Chemical, clay mineralogical, and petrological characteristics of erosional exhumed saprock derived from a 125 Ma granite south of Temecula, California

Susan French
Adviser: G.H. Girty

The study site, located near the top of an ~20^{o} – 30^{o} E-SE dipping slope underlain by ~125 Ma granite, consists of a large mushroom-shaped corestone, ~4 m in width and extending ~3 m above the land surface. Such geometry implies that as much as 3 m of regolith was removed during erosional exhumation of the corestone.

Twelve samples collected from the granitic corestone and 12 from the adjacent saprock were analyzed for their major element chemistry. In addition, the clay mineralogy of the < 2 µm fraction separated from representative saprock samples was evaluated by standard XRD procedures. Following conversion to molar A, CN, and K concentrations, non-central principal component analysis revealed that principal component 1 explained 94.6% of the variance of saprock data about a calculated compositional linear trend. In A-CN-K ternary space, the perturbation vector derived from eigen vectors associated with principial component 1 directed the compositional linear trend away from the CN apex and toward the A-K join, and thus suggested that formation of the saprock involved a loss of Ca and Na mass. Given that these elements are largely held within the crystal lattice of plagioclase, the above data suggest leaching of plagioclase during transformation of granitic basement to saprock. MgO passed all statistical tests for immobility, and was used as a reference framework in mass balance calculations. Results supported the above interpretations and indicated a 37% loss in Ca and a 32% loss in Na mass. Such losses are supported by thin section work which shows that plagioclase has been extensively converted to clay and XRD work which shows that the < 2 µm fraction is dominated by kaolinite and gibbsite. In addition, a 14% loss in Mn mass likely reflects leaching from biotite. In contrast to the above losses in elemental mass, gains of 10% Si, 18% Al, 38% Fe, and 36% Ti mass, are the results of eluviation and leaching within the regolith that once covered the study site. Thin section work revealed that the saprock crack system is lined with a yellowish-brown clay mineral that is likely kaolinite, and thus much of the gain in Si and Al mass can be explained by the illuviation of kaolinite. Gains in Fe and Ti mass are likely the results of adsorption onto the kaolinite lined walls of the saprock crack system.