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Landslide disaster induced by the 2014 Hiroshima rainstorm

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A rainstorm in 20 August 2014 induced many debris slide-flows, resulting in heavy damage including 74 fatalities. I made investigations on the landslides by observation from the air, field surveys, and by high-resolution DEM analysis as a member of the Mountain Hazards Laboratory of DPRI, Kyoto University and the investigation team of the Japan Society of Engineering Geology. Landslides occurred more than 140 in an area with a 3 km of width and a 12 km of length, of which area coincided with an area with over 150 mm rainfall in 3 hours. The highest density was 30 landslides in 1 km2. The affected area is underlain by Jurassic sedimentary rocks and Cretaceous Takada rhyolite and granite; the sedimentary rocks are metamorphosed by the intrusion of the granite.

We identified three types of landslides. The first is a planar type, in which a planar soil layer with a depth of 1 m or so slid. The second is a gush-out type, in which water gushed out from slopes to make holes; the base of a hole is occupied by rock fragments with many openings and less amounts of fine fractions. The third is a long, gully like slide with a wedge-shaped profile sided by an along-valley joint or a fault. In the torrent of the Ken-ei-jyutaku in Yagi 3-chome, debris avalanches went down along the river entraining large rock blocks separated from the bedrock by sheeting joints and high-angle joints. Similar phenomenon occurred in the upstream torrent of Midorii 8-chome. Other than these two torrents, large blocks in debris flows were mainly fine-grained granite, which is resistant to weathering. In hornfels areas on the other hand, gush-out type landslides were predominant.

Landslides and debris flows in granitoid areas have characteristics dependent on weathering extent. In the affected area of the Hiroshima disaster, granite in higher elevations is weathered to form micro-sheeted rock, which is incised deeply to expose fresh rock beneath it. The fresh rock body was separated into large rock blocks by sheeting joints and high-angle joints along the river. Consequently, the debris of landslides in higher elevations came down along a river, entraining the large blocks, getting destructive energies, and hitting the residential houses on fluvial cones. Another cause of the destructive debris flows were large blocks of fine-grained granite, which is more resistant to weathering than medium-grained granite. Gush-out type landslides in hornfels areas are assumed to have occurred when the rainfall intensity became too strong for the openings in the zone of rock fragments to drain the groundwater flow, which finally blew out.

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