Investigation into Methods Used to Analyze Sediment Provenance from Southeastern Africa

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Cation Exchange Capacity(C.E.C.) refers to the quantity of readily exchangeable cations that are adsorbed on the negative sites on soil surface (Bache, 1976). The value is usually expressed in units of milli-equivalents per 100 mg. Cation Exchange Capacity (CEC) influences the soil structure stability, nutrient availability, soil pH and the soil's reaction to fertilizers and other ameliorants (Hazleton and Murphy 2007). It is a distinct property and greatly depends on the chemical composition and mineralogy of the clay. Understanding Cation Exchange Capacity, and the methods used to determine it, could help us gain insights into provenance. In an earlier investigation, Ar/K data for CsCl washed samples seems to show smaller age values than the unwashed ones. (Simon, unpublished). The samples were washed with CsCl in an attempt to determine CEC. This discrepancy in age data prompted us to investigate how cations interacted with soil surfaces and look deeper into methods used for provenance studies. We chose samples from a three different sites located in Southeastern Africa, two of them taken during expedition 361. Understanding the Paleoclimatic Conditions in the region is really important due to geographical positioning and proximity to the Agulhas current. We added 0.1N solutions of Na^+, Mg^{2+}, Ba^{+2}, and La^{+3} to each of the nine sediments. We then studied how each reagent displaced Cs^+ from the clay surfaces. We also did repeated extraction of <2µm fraction in a sample from core U1478. This was to assess if fractionation in the solution impacted the homogeneity which would prompt us to perform more settling rounds. Our results showed that Mg^{+2}, Ba^{+2}, and La^{+3} removed Cs^+ from clay surfaces. Previous studies had found Mg^{+2} and Cs^+ to have almost equal tendency to get latched on the Clay Surface (Carroll, 1959). By introducing 1000 times more Mg^{+2} than the estimated sites on clay surface, we were able to see Cs^+ get replaced. The same effect did not hold for Na^+, as negligible amounts of Cs^+ was removed from clay surface. We also found Cs^+ wash to be an effective method for CEC determination as it seemed to successfully remove all K^+ and Na^+ from the clay surfaces. The ages reflected by each settling round seem to show consistent Ar/K age readings suggesting that settling to completion is not required as there was no significant fractionation observed. However, further work needs to be done in understanding factors impacting cation interactions with clay surfaces.