Deltas and Diversity: Glauconitic maturation and the accumulation of hyper-diverse fossiliferous beds in the Paleogene Gulf Coastal Plain

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The Eocene Gosport Sand of Alabama is renowned for its taxonomically rich and abundant mollusk fossils. The Gosport Sand and other glauconitic shell beds (GSBs) from the Gulf Coastal Plain (GCP) are vertically and laterally limited and are often separated from surrounding units by unconformities suggesting they were geographically constrained and temporally transient. We used sedimentological, mineralogical, and paleoecological observations of the Gosport Sand to test whether GSBs from the GCP formed during transgressive events in a deltaic setting composed of migrating environments.

In the Gosport Sand, siliciclastic grain size shows little variation while total carbonate and grain size decrease and glauconite maturity increase up-section. Glauconite is interpreted to be autochthonous based on observation of multiple stages of glauconite maturation as well as poorly sorted, angular, and fractured glauconite grains. We suggest the Gosport Sand represents a transgressive event. Initially, sedimentation rate was relatively high, shells were buried rapidly, and glauconite had less time to mature. Sediment starvation from continued transgression resulted in taphonomic destruction of shells and winnowing of glauconite grains at the surface producing the pattern of decreased carbonate content and simultaneous glauconite maturation up-section.

At the base of the section, low abundance and taxonomic richness, geometric rank abundance structures, and the dominance of ecological life-modes all suggest harsher environmental conditions during the initial deepening of the transgressive event. Up-section, rank abundance structures become more varied while richness, evenness, and ecological diversity increase. Slight environmental shifts driven by delta migration may have allowed for the time-averaging and concentration of adjacent communities from inter-lobe environments including the inner shallow shelf and open sound, generating the extreme taxonomic diversity. These shallow and sheltered environments may have been susceptible to winnowing from storm currents helping produce the observed shell and glauconite concentrations. We propose the transgressive, inter-lobe depositional setting as a mechanism for the formation of the Gosport and other Paleogene GSBs from the GCP.