Landslides on the tephra slope with the sliding surface formed in pumice and volcanic soil beds triggered by the 2016 Kumamoto Earthquake, western part of Aso caldera, Kyushu, southern Japan

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The Kumamoto earthquake occurred on 16th April 2016 with a moment magnitude of 7.0 and induced many landslides in the western part of the Aso caldera. One of the most devastating landslides induced by this earthquake occurred on tephra slopes, because they occurred on rather gentle slopes and ran out long distances. We investigated the topography and geological features of these landslides and analyzed mineralogy and physical properties of each tephra layer. Their sliding surfaces were accommodated in characteristic beds: The most dominant beds were pumice beds, next were volcanic soil layers, and the much less numbers were scoria layers and volcanic ashes.
The basement of the survey area consists of lava flows and pyroclastic rocks with a wide range of chemistry from basalt to rhyolite (Ono and Watanabe, 1985). They are thickly covered by tephras, of which volcanic soil can be classified from color tone (Watanabe and Takada, 1990); we classified the volcanic soil into brown volcanic soil (Br), black volcanic soil (Bl), and blackish brown volcanic soil (BlBr). The pumice beds distributed to the most in the surveyed area is Kpfa of about 30 ka in age (Miyabuchi et al., 2003).
All of the pumice beds and Vs layers that accommodated sliding surfaces, had a clay mineral, halloysite. The most common pumice beds with sliding surfaces was Kpfa, and other pumice beds accommodating sliding surfaces were very few. The weathering extent of Kpfa varied from rather fresh one to intense one and the pumice clasts of Kpfa with sliding surfaces were intensely weathered to become clayey materials. Vs layers accommodating sliding surfaces were mostly BlBr layers, in which desiccation cracks were made when dried, suggesting that their high water contents just after the landslide. All of the investigated landslides with sliding surfaces in BlBr layers had no pumice layers with them, and landslides involving BlBr and Kpfa layers had sliding surfaces in Kpfa layer. This fact may suggest that that Kpfa could be the most preferable layer for a sliding surface to be made in. Landslides with sliding surfaces in BlBr layers probably occurred on slopes that lacked Kpfa layers because of original non deposition or subsequent removal by landslides. Landslides with sliding surfaces in pumice layers were mainly distributed on gentle slopes at the foot of the Aso central cones, while the landslides with sliding surfaces in BlBr layers were distributed on relatively steeper slopes. Original non deposition may be attributable to so steep slopes for their deposition or their small supply from the eruption sources.

Keywords: Kusasenrigahama pumice (Kpfa), Volcanic soil, Halloysite

