Lithospheric rebuilding of the Alashan and ordos by upper mantle upwelling: evidence from multiscale teleseismic tomography

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Between 2013 and 2015, The China Seismic Array-2 experiment operated 670 broadband seismic stations with an average station spacing of 35km. This seismic array located in northeastern Tibet and covered the Qilian Mountains, Qaidam Basin, and part of Songpan-Ganzi, Gobi-Alashan, Yangzi, and Ordos terrane. ~90,000 P-wave relative travel times from ~300 teleseismic events were picked by cross-correlation method. A new multiscale seismic traveltime tomography technique with sparsity constrains were used to map the upper mantle P-wave velocity structure beneath northeastern Tibet. The seismic tomography algorithm employs sparsity constrains on the wavelet representation velocity model via the L1-norm regularization. This algorithm can efficiently deal with the uneven-sampled volume, and give multiscale images of the model.

Our preliminary results can be summarized as follows: 1) in the upper mantle down to 200km, significate low-velocity anomalies exist beneath the northeastern Tibet, and slight high-velocity anomalies beneath the Qaidam basin; 2)under Gobi-Alashan, Yangzi, and Ordos, high-velocity anomalies appear to extend to a depth of ~250km, this high-velocity may correspond to the lithosphere; 3) there exist relative high-velocity anomalies at depth of 250km-350km underneath north Tibet, which suggests lithospheric delamination; 4) there exist low-velocity anomalie from depth of 500km under Qinlin extented to uppermantle of the north part of Ordos and eastern margin of Gabi-Alashan terrane, which implied the upper mantle upwelling transform and rebuild the lithosphere of Gabi-Alashan and Ordos.

Keywords: upper mantle upwelling, Alashan, Ordos, multisacle seismic tomography

