

The Implications of Crustal Kinematics Associated with the 2008 M=8 Wenchuan Earthquake by Land-based Gravity Surveys

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The M=8 Wenchuan earthquake significantly ruptured Longmen Shan along the Eastern Margin of Tibetan Plateau in 2008. This event provides important implications to the tectonics and rheology of the Longmen Shan area. Several high-resolution gravity surveys were conducted before and after the event to investigate the regional isostasy and crustal kinematics. From 2008 to 2011, four gravimetric surveys were carried out along two profiles across the northern and southern Longmen Shan from the Sichuan Basin to the Songpan-Graze Terrane. The Bouguer anomalies reveal a sharp increase of crustal thickness from 40 km in Sichuan Basin to more than 60 km in the Tibetan Plateau. Negative isostatic anomaly spans over 100 km of the Songpan-Graze Terrane infers crustal over-compensation and on-going upward isostatic rebound. Across the epicenter in Yingxiu, gravity

values change significantly before and after the Wenchuan earthquake. The co-seismic gravity changes imply a normal slip along the Wenchuan fault and a reverse slip along the Beichuan fault. This normal slip corroborates large-scale crustal extensional settings, lending support to a model with the inflation of lower crustal flow. The two-year post-seismic gravity variations were more than 0.1 mGal of which 25% could be attributed to the viscoelastic mantle relaxation. The abrupt topography along the eastern margin of the plateau is proposed to be a consequence of lower crustal flow squeezed by the isostatic rebound and topographic load. The strong Yangtze Block is thought to obstruct the crustal flow horizontally and direct it to inflate beneath Longmen Shan. This inflation probably contributes to the mountain building of Longmen Shan and the generation of the 2008 Wenchuan earthquake.