第八章　　英文摘要

Abstract on Active Fault Survey and Stress Measurement along the Golmud-Lhasa Railway, Tibetan Plateau, China

The Golmud-Lhasa Railway across the Tibetan Plateau faces permafrost deformation, active faulting, earthquakes and various geological hazards. China Geological Survey (CGS) together with Railway Ministry of China deployed active fault mapping, geological hazard survey and stress measurement along the Golmud-Lhasa Railway in 2001-2003, provided necessary geological data for designing railway construction and decreasing geological hazards besides dense drilling and large-scale engineering geological survey along the railway-line organized by Railway Ministry of China in 2001.

Quaternary geological survey finished Quaternary geological mapping of Kunlun Mts., Tanggula Mts., Nyainqentanglha Mts. Chumaerhe River, Tuotuohe River, Naqu River and Namco Lake at scale 1:100 000 and dating on glacial, lacustrine, fluvial and alluvial deposits, established new time constrains for active faults along the Golmud-Lhasa Railway. New evidences on Quaternary environment changes in central Tibetan Plateau, especially glaciation and lake level change, were discovered during Quaternary geological survey along the Golmud-Lhasa Railway.

ETM remote sensing images, geophysical prospecting, trenching and field mapping at scale 1:2000 were used for active fault survey along the Golmud-Lhasa Railway, identified and marked 114 active faults in railway designing map at scale 1:2000, including 4 intensive active faults, 28 regional active faults and other minor active faults. Geological hazards posed by active faulting in permafrost areas, e.g. surface rupture and deformation of earthquakes, fault creep, thaw depression, freezing expansion and fracture zone were measured in detail along the Golmud-Lhasa Railway.

It is estimated that the Xidatan active faults existed sinistral strike-slipping at an average rate of 7.7mm/a in Holocene, the Hohxil active faults occurred sinistral strike-slipping at rate of 3.3-7.8mm/a in Holocene, and the Bengco active faults dextrally strike-slipped at an average rate of 11.5mm/a in Late Pleistocene-Holocene. Major boundary faults of Wenquan, Ando, Gulu-Sangxiong and Yangbajain-Damxung grabens existed vertical slip at rate of 0.45-1.2mm/a, 0.3-0.5mm/a, 0.8-1.4mm/a and 1.1-2.0mm/a respectively in Late Quaternary, corresponding to evident crust extension of central Tibetan Plateau. More than 3-4 times of intensive palaeo-earthquakes were identified in Late Pleistocene-Holocene in the Xidatan, Hohxil and Bengco strike-slip faults and major boundary faults of the Wenquan, Gulu-Sangxiong and Yangbajain-Damxung grabens.

Migrating pingos were discovered in Budongquan valley, Chumaerhe River, South Yamaerhe River and the 83rd station, 85th station and 86th station along the Golmud-Lhasa Railway. Large pingos in permafrost north Tibetan Plateau form along active faults, and many change position annually along active fault zones and thus appear to migrate. Migrating pingos had damaged the highway and the oil pipeline adjacent to the railway since 2001, one caused tilting and breaking of a bridge pier and destroyed a highway bridge across the Chumaerhe River. And potential hazards of migrating pingos to railway bridges were discovered at the 83rd and 85th stations of the highway.

In-situ stress measurements were carried out in surrounding areas of the Kunlunshan,

Fenghuoshan and Yangbajain tunnels of the Golmud-Lhasa Railway by overcoring piezomagnetic method, provided one kind of important data for tunnel design. And stress change before and after the Ms 8.1 Kunlun Earthquake was measured in north of the Xidatan active fault. Stress before the earthquake reached to as high as 6-12MPa, and decreased to as low as 2-3MPa 6 months after the earthquake, giving constrain for modeling and precursor for prediction of intensive earthquakes.

Stress fields of tunnels with different geometric features were calculated by finite element modeling. Laboratory testing for mechanical properties of rocks and assessments on tunnel stability and crust stability had been carried out respectively for the Golmud-Lhasa Railway, followed by available suggestions on strengthening engineering facilities and decreasing geological hazards.