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

Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area

aflm_geology.pdf

Version: 3/19/2015

Geologic Resources Inventory Map Document for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area

Table of Contents

Geologic Resources Inventory Map Document

Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area, Texas

Document to Accompany Digital Geologic-GIS Data

aflm_geology.pdf
Version: 3/19/2015

This document has been developed to accompany the digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area, Texas (AFLM).

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.

National Park Service (NPS) Geologic Resources Inventory (GRI) Program staff have assembled the digital geologic-GIS data that accompanies this document.

For information about the status of GRI digital geologic-GIS data for a park contact:

Tim Connors
Geologist/GRI Mapping Contact
National Park Service Geologic Resources Division
P.O. Box 25287
Denver, CO 80225-0287
phone: (303) 969-2093
fax: (303) 987-6792
email: Tim_Connors@nps.gov

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
1201 Oak Ridge Drive, Suite 200
Fort Collins, CO 80525
phone: (970) 491-6655
fax: (970) 225-3597
e-mail: stephanie.omeara@colostate.edu

About the NPS Geologic Resources Inventory Program

Background

Recognizing the interrelationships between the physical (geology, air, and water) and biological (plants and animals) components of the Earth is vital to understanding, managing, and protecting natural resources. The Geologic Resources Inventory (GRI) helps make this connection by providing information on the role of geology and geologic resource management in parks.

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 Geologic Resources Inventory aims to raise awareness of geology and the role it plays in the environment, and to provide natural resource managers and staff, park planners, interpreters, researchers, and other NPS personnel with information that can help them make informed management decisions.

The GRI team, working closely with the Colorado State University (CSU) Department of Geosciences and a variety of other partners, provides more than 270 parks with a geologic scoping meeting, digital geologic-GIS map data, and a park-specific geologic report.

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: http://science.nature.nps.gov/im/inventory/geology/GeologyGISDataModel.cfm

Geologic Reports: Park-specific geologic reports identify geologic resource management issues as well as features and processes that are important to park ecosystems. In addition, these reports present a brief geologic history of the park and address specific properties of geologic units present in the park.

For a complete listing of Geologic Resource Inventory products and direct links to the download site visit the GRI publications webpage http://www.nature.nps.gov/geology/inventory/gre_publications.cfm

GRI geologic-GIS data is also available online at the NPS Data Store Search Application: http://irma.nps.gov/App/Reference/Search. 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: http://www.nature.nps.gov/geology/inventory, or contact:

Bruce Heise
Inventory Coordinator
National Park Service Geologic Resources Division
P.O. Box 25287
Denver, CO 80225-0287
phone: (303) 969-2017
fax: (303) 987-6792
email: Bruce_Heise@nps.gov

The Geologic Resources Inventory (GRI) program is funded by the National Park Service (NPS) Inventory and Monitoring (I&M) Division.

Map Unit List

The geologic units present in the digital geologic-GIS data produced for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area, Texas (AFLM) 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 Geologic Unit Information (AFLMUNIT) table included with the GRI geology-GIS data.

Cenozoic Era

Quaternary Period
Qal - Alluvium
Qs - Windblown sand, sheets
Qsd - Windblown sand, dunes
Qt - Fluviatile terrace deposits
Qp - Playa deposits
Ql - Loess
Qbd - Blackwater Draw Formation

Tertiary Period
To - Ogallala Formation

Mesozoic Era

Triassic Period
TRdj - Trujillo Formation
TRdv - Tecovas Formation

Permian Period
Pqw - Quartermaster Formation, Cloud Chief Gypsum, and Whitehorse Sandstone undivided
Pqwa - Alibates Dolomite

Unit Pqwa is mapped only as a linear (line) feature and not an area (polygon) feature, and so the unit is present in the Linear Geologic Units data layer and not the area (polygon) Geologic Units data layer.

Map Unit Descriptions

Descriptions of all geologic map units, generally listed from youngest to oldest, are presented below.

Qal - Alluvium (Holocene)

Amarillo Sheet (Qal) and Tucumcari Sheets (Qal):
Flood-plain deposits, includes lowest terrace along Canadian River.

(Geologic Database of Texas)

Qs - Windblown sand, sheet (Holocene)

Amarillo Sheet (Qs):
Sand and silt, in sheets, Qs, locally modified by surface wash.

Tucumcari Sheet (Qs):
In Texas, sand and silt, in sheets.

(Geologic Database of Texas)

Qsd - Windblown sand, dunes (Holocene)

Amarillo Sheet (Qsd):
Dunes and dune ridges, Qsd, locally.

Tucumcari Sheet (Qsd):
Locally modified by surface wash, and dunes and dune ridges.

(Geologic Database of Texas)

Qt - Fluviatile terrace deposits (Pleistocene)

Amarillo Sheet (Qt) and Tucumcari Sheet (Qt):
Gravel, sand, and silt. Gravel, sandy, composed of pebbles and cobbles of quartz, quartzite, chert, igneous rock, metamorphic rock, caliche, and rare abraded *Gryphaea*. Sand, fine to coarse-grained quartz, cross-bedded to massive, lenticular, reddish brown, pink, gray. Silt, sandy, lenticular. Contiguous terraces of different ages separated by solid line.

(Geologic Database of Texas)

Qp - Playa deposits (Pleistocene)

Amarillo Sheet (Qp):
Clay and silt, sandy, gray in shallow depressions, usually covered by thin deposit of recent sediment; weathers light gray. (Wisconsinan) Note: Water in depressions not shown.

Tucumcari Sheet (Qp):
Clay and silt, sandy, light-gray, in shallow depressions (Wisconsinan), mostly covered by thin deposit of Holocene sediment. Note: water in depressions not shown.

(Geologic Database of Texas)

Ql - Loess (Pleistocene)

Amarillo Sheet (Ql):
Windblown silt.

(Geologic Database of Texas)

Qbd - Blackwater Draw Formation (Pleistocene)

Amarillo Sheet (as Qcs) and Tucumcari Sheet (as Qbd):
Sand, fine to medium-grained quartz, silty, calcareous, caliche nodules, massive, pink to grayish red, reddish brown, olive gray; distinct soil profile locally; thickness 25 feet, feathers out locally. (Mostly Illinoian, may include younger deposits).

(Geologic Database of Texas)

To - Ogallala Formation (Pliocene)

Amarillo Sheet (as Po-M-o) and Tucumcari Sheet (as To):
Sand, silt, clay, gravel, and caliche. Sand, fine to coarse-grained quartz, silty in part, caliche nodules locally, cemented locally by calcite and by silica, locally cross-bedded, various shades of gray, brown, and red. Minor silt and clay with caliche nodules, sandy in places, massive, white, gray, olive-green, brown, red, and maroon. Gravel, not everywhere present, composed of pebbles and cobbles of quartz, quartzite, minor chert, igneous rock, metamorphic rock, limestone, clay balls in lower part, and abraded *Gryphaea* in intraformational channel deposits and in basal conglomerate. Caliche, not everywhere present, sandy, pisolitic, white, gray, pink, comprises four or five beds up to 12 feet thick in upper part, forms ledges and caprock. Maximum thickness 550 feet, thins westward. (Locally includes Ogallala sand which has moved downslope covering older formations).

(Geologic Database of Texas)

TRdj - Trujillo Formation (Triassic)

Amarillo Sheet (TRdj) and Tucumcari Sheet (TRdj):
Conglomerate, sandstone, and shale. Conglomerate, sandy, composed of granules and pebbles of quartz, limestone, sandstone, siltstone, minor chert, and fragments of petrified wood, massive, gray, brown. Sandstone, conglomeratic, fine to coarse grains of quartz and limestone, micaceous, calcareous locally, cross-bedded to massive, gray, greenish gray, and brown. Shale, micaceous, occurs as thin interbeds, gray and red. Forms scarp. Thickness 30 feet, truncated locally.

(Geologic Database of Texas)

TRdv - Tecovas Formation (Triassic)

Amarillo Sheet (TRdv) and Tucumcari Sheet (TRdv):
Shale, clay, siltstone, and sand. Shale, clay, and siltstone, sandy in places, micaceous, calcareous locally, reddish brown, various shades of red, maroon, gray, greenish gray, yellow, and purple. Sand, fine to medium-grained quartz, locally large petrified logs, unconsolidated, massive, lenticular, white, and

light gray. Thickness 275 feet, truncated eastward.

(Geologic Database of Texas)

Pqw - Quartermaster Formation, Cloud Chief Gypsum, and Whitehorse Sandstone undivided (Permian)

Amarillo Sheet (Pqw) and Tucumcari Sheet (Pqw):
Sandstone, sand, siltstone, shale, gypsum, and dolomite, interbedded. Sandstone and sand, fine-grained quartz, scattered to locally abundant frosted and polished coarse quartz grains, silty, massive, friable to indurated, various shades of red and orange, orange brown, and grayish green. Shale and siltstone, sandy in part, indistinctly bedded to massive indurated, thin interbeds and veins of satin spar in upper part, various shades of red and orange, reddish brown, and grayish green. Gypsum, white, gray, and pink. Maximum thickness 650 feet.

(Geologic Database of Texas)

Pqwa - Alibates Dolomite (Permian)

Amarillo Sheet (Pqwa) and Tucumcari Sheet (Pqwa):

This unit is mapped only as a linear (line) feature and not an area (polygon) feature, and so the unit is present in the Linear Geologic Units data layer and not the area (polygon) Geologic Units data layer.

Separately mapped, comprises an upper and lower dolomite separated by shale, upper dolomite locally absent, dolomite locally replaced by chert, which is banded and mottled red, pink, pale blue, pale purple, gray, brown, and black, forms ledges, average thickness 15 feet.

(Geologic Database of Texas)

Oil and Gas Wells and Springs

Oil and gas wells and springs were digitized from the GAT: Amarillo Sheet. The Tucumcari Sheet didn't have any wells or springs indicated on it.

The Railroad Commission of Texas is an excellent source of well data in Texas. A link to their free web viewer is provided. Data can also be purchased.
http://www.rrc.state.tx.us/data/online/gis/index.php

Geologic Resource Division also helps with oil and gas issues in and near parks.
http://www.nature.nps.gov/geology/oil_and_gas/index.cfm

GRI Source Map Citations

The GRI digital geologic-GIS map for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area, Texas (AFLM) was compiled from the following sources:

Eifler, G.K., Phillips Petroleum Co., Humble Oil and Refining Co., Frye, J.C., Leonard, A.B., Knight, G. L., Hughes, C.D., Horn, P.H., and Quackenbush, W.M., 1969, Geologic Atlas of Texas, Amarillo sheet, University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas GA0002, 1:250,000 scale (GAT: Amarillo Sheet) (*GRI Source Map ID 2206)*

Texas Water Development Board, 2007, Geologic Database of Texas: 1:250,000 Geologic Data for Amarillo and Tucumcari Sheets derived from the Geologic Atlas of Texas, 1:250,000 scale (Geologic Database of Texas) (*GRI Source Map ID 75030)*

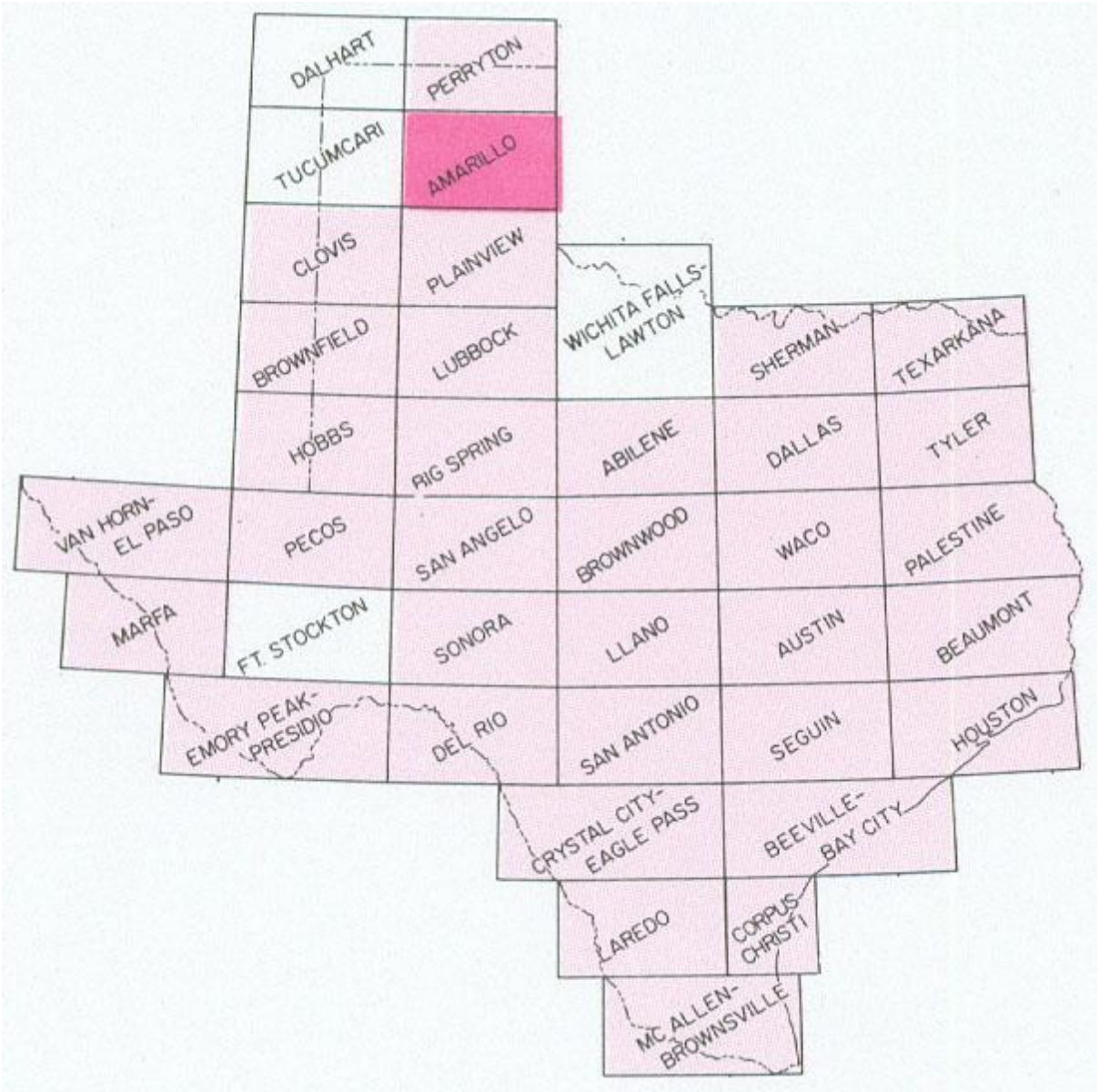
Texas Commission on Environmental Quality, 2004, Geologic Atlas of Texas (GAT sheets), Tucumcari sheet, University of Texas at Austin, Bureau of Economic Geology and Texas Commission on Environmental Quality, GAT 0712, 1:250,000 scale. (Geologic Atlas of Texas) (*GRI Source Map ID 72509)*

GAT: Amarillo Sheet

Eifler, G.K., Phillips Petroleum Co., Humble Oil and Refining Co., Frye, J.C., Leonard, A.B., Knight, G. L., Hughes, C.D., Horn, P.H., and Quackenbush, W.M., 1969, Geologic Atlas of Texas, Amarillo sheet, University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas GA0002, 1:250,000 scale (*GRI Source Map ID 2206)*

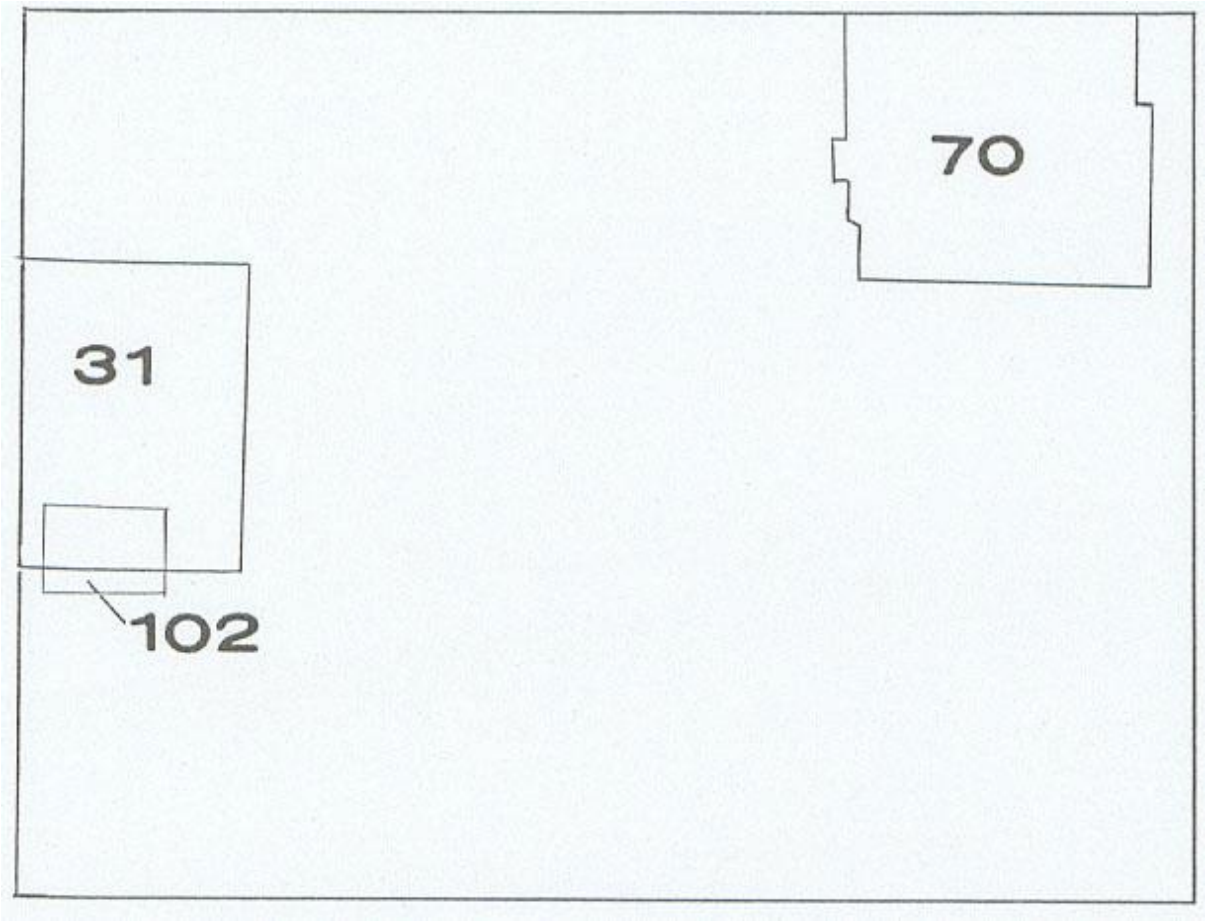
This map was reprinted in 1981 with limited revisions as the "Leroy Thompson Patton Memorial Edition".

Location Map



Extracted from: (GAT: Amarillo Sheet).

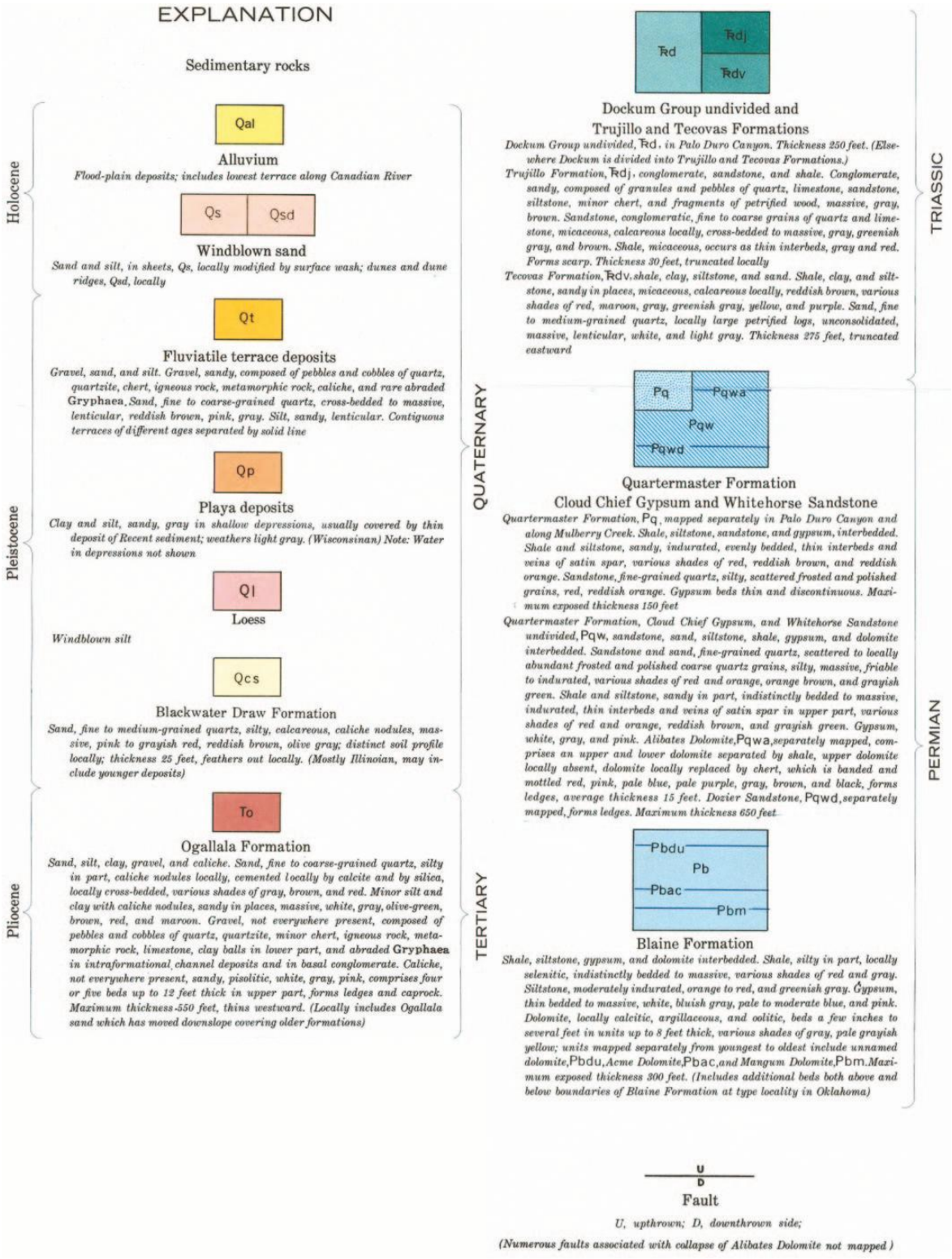
Index Map



INDEX OF GEOLOGIC MAPPING
Numbers in outlined areas refer to items in bibliography in "Index to Areal Geologic Maps in Texas, 1891-1961," by T. E. Brown (1963), Bureau of Economic Geology, The University of Texas at Austin. Although no geologic mapping was involved, the Quaternary correlations shown for the Amarillo Sheet are those made by John C. Frye and A. Byron Leonard (1957), Studies of Cenozoic geology along eastern margin of Texas High Plains, Armstrong to Howard counties: Bureau Economic Geology Report Inv. 32, 62 pp.

Extracted from: (GAT: Amarillo Sheet).

Legend



Extracted from: (GAT: Amarillo Sheet).

Acknowledgements

VIRGIL E. BARNES, PROJECT DIRECTOR
Geologic mapping from sources shown on index map and from Phillips Petroleum Company, Humble Oil & Refining Company, and U.S. Bureau of Reclamation gratefully acknowledged. Geologic mapping mostly by G. K. Eifler, Jr., who field checked the geology for the entire sheet and compiled it on high altitude aerial photographs. Map scribed by J. W. Macon. Mapping reviewed by Panhandle Geologic Society, Geologic Atlas Committee, G. L. Knight (Independent geologist), Chairman, C. Don Hughes (Independent geologist), Paul H. Horn (Sun Oil Company), W. M. Quackenbush (Independent geologist).

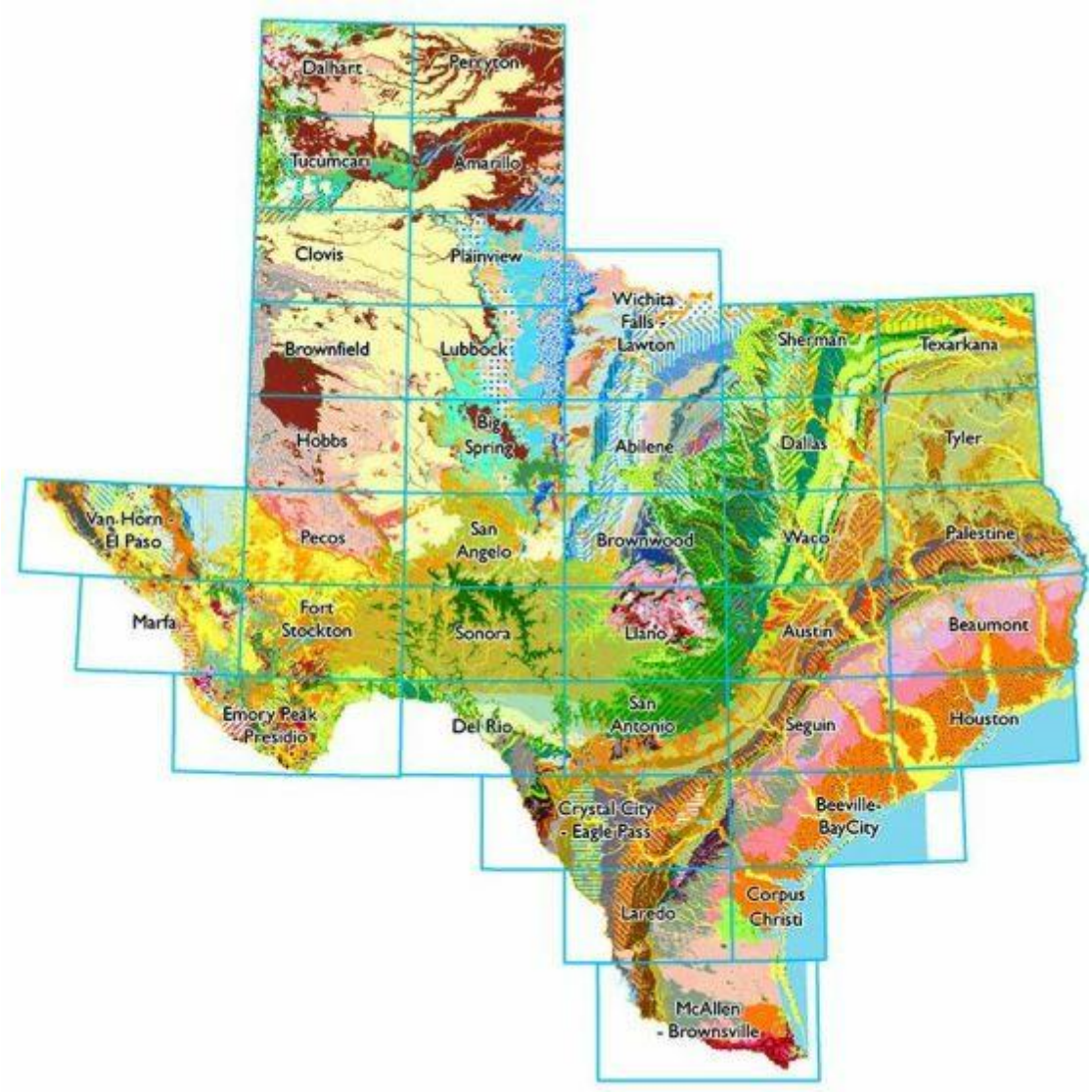
Extracted from: (GAT: Amarillo Sheet).

Geologic Database of Texas (GIS)

Texas Water Development Board, 2007, Geologic Database of Texas: 1:250,000 Geologic Data for the Amarillo Sheet and Tucumcari Sheets, Adapted from Eifler, Jr, G.K., and Barnes, V.E., 1969 - Geologic Atlas of Texas, Amarillo Sheet - Leroy Thompson Patton Memorial Edition, Reprinted 1981 with limited revisions and Eifler, Jr, G.K., Trauger, F.D., Spiegel, Z., Hawley, J.W., and Barnes, V.E., 1983 - Geologic Atlas of Texas, Tucumcari Sheet - Henryk Bronislaw Stenzel Memorial Edition, University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas, 1:250,000 scale. (*GRI Source Map ID 75030*)

More details regarding the creation of the Geologic Atlas of Texas and the Geologic Database of Texas can be found at:
http://tx.usgs.gov/GAT/index.html or http://www.beg.utexas.edu/pubs/pubs-CrossSecAtlas.php

The complete Geologic Database of Texas can be purchased from the Texas Natural Resources Information System at:
http://www.tnris.org/

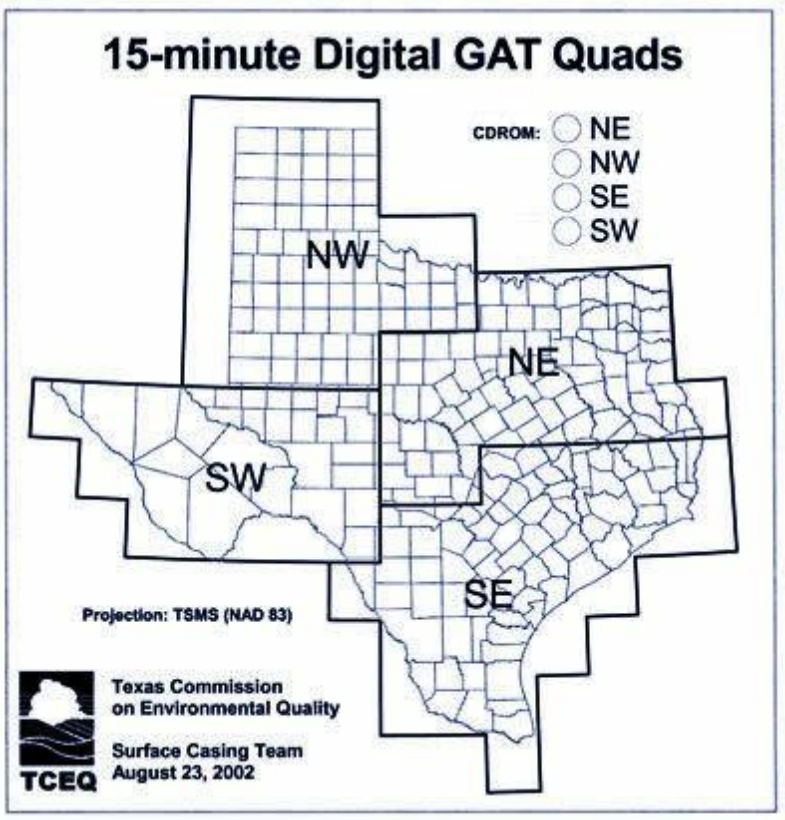


Extracted from the TNRIS website.

Geologic Atlas of Texas (TIFs)

Texas Commission on Environmental Quality, 2004, Geologic Atlas of Texas (GAT sheets), Tucumcari sheet, University of Texas at Austin, Bureau of Economic Geology and Texas Commission on Environmental Quality, GAT 0712, 1:250,000 scale. (*GRI Source Map ID 72509*)

More details regarding the creation of the Geologic Atlas of Texas can be found at:
http://www.beg.utexas.edu/pubs/15minquads.php



Extracted from the TBEG website.

GRI Digital Data Credits

This document was developed and completed by Andrea Croskrey (National Park Service) for the NPS Geologic Resources Division (GRD) Geologic Resources Inventory(GRI) Program.

The information contained here was compiled to accompany the digital geologic-GIS map and other digital data for Alibates Flint Quarries National Monument and Lake Meredith National Recreation Area, Texas (AFLM) developed by Andrea Croskrey and Heather Stanton (Colorado State University).

GRI finalization by Heather Stanton, update by Stephanie O'Meara (Colorado State University).

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