Geophysical Research Abstracts
Vol. 19, EGU2017-3172, 2017
EGU General Assembly 2017
© Author(s) 2017. CC Attribution 3.0 License.

The Long-term deformation of the Longmen Shan (Sichuan, China), a key to understand the present structure of the eastern Tibet

Laura Airaghi (1), Julia de Sigoyer (1), Stéphane Guillot (1), Pierre Lanari (2), Clare J. Warren (3), and Alexandra Robert (4)

(1) ISTerre, Université Grenoble Alpes, Grenoble, France , (2) Institute of Geological Sciences, University of Bern, CH-3012 Bern, Switzerland , (3) School of Environment, Earth and Ecosystem Sciences, The Open University, Milton Keynes, MK7 6AA, UK , (4) Géosciences Environnement Toulouse, Observatoire Midi-Pyrénées, Toulouse, France

The Longmen Shan thrust belt, at the eastern border of Tibetan plateau, is a tectonically active region as demonstrated by the Mw 7.9 Wenchuan (2008) and Mw 6.6 Lushan (2013) earthquakes. The Moho discontinuity deepens across the Longmen Shan (below the along-strike Wenchuan fault) from ∼40 km beneath the Sichuan basin to more than 60 km beneath the Songpan-Ganze block. Such a thickness is not compatible with the only ∼35 km of shortening estimated at the front of the belt during the Cenozoic-Quaternary compressive reactivation. The geological inheritance may thus play a key role in the present structure of the Longmen Shan. However the long-term history of the belt is still poorly documented.

The major Wenchuan fault separates medium-grade metamorphic rocks to the West (internal domain of the Longmen Shan) to the greenschist metamorphic rocks to the East (external domain). In the hanging and footwall of the fault the South China basement also crops out. Metamorphic rocks, exhumed from depth, offer the opportunity to investigate the deep processes occurred in the Longmen Shan.

We have characterized and dated the metamorphism in the central part of the belt by combining structural and microstructural observations with high-resolution X-ray mapping and chemical analyses of metamorphic minerals related to the different stages of deformation. *In situ* $^{40}Ar/^{39}Ar$ dating on mica and *in situ* U-Pb/Th dating on allanite (REE-rich epidote) allowed the different phases of metamorphism and deformation to be dated. Our results show that the Longmen Shan underwent a complex Mesozoic tectono-metamorphic history, articulated in a succession of pulses of deformation (burial or uplifting) and periods of quiescence. A first phase of rapid thin-skinned deformation occurred about 200 Ma ago. Internal sedimentary units were strongly deformed and buried down to 11±1 kbar, 550±30˚C. This phase was followed by a period of slow exhumation between 200 and 170 Ma. A second pulse of deformation took place during the Lower Cretaceous (130-150 Ma) and involved both the sedimentary cover and the basement in the internal and external domains. This period therefore marks the onset of the thick-skinned deformation in the Longmen Shan. Sedimentary units were partially exhumed up to 4.5 ± 1 kbar, 380˚±30˚C (internal sediments) and 4.5 ± 1 kbar, 340±30˚C (external sediments) while the basement was re-activated at 7 ± 1 kbar, 350±50˚C.

The geodynamic setting responsible for the Early Mesozoic thin-skinned deformation was related to the closure of Paleothethys in a context of accretionary wedge. The Early Cretaceous thick-skinned deformation is instead attributed to an intra-continental re-activation of the belt, enhanced by the collision between the Lhasa and Qiantang blocks.

Therefore, although the geodynamics and the mechanisms of the deformation have changed with time, the kinematic setting in the Longmen Shan remained rather constant. The long-term deformation responded indeed to the N-S convergence that built up the Tibetan plateau and provoked the extrusion of the Songpan Garze sediments towards the SE above the rigid South China craton.