

Kokkorn Hemtanon 2009: Genesis and Factor Affecting Smectite Formation of Upland Vertisols in Thailand. Master of Science (Soil Science), Major Field: Soil Science, Department of Soil Science.
Thesis Advisor: Professor Irb Kheoruenromne, Ph.D. 176 pages.

A study on genesis and factor affecting smectite formation of upland Vertisols in Thailand was carried out on seven representative locations of soils in Central Plain and Central Highlands. Methods of study included analysis of soil environments, field morphology and laboratory analyses of soil samples on their physical, chemical and mineralogical properties and micromorphological characteristics according to standard methods.

Results of the study revealed that these Vertisols have clay content of 316 to 910 grams per kilogram within 18-50 cm depth, very high coefficient of linear extensibility ($COLE = 0.09-0.28$), slightly to strongly alkaline ($pH\ 7.4-8.7$), very low to moderately high available phosphorus ($0.1-21.1\ mg\ kg^{-1}$), very low to very high available potassium ($18-126\ mg\ kg^{-1}$), high base saturation percentage ($76-98\%$). Smectite is the dominant mineral (approx. 40 to $>60\%$) of the clay fraction with traces of kaolinite, vermiculite, quartz and goethite. Quartz dominates minerals of the silt fraction with trace to moderate amount of feldspar, and calcite can be detected in some soils. Residual parent rock fragments, carbonate and iron oxide nodules are the dominant micromorphological features of the soils. Taxonomically, these soils are Haplusterts.

Analyses based on these characteristics of Vertisols indicate that smectite can be formed by transformation of other phyllosilicates and neoformation. The important factors affecting smectite formation in these Vertisols include parent materials that derived from limestone, andesite, basalt and calcareous rocks that weathered and released slightly high amount of magnesium and iron, tropical savanna climate with mean annual precipitation of 1,207 mm, distinct wet and dry cycles, very low hydraulic conductivity, low leaching of cations in soil profiles, high pH, high to very high CEC, high to very high bases, high SiO_3/Al_2O_3 ratios and high iron oxides. Feldspar, calcite and goethite are important sources of Ca, Mg, Na, K and Fe ions, for formation and stability of smectite in the soils. Smectite correlates with COLE ($R^2 = 0.53$), CEC ($R^2 = 0.54$) and sum bases ($R^2 = 0.43$) in these soils. The presence of smectite positively affects soil fertility but can pose some physical limitation on land uses. The understanding on intrinsic properties of these soil can help promote more effective land uses and land use planning.

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Thesis Advisor's signature

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