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Provenance and depositional system reconstruction in the Lower Miocene of the Gulf of Mexico

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The Gulf of Mexico (GOM) has a long hydrocarbon exploration and production history and is perhaps one of the best studied basins in the world. However much is still unknown about the depositional history of the basin. For example, the Lower Miocene is a transitional time of considerable tectonic, climatic, and oceanographic change worldwide (Potter and Szatmari, 2009). Tectonic reorganization, climate change and local uplift distinguish the Lower Miocene of the GOM from temporally adjacent Oligocene and Middle Miocene units. A unique confluence of sedimentary processes, involving a continental-scale drainage system network, robust depositional systems, unusual extrabasinal perturbations, and long-lived salt tectonics make understanding the Lower Miocene interval in the GOM challenging.

The objective of this study is to investigate provenance shifts and reconstruct the depositional systems in the Lower Miocene of the GOM. Previous provenance studies were based on traditional methods, using proportions of quartz, feldspar and lithic fragments and consideration of likely river courses through known paleogeomorphological elements (Galloway et al. 2011; Dutton et al. 2012). In this study, the latest geochronology and geothermal analytical approaches, detrital zircon (DZ) U-Th/He and U/Pb double dating, are used to identify the potential source terrains and thus the likely sand transport pathways. The double dating is also useful for revealing the exhumation history of source terrains.

Several wells from the BEG core database within the Lower Miocene section have been selected for DZ U-Th/He and U/Pb double dating. Outcrop samples will also be collected for this analysis. Combination of these advanced DZ dating techniques and traditional methods such as analysis of well-logs and seismic data will help constrain provenance and allow reconstruction of depositional systems from source terrains to deep-water sink. In addition, study of this globally important transitional period has important implications for understanding important climate changes, tectonics and paleoflow.

Keywords: Gulf of Mexico, Lower Miocene, provenance, depositional system, DZ double dating