Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

HQR23-01 Room:302 Time:May 25 09:00-09:15

Relationship between grouth of active fold and slope collapse in Chuetsu District, Niigata Prefecture

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This study compared the relationship between growth of active fold accompanied by an earthquake and concentration of slope collapse about the case of the Yamakoshi area in the 2004 Niigata Prefecture Chuetsu Earthquake and the Nishiyama hills in the 2007 Niigata Prefecture Chuetsu-oki Earthquake. Koarai et al. (2011a, 2011b) have reported the result of this research in the first year.

The result of terrace classification in the area along Imokawa River interpreted from the 1-m interval contour lines by airborne laser survey data is shown in Fig. 1. The terrace was divided into eight steps, and terrace 5 is not covered with loam, but terrace 3 is covered with loam which contains bubble wall type volcanic glass and ortho-pyroxene. This tephra is not identified with known tephra. While UG tephra which regarded as having descended about 12,000 years ago is detected on terrace 1 (equivalent to terrace Lf1 by Hataya et al. (2006)), K-Ah tephra which descended about 7,000 years ago is detected and the tephra before UG is not detected on terrace 3. Thus, it is considered that terrace 3 was formed between 12,000 years ago and 7,000 year ago.

On the other hand, the volcanic glass which can be identified as UG was detected in the layer on terrace Lf4 along Uono River with chemical composition analysis. The existence of As-K tephra which descended about 15,000 years ago in this layer was reported by Hataya et al. (2006). The formed age of the terrace along Uono River has the possibility to be younger than before.

Displacement between present river bed and terrace 3 is about 30 m in the upstream area of the Imokawa River (near the axis of Komatsukura anticline), and is about 20 m in the downstream area of the river (near the Uono River juncture), with horizontal distance of 750 m. It is assumed that the difference of the displacement is brought by the growth of Komatsukura anticline. Based on Koarai (1990), it is considered as the growth rate of active fold is supposed to be equivalent to: (vertical displacement / horizontal distance) / terrace formation age. The growth rate of Komatsukura anticline might be calculated as: (vertical displacement of terrace 3 / horizontal distance) / formation age of terrace 3 = (10m / 750m) / 7,000-12,000yr =1.1-1.9$*10^{-6}$/year. According to Koarai et al. (2010), the growth rate of active fold is 8.3$*10^{-7}$/year in the Nishiyama Hills, and 4.5-5.3$*10^{-7}$/year at Yamamotoyama terrace (covered with Iz-Kt), 1.0-1.2$*10^{-7}$/year at Kowadahara terrace (covered wiyh Aso-4), 1.0$*10^{-6}$/year at Ikenaka-shinden terrace (covered with DKP), and 1.1$*10^{-6}$/year at Ojiya terrace (covered with AS-K) in the Ojiya area. The growth rate of active fold (Komatsukura anticline) near Imokawa River region is corresponded to the Nishiyama hills or the Ojiya area in order level.

In the case of the 2011 Nagano and Niigata border Earthquake, slope collapse was concentrated on Matsunoyama area which is located on the hanging wall side of a reversed fault and crustal deformation was detected by InSAR in this area (Nakano et al.2012).The phenomenon that slope collapse by an earthquake is concentrated on the upheaval region was also observed by the 2004 Niigata Prefecture Chuetsu Earthquake and the 2007 Niigata prefecture Chuetsu-oki Earthquake. Since Matsunoyama anticline existed in Matsunoyama area, slope collapses may have occurred in the growth region of active fold accompanied by an earthquake.

Keywords: active fold, slope collapse, Chuetsu District, Imokawa River basin, growth speed, UG tephra

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