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Relationships among shallow landslide densities, weathering styles, and petrologic textures in a granitic rock area, central Japan

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Numerous numbers of shallow landslides were induced in granite and granodiorite areas by a heavy rainstorm in July 1972 in Obara village, central Japan. We analyzed the relationships among the distribution and density of landslides, precipitation, and petrologic types of the granitic rocks quantitatively in the affected area. The landslide density in granite area was 293 /km^2 in maximum and was more than ten times larger than that in granodiorite area (28 /km^2 in maximum), even though both the areas had experienced the same precipitation. Landslide densities increased with the amounts of precipitation in the granite area, but did not in the granodiorite area. Airborne laser scanner was successively applied to detect landslides by the 1972 rainstorm and also preceding landslides in an area of 3km^2, indicating that the above contrast of landslide densities had already existed before the 1972 disaster. The landslide densities during the 1972 disaster thus showed the same trend of landslide densities in a long term.

The difference in landslide density and the relation between landslide densities and precipitations could result from the difference in weathering profiles, which reflect the difference of petrologic texture in two rock types. We analyzed the petrologic textures by cutting rock samples, staining potassium feldspar with sodium cobaltinitrite, and processing texture images by computer. Plagioclase, which weathers much faster than quartz and potassium feldspar and changes into clay minerals like halloysite and kaolinite, had lower connectivity in granite than in granodiorite. Therefore, clay minerals from plagioclase effectively combine the surrounding minerals in weathered granodiorite but not in weathered granite. Consequently, weathered granite easily loosens and slides at its surface part, but weathered granodiorite does not. The binding effect of

weathered plagioclase was supported by in-situ shear experiments, and loosening patterns of weathered granite were confirmed in the field.