

Role of Lithosphere structural inheritance in the localization of intraplate deformation: the example of the Tien Shan (Central Asian Orogenic Belt)

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Due to the India-Asia collision, the deformation of the Eurasian continent extends over several thousand kilometers, far away from the Himalayan belt. However, some areas like the Tarim craton are poorly deformed while others, as the Tien Shan belt or Tibet plateau, display large deformation rates.

These actively deforming areas correspond to ancient plate boundaries which were previously involved in the construction of large orogenic belts. The Tien Shan is a relevant example to study the role of structural inheritance in the localization of recent deformation because of its Paleozoic tectonic history. Indeed, the Tien Shan has been built during two consecutive orogenies (Caledonian and Variscan) which formed large scale structures (as suture zones) clearly identifiable on the field. These structures are now reworked as active deformation zones where large earthquakes can occur.

In order to improve our understanding of the role of this strong structural inheritance on the Cenozoic deformation, this study couples two approaches:

1-A field study which allowed us to identify the major Paleozoic structures, their geometry and the main lithologies involved. Our new findings include the reconnaissance of a transcurrent system in Middle Tien Shan, and a south-dipping structure of the major suture zone of the South Tien Shan/ North Tarim.

2-Based on a reconstruction of the pre-Cenozoic structure geometries, we use the thermomechanical modeling code Ptatin to simulate the lithospheric deformation of the belt depending on the geometry and rheology of inherited structures.

Our results show that inherited structures first localize the deformation before that antithetic neoformed structures develop on the outer parts of the belt. This result is consistent with seismologic, seismic and GPS data, which show that the deformation is now localized on the borders of the belt, and especially propagates in the South Tien Shan/ North Tarim boundary along a N-dipping top-to-the South fold and thrust belt. It suggests that all present-day structures must not be interpreted as reflecting the Paleozoic structuration of the belt.