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Focal Mechanism and Tectonic Deformation in Seismogenic Area of the 2013 Lushan Earthquake Sequence, China

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Based on the waveform data from Sichuan Regional Seismic Network, China, our present study calculated the focal mechanism solutions and centroid depths of the 20 April 2013 Lushan Ms7.0 earthquake sequence on the southern segment of the Longmenshan fault zone by CAP waveform inversion method. Along with analysis on the strain rosette and areal strain (As), we aimed to discuss the focal mechanism of the sequence and its implications to the tectonic deformation in the seismogenic area. The major findings are as follows: (1) The parameters of the rupture plane are strike 219^o, dip 43^o and slip 101^o for the Lushan Ms7.0 mainshock with moment magnitude Mw6.55 and centroid depth 15 km. The centroid depths of 87 Mw>3.3 aftershocks range from 7 km to 22 km, most of the aftershocks are above the mainshock. The average depth of the sequence is about 13km. No aftershocks occurred shallower than 7 km, indicating the seismogenic source was buried relatively deep. (2) The As values show that reverse faulting is dominant for the sequence, and the strike of the seismogenic structure of the Lushan earthquake is NE with average dip of about 45^o. This is consistent with a dip angle of 43^o for the main rupture plane. P-axis is nearly horizontal and orientated in NW-SE direction, coinciding with the regional stress field. This finding indicates that the seismogenic area is controlled by the stress field, and the Lushan earthquake sequence was resulted from the reverse faulting of the NE-trending faults under a nearly horizontal principle stress with NW-SE orientation. (3) The strain rosettes exhibit self-similarity in terms of orientation and shape for different magnitude intervals, and the As value for every magnitude interval is close to 1.0, reflecting that the seismogenic faults are of nearly pure compressional deformation and independent with magnitude. (4) As value is greater than 0.7 at each depth, and the strike of related strain rosette is NW∼NWW, indicating all the geological structures for the entire seismogenic area or individual segments within different depths are under NW∼NWW compressional deformation. However, variation of As value and both of the shape and orientation of the strain rosette with depth is observed, indicating existence of segmentation of tectonic deformation in a vertical direction.

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