Perliminary thermal metamorphic constraints on tectonic evolution in the eastern margin of Tibetan Plateau: lessons from the slate belt of Taiwan?

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The Tibetan Plateau, resulting from the active Eurasian-India collision, presents a major scientific challenge in understanding its growth and propagation. One key region is the Longmen Shan mountain belt in western Sichuan, which forms the steepest margin of the plateau and has been active as demonstrated by the Mw 7.9 Wenchuan (2008) and Mw 6.6 Lushan (2013) earthquakes. Tectonic history of the Longmen Shan belt and the neighboring Songpan-Garze terrane, however, began in the Triassic Indosinian orogenesis, which complicates the geologic records. But the major thickening of Tibet was formed in Himalayan orogenesis. Therefore, quantitative constraints on the pre-Tertiary tectonic evolution of the region are crucial in delineating Himalayan geodynamics. In this study, the raman spectroscopy of carbonaceous material (RSCM) geothermometer is applied to the metasediments of the Longmen Shan and Songpan-Garze terrane to obtain their peak metamorphic states. Combining existing metamorphic, geochronologic and thermochronologic data, better rock thermal histories may be reconstructed, providing insights to the structure and development of the orogenic system.

In this study, 50 samples were collected in eastern margin of Tibetan Plateau along several transects in NW-SE direction, perpendicular to the structural grain of the Longmen Shan and into the Songpan-Garze terrane. Together with existing data, distribution of the peak temperatures from RSCM analyses is not correlated to later igneous intrusions, ruling out significant contact metamorphism overprint. Along the WenChuan Fault, the Songpan-Garze terrane is of higher grade than the Longmen Shan, indicating it is a major reverse shear zone. The rather high RSCM temperatures (over 500 °C) acquired from Songpan-Garze metasediments are inconsistent with past models as remnants of a classical accretionary prism; the complex wedge kinematics involving significant basal accretion observed in the slate belt of Taiwan orogen may give clues in reconstructing the structure and evolution of eastern Tibetan Plateau.

Keywords: Tibetan Plateau; Longmen Shan; RSCM geothermometer