

Active faulting along the mount foot of the Bhutan Himalayas near Phuentsuoling, Southwestern Bhutan

Hiroshi Yagi[1], Daisuke Higaki[2], Yeshe Dorji[3], Touru Koike[4]

[1] Geogr., Yamagata Univ., [2] Agriculture and Life Sci., Hirosaki Univ., [3] GSB, [4] JOCV/GSB

I. Introduction

Crustal shortening due to the collision of the Indian and the Eurasian Plates has originated active faults in the Himalayan region. Active fault systems in the Himalayas have been gradually clarified since 1970's in the Nepal and India. However, there are few studies on active faults in Bhutan territory, though Ganser (1964) and Nakata (1972) pointed out neotectonic movement along Jaldhaka River in Indian Territory just near far southwestern Bhutan. This paper reports the first findings of active fault along the mount foot of the Bhutan Himalayas near Phuntsholing, southwestern Bhutan and reports sense and activity of the faults.

II. Geographical and Geological setting around Phuntsholing

Phuntsholing is a gateway city of Bhutan to India on a left bank of Torsa River in an altitude of 250 meters a.s.l. It locates in a northern end of a re-entrant and locates on a piedmont line of Bhutan Himalayas that abruptly rises up to 4,000 meters a.s.l. Lower slope of Bhutan Himalayas is composed of meta-sediments. Siwaliks are not recognized around Phuntsholing. MBT is presumed to be under the alluviums of Torsa River.

III. Method of this study

Interpretation of aerial photographs in scale of 1/12,500 was carried out with a topographical map of 1/50,000 issued from Topographical Survey Department of Bhutan.

Field survey was done along a foothill of Torsa - Basra Rivers. Deformation of terrace deposits was observed together with topographic survey of displacement of the terrace surfaces.

IV. Deformation of fan surfaces and neotectonic movement in this study area

Four levels of colluvio-fluvial fan surfaces are distributed sporadically along the mount foot near Phuntsholing. They are the Highest, Higher, Middle and Lower surfaces in descending order.

Jogi Fault : Obvious evidence of continuous upheaval in late Holocene is also observed on Lower surface at an outlet of Jogi Khola (River) just across the piedmont line. Lower surface warps up on a lower course side along Jogi Khola. The surface is tilting to the north as a whole. And then the surface is abruptly downthrown to the lower course, forming a steep south-facing scarp perpendicular to the river course. Deposits of the surface that consist of sub-angular to sub-round gravels also dip to the north concordant to the surface, though they were brought from the Bhutan Himalayan side. The south facing scarp is traceable along the piedmont line, towards eastern and western extension of the scarp, forming discontinuity on the young fan surfaces along their fringe.

Malbanse Fault : An uphill facing (anti) scarp of East-West direction runs across Middle surface perpendicular to the river course of Dozamara Khola. A transversal shallow graven develops just behind the anti scarp. The anti scarp is formed by active faulting, indicating relative subsidence of the Bhutan Himalayan side.

Active faults with sometimes occur in the Lower Nepal Himalayas. Malbanse Fault is presumed as a normal fault, comparing with features of the faults in the Lower Nepal Himalayas that show a sense of downthrow on the upper course side. Because normal faults of high angle in Lower Nepal Himalayas usually occur sporadically with straight traces and are distributed behind rapidly uplifting blocks fringed by reverse faults as MBF along their southern margin. Malbanse fault is neighboring just behind the block of which southern margin is bordered by Jogi fault. A wedge shaped block fringed by Jogi fault in the south and by Malbanse fault in the north is uplifting very rapidly, however, a huge mass of Bhutan Himalayas can not smoothly catch up with the wedge due to its enormous gravity. It is a reason why a sense of Malbanse fault is normal, although regional tectonic stress is compressional over South Asia.