Experiment name* North China Interior Structure Project-Experiment 1 (NCISP1)

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

Mobilization date* 2000-11-02

Demobilization date* 2001-11-01

Number of stations: 47

Network Code and Years: YY 2000-2001

A brief summary of the experiment:

The North China Craton (NCC) is one of the world's oldest, preserving continental rocks as old as 3.8 Ga; the basement consists of variably exposed Archean–Paleoproterozoic rocks. The craton is composed of two major Archean blocks, the eastern and western NCC, that was sutured along the Trans-North China orogeny in the Paleoproterozoic. After cratonization, the NCC remained relatively stable with a thick Archean lithospheric keel until the early Mesozoic. The NCC settled into the East Asia continent by amalgamating with the surrounding continental blocks. To the north, amalgamations of the NCC with the accretion terranes of the Central Asian Orogen occurred during the Late Permian to Early Triassic. To the south, the continent-continent collision between the NCC and the Yangtze craton was one of the most important accretion events in the Triassic. Since the Late Mesozoic, the craton has become unstable and marked by large-scale structural deformation and magmatic activity occurred in the eastern NCC.

The NCC is a classic example of ancient destroyed cratons. For understanding the interior structure and the tectonic evolution of the NCC, the North China Interior Structure Project (NCISP) had been carried out in 2000-2009. This seismic experiment had deployed 478 portable broadband seismometers with an average spacing of about 10–17 km in eight profiles and covered several major tectonic units. Seismic results based on such observations had revealed many interesting features of the crust and upper mantle of the NCC.

The NCISP-1 consists of two linear seismic arrays. The stations oriented in an E-W direction crossed the Shandong Province over a distance of ~230 km from the western margin of the Luxi uplift to the east of the Tanlu fault zone, which is one of the largest continental faults on the East Asia continent. The stations oriented in an N-S direction crossed the northern Luxi uplift in the south and the Jiyang depression in the north.

Preliminary scientific results, if any:

The velocity structure information, including crust, lithospheric mantle, upper mantle and mantle transition zone, as well as the seismic anisotropy in the observation area and the NCC have been extracted based on these observations.

The seismological results revealed that the present lithosphere beneath the E-W

profile consists of two parts with different structural features throughout, including crustal fabric, lithospheric velocity stratification, and anisotropic patterns. The formation of the contrasting structure is attributable to one of two possibilities: the trans-lithospheric Tanlu fault zone operated as an asthenospheric upwelling channel and facilitated the NCC reactivation, or the Tanlu Fault Zone separates the study region into two lithospheric blocks, with the ancient lithospheric materials remaining within the rejuvenated lithospheric mantle. (Zheng et al., 2008)
The receiver function imaging result reveals a 60- to 80-km-thick present-day lithosphere beneath the study region, significantly thinned from the Paleozoic lithosphere of >180 km. (Chen et al., 2006)
The receiver function imaging shows that the 660 km discontinuity is locally depressed in the eastern region, and then it splits into multiple discontinuities. The multiple discontinuity structure is attributable to the stagnating of the paleo-pacific slab near the bottom of the upper mantle. (Ai and Zheng, 2003)

Approximate amount of data (in MB): 587000

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

List of publications submitted:

1. Ai, Y. & Zheng, T. Y. The upper mantle discontinuity structure beneath eastern China. *Geophys. Res. Lett. 30*, 2089, doi:10.1029/2003GL017678 (2003).
2. Chen, L., Zheng, T. Y. & Xu, W. W. A Thinned Lithospheric Image of the Tanlu Fault Zone, Northeastern China: Constructed from Wave Equation Based Receiver Function Migration. *J. Geophy. Res, 111*, B09312, doi:10.1029/2005JB003974 (2006).
3. Zhao, L. F., Wang, W. M., Li, J. & Yao, Z. X. Modeling the seismic response of basin-edge structure by a sequential waveform method. *Tectonophysics 420,* 493–507 (2006).
4. Zheng, T. Y., Zhao, L., Xu, W. W. & Zhu, R. X. Insight into modification of North China Craton from seismological study in the Shandong Provice. *Geophysical Research Letter, 35*, L22305, doi:10.1029/2008GL035661 (2008).
5. Chen L., Wang T., Zhao L. & Zheng T.Y. Distinct lateral variation of lithospheric thickness in the northeastern North China Craton. *Earth and Planetary Science Letters 267*, 56-68 (2008).
6. Chen, L., Cheng, C. & Wei, Z. G. Seismic evidence for significant lateral variations in lithospheric thickness beneath the central and western North China Craton. *Earth and Planetary Science Letters, 286,* 171-183 (2009).
7. Zhao, L., Richard, M. A., Zheng, T. Y. & Hung, S. H. Reactivation of an Archean craton: Constraints from P- and S-wave tomography in North China. *Geophysical*

Research Letters, 36, L17306, doi:10.1029/2009GL039781 (2009).

8. An, M., Feng, M. & Zhao, Y. Destruction of lithosphere within the north China craton inferred from surface wave tomography, *Geochem. Geophys. Geosyst., 10*, Q08016, doi:10.1029/2009GC002562 (2009).
9. Chen, L. & Ai, Y. S. Discontinuity structure of the mantle transition zone beneath the North China Craton from receiver function migration. *Journal of Geophysical Research, 114,* B06307, doi:10.1029/2008JB006221 (2009).
10. Zhao, L. & Xue, M. Mantle flow pattern and geodynamic cause of the North China Craton reactivation: Evidence from seismic anisotropy. *Geochemistry, Geophysics, Geosystems*, 11, Q07010, doi:10.1029/2010GC003068 (2010).
11. Xu, W. W., Zheng, T.,Y. & Zhao, L. Mantle dynamics of the reactivating North China Craton: Constraints from the topographies of the 410-km and 660-km discontinuities, *Science China Earth Sciences, 54,* 881-887 (2011).
12. Zheng, T. Y., Zhu, R. X., Zhao, L. & Ai, Y. S. Intralithospheric mantle structures recorded continental subduction. *Journal of Geophysical Research, 117*, B03308, doi:10.1029/2011JB008873 (2012).
13. Zhao, L., Allen, R. M., Zheng, T. Y. & Zhu, R. X. High-resolution body-wave tomography models of the upper mantle beneath eastern China and the adjacent areas. *Geochemistry, Geophysics, Geosystems, 13,* Q06007, doi:10.1029/2012GC004119 (2012).
14. Zhao, L., Zheng T. Y., & Lu, G. Distinct upper mantle deformation of cratons in response to subduction: constraints from SKS wave splitting measurements in eastern China. *Gondwana Research 23*, 39-53 (2013).
15. Si, S. K., Zheng, Y. P., Liu, B. H., & Tian, X. B., Structure of the mantle transition zone beneath the North China Craton, Journal of Asian Earth Sciences 116, 69–80, http://dx.doi.org/10.1016/j.jseaes.2015.11.006 (2016).

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