No channel flow in the Longmen Shan: evidence from the Maoxian-Wenchuan fault Cenozoic kinematics (SE Tibet)

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Résumé

The NE striking Longmen Shan (LMS) mountains are located at the eastern margin of the Tibetan plateau, and towers nearly 5000m above the Sichuan basin, which is considered to be the greatest relief than anywhere else around the plateau. From west to east, three major sub-parallel faults straddle the Longmen Shan: Wenchuan-Maoxian fault (WMF), Yingxiu-Beichuan fault and Guanxian-Anxian fault. Several models have been proposed to explain the Cenozoic uplift of the Longmen Shan. The major two models are lower crustal channel flow and upper crustal shortening, which imply different movement sense on the Wenchuan-Maoxian fault. The former suggests that the LMS were uplifted above a lower crustal flow expulsed from below the Tibetan plateau and would require a normal sense movement on the MWF. The latter implies that a series of upper crustal thrusts controlled the uplift of the LMS, and the WMF should have a reverse sense. Here we present structural geology and geochronology data from the WMF. 40Ar/39Ar ages on syn-kinematics white mica grown show that normal / right lateral ductile deformation occurred at 28.0 ± 0.9 Ma, and top-to-the-east reverse deformation at 15.4 ± 0.2 Ma. K-Ar ages of authigenic illite from two fault gouges show that brittle right-lateral / reverse deformation occurred at 6.9 ± 2.9 Ma. These ages are coherent with the relative vertical motions across the fault zone deduced from thermochronology data. Three deformation phases are thus defined: right-lateral / normal in the Middle Oligocene (_˜30 - 25 Ma), reverse in the Middle Miocene (25-15 Ma), and right-lateral / reverse since the Upper Miocene (since _˜6 Ma). The WMF never experienced pure normal motion, and only shortening since the Oligocene, in contrast to predictions of lower crustal channel-flow models, thus favoring a crustal accretionary prism model for the Longmen Shan building.

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Mots-Clés: Longmen Shan, Wenchuan, Maoxian fault, crustal channel flow, Argon dating, Fault gouge dating