Landslides of altered rhyolite induced by the Heavy Rain Event of July 2018 in the south of Hiroshima Prefecture, Japan

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The Heavy Rain Event of July 2018 caused numerous debris avalanches and debris flows in areas underlain by the Late Cretaceous Takada Rhyolites in the southern part of Hiroshima Prefecture. We made GIS analyses and field investigation along road cuts and landslide scars in order to clarify the geological factor of landslide sources in the rhyolite area. The study area is a 10 km long, 3 km wide rectangular area whose long sides are a WSW-ENE direction from Nikyukyo to Akozaka in Kure. According to precipitation data measured by MILT using radar-AMeDAS, the 45-hr cumulated rainfall before the landslide event from 05:00 to 06:00 on 7 July was 550–750 mm and the 4-hr cumulated rainfall was 120–180 mm. These rainfall distributions were common both in the western and eastern part of the study area. The landslide distribution plotted from aerial photographs showed that landslide density is 10–45 /km^2 in the eastern part and it is about ten times larger than that in the western part. This difference of landslide densities can be attributed to some geological and geomorphological factors in the rhyolite. The main rhyolite mass (Norosan Welded Tuff) in the study area has near-vertical joints with 0.5–3 m spacing and a considerable number of high-angle hydrothermal alteration veinlets and dikes. The hydrothermal alteration veinlets near the ground surface are made of white halloysite and are surrounded by altered or weathered rhyolite with blue, yellow, or red clay. These alteration bands have a width of 0.2–5 m and their predominant strike is N-S. The altered rhyolite was observed in parts of ridges that have a gentle slope of 20˚ or less. The area of altered rhyolite in the eastern part of study area was estimated to be larger than that in the western part. In the study area, landslide source areas had 10–20 m long and 5–10 m wide altered rock surfaces, on which 1-m-thick soil layers had slid down. The lower edges of some source areas were on slope breaks at the middle of slopes and coincided with boundaries between altered rock and wall rock. In addition, the presence of high-angle clay veinlets and the result of a cone penetration test implied that the boundaries are high-angle surfaces. Accordingly, landslides densities in this event may have become larger in the eastern part of the study area where hydrothermal alteration is more intensive.

Keywords: slope failure, hydrothermal alteration, clay veinlet, Takada Rhyolites

