Kinematics of mountain-building of the Central Andes, from structural geology to analogue modeling.

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Résumé

The processes driving Andean mountain-building, along a subduction margin, have been largely questioned since the _˜1970s but have remained relatively unclear, in particular within the western part of the belt where the geometry of structures is most often obliterated by active magmatism. The discovery of the active West Andean fold-and-thrust belt along the western Andean flank at the latitude of Santiago (Chili, _˜33.5 ◦S) (Armijo et al., 2010) has

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launched a vigorous debate on the relative contribution of the structures of the west Andean flank to overall Andean mountain-building.
Here we review our most recent work on the structures and kinematics of deformation of the western Andes at two distant latitudes (_˜33.5 ∘S and _˜20∘S). Our approach is based on structural mapping, in the field and using satellite imagery, with particular emphasis on dated growth layers for the kinematic modeling of the investigated structures. Our results indicate that Andean mountain-building appears to have first been primarily sustained by west-vergent structures, synthetic to the subduction zone, at both investigated latitudes. Furthermore, in both cases, deformation evolved over time towards out-of-sequence thrusting and /or later east-vergent thrusting towards the South American continent. Such kinematics may possibly be found, to the first-order, all along the Andes and we question the idea that it could be characteristic of Andean mountain-building. From there, a first-order comparison of the evolution of this cordilleran orogen to that of collisional systems can be tentatively addressed.
To further investigate the processes driving Andean mountain-building, we recently set up a series of analogue models of a subduction zone, exploiting an original experimental set-up where plate kinematics is driven by the underlying mantle flow. We first explored the geodynamic conditions that permit upper plate deformation in an oceanic subduction context. Following on these achievements, future work will test and use a new analogue material capable of localizing deformation to tentatively reproduce the observed Andean kinematics of deformation and unravel the parameters controlling it.

Mots-Clés: subduction orogen, structural geology, analog modeling