

Terrain and weathering properties that determined mass movements such as landslides and deep-seated landslides

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1. Importance of mass movements in land formation processes in mountains

The concept of cycle of erosion proposed by Davis is mainly based on River Process, that is, downward and lateral erosion by surface water. However, comprehension of precise landform and topographical analysis by recent laser profilers have revealed that the topographical features of mountain slopes are a wide-ranging land not clearly due to the erosion of surface water. Although it can hardly be disputed that the greatest process and agent of mountain erosion is often erosion by rivers, it is also necessary to consider Slope Process in terms of formation of mountain slopes. Approximately 100 million cubic meters of rubble and sand is estimated to have resulted by collapse phenomena such as deep-seated landslides at the time of Typhoon No. 12 in 2011 and approximately one billion cubic meters at the time of the Totsugawa Disaster in 1889. It is assumed that vast sand gravel layers deposited from the Totsugawa River to the Kumanogawa River are the result of repeated large-scale collapses such as deep-seated landslides.

2. Slope characteristics of mass movements

An investigation was conducted focusing on the relationship between slope characteristics of vast areas around the sites of incidence (slope frequency distribution and mode value) and basement rock weathering characteristics, including cases of landslides and deep-seated landslides caused by Typhoon No. 12 and slope collapses of a shallow depth and rock slope collapses having occurred before then.

3. Conclusion

The areas where the so-called deep-seated landslides occurred this time have the distinctive characteristic of chemical weathering development compared with rock creep slopes that have not collapsed despite steeper slopes. In addition, relatively large-scale twin ridges have been formed along the head ridge of the areas where deep-seated landslides occurred in Kitamata. It is thereby assumed that separation and fracture associated with movement and deformation of land blocks due to chemical weathering and rock creep has been developing for quite a long time at least in part of the areas where deep-seated landslides occurred this time. With regard to the locations where deep-seated landslides occurred, it is considered that massif remaining above the knick line, which becomes a post-glacial erosional front referred to by Hatano, constitutes a large portion of moving land blocks and slope inclination angles in the sites of incidence are smaller than the mode value in the slope inclination angle frequency distribution in vast areas around the sites.

Keywords: slope process, mass movemnts, rock creep, deep seated landslide, slope angles, mode