A new result of the crustal structure and variation of the Moho in central Tibet-revealed by the 300 km long deep seismic reflection profile

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The Bangong-Nujiang Suture (BNS) resulted from the collision of the Lhasa terrane（LB）and Qiangtang terrane（QB）in the late Jurassic(Yin A. & Harrison T. M., 2000), was subsequently reactivated by strike slip deformation by the Himalayan collision. The QB has also been associated with the mantle suture between India and Asia, i.e. northern limit of penetration of the subducted Indian lithosphere beneath the Asian Tibetan crust. Partial melting zone in the lower crust of the LB is suspected to be one factor that may have limited seismic penetration in this region. The E-W trending Qiangtang central uplift, located in the interior of the Qiangtang terrane is interpreted as a major convergence structure associated with the west Kunlun orogenic belt (Gao, et al., 2000).

Understanding the composition and structure of the over thickened crust of the Tibetan plateau is fundamental to unraveling the mechanisms for uplift of the Tibetan plateau. Deep seismic reflection profiling is one of the internationally recognized advanced techniques that can reveal the fine structure of continental lithosphere.

In the early 1990s, deep reflection profiling was successfully carried out in the southern Tibetan plateau by the INDEPTH project, imaging the Main Himalaya Thrust which marks the underthrusting of the Indian plate beneath Himalaya. However, subsequent deep seismic by INDEPTH efforts within the interior of the Tibetan plateau was too limited to trace lower crustal structure near the Bangonghu-Nujiang suture (BNS) (Ross, et al., 2004).

As part of the new SINOPROBE-02 initiatiave (Sinoprobe-02) and with funding from the NSF of China (40830316), we collected a 310 km of deep seismic reflection profile is crossing Bangong-Nujiang suture and Qiangtang terrane, successfully revealed details of thecrustl structures down to the Moho and possible deeper. The profile starts west of the Silin Co in the northern Lhasa block, crosses the Bangong-Nujiang suture west of Lunpola, skirts the eastern extension of the central Qiantang anticline and ends at Dogai Coring just of south of Jinsha suture. Main acquisition methods are showed in Table1.

Recording system	408XL	Near offset(m)	225
Geophones(Hz)	10	seismic source(kg)	50(small)
Receiver group spacing(m)	50		200(middle)
Numbers of one receiver group	24		1000(large)
Number of channels	960(large)	shot spacing(m)	250(small)
	720(middle/small)		500(middle)
Record length(s)	60(large)		50000(large)
	30(middle/small)	shot depth(m)	30*1(small)
Sample interval(ms)	4(large)		50*2(middle)
	2(middle/small)		50*10(large)
Far offset(m)	47975(large)	fold	72(small)
	17975(middle/small)		36(middle)

Table 1: Acquisition parameters of the deep seismic reflection profile. We used large explosive (1000kg), deep drill (50m) and long spread (ac.50km) to get more deep reflection data.

The stack of 300 km long section provides us a with the first detailed image of this area. The result shows that (1) beneath the southernmost portion of the profile there are two sets of strong north-dipping reflectors between 10 s-19 s TWT, which we interpreted to indicate that the LB may underthrust beneath the BNS; (2) there is a well-developed northward thrust beneath the shallow crust near the BNS; (3) there is a broad, gently folded reflection that presents close to the southern segment of the BNS at 10s and shallower to ca. 7 s crossing the BNS; (4) that the Moho reflection appears at 23-24 s in the southern of BNS, with an indication of the change in the Moho depth across the BNS, Moho reflection appears at 20 s. New data should provide us with the first detailed reflection image of crustal structure in Central Tibet.

References

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