Experiment name* North China Interior Structure Project-Experiment 5 (NCISP5)

Names of Principal Investigators and their institutions* Ling Chen, Institute of Geology and Geophysics, Chinese Academy of Sciences (IGGCAS)

Mobilization date* 2006-12-25

Demobilization date* 2008-05-23

Number of stations: 64

Network Code and Years: ZB, 2006-2008

A brief summary of the experiment:

We have deployed a ~1000-km long E-W directed temporary seismic array at ~36°N in north China, starting from around the boundary between the Bohai Bay Basin (the major part of the eastern North China Craton, or NCC) and the Taihang Mountain (eastern portion of the central NCC), crossing the Ordos Basin (western NCC) and ending at the Qilian Orogenic Belt (bounding the NCC to the west). This array consists of 64 broadband seismic stations, with an average intra-station distance of ~15 km. By employing receiver function migration, surface wave and body wave tomography, and shear wave splitting methods, we have studied the crustal and upper mantle structure beneath the array and adjacent areas.

Preliminary seientific results, if any:

- Crustal thickness and average Vp/Vs ratio at most of the 64 stations as well as the crustal shear wave velocity structure beneath a major part of the seismic array were derived by adopting H-κ stacking and waveform inversion of P-receiver functions, respectively. In combination with imaging results for other parts of the NCC, these robservations reveal significant crustal structural variations of the craton, consistent with the long-term evolution and diverse tectonics in its different parts during the Phanerozoic.
- An integrated lithospheric structure image was constructed by combining S- and P-receiver function images and surface-wave tomography results using this array data and other geophysical and geological observations. A relatively low velocity layer (LVL) was detected within the thick (~160-200 km) and overall high velocity mantle root in the central-western NCC, with its top interface imaged as a negative velocity discontinuity at the depth of ~80–100 km. Our observation corroborate recent seismic studies under stable continental regions worldwide, and suggest the common presence of vertical heterogeneities and layering in the sub-continental lithospheric mantle.
- Shallow upper mantle deformation in the NCC sampled by both this array data and other datasets was investigated by shear-wave splitting measurements. The results suggest the presence of a weakly deformed mantle lithosphere beneath the major part of the western NCC bounded by strongly but differently deformed mantle lithosphere in the surrounding orogenic belts of different ages, in good agreement with the lithospheric structural features derived from other data and regional tectonics of the craton.

Approximate amount of data (in MB): 398000

Describe any known problems with the data or particular problems encountered during the experiment:

List of publications submitted:

1. Wei, Z.G., Chen, L., Jiang, M.M., Ling, Y., 2015, Lithospheric structure beneath the central and western North China Craton and the adjacent Qilian orogenic belt from Rayleigh wave dispersion analysis, Tectonophysics, 646, 130-140.
2. Wei, Z.G., Chu, R.S., Chen, L., 2015, Regional differences in crustal structure of the North China Craton from receiver functions, Science China Earth Science, 58(12), 2200-2210.
3. Chen, L., Jiang, M.M., Yang, J.H., Wei, Z.G., Liu, C.Z., Ling, Y., 2014, Presence of an intralithospheric discontinuity in the central and western North China Craton: Implications for destruction of the craton, Geology, 42(3), 223-226.
4. Wei, Z., Chen, L., Wang, B.Y., 2013, Regional variations in crustal thickness and Vp/Vs ratios beneath the central-western North China Craton and adjacent regions, Geological Journal, 48(5), 531-542.
5. Zhao, L., Allen, R.M., Zheng, T., Zhu, R., 2012, High-resolution body-wave tomography models of the upper mantle beneath eastern China and the adjacent areas, Geochem. Geophys. Geosyst., 13, Q06007, doi: 10.1029/2012GC004119.
6. Wei, Z., Chen, L., Xu, W.W., 2011, Crustal thickness and Vp/Vs ratio of the central and western North China Craton and its tectonic implications, Geophysical Journal International, 186, 385-389.
7. Chen L., 2010, Concordant structural variations from the surface to the base of the upper mantle in the North China Craton and its tectonic implications, Lithos, 120, 96-115.
8. Zhao, L., Xue, M., 2010, Mantle flow pattern and geodynamic cause of the North China Craton reactivation: Evidence from seismic anisotropy, Geochem. Geophys. Geosyst., 11, Q07010, doi:10.1029/2010GC003068.
9. Zhao, L., Allen, R.M., Zheng, T., Hung, S., 2009, Reactivation of an Archean craton: Constraints from P- and S-wave tomography in North China, Geophysical Research Letter, 36, L17306, doi:10.1029/2009GL039781.
10. Zhu, R.X., Zheng, T., 2009, Destruction geodynamics and Paleoproterozoic plate tectonics of the North China Craton, Chinese Science Bulletin 54 (19), 3354–3366.

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