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Comparative Analyses of Piped-Zone Ichnofabrics in Cretaceous-Paleocene Shelf Sea Chalk-Marl Sequences, U.S. Gulf Coastal Plain

Charles E. Savrda, Department of Geosciences, Auburn University

Since last report, four manuscripts linked to this ongoing project have been published in or submitted to peer-reviewed journals. All of these manuscripts thus far report on work completed at Moscow Landing along the Tombigbee River, western Alabama, and three of the four were part of an MS thesis completed in June 2018 with help from undergraduate research assistants. Brief synopses of these papers are provided below.

(1) The PI, as sole author, reported in PALAIOS (v. 33, p. 555-567) on stratigraphy, sedimentology, and ichnology of isolated sand bodies (i.e., Clayton sands) occurring at the K-Pg boundary. Observations, including those regarding internal bioturbated intervals within several sand bodies, support previous interpretations that the Clayton sands were, at least in part, deposited by impact-generated megawaves. Production of internal bioturbated horizons indicate that trace-making crustaceans temporally survived megawave transport or that upper parts of some sand bodies accumulated after the megawave event in high-energy nearshore settings during earlier Danian sea-level rise.

(2) The PI and MS student have submitted to a regional journal a manuscript that presents, and describes features depicted in, a nine-panel strip map of the Moscow Landing section. The maps, which depict the distribution of stratigraphic units (Upper Cretaceous Prairie Bluff Chalk and associated marker bed, K-Pg sand bodies, Paleocene Clayton Formation and associated chalk marker bed, and the basal Paleocene Porters Creek Formation) and various structural features, will be of use to researchers and students who visit this important exposure in the future.

(3) The PI, with MS and undergraduate student co-authors, has submitted to an international journal a manuscript describing a comparative ichno-sedimentologic study of two marl-limestone parasequences in the Clayton Formation, one bound at the top by a minor marine flooding surface and one bound at the top by a transgressive ravinement surface. Both surfaces represent source horizons for large, irregularly branched, firmground crustacean burrow systems that cross-cut softground ichnofabrics in the marls. Excavation of burrow systems in both intervals indicate that they represent cumulative structures produced by multiple organisms over extended periods of time during depositional hiatuses. Morphological contrasts between burrow systems are consistent with sequence stratigraphic context and inferred differences in mechanism and magnitude of hiatuses responsible for firmground development.

(4) The PI, with MS student and an additional collaborator, has submitted to an international journal a manuscript describing the sedimentology, ichnology, and micropaleontology of a thin chalk bed and bounding marls in the upper part of the Clayton Formation. The chalk bed (aka Clayton chalk) appears to record the last gasp of relatively pure pelagic carbonate (shelf-sea chalk) deposition in the U.S. Gulf coastal plain region. Deposited in a clastic-starved outer-shelf setting, the Clayton chalk records a significant transgressive pulse circa 63.8-63.2 Mya, during which inundation of the mid-continent by the eastern arm of the Gulf of Mexico may have been more extensive than previously recognized. These observations were originally presented in an oral session at the 2019 SE GSA meeting.

Recent efforts have focused on the ichno-sedimentology of Maastrichtian Prairie Bluff Chalk (exposed at Moscow Landing) and Santonian-Campanian Mooreville Chalk in central Alabama. For the Prairie Bluff Chalk, the PI and an undergraduate are characterizing decimeter-scale carbonate rhythmicity, petrography, and ichnofossil assemblages. Results obtained thus far, presented in poster format at the 2019 SE regional GSA meeting, suggest deposition in an inner-shelf setting. Carbonate rhythms appear to have been controlled by combined dilution-scour cycles mediated by Milankovitch orbital parameters. Similar studies of Mooreville chalk, with a newly recruited undergraduate participate, are ongoing. Preliminary results of Mooreville investigations will be presented in poster format at the 2019 National GSA meeting as part of a broader comparison of carbonate depositional rhythms in the chalk-marl formations of the Cretaceous Selma Group.

This ongoing project provided the foundation for an MS thesis, is helping undergraduate assistants prepare for employment or MS degree programs in geosciences (two former undergraduate participants began MS programs

elsewhere in Fall 2018), and is facilitating the PI's efforts to better understand carbonate cyclicity as well as to provide hands-on experiences for future geoscientists.