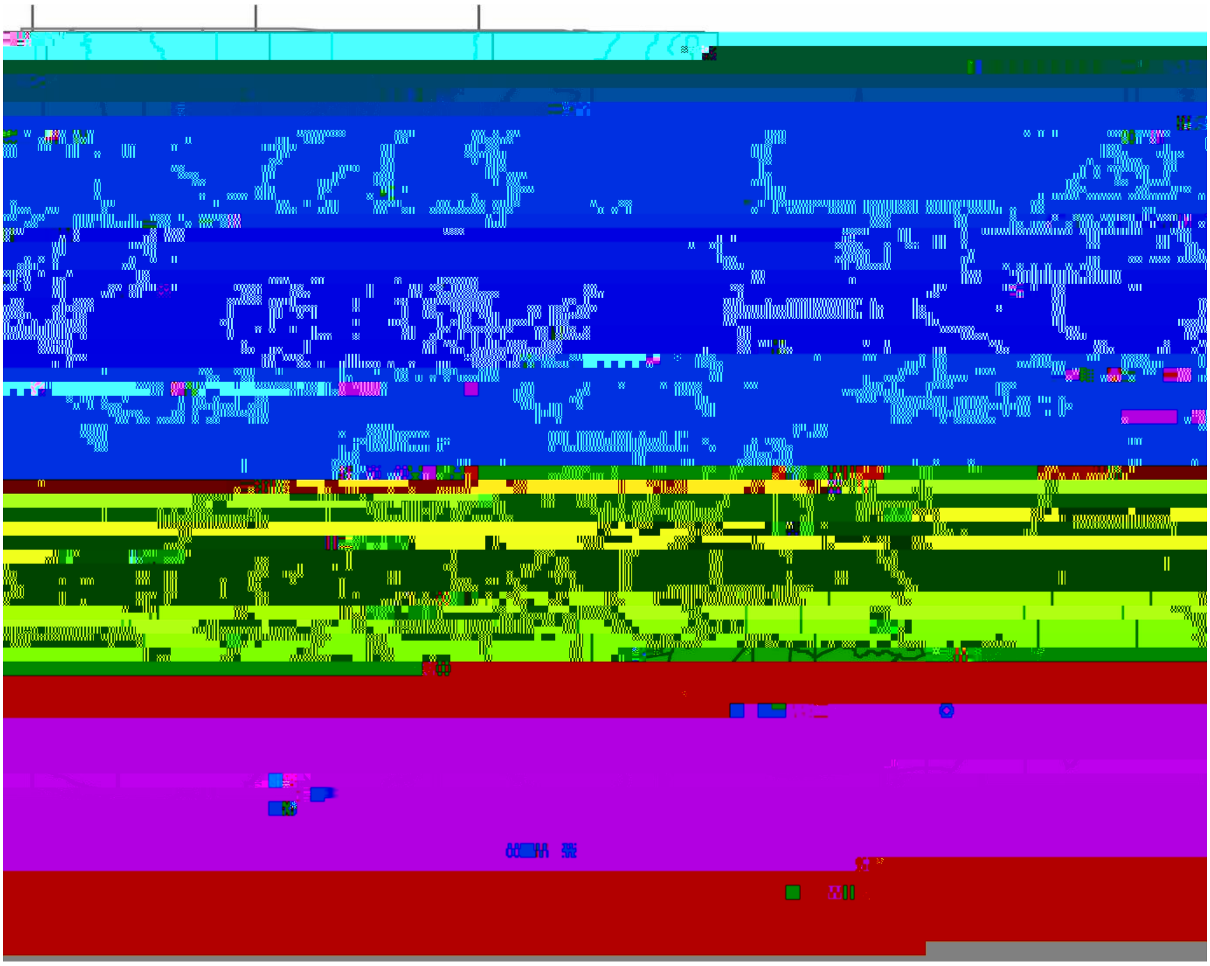
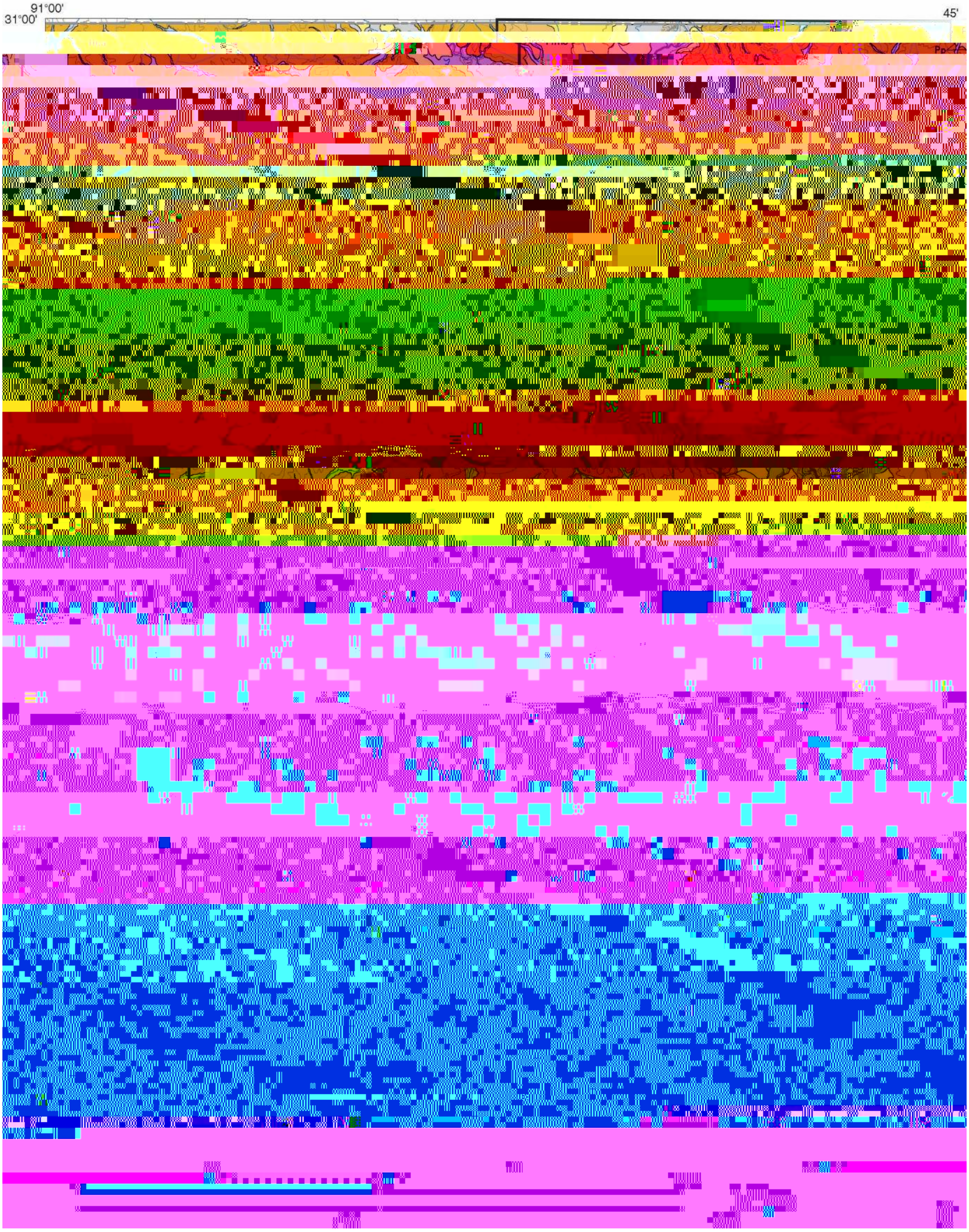
Geology of the Chipola 7.5-Minute Quadrangle

in road- and drainage-associated excavations, to examine and sample the texture and composition of the surface-geologic map units. Field observations were then synthesized with the draft surface geology to prepare an updated integrated surface geology layer for the 7.5-minute quadrangle.



1. Location of Chipola 7.5-minute quadrangle, southeastern Louisiana.



2. Surface geology of Chipola 7.5-minute quadrangle and vicinity (adapted from McCulloh et al., 2009). (**$P_o$uc**, Citronelle Formation, Upland allogroup (Pliocene); **Pimo**, Montpelier alloformation, Intermediate allogroup (Pleistocene); **Ppi**, Irene alloformation, Prairie Allogroup (Pleistocene); **Pph**, Hammond alloformation, Prairie Allogroup (Pleistocene); **Pp**, Prairie Allogroup, undifferentiated (Pleistocene); **Hua**, Holocene undifferentiated alluvium.)

QUATERNARY SYSTEM

HOLOCENE

Hua Holocene undifferentiated alluvium

QUATERNARY UNDIFFERENTIATED
Qaf Quaternary alluvial-fan deposits

PLEISTOCENE

LOESS
[pattern] Peoria Loess

PRAIRIE ALLOGROUP
Pph Hammond alloformation
Ppi Irene alloformation

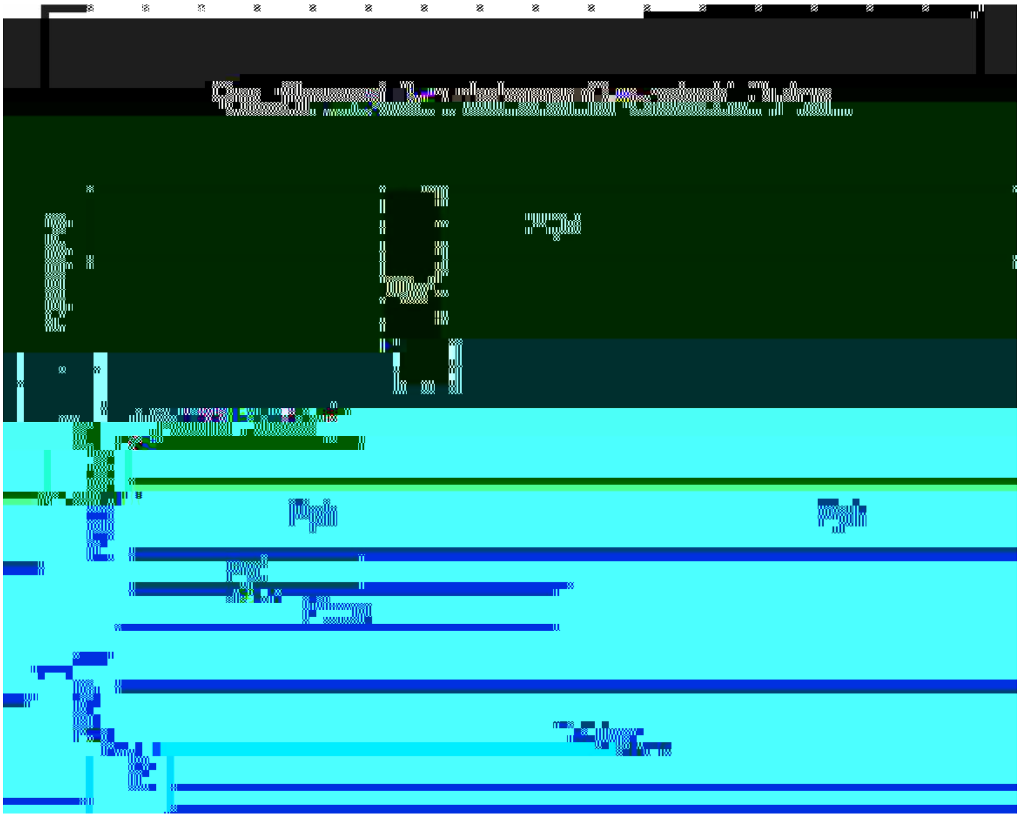
INTERMEDIATE ALLOGROUP
Pimo Montpelier alloformation

TERTIARY SYSTEM

PLIOCENE

UPLAND ALLOGROUP
$P_o$uc Citronelle Formation

3. Units mapped in the Chipola 7.5-minute quadrangle.



4. Correlation of strata mapped in the Chipola 7.5-minute quadrangle.

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 Chipola quadrangle consists exclusively of Quaternary and Pliocene strata, which dictated a continuation of this practice for this investigation.

Citronelle Formation, Upland allogroup (Pliocene)

The Citronelle Formation was first recognized and mapped by Hilgard (1860) as the “Orange Sand Formation” that consisted of a widespread, surficial mantle of weathered sands and gravels that cover much of the state of Mississippi. As originally defined and mapped it consisted of a mixture of Pliocene sands and gravels and weathered “bedrock.” In order to conform to the policies of the U.S. Geological Survey, which forbade the use of descriptive names for formations, Hilgard (1891) renamed his "Orange Sand Formation" as the “Lafayette Formation” for railroad cuts at Oxford in Lafayette County, Mississippi. Also, it replaced another name, the Appomattox Formation, used for these sands and gravels. It was under the name Lafayette Formation that McGee (1891) published a treatise on this stratigraphic unit (Dockery and Thompson, 2016).

Later, Matson (1916) named the Citronelle Formation for highly weathered, nonmarine, Pliocene sediments that occupy the seaward margin of the Gulf Coastal Plain that extends from western Florida to Texas and consist of yellow and red sands and clays and include significant amounts of gravel near their landward margins. The type locality is a 3- to 4-mile stretch of the Mobile and Ohio Railroad north of the town of Citronelle in Mobile County, Alabama. South of its type locality, it contains a fossiliferous clay bed with a well-preserved flora that was regarded by Berry (1916) as Pliocene in age (Dockery and Thompson, 2016).

The regional distribution of the Citronelle Formation has been mapped and illustrated by numerous studies. They include Matson (1916); Doering (1935, 1956); and the “High Terraces” of Mossa and Autin (1989) and of Snead and McCulloh (1984). A georeferenced comparison using ArcGIS of Fisk’s (1938a) Williana, Bentley, and Montgomery Formations as illustrated by Bernard and Leblanc (1965, their figure 2) with published LGS 30 × 60 degree geologic quadrangle maps (Heinrich and Autin, 2000; Heinrich

crests), and accordant summits. Within the region of the Chipola 7.5-minute quadrangle, its fluvial terrace is too fragmented for the slope to be measured. At this time, little is known about the lithology of the Irene alloformation, except that it is distinctly finer-grained than the underlying Citronelle Formation. Close to the Mississippi Valley, the Peoria and Sicily Island loesses blanket the surface of the Irene alloformation (Miller et al., 1985).

Within the Chipola 7.5-minute quadrangle, information concerning the age of the Irene alloformation is lacking. An optical luminescence date of 206 ± 14 ka (Baker I-1) from this alloformation near Baker, Louisiana indicates that it dates to Marine Isotope Stage 7; that it correlates with the Bastrop alloformation in northern Louisiana; and that the Hammond alloformation postdates Marine Isotope Stage 7 (Shen et al., 2012, 2016).

Hammond alloformation, Prairie Allogroup (Pleistocene)

Within the Florida Parishes, the youngest and most extensive surficial unit is the Hammond alloformation of the Prairie Allogroup (Heinrich, 2006; McCulloh et al., 2009). Its name is derived from Hammond, Louisiana and the Hammond terrace of Matson (1916). It is an allostratigraphic unit that forms part of the Prairie Allogroup. The surface of the Hammond alloformation is a coast-parallel terrace that is 16–40 km (10–25 mi) wide and extends from the eastern valley wall of the Mississippi River alluvial valley eastward across the Florida Parishes and the Pearl River into Mississippi. It is the lowest and best preserved of the Pleistocene terraces found between the Mississippi and Pearl rivers. In the Florida Parishes it exhibits moderately to poorly preserved relict constructional landforms. These landforms include relict river courses, meander loops, ridge-and-swale topography, coastal ridges, and beach ridges. In some areas, they include valley walls and flood plains of entrenched valleys. Overall, the surface of the Hammond alloformation consists of a series merged alluvial cones that abruptly flatten out into a broad coastal plain. In areas to the south of the Chipola quadrangle, faulting has displaced the surface of the Hammond alloformation, creating numerous fault-line scarps.

Within the Chipola 7.5-minute quadrangle, the surface of the Hammond alloformation is only moderately well preserved. Although this surface is undissected, it noticeably lacks obvious relict fluvial landforms. It lies just above the level of the modern Amite River floodplain. In this area, the surface of the Hammond alloformation consists of the proximal apex of the alluvial cone of the Amite River. Multiple, well-preserved paleochannels and channel belts can be observed in lidar DEMs. The slope of its fluvial terrace within the study area is 0.8 m/km (4.2 ft/mi) within this quadrangle.

Information concerning the age of the Hammond alloformation in the Chipola 7.5-minute quadrangle is lacking. However, optical luminescence dates from the Baton Rouge and Denham Springs areas indicate that the Hammond alloformation is a mixture of sediments that accumulated during Marine Isotope Stages 5 and 3 and postdates Marine Isotope Stage 7 (Shen et al., 2012, 2016).

Peoria Loess (Pleistocene)

Within the Chipola 7.5-minute quadrangle, a blanket of relatively homogeneous, seemingly nonstratified, unconsolidated, well-sorted silt blankets the formations of Pleistocene and Tertiary age. This surficial layer of well-sorted ,e,e,e,e,e,e,e,e|e,e to form and maintain vertical slopes or cliffs (Miller et al., 1985; Pye and Johnson, 1988; McCraw and Autin, 1989; and Saucier, 1994).

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 (tens to hundreds of miles) to the east and south. Eventually, this deflated silt fell out of suspension and incrementally accumulated within adjacent uplands as a drape over either preexisting terraces or dissected, hilly landscape. The greatest amount and relatively coarsest of the silt accumulated closest to the source areas (Miller et al., 1985; Pye and Johnson, 1988; McCraw and Autin, 1989; and Saucier, 1994).

The two loess sheets that occur within the Chipola 7.5-minute quadrangle are, from youngest to oldest, the Peoria and Sicily Island loesses. Numerous radiocarbon, thermoluminescence, and optical luminescence dates and other lines of evidence have been used to determine the age of the Peoria Loess. It has been found to be unquestionably of Late Wisconsin age, between 22,000 and 12,500 years BP, and consistent with the age of known meltwater valley trains (Miller et al., 1985; Pye and Johnson, 1988; McCraw and Autin, 1989; and Saucier, 1994). The favored age of the Sicily Island Loess is an Early Wisconsin age, which is consistent with its presence overlying the surface of the Irene Alloformation and its absence beneath the Peoria Loess where it overlies the Hammond alloformation.

Quaternary alluvial-fan deposits (Quaternary undifferentiated)

Alluvial-fan deposits (**Qaf**) comprise sediment at the termini of two very small drainage courses incising strata of the Montpelier alloformation, Intermediate allogroup and the Irene alloformation, Prairie Allogroup on the east side of the Amite River valley. These two alluvial-fan deposits lie in the southwestern portion of the quadrangle, where their source drainages debouch onto the surface of the adjacent Hammond alloformation, Prairie Allogroup.

Holocene alluvium

natural levees and the upper portion of abandoned chute and thalweg channel fills (Autin, 1985, 1989; Mossa and Autin, 1989). These sediments were differentiated by Autin (1989) into three alloformations, known as the Magnolia Bridge, Denham Springs, and Watson alloformations

Shen, Z., N. H. Dawers, T. E. Tornqvist, N. M. Gasparini, M. P. Hijma, and B. Mauz, 2016, Mechanisms of late Quaternary fault throw-rate variability along the north central Gulf of Mexico coast: implications for coastal subsidence: Basin Research, p. 1–14, doi:10.1111/bre.12184.

Shen, Z., T. E. Törnqvist, W. J. Autin, Z. R. P. Mateo, K. M. Straub, and B. Mauz, 2012, Rapid and widespread response of the Lower Mississippi River to eustatic forcing during the last glacial-interglacial cycle: Geological Society of America Bulletin, v.