

**Petrological and Chemical Trends Associated with the
Development of Corestone and Saprolite,
Santa Margarita Ecological Reserve
Temecula, California**

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H. Wayne Nesbitt proposed a chemical weathering model for the development of corestone and saprolite that has gained wide recognition in the geological community. However, this model has not been tested in a wide variety of settings and more work is clearly warranted. Hence, the purpose of this thesis is to investigate chemical and petrological trends associated with the development of corestone and saprolite from a single outcrop of tonalite in the Santa Margarita Ecological Reserve, Temecula, California.

Nine samples were collected from an ~1 meter traverse across the margin of an outcrop of corestone (relict unaltered tonalite) surrounded by saprolite (in situ weathered tonalite). Seven samples were thin sectioned, and chemically stained to distinguish potassium feldspar from plagioclase. All collected samples were analyzed by XRF for major and trace element concentrations.

From resulting chemical data, the Chemical Index of Alteration (CIA) was calculated as follows:

$$\text{CIA} = \text{Al}_2\text{O}_3 \text{ (molar \%)} / \text{CaO} + \text{Na}_2\text{O} + \text{K}_2\text{O} + \text{Al}_2\text{O}_3 \text{ (all molar \%)}.$$

In the above formula CaO represents only that proportion in the silicate fraction. Resulting CIA values ranged from 52 to 55, with three saprolite specimens having the highest CIA (54-55). These three relatively highly altered samples were also located the greatest distance from the corestone.

The results of point counting 300 points in each specimen revealed that the three saprolite samples with high CIA also were depleted in plagioclase relative to all other analyzed specimens. Given this observation, it is therefore not surprising that on molecular A-CN-K and A-CNK-FM diagrams, the three saprolite samples cluster plotting either more close to the A apex or CNK-FM join than do other samples with lower CIA values.

The transport function, τ , was used to evaluate the percent change in elemental mass relative to the mass of a known or suspected immobile element. For the purposes of this study, the immobile element of choice was titanium. In general, CaO, Na₂O, K₂O, Rb, Sr, and Ba are depleted relative to the sample displaying the lowest CIA value, while Fe₂O₃, MgO, MnO, Sc, V, and Zr appear to have been unaffected by formation of the saprolite and corestone. Hence, data summarized here indicate that corestone-saprolite formation in the Santa Margarita Ecological Reserve follows a predictable trend that is similar to that documented originally by H. Wayne Nesbit.