Napaporn Wongpokhom 2007: Variability of Natural Soil System as Affected by Salinity Levels in Thailand. Doctor of Philosophy (Soils), Major Field: Soil Science, Department of Soil Science. Thesis Advisor: Professor Irb Kheoruenromne, Ph.D. 352 pages.

Twenty eight salt affected soil profiles were selected for this study of Variability of Natural Soil System as Affected by Salinity Levels in Thailand. Five or six profiles at each locations were sampled along a linear traverse that included the highest and lowest levels of salt accumulation for five transects in the Khorat basin, Northeast Thailand where extensive salt affected areas were reported. Methods of study included pedon analysis of soils and laboratory analysis of soil samples for their physical, chemical, mineralogical and micromorphological properties. Properties of kaolin were determined using TEM and XRD techniques and smectite group minerals were determined by the Greene-Kelley method. The micromorphological properties were determined using optical microscope and SEM/EDS techniques.

Results of the study revealed that the highest salt affected profiles show salt crusts, salt patches, bare surfaces and halophytic plants and these soils have been left idle. All soils are deep, poorly drained, moderately to highly developed and with various salinity levels. They are twenty six Natraqualfs and two Endoaqualfs that can be classified into four groups, saline sodic soil (locations 1, 2 and 5), sodic soil (location 3), acid saline sodic soil (location 4) and normal soil (pedon 13 at location 3). Salt affected soils have sandy to clayey textures, high bulk density value (>1.6 Mg m^{-3}) and very low to low hydraulic conductivity. Salt can induce the soil to have poor physical properties but these effects are not constant. These soils exhibit great variation in chemical properties and diversity in the geochemistry. The soils at locations 1, 2, 3 and 4 mostly have high EC and ESP. Soils at location 3 may have been affected by desalinization as is indicated by low EC, high basic cations and high pH. Salt affected soils consist predominantly of quartz and clay minerals. Clay fractions consist predominantly of kaolin, smectite and trace of illite and interstratified minerals in various proportions. The smectite species of these soils consist mostly of beidellite. Kaolin consists of platy crystals. Euhedral faces are more abundant in Kaolin in location 3 where the EC value is low. The median size of kaolin crystals tends to be smaller than kaolin crystals in several other soil types in Thailand. The increasing values of EC, SAR and ESP in salt affected soils may have caused the small size of kaolin crystal and also reduced to number of euhedral face.

Field morphology, optical micromorphology and SEM/EDS analysis results show clear accumulation of salts in some profiles. Halite occurs in voids and in matrix in soils at locations 1, 2, 4 and 5 and is abundant in Pedons 1, 2, 6 and 17-23 where salt crusts or salt patch exist. Calcite is present in topsoil only in one profile indicate and in the associated substratum (BC and C) horizons. The EDS spectra indicate the presence of halite (NaCl) barite ($BaSO_4$) and sylvite (KCl) that have crystallized in voids or mixed through matrix in some of the soils. The element composition of the soil matrix indicates that very fine-grained quartz and/or a Si-rich clay mineral (s) is present in the matrix in addition to kaolin. The presence of a Si-rich clay minerals may be evidence of the resilication process that can occur in salt affected soils. The normalized element composition of the matrix in a triangle graph demonstrates show in some instances the salts of Na, Ca and Mg have indurated the soil matrix.

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