Eocene and Oligocene Otay-Type Waxy Bentonites of San Diego County and Baja California: Chemistry, Mineralogy, Petrology and Plate Tectonic Implications

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Abstract: Otay-type waxy bentonites of San Diego County are illite-smectite (I-S) with 85% dioctahedral smectite mixed with dioctahedral illite showing a Reichweite of 0. Primary or secondary waxy bentonite exposures are found in all Eocene and Oligocene formations of southwest San Diego County and western Baja California north of Ensenada. Primary waxy bentonites formed when hot volcanic ash fell into quiet marine or brackish coastal water. The transformation from glass to bentonite occurred within hours or days but consolidation of the bentonite into its waxy consistency took longer. Primary waxy bentonite consists of 95 wt% I-S with the remainder consisting of volcanic glass shards, sanidine fourling twins, hexagonal biotite crystals and amorphous manganese oxides and hydroxides. Secondary waxy bentonite is primary waxy bentonite that was mixed with nonvolcanic detritus either before consolidation or after consolidation and subsequent erosion. The hydrophobic character of primary waxy bentonite allows it to reflect, accurately, the chemistry and petrology of the original volcanic material. Chemical analysis of primary waxy bentonites shows that the original lava was subduction-related and exhibited petrologic variations nearly identical to those of the modern Cascades of the northern Pacific coast of the lower United States. Primary and secondary waxy bentonites as well as smectites derived from the weathering of volcanic ash that fell outside the waxy bentonite-producing environments are the previously unrecognized products of extensive Eocene and Oligocene subduction-related volcanic activity. Baja California exposures of waxy bentonite demonstrate pre-Pliocene subduction tectonics that gave way to rifting tectonics.

Key Words: Chemistry • Mineralogy • Otay Bentonite • Plate Tectonics • Volcanism • Waxy Bentonite

Clays and Clay Minerals; February 1999 v. 47; no. 1; p. 70-83; DOI: 10.1346/CCMN.1999.0470108

Clay Minerals Society (www.clays.org)