Effectiveness and problems of pit excavation on a mountain slope as a paleoseismological method

Heitaro Kaneda[1], Keiji Takemura[2], Masaaki Kanehara[3]

[1] Earth and Planetary Sci., Kyoto Univ, [2] Dept.Geophysics, Grad. Sci., Kyoto Univ., [3] Fac. Edu., Nara Univ of Edu.

http://www-crus.kugi.kyoto-u.ac.jp/member/kaneda/index2.htm

Trench excavation is less effective for active faults in mountainous regions. We propose a new method pit excavation on a mountain slope to reveal timing of latest events of such faults. This method is carried out across a fault scarp of less than about 2m high which dams up a mountain slope and sediment trapped by the scarp should provide better information on the timing of the latest event.

We applied the method experimentally to the northern segment of the Daguchi fault, a short right-lateral active fault in the Nosaka Mountains, north of Lake Biwa. The rupture history of the segment has remained unknown because of lack of a good trench site. We found out a fault scarp of about 1m high which dams up a mountain slope along the fault trace and carried out a pit excavation across the scarp. A very clear fault and trapped sediment of about 75cm thick are observed on the pit wall. The upper 60cm of the sediment is peaty soil and lower 15cm is a gravel layer of probable rockfall origin. Since the sediment showed no displacement or deformation associated with surface faulting, we interpreted that they all deposited after the latest event. We also carried out identification of species and region for wood fragments from the sediment. Unfortunately, all samples except those unable to identify were parts of Cryptomeria japonica or Cupressaceae which can live for hundreds or even thousands of years: this means possible large offset between deposition and radiocarbon age for these samples. However there are samples from outermost trunk among them. We can regard radiocarbon age as deposition one for such samples in consideration of very small catchment area of the pit site (several hundreds m2). The radiocarbon age of wood samples, mainly from outermost trunk, are 1550+/-40yBP, 1470+/-40yBP, 1015+/-50yBP, 605+/-50yBP and 580+/-60yBP from the bottom of the trapped sediment. On the basis of these ages, the timing of the latest surface faulting along the northern segment of the Daguchi fault is estimated about 1500 years ago (5th to 7th century AD). This age is about 1000 years older than the estimation for the southern segment of the fault based on trench and pit excavations by Sugiyama and Yoshioka (1999).

From the previously mentioned result of the experimental investigation, we can conclude that information on timing of a latest event is possibly extracted by use of pit excavation on a mountain slope even for an active fault without a good trench site. The remaining problem is applicability of the method for other faults. Based on preliminary geomorphological mapping for active faults having ruptured in the recent 120 years, the Neodani fault which ruptured during the 1891 Nobi earthquake must be applicable. More applications of the method for other faults including the Neodani fault are necessary.