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Chemical and Mineralogical Heterogeneity of Weathered Igneous Rocks: Implications for Landslides Studies

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Slope instability in tropical and sub-tropical regions is generally associated with weathered rock profiles. Weathering processes gradually modify mineralogical, petrographical (microfabric), geochemical, physical and thus engineering characteristics of fresh rocks through their thermodynamic readjustment, as encapsulated in the Le Chatelier's principle. This readjustment takes place in a unique way depending on the overall geological setting of the profile (largely determined by lithological, structural, geomorphological and hydrological-particularly leaching and pH-conditions). The resulting profiles often possess chemical, mineralogical and microfabric heterogeneity at the material scale. Understanding the nature and distribution of such heterogeneities is essential to characterize and to assess the evolution and present stability of slopes.

This study presents the results of a number of integrated studies of weathered profiles derived from Hong Kong's felsic igneous rocks. The type and abundance of secondary oxyhydroxides and clay minerals within these profiles result from complex combinations of several different processes controlled mainly by three factors: pre-weathering history of the parent-rock, degree of weathering and micro-environmental conditions. At the advanced stages of weathering, however, micro-environmental conditions ultimately control the heterogeneity of the profile. Based on these observations, the chemical indices are promoted to assess the level of heterogeneity rather than its use as a direct profile characterization tool.