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Temporal variations in erosion rate, moisture and water contents near slope surface in a badland in southwestern Taiwan

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We have measured erosion rate and investigated the weathering mechanism of Pliocene-Pleistocene mudstone in the badland of southwest Taiwan. Erosion rate was measured by using erosion pins set on slopes with an average inclination of 45-55 degrees. We found that significant erosion occurred only in wet season from May to September and that the rates were as large as 10 cm/y on average. Such a high rate of erosion is due to the characteristic manner of the weathering of the mudstone, of which uniaxial compressive strength is as high as 10 MPa when dry but becomes a few Mpa when it is wet (Lee, 2007). Physical property measurements and needle-penetration tests performed for the samples drilled from slope surfaces indicated that weathering extended as deep as 10 to 20 cm from a slope surface. The surface layer of mudstone changes its moisture content and hardness according to the precipitation condition. X-ray CT images for the drilled cores show that the density of mudstone has decreased in the surface layer. In-situ monitoring of moisture content and electric resistivity in the slope suggested that salt and water migration occurs in a periodic manner with one or two year cycle in the surface layer of a slope. Salt materials migrate from the depths and are concentrated in the surface part of a slope in dry season and beginning of wet season and are then diluted in wet season. This dilution of interstitial water is assumed to be accompanied by chemical osmosis and following expansion of rocks, of which process may be the essential mechanism of the rapid weathering and erosion of the mudstone in the badland of Taiwan.

Keywords: badland, Pliocene-Pleistocene mudstone, rapid erosion, salinity-moisture variation, monitoring