
Clay Mineralogy and Occurrence of Ferrian Smectites between Serpentinite Saprolites and Basalts in Biga Peninsula, Northwest Turkey

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Abstract: The clay mineralogy of an oxisol-saprolite overlying serpentinite and underlying basalt was studied with different techniques to evaluate the clay mineral transformation that occurred and to understand the origin of Fe³⁺-rich smectite. The saprolite zone of the oxisol, up to 30 m thick, contains smectites of the montmorillonite-beidellite and montmorillonite-nontronite series, as well as illite, chlorite, talc, and goethite or amorphous oxyhydrates. Illite is mainly concentrated in the upper 50 cm thick zone underlying the basalt layer and chlorite-content increases toward altered serpentinite at the base. Minor amounts of nontronite formed mostly toward westward exposures where the hot contact layer between serpentinite and basalt is only 20 cm thick. Greene-Kelly Li-tests revealed that all samples contain montmorillonite, but one sample shows the presence of a minor amount of beidellite.

Parent rocks are a mixture of mainly mica schist (the source of beidellite), and minor serpentinite in different percentages and laterally distributed. These rocks were intensely weathered under humid climatic conditions. Silica was concentrated as amorphous transparent (pure silica) cobbles and milky quartz pebbles, and originated from geothermal solutions rising through the Ovacik thrust fault. The Mg partly formed chlorite. Ferrian smectites in serpentinites were derived obviously from the Mg-rich minerals but Mg is lost much more rapidly than Si during the formation of the clay deposit. The structural formula of the most Fe-rich smectite samples from the study area is $(\text{Si}_{6.60-7.10}\text{Al}_{1.40-0.90})(\text{Al}_{2.54-1.22}\text{Mg}_{0.32-0.92}\text{Fe}^{3+}_{1.18-1.68}\text{Ti}_{0.06-0.04})(\text{Ca}_{0.16-0.10}\text{Na}_{0.02}\text{K}_{0.02-0.12})\text{O}_{20}(\text{OH})_4$. This composition is within the range recorded for the ferrian montmorillonite-beidellite series, with very little vermiculite forming the oxisol-vertisol horizon.

Key Words: Alteration • Basalt • Beidellite • Ferric Iron • Mica Schist • Montmorillonite • Serpentinite • Turkey

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