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Inversion tectonics in the pre-andean basement of the Sierra de Cachi (Salta, Argentina)

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The Sierra de Cachi is a mountain range located in NW Argentina, near Salta; it spreads along 50 km in a N-S direction across the pre-Andean basement of the Calchaqui Valley. This window of pre-Andean consists of: 1) greywacke and slates of the uppermost Neoproterozoic to Early Cambrian Puncoviscana Formation, 2) schists, gneissic rocks and migmatites grouped in the so-called La Paya Formation, and 3) granodiorite and trondhjemite plutons, intruded at different structural levels within the La Paya Formation. Detailed cartographic and structural data support that the Sierra de Cachi forms a complex plutono-metamorphic dome, reflecting a polyorogenic evolution.

This region is characterized by the following features: 1) there is a reverse metamorphism ranging from very-low metamorphic grade conditions below, to migmatization at upper structural levels, 2) the metamorphism was associated to a strong telescoping of the isograds and is representative of LP and HT conditions, 3) metamorphism reached partial melting conditions and was coeval with the intrusion of sheeted granodiorite and trondhjemite plutons, 4) these plutons are concordant with the metamorphic zoning and are also affected by the east-verging folds 5) the reverse metamorphism is related to large- scale and E-verging folds that are linked to the dominant west-dipping foliation, 6) the dominant N-S striking and W-dipping schistosity post-dates the regional metamorphism and is related with a major D2-deformation, as an older extensional foliation is still recognized in the gneissic domain, and 7) subsequent to the east-verging folds and the development of the main foliation, the active shortening gave rise to mylonitic bands parallel to the reverse limbs of the folds.

We consider that such features are the result of a positive inversion tectonics within intermediate crustal levels. The metamorphic evolution and the formation of the sheeted plutons are consistent with an extensional event, whereas the shortening produced by the younger east-verging folds evidences the superposition of a compressional stress field. The extensional event took place at ca. 460 Ma, according to U-Pb SHRIPM dating of zircons from the migmatite and granites. From the above features, we propose that the extensional event recognized in this sector of the Calchaqui Valley took place along the western border of Gondwana in a back-arc setting related to an eastward-directed subduction of Ordovician age.