Joint structures and slope characteristics, and the estimation of type and frequency of the occurrences of slope movements

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Combination of two or three systems of joint planes with different direction and spacing controls types of slope movements and the degree of instability in rock slopes. In addition to them, weathering rate of rock mass may influence on regression rate of slopes, and consequently they may control the configurations of steep slopes by repeating slope movements. The author studied joint structures in volcanic rock slopes of Mt.Kirikabu, western Oita, Japan, in addition to the information on types of movements, degree of instability, and slope topography to understand the relationships among them.

The mountain is composed of Pliocene andesite lava and thin intrusive rocks, and is characterized by remarkable mesa topography with steep slopes of 100 meters high. Based on strike and dip of joint planes, one system of low angle joints and two systems of high angle joints are commonly recognized in the steep slope. Low angle joints are mostly coincide with that of flow structures of the rocks.

Regarding the relation between dip directions of joint planes and slopes, low angle joints are subdivided into two types, outward dip and inward dips types, respectively. The former is dominant in intrusive rocks, whereas the later in lava portion. Either translational slide or toppling occur depending on the geometrical relations between joint planes and slope, and the combination of direction of joint planes and spacing in low angle joints dominant area. Inward dip type are dominant in northern portion, and relatively stable.

Slope angle is small with a little variation in translational slide zone, whereas large with large variation in toppling zone. The latter is a alternating slopes of steep toppling and gentle sediment slopes. These contrasts reveals on the characteristics of slope topography of this mountain.

Safety factor Fs estimated for sliding and toppling is relatively low in western slopes, whereas high in eastern slopes. Under the assumption that weathering rate of rock mass is constant, the occurrence of sliding is more frequent in western slopes than that in eastern slopes. This reveals the characteristics of asymmetric slope configuration of the mountain. This means that it is possible to estimate types and frequency of slope movements along individual slopes based on the information on both joint structures and characteristics of slopes. Consequently, we can obtain a susceptibility map of slope movements.