THE MIDDLE ASIAN ACTIVE SOURCE (MANAS) PROFILE: PRELIMINARY RESULTS FROM AN INTEGRATED SEISMIC TRANSECT IN THE TIEN SHAN OF KYRGYZSTAN AND CHINA

James H. Knapp (Dept. Geological Sciences, Univ. of South Carolina, Columbia, SC 29208 USA), Steven W. Roecker (Earth & Environmental Sciences, Rensselaer Polytechnic Institute, Troy, NY 12180, USA), Steven K. Park (Dept. Earth Sciences, University of California, Riverside, CA 92521, USA), Gennady Schelochkov (Research Station of the Russian Academy of Sciences, Geodynamic Proving Ground, Bishkek, 720049, Kyrgyzstan), He Rizheng (Chinese Academy of Geological Sciences, No. 26 Bai Wan Zhuang St., Xicheng, Beijing, 100037, China)

Recognized as one of the highest, youngest, and most active orogenic systems on Earth, the Tien Shan are situated internal to the Eurasian continent, up to 3000 km from the former plate boundary with the Indian subcontinent. Existing geologic constraints imply that up to 200 km of shortening may have occurred within the Eurasian plate in Late Tertiary to Recent time. Additionally, geologic, topographic, and gravimetric data suggest that continental lithosphere of the Tarim basin may presently be subducting beneath the southern margin of the Tien Shan, in the absence of an oceanic slab. While geodetic measurements document that the Tien Shan currently record about half of the shortening between India and Eurasia, geologic data dictate that active faults are restricted to only several of the individual ranges that make up the mountain belt. Passive-source seismological studies have suggested the perhaps surprising result that the orogenic crust is thickest (65-70 km) at both the southern and northern margins of the Tien Shan, and thins dramatically (to ~35 km) within the internal part of the orogen. New near-vertical deep seismic reflection data, acquired during the summer of 2007, constitute an ~350 km lithospheric transect from the northwestern Tarim Basin in China to the central Tien Shan of Kyrgyzstan. Key targets of the MANAS (Middle AsiaN Active Source) Profile included (1) the top of the Tarim crust as it descends beneath the southern Tien Shan, (2) an inferred crustal-scale frontal ramp, representing where the continental plate may have broken and is now descending into the upper mantle, (3) the geometry of demonstrably active faults below the shallow depths to which they can be inferred from surface geologic constraints, (4) the topography and seismic reflection signature of the Moho, especially given the unexpected variations in crustal thickness across the orogen, and (5) the significance of both crustal and upper mantle conductivity anomalies previously identified through magnetotelluric studies. The experimental design involved roll-along of stand-alone seismometers (Reftek-125A), allowing essentially continuous CMP coverage along the entire ~350-km transect, despite the challenging terrain. These seismic reflection data are coincident with broadband array (40 stations at ~10 km spacing for two years) and magnetotelluric measurements along the profile route to provide an integrated geophysical fingerprint of the lithospheric structure of intracontinental mountain building. Of particular note in our preliminary analysis is the dramatic inconsistency of estimates on crustal thickness as determined from passive and active seismology. MANAS Profile data suggest crustal thickening to as much as 50+ km within the central Tien Shan, in contrast with results from passive source analysis.