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Granite weathering, slope instability and associated hazards in subtropical hilly terrain, Acapulco, Mexico

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The seaside resort of Acapulco occupies a narrow coastal plain along the Pacific shore of southern Mexico, backed by steep slopes of the Veladero granite highland (elevation above 950 m a.s.l.). The mountain massif is horseshoe-like in plan and its deeply dissected southern amphitheatre is open towards the Acapulco Bay. Slopes are not uncommonly inclined over 30˚. Despite subtropical climate and high annual precipitation, up to 1500 mm, granite is only moderately weathered. Slope cuts reveal a mantle of sandy saprolite with embedded corestones, corresponding to the weathering grade II and III in the Geological Society classification scheme. Boulder piles and nascent domes are common on slopes, indicating discontinuous nature of the weathering mantle. Footslope sections show thick colluvial units with big rounded boulders, up to 3 m long, set in sandy-silty matrix, whereas vegetated scars higher upslope suggest that these deposits are products of debris slides. By contrast, the valley floor of the main Cameron river draining the Veladero massif is filled with residual boulder deposit, most likely an old debris flow sediment. These observations point to shallow slides as the principal means of slope denudation and long-term retreat, and the slopes are probably weathering-limited. Rapid and poorly controlled expansion of the city, now populated by over 900,000, onto the steep slopes of the Veladero massif increases the risk of the occurrence of mass movement phenomena. Frequent slope undercutting for access roads and housing exposes weathered granite with corestones, whereas high erodibility of sandy saprolite creates conditions for corestone detachment and fall. Likewise, corestone fill in valley floors is susceptible to erosion and transport during extreme weather and hydrological events. Most damage to buildings and infrastructure associated with the Paulina hurricane in October 1997 was caused by movement

of rounded boulders downslope and down the channels. Some of the boulders were as long as 9 m. The Acapulco evidence shows that extensive landsliding is not necessarily associated with highly weathered terrain. In suitable topographic settings it may also occur within moderately weathered rock and become a hazardous phenomenon.