Geophysical Research Abstracts
Vol. 18, EGU2016-7747-1, 2016
EGU General Assembly 2016

Regional polyphase deformation of the Eastern Sierras Pampeanas (Argentina Andean foreland): strengths and weaknesses of paleostress inversion

Anna Traforti (1), Dario Zampieri (1), Matteo Massironi (1), Giulio Viola (2,3), Patricia Alvarado (4,5), and Giulio Di Toro (6)

(1) Department of Geosciences, University of Padua, Via Gradenigo 6, 35131 Padova, Italy (anna.traforti@studenti.unipd.it), (2) Geological Survey of Norway-NGU, 7491 Trondheim, Norway, (3) Department of Geology and Mineral Resources Engineering, Norwegian University of Science and Technology-NTNU, 7491 Trondheim, Norway, (4) Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET-CIGEOBIO), Argentina, (5) Departamento de Geofísica y Astronomía, Facultad de Ciencias Exactas, Físicas y Naturales, Universidad Nacional de San Juan, Meglioli 1160 S, (5406) Rivadavia, San Juan, Argentina, (6) School of Earth, Atmospheric and Environmental Sciences, Manchester University, Oxford Street, M13 9PL Manchester, United Kingdom

The Eastern Sierras Pampeanas of central Argentina are composed of a series of basement-cored ranges, located in the Andean foreland c. 600 km east of the Andean Cordillera. Although uplift of the ranges is partly attributed to the regional Neogene evolution (Ramos et al. 2002), many questions remain as to the timing and style of deformation. In fact, the Eastern Sierras Pampeanas show compelling evidence of a long lasting brittle history (spanning the Early Carboniferous to Present time), characterised by several deformation events reflecting different tectonic regimes. Each deformation phase resulted in further strain increments accommodated by reactivation of inherited structures and rheological anisotropies (Martino 2003). In the framework of such a polyphase brittle tectonic evolution affecting highly anisotropic basement rocks, the application of paleostress inversion methods, though powerful, suffers from some shortcomings, such as the likely heterogeneous character of fault slip datasets and the possible reactivation of even highly misoriented structures, and thus requires careful analysis. The challenge is to gather sufficient fault-slip data, to develop a proper understanding of the regional evolution. This is done by the identification of internally consistent fault and fracture subsets (associated to distinct stress states on the basis of their geometric and kinematic compatibility) in order to generate a chronologically-constrained evolutionary conceptual model.
Based on large fault-slip datasets collected in the Sierras de Cordoba (Eastern Sierras Pampeanas), reduced stress tensors have been generated and interpreted as part of an evolutionary model by considering the obtained results against: (i) existing K–Ar illite ages of fault gouges in the study area (Bense et al. 2013), (ii) the nature and orientation of pre-existing anisotropies and (iii) the present-day stress field due to the convergence of the Nazca and South America plates (main shortening oriented WSW-ENE). Although remarkable differences in reactivation mechanisms have been observed for the various studied lithological domains (schist, gneiss and granitic rocks), the brittle regional polyphase deformation of the Eastern Sierras Pampeanas appears to be dominated by two extensional episodes ($\sigma 3$ oriented NE/ENE and WNW, respectively), which can be associated with Middle-Late Permian to Early Cretaceous tectonism, followed by a compressional paleostress ($\sigma 1$ oriented ENE), which is compatible with the present day Andean convergence. Paleostress inversion techniques, despite all uncertainties involved, represent a robust approach to disentangle complex polyphase deformation histories both in term of reactivation mechanisms and strain partitioning.

References:
Bense, F. A., Wemmer, K., Löbens, S., & Siegesmund, S. (2013). Fault gouge analyses: K–Ar illite dating, clay mineralogy and tectonic significance–a study from the Sierras Pampeanas, Argentina. International Journal of Earth Sciences, 103, 189–218.
Martino, R. D. (2003). Las fajas de deformación dúctil de las Sierras Pampeanas de Córdoba[U+202F]: Una reseña general. Revista de La Asociación Geológica Argentina, 58(4), 549–571.
Ramos, V. A., Cristallini, E. O., & Perez, D. J. (2002). The Pampean flat-slab of the Central Andes. Journal of South American Earth Sciences, 15, 59–78.