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Thermo-rheological structure of continental lithosphere in middle and west China: its implications for Cenozoic tectonics

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The middle and west China is one of the best natural laboratories for intracontinental deformation, characterized by uplift of the Tibet Plateau and reactivation of Tianshan and numerous earthquake activities and neotectonics. The mechanism and process of this diffuse deformation are still unclear. Here we present the thermal state and rheological structure of lithosphere beneath this area and its implications for Cenozoic tectonics.

Our results show that the lithosphere in middle and west China is of distinct thermo-rheological heterogeneities. Temperature at Moho depth beneath such blocks circum Tibet Plateau as Tarim, Junggar, Ordos and Sichuan are all relatively low and less than 500 °, along with the lithospheric thickness more than 140 km and surface heat flow less than 50 mW/m^2, indicating the rigidity of the lithosphere, maybe representative of Precambrian lithosphere. Effective elastic thickness (Te) of the lithosphere in these blocks is larger than the corresponding crustal thickness and brittle-ductile transition depth, implying the dominant contributions of the mantle part. Contrary to these blocks, those ranges such as Tianshan and Longmenshan bounding these blocks are characterized by relatively hot and thin lithosphere; the Te is less than crustal thickness, approximating to the brittle-ductile transition depth, the total rheological strength is less than those of the blocks mentioned above. The middle and west China is mosaic like structure in strength and thermal state, composed by strong and cold blocks and relatively weak and hot orogenic belts. Existence of rheologically weak lower crust as shown in the rheological profiles for different tectonic units may indi-

cate the possibility of decoupling of the uppermost mantle from the upper crust.

Lithospheric thermo-rheological heterogeneities in middle and west China control the Cenozoic deformation pattern and topography configuration, under the boundary force derived from India-Eurasia continental collision. The interior of blocks deform little, due to their rigidity, but rotate in a whole and transfer the collisional force passively, resulting in the uplift of the mountain ranges around; subsidence develop simultaneously at the margins of these blocks where thrust derived tectonic load and erosion derived sedimentation load exert most. The conjunct areas of different blocks and preexisting sutures as thermo-rheological gradient zones are mechanically weak and facilitate to reactivate again under tectonic force, and the uplift of Tianshan Mountain is one good example. This phenomenon of inherited tectonics is common in continental deformation, and should be paid attention in future study.