



Orogen-parallel stretching of a HT-LP foreland: insights from the Ordovician Famatinian orogeny, NW Argentina

Pablo Farias (1), Roberto Weinberg (1), Alfonso Sola (2), and Raul Becchio (3)

(1) Monash University, School of Earth, Atmosphere and Environment, Australia (pablo.farias@monash.edu), (2) INENCO, CONICET - Universidad Nacional de Salta, Argentina, (3) LaTe Andes. Las Moreras 510, 4401-Vaqueros-Salta, Argentina

Most orogenies are characterized by plane strain with shortening perpendicular to the orogenic front. Here, we describe a mid-crustal section of the accretionary ~470 Ma Famatinian orogeny that evolves from the typical shortening perpendicular to the orogen, to stretching parallel to the orogen associated with constriction and a top-to-the-south non-coaxial component. This section of the crust, currently exposed in the Sierra de Quilmes, represents the foreland of the thermally-weakened orogen that underwent E-W shortening as a result of the accretion of a Laurentian-derived Precordillera terrane to the western margin of Gondwana.

In this area, three dominantly meta-sedimentary complexes were juxtaposed, as thrust-bound horses within a thrust duplex system. Two of the complexes form the hanging wall are separated by a splay of the main thrust forming a duplex. They constitute high-grade rocks derived from typical Al-rich turbidite sequences and were thrust over a footwall that comprises a different package of high-grade, Ca-rich metasedimentary rocks. All the complexes are dominantly migmatitic, recording a high-T/low-P (HTLP) metamorphic history.

East-west shortening started with this large-scale thrusting and crustal thickening, generating the anomalously wide thrust zones, such as the 1 km wide ultramylonite between footwall and hanging wall. This phase was characterized by top-to-west kinematics, representing a tectonic transport perpendicular to the orogenic front, as well as plane strain leading to crustal thickening. After reaching a critical crustal thickness, further thrusting to the west was impeded because the vertical gravitational and the horizontal tectonic forces became balanced. At this point, the thermally-weakened footwall reacted by escaping to the south, parallel to the orogen under a non-coaxial constriction. This later event is characterized by syn-folding shearing with a consistent top-to-south kinematics that resulted in an intense stretching lineation, L-tectonite domains, and sheath folding subparallel to the transport direction.

Deformation of the footwall during this late stage was accompanied by renewed anatexis. The latter is constrained by U/Pb ages of zircon, monazite, and titanite, which date crystallization and metamorphism. While a number of events of anatexis occurred in the hanging wall between ~510 and 440 Ma, the footwall complex record systematically younger ages, suggesting a sustained and prolonged deformational and metamorphic history in the footwall.

In summary, the Sierra de Quilmes records a case in which forces related to terrane accretion caused crustal thickening of hot rocks, until these forces equilibrated with gravity. At this point continued accretionary forces led to the lateral escape of the footwall parallel to the length of the orogen under constrictional deformation.