U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science Directorate
Geologic Resources Division

Vicksburg National Military Park

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Vicksburg National Military Park

vick_geology.pdf

Version: 5/20/2021

Geologic Resources Inventory Ancillary Map Information Document for Vicksburg National Military Park

Table of Contents

Geologic Resources Inventory Map Document

Vicksburg National Military Park, Mississippi

Document to Accompany Digital Geologic-GIS Data

vick_geology.pdf

Version: 5/20/2021

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Vicksburg National Military Park, Mississippi (VICK).

Attempts have been made to reproduce all aspects of the original source products, including the geologic units and their descriptions, geologic cross sections, the geologic report, references and all other pertinent images and information contained in the original publication.

This document contains the following information:

1)**About the NPS Geologic Resources Inventory Program** – A brief summary of the Geologic Resources Inventory (GRI) Program and its products. Included are web links to the GRI GIS data model, and to the GRI products page where digital geologic-GIS datasets, scoping reports and geology reports are available for download. In addition, web links to the NPS Data Store and GRI program home page, as well as contact information for the GRI coordinator, are also present.

2)**GRI Digital Maps and Source Citations** – A listing of all GRI digital geologic-GIS maps produced for this project along with sources used in their completion.

3)**Map Unit Listing** – A listing of all geologic map units present on maps for this project, generally listed from youngest to oldest.

4)**Map Unit Descriptions** – Descriptions for all geologic map units.

5)**Ancillary Source Map Information** – Additional source map information present with each source map. This includes a map legend and references for each source map.

6)**GRI Digital Data Credits** – GRI digital geologic-GIS data and ancillary map information document production credits.

For information about using GRI digital geologic-GIS data contact:

Stephanie O'Meara
Geologist/GIS Specialist/Data Manager
Colorado State University Research Associate, Cooperator to the National Park Service
Fort Collins, CO 80523
phone: (970) 491-6655
e-mail: stephanie_o'meara@partner.nps.gov

About the NPS Geologic Resources Inventory Program

Background

The Geologic Resources Inventory (GRI) provides geologic map data and pertinent geologic information to support resource management and science-informed decision making in more than 270 natural resource parks throughout the National Park System. Geologic resources for management consideration include both the processes that act upon the Earth and the features formed as a result of these processes. Geologic processes include: erosion and sedimentation; seismic, volcanic, and geothermal activity; glaciation, rockfalls, landslides, and shoreline change. Geologic features include mountains, canyons, natural arches and bridges, minerals, rocks, fossils, cave and karst systems, beaches, dunes, glaciers, volcanoes, and faults.

The GRI is one of 12 inventories funded by the National Park Service (NPS) Inventory and Monitoring Program. The Geologic Resources Division of the NPS Natural Resource Stewardship and Science Directorate administers the GRI. The NPS Geologic Resources Division partners with the Colorado State University Department of Geosciences to produce GRI products. Many additional partners participate in the GRI process by contributing source maps or reviewing products.

The GRI team undertakes three tasks for each park in the Inventory and Monitoring program: (1) conduct a scoping meeting and provide a summary document, (2) provide digital geologic map data in a geographic information system (GIS) format, and (3) provide a GRI report. These products are designed and written for nongeoscientists.

Products

Scoping Meetings: These park-specific meetings bring together local geologic experts and park staff to inventory and review available geologic data and discuss geologic resource management issues. A summary document is prepared for each meeting that identifies a plan to provide digital map data for the park.

Digital Geologic Maps: Digital geologic maps reproduce all aspects of traditional paper maps, including notes, legend, and cross sections. Bedrock, surficial, and special purpose maps such as coastal or geologic hazard maps may be used by the GRI to create digital Geographic Information Systems (GIS) data and meet park needs. These digital GIS data allow geologic information to be easily viewed and analyzed in conjunction with a wide range of other resource management information data.

For detailed information regarding GIS parameters such as data attribute field definitions, attribute field codes, value definitions, and rules that govern relationships found in the data, refer to the NPS Geology-GIS Data Model document available at: https://www.nps.gov/articles/gri-geodatabase-model.htm

Geologic Reports: GRI reports synthesize discussions from the original scoping meeting, follow up conference call(s), and subsequent research. Chapters of each report discuss the geologic setting of the park, distinctive geologic features and processes within the park, highlight geologic issues facing resource managers, and describe the geologic history leading to the present-day landscape. Each report also includes a poster illustrating these GRI digital geologic-GIS data.

For a complete listing of GRI products visit the GRI publications webpage: https://go.nps.gov/gripubs. GRI digital geologic-GIS data is also available online at the NPS Data Store: https://irma.nps.gov/DataStore/Search/Quick. To find GRI data for a specific park or parks select the appropriate park(s), enter “GRI” as a Search Text term, and then select the Search button.

For more information about the Geologic Resources Inventory Program visit the GRI webpage: https://

www.nps.gov/subjects/geology/gri.htm. At the bottom of that webpage is a “Contact Us” link if you need additional information. You may also directly contact the program coordinator:

Jason Kenworthy
Inventory Coordinator
National Park Service Geologic Resources Division
P.O. Box 25287
Denver, CO 80225-0287
phone: (303) 987-6923
fax: (303) 987-6792
email: Jason_Kenworthy@nps.gov

The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division. Learn more about I&M and the 12 baseline inventories at the I&M webpage: https://www.nps.gov/im/inventories.htm.

GRI Digital Maps and Source Map Citations

The GRI digital geologic-GIS maps for Vicksburg National Military Park, Mississippi (VICK):

The GRI compiled park extent and vicinity map (sources are listed with the individual 7.5' quadrangle component maps below).

Digital Geologic-GIS Map of Vicksburg National Military Park and Vicinity, Mississippi and Louisiana (*GRI MapCode VICK*)

Individual 7.5' quadrangle GRI maps with source publications. These maps were compiled to produce the park and vicinity (VICK) map.

Digital Geologic-GIS Map of the Long Lake Quadrangle, Mississippi and Louisiana (*GRI MapCode LOLA*)

Smith, Taryn E., and Schmitz, Darrel W., 2016, Geologic Map of the Long Lake Quadrangle, Warren County, Mississippi, Madison Parish, Louisiana: Mississippi State University, Department of Geosciences, unpublished map and GIS data; scale 1:24,000. (*GRI Source Map ID 76076*).

Digital Geologic-GIS Map of the Redwood Quadrangle, Mississippi (*GRI MapCode REWD*)

Smith, Taryn E., and Schmitz, Darrel W., 2016, Geologic Map of the Redwood Quadrangle, Warren and Issaquena Counties, Mississippi: Mississippi State University, Department of Geosciences,unpublished map and GIS data; scale 1:24,000. (*GRI Source Map ID 76077*).

Digital Geologic-GIS Map of the Vicksburg East Quadrangle, Mississippi (*GRI MapCode VIEA*)

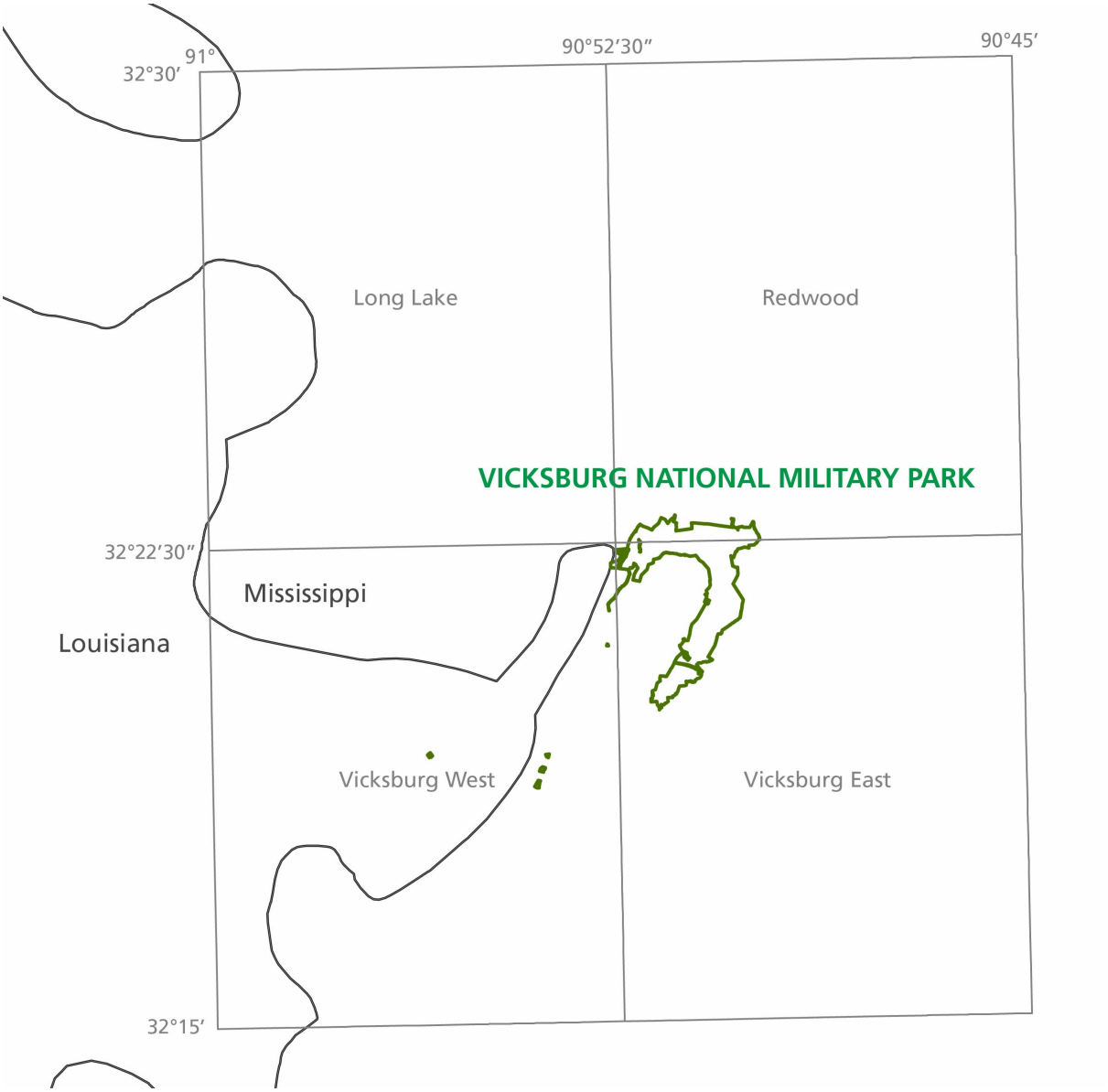
Smith, Taryn E., and Schmitz, Darrel W., 2016, Geologic Map of the Vicksburg East Quadrangle, Warren County, Mississippi: Mississippi State University, Department of Geosciences, unpublished map and GIS data, scale 1:24,000. (*GRI Source Map ID 76078*).

Digital Geologic-GIS Map of the Vicksburg West Quadrangle, Mississippi and Louisiana (*GRI MapCode VIWE*)

Smith, Taryn E., and Schmitz, Darrel W., 2016, Geologic Map of the Vicksburg West Quadrangle, Warren County, Mississippi and Madison Parish, Louisiana: Mississippi State University, Department of Geosciences, unpublished map and GIS data, scale 1:24,000. (*GRI Source Map ID 76079*).

Index Map

The following index map displays the extent of the GRI digital geologic-GIS maps produced for Vicksburg National Military Park (VICK). Each 7.5' quadrangle (component) map is outlined (in gray). The extent of the park map is the extent of all four 7.5' quadrangle maps. The boundary for Vicksburg National Military Park (as of May, 2021) is outlined in green.



Index map by Stephanie O'Meara (Colorado State University).

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Vicksburg National Military Park, Mississippi (VICK) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., Qal - Alluvium). Units are listed from youngest to oldest. No description for water is provided. Information about each geologic unit is also presented in the GRI Geologic Unit Information (VICKUNIT) table included with the GRI digital geologic-GIS data.

Cenozoic Era

Quaternary Period

Holocene Epoch
Alluvial Deposits
- Qal - Alluvium
- Qab - Backswamp
- Qalt - Alluvial terrace
- Qapb - Point bar
- Qac - Abandoned channel

Qaf - Alluvial fans
Qc - Colluvium

Pleistocene Epoch
Ql - Loess
Qpl - Pre-Loess

Tertiary Period

Miocene Epoch
Tca - Catahoula Formation

Oligocene Epoch
Tv - Vicksburg Group

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below. Unit descriptions were provided by the source map authors as one description per unit, and not for each source map.

Qal - Alluvium (Holocene)

Alluvium (Qal) comprises of flood plain sands, silts, gravels, and clays. Backswamp (Qab) is characterized by the gradual accumulation of fine-grained sediments during periods of overbank flooding. Includes areas of thick, massive sequences of fine-grained overbank deposits.Point bars (Qapb) consists of relatively coarse-grained deposits, mostly silts and sands. Abandoned channels (Qac) consist of fine-grained channel-fill deposits such as clays and silts.

Qab - Backswamp (Holocene)

Backswamp is characterized by the gradual accumulation of fine-grained sediments during periods of overbank flooding. Includes areas of thick, massive sequences of fine-grained overbank deposits.

Qalt - Alluvial terrace (Holocene)

Alluvial terrace comprised of sands, silts, gravels, and clays.

Qapb - Point bar (Holocene)

Point bars consist of relatively course-grained deposits, mostly silts and sands.

Qac - Abandoned channel (Holocene)

Consists of fine-grained channel-fill deposits such as clays and silts.

Qaf - Alluvial fans (Holocene)

Alluvial Fans (Qaf) comprise of a mass of alternating silts, sands, and gravels. Characterized by the gently sloping fan or cone shape. Deposited where streams discharge from an upland to a basin or onto a plane. May interfinger with other fans, forming an alluvial apron.

Qc - Colluvium (Holocene)

Colluvium (Qc) is composed of thick masses of stony, clayey slope wash, ranging from silt to rock fragments.

Ql - Loess (Pleistocene)

Fine silt, buff to tan, pale yellow, red, or gray in color. Contains gastropod shells and calcareous concretions and sometimes extinct mammal bones throughout the unleached portions. Loess is eolian deposit derived from glacial outwash and varies in thickness. Loess unconformably blankets the pre loess.

Qpl - Pre-Loess terrace deposits (Pleistocene)

Sand and gravel deposits, fine-to coarse grained. Predominantly quartzose with pea to cobble size clasts. Sands are red, pink, orange, purple, or yellow in color. Contains clay lenses and petrified wood. Gravels are predominantly well rounded chert and also contains quartz, agates, geodes, silicified wood, arkose clasts, sandstones, and rhyolite.

Tca - Catahoula Formation (Miocene)

Consists of sands and clays. Sands are predominantly quartz with mica, chert, and heavy minerals. Color varies from gray to white and slightly glauconitic locally. The clays are green, gray, or brown and weather to brown with a red mottel appearance. Sands are often cemented with silica to form hard layers.

Tv - Vicksburg Group (Oligocene)

Includes in ascending order:

Mint Spring: light-greenish gray to dark-gray, fossiliferous, glauconitic sandy marls and limy sand.
Glendon Limestone and Marls**:** limestones and marls.
Byram: greenish-gray to dark-gray, fossiliferous, glauconitic marl and weathers to a rusty yellowish color with the upper portion containing thin beds of clays and sands
Bucatunna Clay: dark brown to gray, stiff organic rich clay to an absorbent clay with alternating beds of fine sand.

Ancillary Source Map Information

Additional or ancillary map information present on source geologic maps or data used by the Geologic Resources Inventory (GRI) Program in the production of digital geologic-GIS data for Vicksburg National Military Park, Mississippi (VICK) is presented below.

Mapping and Source GIS Information

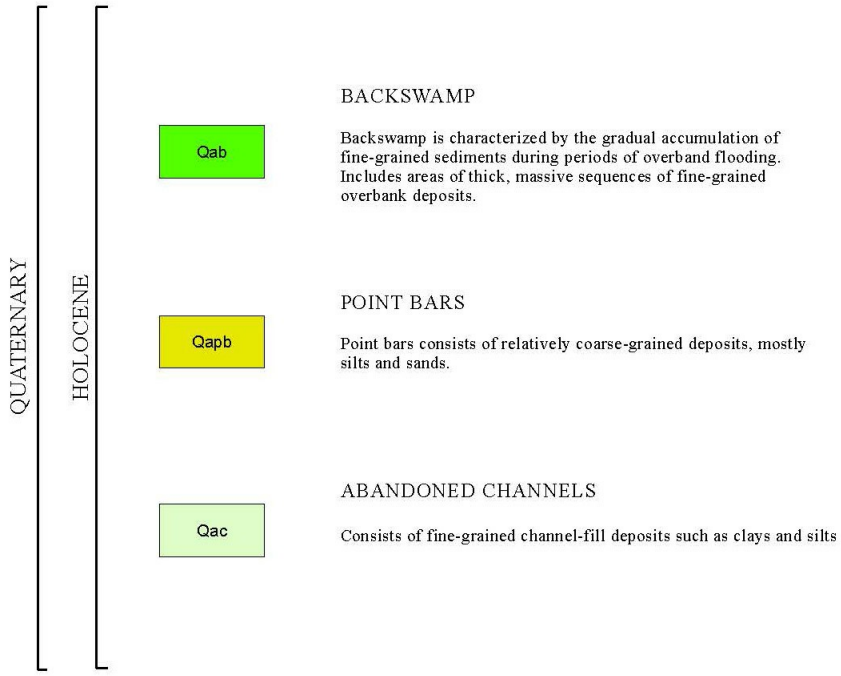
Mapping was conducted in the field by using basic mapping techniques as well as collecting data from a newly produced bore hole. Outside of the filed, aerial imagery such as LIDAR and Google Earth were utilized, as well as observing log data that was provided. USGS topographic maps were issued at a scale of 1:24,000 each, which provided a base for geologic mapping. Contacts and exposures were located by driving the study area, as well as walking creek beds and other areas that were unreachable by vehicle. Once an outcrop was located, it was studied, the details of the outcrop were noted in a field book, photographed, and location determined by GPS then referenced onto the topographic map. Aerial imagery was also studied to observe the change of channel drainage direction as well as width to determine the floodplain patterns and underlying formations outside of the Mississippi River floodplain. The LIDAR was used to verify the provided Saucier 15 minute Mississippi River floodplain map from the Army Corps of Engineers. Geophysical and geotechnical logs provided by Burns Cooley Dennis Geotechnical and Materials Engineering Consultants, North American Coal, and Mississippi Department of Transportation (MDOT) were utilized in defining each unit's locations, thicknesses, and elevations. Morse, 1941 contour map of the top of the Glendon limestone was utilized in determining the Vicksburg Group locality in areas where minimal data was present. Primary sources consulted to create the maps were collected from the National Park Services (NPS), Mississippi Department of Environmental Quality (MDEQ), and The Army Corps of Engineers.

Once all provided and collected data was observed and recorded onto the topographic maps, the data was then transferred into the GIS program ArcMap and digitized, as well as the existing Corps 15 minute floodplain map to produce the finished products. Alluvial fans within the area have previously been recognized and digitized into ArcGIS by MDEQ; the data was then added to the GIS portion of this project. Additional shapefile data such as township and range lines, hydrology, and major highways were downloaded from Mississippi Automated Resource Information System (MARIS). Contact accuracy is expressed as concealed and queried and represents 5 meter accuracy. The final four maps Redwood, Long Lake, Vicksburg East, and Vicksburg West were produced to meet MDEQ standards (Taryn Smith, 2016).

Source Map Legends

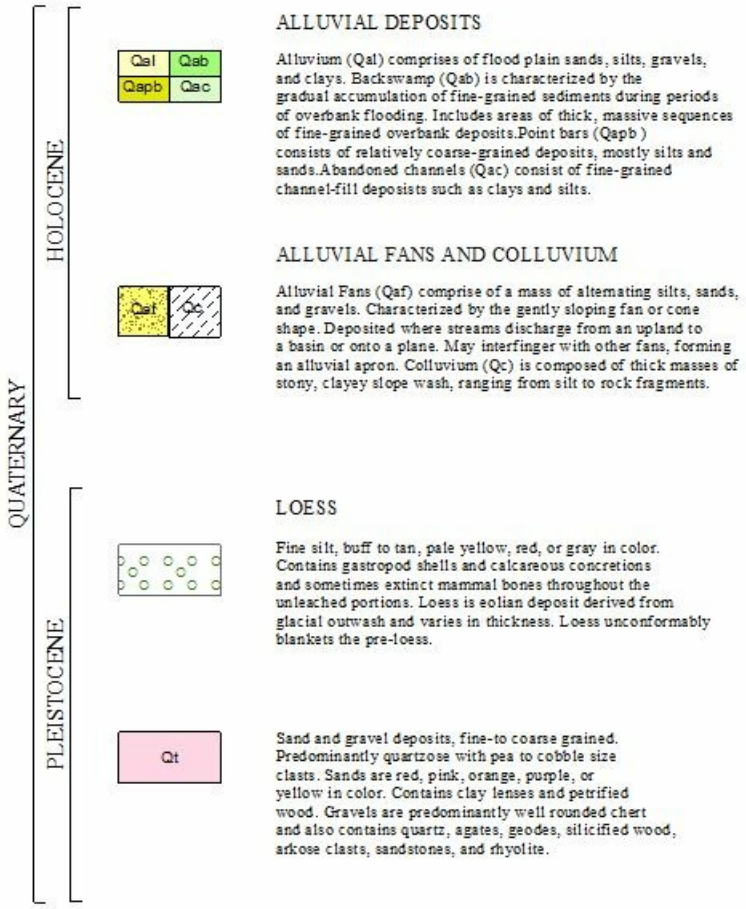
For each source quadrangle map a legend showing unit correlation and ages, as well as description of map units, was provided by the source authors.

Long Lake Quadrangle Legend



Graphic from source map: Long Lake Quadrangle.

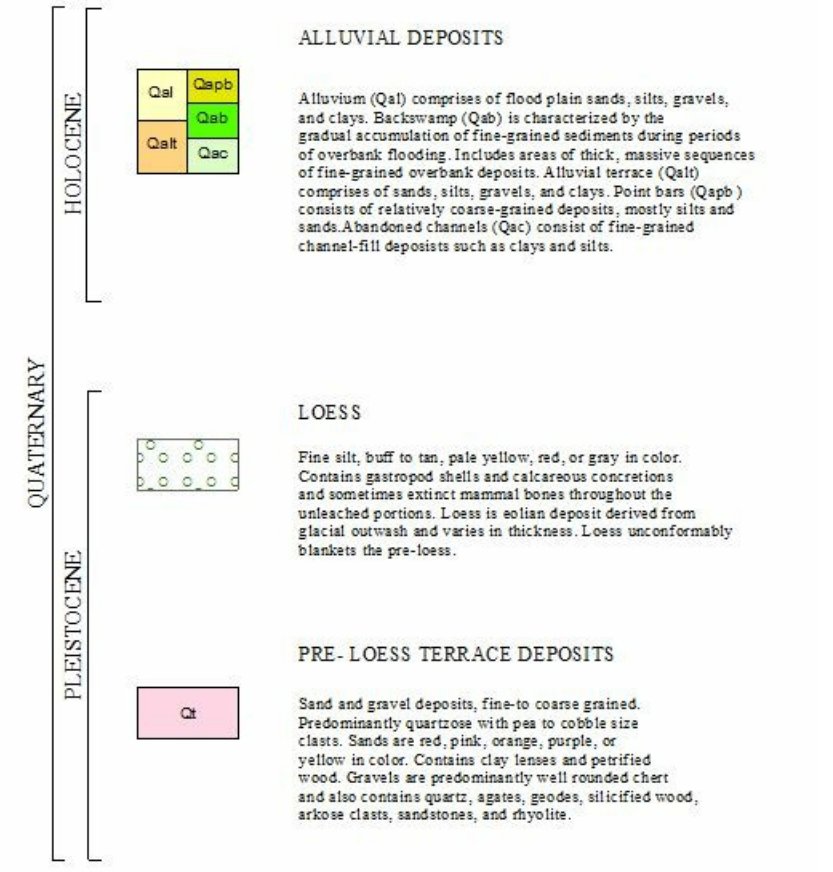
Redwood and Vicksburg West Quadrangle Legend



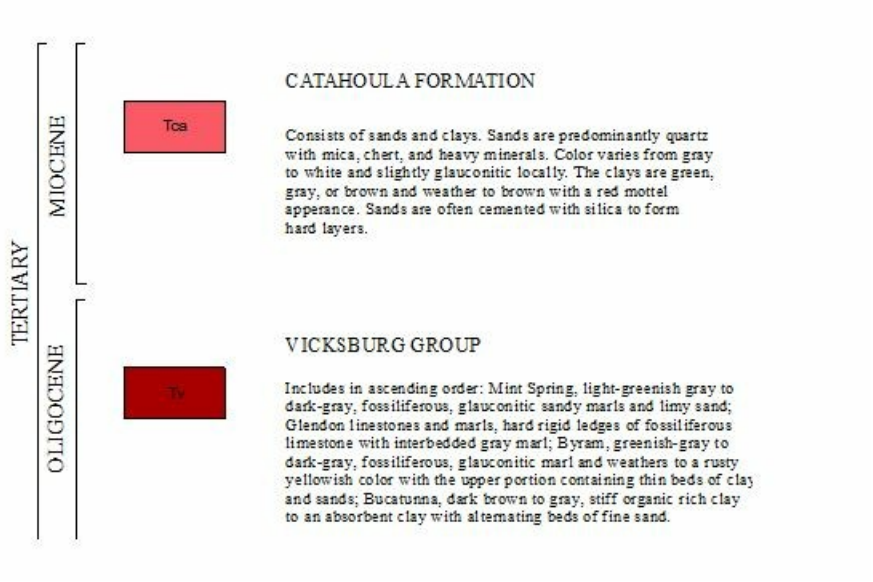
Of note, loess was assigned a unit symbol of Ql in the GRI digital geologic-GIS data, whereas Pre-Loess terrace deposits now have a unit symbol of Qpl. The latter unit symbol was changed from Qt (see above graphic) to Qpl to better represent the unit's name.

Graphic from source maps: Redwood Quadrangle and Vicksburg West Quadrangle.

Vicksburg East Quadrangle Legend



Of note, loess was assigned a unit symbol of Ql in the GRI digital geologic-GIS data, whereas pre-loess terrace deposits now have a unit symbol of Qpl. The latter unit symbol was changed from Qt (see above graphic) to Qpl to better represent the unit's name.



Graphic from source maps: Vicksburg East Quadrangle.

Source Map References

A list of references used in the completion of each source map was provided by the source authors.

Long Lake Quadrangle References

Bicker, R. A., 1969, Geologic Map of Mississippi.

Brown, F. G., 1947, Geology and Artesian Water of the Alluvial Plain in Northwestern Mississippi: Mississippi State Geological Survey, bul. 65, 424 p.

Byerly, R. G., Joeseph, E. H., and McCabe, D., 1988, A New Late Eocene Microspherule Layer in Central Mississippi: The Department of Natural Resources Mississippi Geology, vol. 8, no. 4, 15 p.

Dockery, D. T., and Thompson, E. D., 2011, The Geology of Mississippi, 685 p.

Dockery, T. D., Starnes, E. J., Thompson, E. D., and Beiser, L., 2008, Rocks and Fossils Found in Mississippi's Gravel Deposits, 24 p.

Henderson, S. W., 2000, The significance of Meander Bends in Military History; Three Examples from the Southern United States: Geological Society of America, v. 32, no. 2, 25 p.

Kolb, C.R., Russell, E. E., and Johnson, B. W., 1976, Classic Tertiary and Quaternary Localities and Historical Highlights of the Jackson-Vicksburg-Natchez Area.

Kolb, C.R., Steinriede, Jr., W.B., Krinitzsky, E.L., Saucier, R.T., Mabrey, R.T., Smith, F.L. and Fleetwood, A.R., 1968, Geological Investigation of the Yazoo Basin, Lower Mississippi Valley, U.S. Army Engineer Waterways Experiment Station Technical Report No. 3-480.

Laswell, J. T., 1964, Warren County Mississippi Soil Survey, series. 1961, no. 9, 73 p,

Lutton, J. R., 2009, Sequential Mass Failure as Detailed in Steep Cuts in Loess: Environmental and Engineering Geoscience, vol. XI, no. 1, p. 1-12.

Morse, W., 1935, The Geologic History of the Vicksburg National Military Park Area: Mississippi State Geological Survey, bul. 28, 20 p.

Morse, W., 1941, Warren County Mineral Resources: Mississippi State Geological Survey, bul. 43, 140 p.

Myers, M., May, J., and Haugen, B., 2011, Geology and Geomorphology of the Vicksburg Battlefield Lower Mississippi Valley Section.

References from source map: Long Lake Quadrangle.

Redwood Quadrangle References

Bicker, R. A., 1969, Geologic Map of Mississippi.

Brown, F. G., 1947, Geology and Artesian Water of the Alluvial Plain in Northwestern Mississippi: Mississippi State Geological Survey, bul. 65, 424 p.

Coleman, L. J., 1978, the Stratigraphy of the Glendon Limestone in the Vicksburg Area, Mississippi, 69 p.

Cooke, C. W., 1918, Correlation of the Deposits of Jackson and Vicksburg Ages in Mississippi and Alabama: Washington Academy of Sciences Journal, v. 8, p 186-198.

Dockery, D. T., and Thompson, E. D., 2011, The Geology of Mississippi, 685 p.

Dockery, T. D., 1982, Lower Oligocene Bivalvia of the Vicksburg Group in Mississippi: Mississippi Department of Natural Resources Bureau of Geology, bul. 123, 261 p.

Dockery, T. D., 1992, A Turritelline Gastropod-Dominated Bed in the Byram Formation (Oligocene) of Mississippi: Mississippi Geology, v. 13, no.2, 35 p.

Dockery, T. D., Starnes, E. J., Thompson, E. D., and Beiser, L., 2008, Rocks and Fossils Found in Mississippi's Gravel Deposits, 24 p.

Henderson, S. W., 2000, The significance of Meander Bends in Military History; Three Examples from the Southern United States: Geological Society of America, v. 32, no. 2, 25 p.

Kolb, R. C., Russell, E. E., and Johnson, B. W., 1976, Classic Tertiary and Quaternary Localities and Historical Highlights of the Jackson-Vicksburg-Natchez Area.

Kolb, C.R., Steinriede, Jr., W.B., Krinitzsky, E.L., Saucier, R.T., Mabrey, R.T., Smith, F.L. and Fleetwood, A.R., 1968, Geological Investigation of the Yazoo Basin, Lower Mississippi Valley, U.S. Army Engineer Waterways Experiment Station Technical Report No. 3-480.

Laswell, J. T., 1964, Warren County Mississippi Soil Survey, series. 1961, no. 9, 73 p,

Lutton, J. R., 2009, Sequential Mass Failure as Detailed in Steep Cuts in Loess: Environmental and Engineering Geoscience, vol. XI, no. 1, p. 1-12.

Mason, P and Starnes, J., 2011, Recharge Zones in the Mississippi-Yazoo Alluvial Plain, OLWR Hydrologic Map 2011-7, Mississippi Department of Environmental Quality, sheet 2 of 2.

Morse, W., 1935, The Geologic History of the Vicksburg National Military Park Area: Mississippi State Geological Survey, bul. 28, 20 p.

Morse, W., 1941, Warren County Mineral Resources: Mississippi State Geological Survey, bul. 43, 140 p.

Murphy, L. W. and Albertson, P.E., 1996, Engineering Geological Geographical Information System of the Waterways Experiment Station: Mississippi Geology, v. 17, no. 2, p 25-23.

Myers, M., May, J., and Haugen, B., 2011, Geology and Geomorphology of the Vicksburg Battlefield Lower Mississippi Valley Section.

Steponaitis, P. V., and Dockery, T. D., 2011, Mississippian Effigy Pipes and the Glendon Limestone: American Antiquity, vol. 76, no. 2, p 345-354.

References from source map: Redwood Quadrangle.

Vicksburg East Quadrangle References

Bicker, R. A., 1969, Geologic Map of Mississippi.

Coleman, L. J., 1978, the Stratigraphy of the Glendon Limestone in the Vicksburg Area, Mississippi, 69 p.

Cooke, C. W., 1918, Correlation of the Deposits of Jackson and Vicksburg Ages in Mississippi and Alabama: Washington Academy of Sciences Journal, v. 8, p 186-198.

Davis, D. K. and Starnes, J, E., 2008, Geologic Map of the Big Black Quadrangle, Open File Report 217, Mississippi Department of Environmental Quality Office of Geology.

Dockery, D. T., and Thompson, E. D., 2011, The Geology of Mississippi, 685 p.

Dockery, T. D., 1982, Lower Oligocene Bivalvia of the Vicksburg Group in Mississippi: Mississippi Department of Natural Resources Bureau of Geology, bul. 123, 261 p.

Dockery, T. D., 1992, A Turritelline Gastropod-Dominated Bed in the Byram Formation (Oligocene) of Mississippi: Mississippi Geology, v. 13, no.2, 35 p.

Dockery, T. D., Starnes, E. J., Thompson, E. D., and Beiser, L., 2008, Rocks and Fossils Found in Mississippi's Gravel Deposits, 24 p.

Kolb, R. C., Russell, E. E., and Johnson, B. W., 1976, Classic Tertiary and Quaternary Localities and Historical Highlights of the Jackson-Vicksburg-Natchez Area.

Kolb, C.R., Steinriede, Jr., W.B., Krinitzsky, E.L., Saucier, R.T., Mabrey, R.T., Smith, F.L. and Fleetwood, A.R., 1968, Geological Investigation of the Yazoo Basin, Lower Mississippi Valley, U.S. Army Engineer Waterways Experiment Station Technical Report No. 3-480.

Laswell, J. T., 1964, Warren County Mississippi Soil Survey, series. 1961, no. 9, 73 p,

Lutton, J. R., 2009, Sequential Mass Failure as Detailed in Steep Cuts in Loess: Environmental and Engineering Geoscience, vol. XI, no. 1, p. 1-12.

Morse, W., 1935, The Geologic History of the Vicksburg National Military Park Area: Mississippi State Geological Survey, bul. 28, 20 p.

Morse, W., 1941, Warren County Mineral Resources: Mississippi State Geological Survey, bul. 43, 140 p.

Murphy, L. W. and Albertson, P.E., 1996, Engineering Geological Geographical Information System of the Waterways Experiment Station: Mississippi Geology, v. 17, no. 2, p 25-23.

Myers, M., May, J., and Haugen, B., 2011, Geology and Geomorphology of the Vicksburg Battlefield Lower Mississippi Valley Section.

Steponaitis, P. V., and Dockery, T. D., 2011, Mississippian Effigy Pipes and the Glendon Limestone: American Antiquity, vol. 76, no. 2, p 345-354.

References from source map: Vicksburg East Quadrangle.

Vicksburg West Quadrangle References

Bicker, R. A., 1969, Geologic Map of Mississippi.

Brown, F. G., 1947, Geology and Artesian Water of the Alluvial Plain in Northwestern Mississippi: Mississippi State Geological Survey, bul. 65, 424 p.

Coleman, L. J., 1978, the Stratigraphy of the Glendon Limestone in the Vicksburg Area, Mississippi, 69 p.

Cooke, C. W., 1918, Correlation of the Deposits of Jackson and Vicksburg Ages in Mississippi and Alabama: Washington Academy of Sciences Journal, v. 8, p 186-198.

Davis, D. K. and Starnes, J, E., 2008, Geologic Map of the Big Black Quadrangle, Open File Report 217, Mississippi Department of Environmental Quality Office of Geology.

Dockery, D. T., 2012, Drilling on the River: Mississippi Department of Environmental Quality Environmental News, v. 9, is. 10, p 9-12.

Dockery, D. T., and Thompson, E. D., 2011, The Geology of Mississippi, 685 p.

Dockery, T. D., 1982, Lower Oligocene Bivalvia of the Vicksburg Group in Mississippi: Mississippi Department of Natural Resources Bureau of Geology, bul. 123, 261 p.

Dockery, T. D., 1992, A Turritelline Gastropod-Dominated Bed in the Byram Formation (Oligocene) of Mississippi: Mississippi Geology, v. 13, no.2, 35 p.

Dockery, T. D., Starnes, E. J., Thompson, E. D., and Beiser, L., 2008, Rocks and Fossils Found in Mississippi's Gravel Deposits, 24 p.

Henderson, S. W., 2000, The significance of Meander Bends in Military History; Three Examples from the Southern United States: Geological Society of America, v. 32, no. 2, 25 p.

Kolb, R. C., Russell, E. E., and Johnson, B. W., 1976, Classic Tertiary and Quaternary Localities and Historical Highlights of the Jackson-Vicksburg-Natchez Area

Kolb, C.R., Steinriede, Jr., W.B., Krinitzsky, E.L., Saucier, R.T., Mabrey, R.T., Smith, F.L. and Fleetwood, A.R., 1968, Geological Investigation of the Yazoo Basin, Lower Mississippi Valley, U.S. Army Engineer Waterways Experiment Station Technical Report No. 3-480.

Laswell, J. T., 1964, Warren County Mississippi Soil Survey, series. 1961, no. 9, 73 p,

Lutton, J. R., 2009, Sequential Mass Failure as Detailed in Steep Cuts in Loess: Environmental and Engineering Geoscience, vol. XI, no. 1, p. 1-12.

Mason, P and Starnes, J., 2011, Recharge Zones in the Mississippi-Yazoo Alluvial Plain, OLWR Hydrologic Map 2011-7, Mississippi Department of Environmental Quality, sheet 2 of 2.

Morse, W., 1935, The Geologic History of the Vicksburg National Military Park Area: Mississippi State Geological Survey, bul. 28, 20 p.

Morse, W., 1941, Warren County Mineral Resources: Mississippi State Geological Survey, bul. 43, 140 p.

Murphy, L. W. and Albertson, P.E., 1996, Engineering Geological Geographical Information System of the Waterways Experiment Station: Mississippi Geology, v. 17, no. 2, p 25-23.

Myers, M., May, J., and Haugen, B., 2011, Geology and Geomorphology of the Vicksburg Battlefield Lower Mississippi Valley Section.

Steponaitis, P. V., and Dockery, T. D., 2011, Mississippian Effigy Pipes and the Glendon Limestone: American Antiquity, vol. 76, no. 2, p 345-354.

References from source map: Vicksburg West Quadrangle.

GRI Digital Data Credits

This document was developed and completed by Stephanie O'Meara (Colorado State University) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program. Quality control of this document by James Winter (Colorado State University).

The information in this document was compiled from GRI source map and is intended to accompany the digital geologic-GIS maps and other digital data for Vicksburg National Military Park, Mississippi (VICK) developed by Stephanie O'Meara and James Winter (see the GRI Digital Maps and Source Map Citations section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS maps).

GRI finalization by Stephanie O'Meara.

GRI program coordination and scoping provided by Bruce Heise and Tim Connors (NPS GRD, Lakewood, Colorado).