

Thermal and compositional control on deformation distribution along the Central Andean foreland

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The Central Andean orogen was built during the last 30 Myrs as a result of tectonic shortening of the South American margin between the subducting Nazca plate at the west and indenting Brazilian shield at the east. The corresponding deformation pattern varies both in space and time. Along the strike, tectonics at the plateau foreland changes from thin-skinned in the Altiplano foreland (north to 23 S) to thick-skinned in the Puna foreland (south of 23 S). On the other hand, Altiplano shortening demonstrates an abrupt switch from pure- into simple-shear mode in Late Miocene.

Using 2-D thermo-mechanical numerical simulations we show that spatial and temporal variations of the shortening pattern might be well controlled by the two main parameters: strength of the foreland uppermost crust and temperature of the foreland lithosphere. Mechanical weakening and failure of the thick Paleozoic sediments overlying the cold lithosphere in the Altiplano foreland at 13-9 Ma explains the transition from pure to simple shear shortening accompanied by broad thin-skinned thrusting. On the other hand, at the Puna foreland, the high strength of the uppermost crust combined with relatively warm lithosphere results in the thick-skinned shortening. Failure of Paleozoic sediments in the Altiplano foreland significantly reduces the force required to shorten the lithosphere, which may well be the reason for the increase of bulk shortening rate in the Late Miocene.