

Altération météorique de roche granitique en milieu alpin: le cas de l'orthogneiss associé à l'éboulement de Randa (Mattertal, Valais, Suisse)

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This thesis documents the effects of weathering on an orthogneiss in an Alpine environment (mountainous climate and glacial geomorphology). The site of the 1991 Randa rockfall is investigated, which is located in the Matter valley, Wallis, Switzerland. In order to document the mineralogical reactions occurring during weathering (involving namely clay minerals) and transport mechanisms, a variety of techniques were employed including X-ray diffraction (XRD), scanning electron microscopy (SEM), and infra-red spectroscopy (FTIR). Samples of host rock, fault gouge, surficial weathering products and infiltrating waters were investigated. Two types of alteration processes are identified for the formation of the clay minerals. One type involves the solid state transformation of phyllosilicates into mixed-layer illite/vermiculite during surficial weathering of highly fractured gneiss. A second process involves oxydation of pyrite associated with dissolution of silicate minerals in fissures, primarily Na-feldspars, and the reprecipitation of smectite minerals (montmorillonite). Chemical and biochemical weathering reactions are best observed on freshly exposed surfaces of the host gneiss.

SEM observations within millimetric to micrometric pores show that mostly alkali feldspar dissolves while Fe and Mn oxy-hydroxides precipitate. The preferred fluid flow paths through the gneiss is defined by a complex system of microfractures. These latter are mainly associated at one hand with matrixial quartz and albite grains and at another hand with white micas defining the main schistosity. The slight increase of porosity (3% in volume) due to weathering does not lead to a significant increase of the permeability which ranges between 20^{-18} m^2 and 10^{-19} m^2 .

Authigenic smectite was directly observed in the fault gouge, which is significant because of its well-known physical properties (both swelling and hydration). The presence of authigenic smectite growing within a network of fractures represents a potentially important factor in the risk evaluation of potential rock slides.