# Detection and evaluation of possible catastrophic landslides

Masahiro Chigira[1*]

[1] Fukada Geological Institute, Tokyo, Japan

*Corresponding author: e-mail address: chigira@fgi.or.jp

***Keywords:*** *Prediction, catastrophic landslides, earthquake, rain*

***Abstract:*** Catastrophic landslides, which are deep-seated, extremely rapid and highly mobile, must be predicted and evaluated for their occurrence possibility. This paper is a summary of our experience of catastrophic landslides for their prediction and hazard evaluation. Hazard evaluation would be made for potential landslides, so the prediction of landslide sites or areas need to be made first. Predictive methodology is dependent on the triggers of landslides, such as rainstorms and earthquakes. Some landslides have no specific triggers, but they are very rare. Our recent experience tells that rainfall-induced catastrophic landslides could be predicted pin-point by using high-resolution DEMs obtained by LiDAR, which became popular in the landslide community since 2000s. Most of the rain-induced catastrophic landslides are preceded by some type of deep-seated gravitational slope deformation (DGSD), which is represented by minor displacements with eyebrow scarps and/or smooth slope surfaces with few gullies. Undercutting of the deformed slopes is an additional factor to be considered as a prediction criterion. Most important geological structure for rain-induced catastrophic landslide has been found a downslope dipping fault with brittle crush zone, which is weak and likely become a sliding zone. Brittle crush zone with gouge is impermeable and impedes water drain to cause pressure build up. When the faults dip into the mountain within the flexurally toppled rock mass, pore pressure builds up behind the fault increasing the weight of the slope to trigger a landslide. Earthquake-induced catastrophic landslides have several preparatory processes: preceding gravitational slope deformations are similar to the rain-induced landslides and the topographic features could be used as a criterion for the prediction. A cataclinal slope that is cut at its foot is unstable against shaking and likely to slide when fragile beds like porous tuff are intercalated. First-time landslides of this type are rather difficult to predict, but the geometrical relationships between the bedding and slopes could give a clue. On the other hand, pyroclastic fall deposits, soft mudstone, and carbonate rocks are weathered and become susceptible to earthquake shaking without any topographic features, so their presence should be taken into account and landslide prediction would be made according to the areal distributions of the materials. Pumice layers with mantle bedding on slopes are very susceptible to earthquake shaking, particularly when a clay mineral halloysite is made in the depths by weathering. Mudstone in the dissolved zone, which is made by weathering, is porous and weak and susceptible to earthquake shaking. Carbonate rocks are dissolved by groundwater to have many voids and become susceptible to shaking.