamik, Aachen, Germany (s.virgo@ged.rwth-aachen.de)

Boudins are periodic structures that form by layer parallel extension in mechanically layered rocks. The characteristics of boudins such as orientation and geometry provide constraints on the paleo stress field as well as the rheology of the rocks during deformation. However, most characterizations of boudinage are based on 2D observations and do not consider the 3-dimensional complexity and potentially non-coaxial polyphase genesis of boudinage structures.
In marble quarries in the high grade complex on Naxos, Greece, we studied spectacular outcrops of amphibolite and pegmatite boudins, in combination with serial slicing of quarried blocks to reconstruct the 3D boudin structures. We identified five boudin generations with two distinct generations of early, high grade pinch-and-swell followed by two generations of brittle shearband and torn boudins formed along the retrograde path under greenschist facies conditions. The five generations of boudinage indicate that E-W compression is the main mode of deformation in the marbles. The axis of extension changes from subvertical during pinch-and swell deformation to subhorizontal N-S extension at later stages of deformation.
Later phases of boudinage are influenced by existing boudin geometries, producing complex structures in 3D. In 2D section the complexity is not directly apparent and reveals itself only after statistical analysis of long continuous sections.
Apart from implications for the regional geology, our findings highlight the importance of 3D characterization of boudinage structures for boudin classification. The insights we gain from the analysis of multiphase boudinage structures on Naxos are the basis for quantitative boudin analysis to infer rheology, effective stress, vorticity and strain, and establish a boudin classification scheme with appeal to a complete mechanics.