Geology of the Pioneer 7.5-Minute Quadrangle, LA

Louisiana Geological Survey

Introduction, Location, and Geologic Setting

The Pioneer 7.5-minute quadrangle lies across the boundary between late Pleistocene uplands and Holocene alluvial deposits of the Mississippi River valley in the extreme northeastern portion of Louisiana (Figures 1 3). The quadrangle lies atop the Monroe uplift. Its surface consists exclusively of Holocene and terraced late Pleistocene strata (Figures 2, 3) deposited by the Mississippi River. All these strata consist of terrigenous sediment with

1. Location of Pioneer 7.5-minute quadrangle, northeastern Louisiana.

3. Surface geology of Pioneer 7.5-minute quadrangle and vicinity (adapted from Heinrich et al., 2015). (**Pmrl**, **Pmru**: lower and upper Macon Ridge alloformation (Pleistocene); **Hmm1**, **Hml1**: Holocene meanderbelt and natural levee deposits of Mississippi River course 1; **Hmm4**, **Hml4**, **Hmc4**: Holocene meanderbelt, natural levee, and crevasse complex deposits of Mississippi River course 4; **Harm**, **Harl**: Holocene meanderbelt and natural levee deposits of the Arkansas River

QUATERNARY SYSTEM

HOLOCENE

Hua

Allostratigraphic Approach to Pleistocene Unit Definitions

In the late 1980s the LGS had begun exploring the application of allostratigraphic concepts and nomenclature to the mapping of surface Plio Pleistocene units (e.g., Autin, 1988). In Louisiana these units show a series of geomorphic attributes and preservation states correlative with their relative ages, which eventually led LGS to conclude that allostratigraphy offers an effective if not essential approach to their delineation and classification (McCulloh et al., 2003). The Plio Pleistocene strata for which allostratigraphic nomenclature presently has value to LGS all are situated updip of the hinge zone of northern Gulf basin subsidence, and show a clear spectrum of preservation from pristine younger strata to trace relicts and remnants of older strata persisting in the coastal outcrop belt and on high ridgetops in places updip of it. Allounit nomenclature has figured heavily in the STATEMAP-funded geologic mapping projects of the past two decades because Quaternary strata occupy approximately three-fourths of the surface of Louisiana. The surface of the Pioneer quadrangle consists exclusively of Quaternary strata, which dictated a continuation of this practice for this investigation.

Braid Belts / Valley Trains (Pleistocene)

Large portions of the Mississippi River alluvial valley, of which Macon Ridge is one, consist of extensive deposits of glacial outwash that form ridges and terrace surfaces that lie above the modern floodplain. These deposits of glacial outwash consist of large quantities of sand and gravel overlain by a relatively thin, 2 5-m (~7 16-ft) thick, layer of clay and silt. In many places these sand and gravel deposits extend 30 60 m (~100 200 ft) uninterrupted to the base of the Quaternary alluvial valley fill.

Extensive optically stimulated luminescence dating of the valley train sediments underlying their surface by Rittenour (2004) and Rittenour et al. (2005, 2007) found that these surfaces within the Mississippi Alluvial Valley are associated with meltwater discharges during Marine Isotope Stages 4, 3, and 2. The older Lower Macon Ridge alloformation was found to date to 42 35 ka and the younger Upper Macon Ridge alloformation was dated to 33 30 ka. Radiocarbon ages of 29,100 ± 1200 and 31,200 ± 2400 14C ka BP, which are consistent with these ages, have been determined for samples collected from a shell-rich deposit underlying the Peoria Loess and overlying the sand on this surface (Saucier, 1968). Both stratigraphic units represent glacial outwash deposited during Marine Isotope Stage 3 (Rittenour, 2004; Rittenour et al., 2005, 2007).

Loess (Pleistocene)

Within Macon Ridge, two layers of relatively homogeneous, seemingly nonstratified, unconsolidated, well-sorted silt blanket the surfaces of the Upper and Lower Macon Ridge alloformations. This surficial well-sorted silt, which is called "loess," is distinctive because of its unusually massive nature, uniformly tan to brown color, and extraordinary ability to form and maintain vertical slopes or cliffs (Rutledge and others, 1996; Saucier, 1994a).

Loess is eolian sediment that accumulated during times of near-maximum to early-waning glaciation. During such periods, seasonally prevailing, strong, north and northwest winds deflated large amounts of silt from recently deposited and unvegetated glacial outwash that accumulated within glacial valley trains. These seasonal winds then transported the material for tens to hundreds of kilometers (te6i-i-58(to)-61(hundr)3(e)4(ds)-60(of)-56(kil)3(ng)1lesDC -2

Holocene fluvial sediments of the Tensas River Basin underlie the eastern edge of the Pioneer 7.5-minute quadrangle. This quadrangle straddles the western edge of the Tensas Basin that is defined by the scarp of Macon Ridge. The modern channel of the Mississippi River forms the eastern edge of the Tensas Basin. The northern end of this basin is defined by where the historic Mississippi River meander belt abuts Macon Ridge. Its southern end lies at Sicily Island, where the Ouachita River enters the Mississippi River alluvial valley (Fisk, 1944; Saucier, 1967). The geomorphology of the Tensas Basin is well known and the

Within the Pioneer 7.5-minute quadrangle, the backswamp of the Tensas Basin is underlain by fine-grained Holocene sediments. Research by Kidder (2006) and Kidder et al. (2008) indicate that backswamp deposits derived from both the Arkansas and Mississippi Rivers may be present. In addition, the presence of relict channel segments demonstrated that buried paleochannels of either Arkansas River or Mississippi River distributary paleocourses are present in the subsurface.

Geoarchaeology

The terraced late Pleistocene uplands occupy the western three-fourths of the Pioneer quadrangle, and comprise older and younger members of the Macon Ridge alloformation (Figure 3). The older (stratigraphically lower, geomorphologically higher) member underlies the eastern portion of Pleistocene outcrops in the quadrangle, and forms a surface occupied by an Archaic period archaeological site complex distinguished by sizable earthworks (Figure 6) (Figure 3).

Summary of Results

The Pleistocene strata comprise glaciofluvial outwash deposits of the Mississippi River system previously described as braided stream terraces or valley trains, and are here adapted as formation- and member-rank allostratigraphic units. These deposits comprise sand and gravel channel and bar deposits formed by the Mississippi River during a braided depositional regime associated with the transport of glacial outwash, and are mapped as the Macon Ridge alloformation. The deposits fo

References

Adelsberger, K. A., and T. R. Kidder, 2007, Climate change, landscape evolution, and human

Snead, J., Heinrich, P. V., and R. P. McCulloh (compilers), 2015, Tallulah 30 × 60 minute geologic quadrangle: Louisiana Geological Survey, Baton Rouge, Scale 1:100,000.

Snead, J., P. Heinrich, and R. P. McCulloh (compilers), 2014, Tallulah 30 × 60 Minute Geologic Quadrangle: Unpublished map prepared in cooperation with U.S. Geological Survey, STATEMAP program, under cooperative agreement no. G13AC00166, Open-File Map 2014