

# The Archaeology of Cultural Soilscapes: Using Archaeology to Model Landscape Legacies

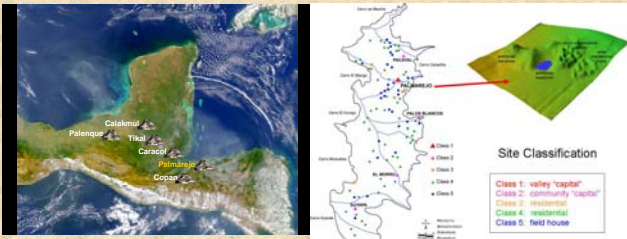
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UNDERGRADUATE  
RESEARCH

## Objectives

While soil is usually considered the product of numerous intersecting natural processes, human activity also has a large and lasting impact on soil. A *cultural soilscape* may be defined as a given area of geomorphic, pedogenic, and cultural processes. The study of such a dialectic between human impacts and soil bodies over long periods of time may contribute useful knowledge to address modern agroecological concerns. The following data were analyzed in the context of recent research on sustainable agricultural practices in the Palmarejo Valley of northwest Honduras. Laboratory analyses applied to soil samples from the region yielded phosphate levels and soil organic matter percentages from two locations in the valley. This allows us to reconstruct and understand soilscapes in prehistory, to observe how soil use has changed over time, and finally to compare land use practices at each site.



## Methods

### Soil Organic Matter (loss-on-ignition)

First we numbered the crucibles by location and pre-weighed them, recording their respective weights. Then we filled the crucibles with approximately 10 grams of ground, dry soil and put them in a drying oven for 2 hours at 100 degrees C. After cooling, the crucible was weighed, and we determined the soil weight by subtracting the crucible weight.

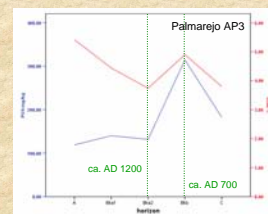
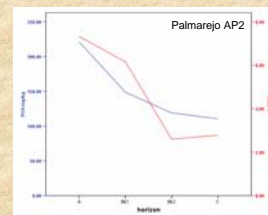
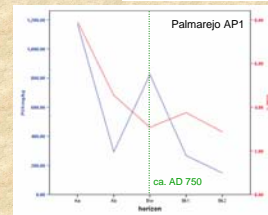
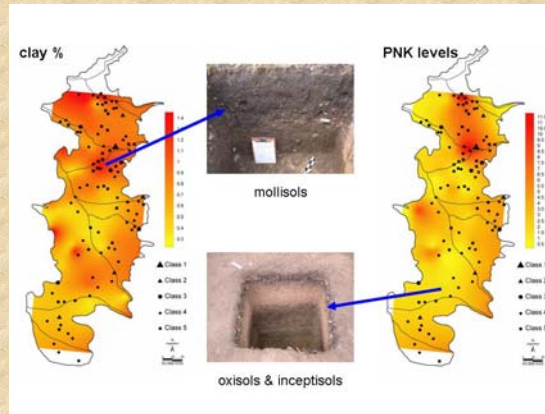
We then placed the crucibles in the furnace at 550 degrees C for one hour. After removal and cooling, we weighed the crucibles, and determined the new soil weight by subtracting the crucible weight.

Percent organic matter was then calculated in the following manner:  
Wt. of 100 deg. Dry soil - wt. of 550 deg. Dry soil / wt. of 100 deg dry soil x 100 = percent organic matter in soil sample

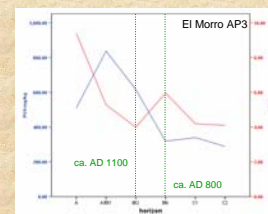
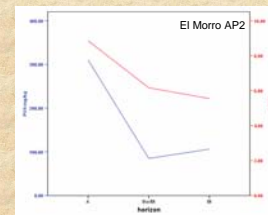
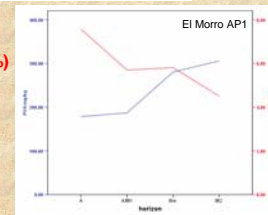
### Phosphate Characterization

For each of the samples, we mixed a 1:10 ratio of Mehlich II acid and de-ionized water. We added 2.00 g of the soil sample to the acid and water mixture. The test tube was capped with a rubber cork and agitated for five minutes. We filtered it through the filter paper into another test tube. We then took 1 mL of the extraction, and diluted it with 9 mL of water. We then added the molybdate to the diluted extraction solution and capped and agitated for four minutes. We then analyzed the sample in the colorimeter after zeroing it out with 25 mL of the acid extract.

## Results



changes in  
**PO<sub>4</sub> (mg/kg) and SOM (%)**  
by depth (horizon)



Extractable Phosphate (PO<sub>4</sub>)  
Mehlich II extraction  
& molybdate colorimetry

Soil Organic Matter (SOM)  
loss-on-ignition estimation

## Discussion

As seen in the graphs to the left below, phosphate levels peak and are then followed by a sharp decline corresponding to the soil horizon of the Late Classic period, roughly AD 700-800 (Bt and Bk horizons). This indicates human occupation and agricultural use of the area, confirmed by the presence of field houses. Generally, soil organic matter percentages for the region were low, and fluctuations in organic matter tended to correspond with the phosphate levels. In comparing the two fields, Palmarejo was used for agricultural purposes more so than El Morro, as the soil is of better quality (mollisols) versus the lower quality of soil in El Morro (oxisols and inceptisols). The greater number of field houses in Palmarejo also suggests more intensive agricultural use. The sharp decline in phosphate levels seen in this specific region indicate exhaustion of the land due to this intense agricultural use. The following rise in phosphate levels indicate the use of fertilizers, including manure. Present day farmers have to find methods of handling the soil depletion of the past. Intensive fertilizing is being utilized to rehabilitate the land and resume farming. Because farmers are implementing the use of intensive fertilizers as a result of the depletion of the land's nutrients from the past, it explains the extremely high phosphate concentrations in the soil today.



## Conclusion

Overall, ancient agricultural practices have, as indicated by phosphate and soil organic matter depletion, contributed to creating a legacy of land use that farmers today must bear the burden for. Thus, farmers today can learn valuable lessons by looking to the past, and hopefully contribute sustainable agricultural practices to the future. The archaeology of soils can help us understand the legacies of past land use practices.