Examining Mineralogical Variations Through ODP Site 959 in the Gulf of Guinea

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Glauconite is an authigenic mineral that is produced through coupled redox processes in sediment. We need to better understand the specific conditions required for glauconite synthesis, rate, and mechanisms for glauconite formation because of its importance as a chronometer and its likely importance in the ocean potassium (K) budget. Glaucony is glauconite's precursor and it is currently forming in the Gulf of Guinea. Existing data from ODP Core 959B from the Gulf of Guinea were fused with in depth mineralogical, color, and elemental composition data of shallow sediment sections, and on individual grains of glauconite found primarily within fecal pellets isolated by passing wet-sieved sediments through a magnetic separator and examining the sand fractions under a microscope. Although the numbers of pellets are small, it appears that glauconite formation has been captured here as an ongoing process within foraminifera shells and pellets. Bulk X-ray diffraction (XRD) data are consistent with the rare observations of glauconite grains in the sand fraction of shallow sediments, suggesting the concentration of glauconite formation is too small to be detected in the bulk sample XRD data. In the upper few meters, the consistent ratio of 2:1 phyllosilicate and kaolinite indicate that there is a consistent delivery of terrigenous sediment source mixture to the ocean and high kaolinite abundance is consistent with the tropical setting. X-ray fluorescence analyzed changes in the sources of sediment, while X-ray absorption spectroscopy provided details on the sulfur, potassium, and iron content in individual glauconite pellets. The presence of the close association of sulfur-rich particles in the microprobe data, likely as metal sulfides, suggests that it takes sulfate reducing conditions for glauconite to form. In the color data, there are oscillations between dark and light sediment and this could suggest orbital-bases cyclicity in organic carbon burial and/or variations in calcium carbonate or terrigenous sediment deposition. Looking at glauconite grains that span a range of different input conditions will help us understand more about the role of organic carbon in glauconite formation.