## ABSTRACT

**A field and petrologic study of the Memphis Sand, host to the regionally important Memphis Aquifer, was conducted to provide information about its porosity, origin, environment of deposition and possible hydraulic compartmentalization. Sample collection at six exposures, three wells, and two cores reveal that the Memphis Sand in the Northern Mississippi Embayment (NME) is a friable fine to coarse quartz wacke or quartz arenite. Primary intergranular porosity approached 40% and remains 25% to 35%. Although dominated by sharply angular monocrystalline quartz grains, rounded coarse sand polycrystalline quartz grains are abundant (30% to 55%) toward the east margin of the NME where they are associated with trace amounts of kyanite and zircon. We observed no glauconite. The grain size of sieved disaggregated samples varies from coarse sand near the embayment margin to fine sand near the center of the NME. Quartz cement is essentially absent. The weak coherence of the Memphis Sand is due to secondary kaolinite matrix, which shows meniscus texture and other petrographic signatures that indicate formation in a vadose environment. The clay mineralogy of Claiborne Group strata changes from kaolinite in the north of the NME through mixed kaolinite/smectite to smectite dominated composition south of the 35th parallel. Our results document the extraordinary porosity of the Memphis Sand and the partial occlusion of the porosity by vadose-zone kaolinite during early diagenesis. The results also support a scenario in which the Memphis Sand was deposited in braided and meandering fluvial environments north of the 35th parallel.**