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Characteristics of failure landform and incised valley in Shirasu area in Southern Kyushu

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In Southern Kyushu, covered with pyroclastic flow deposits named as“Shirasu” , slope failure disasters have occurred repetitively during rainy and typhoon seasons with a return period of several decades. In Kagoshima Prefecture, in particular, the cliff overlain by “Shirasu” deposits has undergone repeated slope failures during a period of several decades, which is an extremely short timeframe for such activity (Tsukamoto, 1993). Ito pyroclastic flow deposits are part of a huge pyroclastic flow that occurred approximately 29,000 years ago (Machida and Arai, 2003); these deposits span an area of approximately 90 km from Aira Caldera, which was the source of Shirasu deposits (Yokoyama, 2000).

This study examined the relationships between the slope failure and the long-term development process of the erosional landform in the Shirasu distribution area. We focused on the plateau cliff which occurred in the erosion-denudation processes such as slope failure and erosion of Shirasu with the running water. Morphometric analyses the measurement of permeability and strength of Shirasu deposits were performed. The strength of Shirasu deposits was relatively homogeneous and showed a weakness comparable to the unconsolidated conglomerate and unconsolidated sandstone. The very high permeability of 0.02-0.05 mm/s is consistent with the low density of the incised valleys and suggests very low groundwater level. Probably because of this, there are fossilized shallow valleys ceasing their own growth on the Shirasu plateau among the valleys engraving the plateau. Landslides are densely distributed in the steep, uniform linear type slopes surrounding the plateau edge. To summarize in Shirasu area, surface failure occurs on the uniform linear type slope of the incised valley wall by the influence of the transient elevated groundwater level due to heavy rainfall. And besides, a fine, low-density failure materials can so easily be removed by a river that the parallel slope retreat continues. From a long-term perspective, it can be said that the failure potential is high for current incised valleys dominated by width enlargement processes.

Keywords: Shirasu, Incised Valley, Slope Failure, Records, Geomorphological Development, Southern Kyushu