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

Chattahoochee River National Recreation Area Parts of the Sandy Spring 7.5' Quadrangle Map (Bedrock Geology)

GRI Ancillary Map Information Document

Produced to accompany the Geologic Resources Inventory (GRI) Digital Geologic Data for Chattahoochee River National Recreation Area

chat_geology.pdf

Version: 6/5/2015

Geologic Resources Inventory Map Document for Chattahoochee River National Recreation Area

Table of Contents

Geologic Resources Inventory Map Document **1**
About the NPS Geologic Resources Inventory Program **2**
GRI Digital Map and Source Map Citation **4**
Map Unit List **5**
Map Unit Descriptions **6**
OZg - Granite (Proterozoic to Ordovician) 6
OZli - Long Island Creek Gneiss (Proterozoic to Ordovician) 6
OZsau - Schist, amphibolite, and ultramafic (Proterozoic to Ordovician) 6
OZq - Quartzite (Proterozoic to Ordovician) 6
OZgg - Granitic-gneiss (Proterozoic to Ordovician) 6
OZpq - Palisades Quartzite (Proterozoic to Ordovician) 6
OZsg - Rottenwood Creek Mixed Unit (Proterozoic to Ordovician) 6
OZbg - Biotite gneiss (Proterozoic to Ordovician) 7
OZgs - Garnet schist (Proterozoic to Ordovician) 7
OZmg - Migmatitic gneiss (Proterozoic to Ordovician) 7
OZsh - Muscovite schist (Proterozoic to Ordovician) 7
OZgn - Gneissic granite (Proterozoic to Ordovician) 7
OZa - Amphibolite (Proterozoic to Ordovician) 7
OZps - Pappasito Schist (Proterozoic to Ordovician) 7
OZmu - Mixed schist/gneiss (Proterozoic to Ordovician) 7
OZog - Orange Gneiss (Proterozoic to Ordovician) 8
Sandy Springs Quadrangle Map **9**
Introduction 9
Explanation of Map Symbols 10
Figure 1: Tight Fold 11
Figure 2: Biotite Gneiss 12
Figure 3: Brevard Zone 13
Figure 4: Gneiss/Amphibolite 14
Composition of Exposed Terranes 15
Stereonet of Foliation 16
Stereonet of Lineations 17
References 17
Geologic Mapping Support 18
GRI Digital Data Credits **19**

Geologic Resources Inventory Map Document

Chattahoochee River National Recreation Area, Georgia

Document to Accompany Digital Geologic-GIS Data

chat_geology.pdf

Version: 6/5/2015

This document has been developed to accompany digital geologic-GIS data developed by the Geologic Resources Inventory (GRI) program for Chattahoochee River National Recreation Area, Georgia (CHAT).

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
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.

GRI Digital Map and Source Map Citation

An added GRI digital geologic-GIS map for Chattahoochee River National Recreation Area, Georgia (CHAT):

Digital Bedrock Geologic Map of parts of the Sandy Springs Quadrangle, Chattahoochee River National Recreation Area, Georgia (*GRI MapCode SASP*)

Harden, Hailey M., Kath, Randy L., Crawford, Thomas J., 2013, Geologic Map Illustrating the Tectonostratigraphy and Structural Geology of part of the Brevard Zone in Georgia: Results from Detailed Surface Geologic Mapping in the Chattahoochee River National Recreation Area, Sandy Springs Quadrangle, Georgia, GeoCorps of America and University of West Georgia, scale 1:24,000. (*GRI Source Map ID 75967*).

Additional information pertaining to each source map is also presented in the GRI Source Map Information (SASPMAP) table included with the GRI geologic-GIS data.

Map Unit List

The bedrock geologic units present in the digital geologic-GIS data produced for the Sandy Springs 7.5' quadrangle map (parts of) for Chattahoochee River National Recreation Area, Georgia (CHAT) are listed below. Units are listed with their assigned unit symbol and unit name (e.g., OZg - Granite). Units are listed from youngest to oldest. Information about each geologic unit is also presented in the GRI Geologic Unit Information (SASPUNIT) table included with the GRI geology-GIS data. Some source unit symbols, names and/or ages may have been changed in this document and in the GRI digital geologic-GIS data. This was done if a unit was considered to be the same unit as one or more units on other source maps used for this project, and these unit symbols, names and/or ages differed. In this case a single unit symbol and name, and the unit's now recognized age, was adopted. Unit symbols, names and/or ages in a unit descriptions, or on a correlation of map units or other source map figure were not edited. If a unit symbol, name or age was changed by the GRI the unit's source map symbol, name and/or age appears with the unit's source map description.

Proterozoic to Ordovician

OZg - Granite
OZli - Long Island Creek Gneiss
OZsau - Schist, amphibolite, and ultramafic
OZq - Quartzite
OZgg - Granitic-gneiss
OZpq - Palisades Quartzite
OZsg - Rottenwood Creek Mixed Unit
OZbg - Biotite gneiss
OZgs - Garnet schist
OZmg - Migmatitic gneiss
OZsh - Muscovite schist
OZgn - Gneissic granite
OZa - Amphibolite
OZps - Pappasito Schist
OZmu - Mixed schist/gneiss
OZog - Orange Gneiss

Map Unit Descriptions

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

OZg - Granite (Proterozoic to Ordovician)

Biotite-quartz-feldspar granite, medium- to coarse-grained, equigranular,massive, without foliation or with a poorly developed foliation. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZli - Long Island Creek Gneiss (Proterozoic to Ordovician)

Sphene-epidote-biotite-quartz-feldspar gneiss, medium- to coarse-grained; very felsic; yields light-colored soil; foliation is moderately well-developed. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZsau - Schist, amphibolite, and ultramafic (Proterozoic to Ordovician)

Garnet-kyanite-feldspar-muscovite-biotite-quartz schist, fine- to coarse-grained; very quartzose, in part. Garnet kyanite-muscovite-biotite-quartz-feldspar gneiss, fine- to coarse-grained, schistose in part; quartzite; medium-grained and clean in part; also, fine to coarse-grained and micaceous and/or feldspathic. Amphibolite/hornblende gneiss, fine- to medium-grained. Ultramafic coarse-grained pyroxenes and amphibole; massive; apparently as small ovoid bodies several 10's of feet to a few 100 feet in their longest dimension. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZq - Quartzite (Proterozoic to Ordovician)

Fine-grained, moderately- to well-foliated, locally micaceous, locally contains fine-grained black opaques. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZgg - Granitic-gneiss (Proterozoic to Ordovician)

Biotite-quartz-feldspar gneiss, very feldspathic; quartz and feldspar are medium- to coarse-grained; biotite is fine- to medium-grained. Muscovite is present where this gneiss is sheared. Shear foliation is commonly developed. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZpq - Palisades Quartzite (Proterozoic to Ordovician)

Fine-grained, equigranular, weakly-foliated, massive, cherty, vitreous. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZsg - Rottenwood Creek Mixed Unit (Proterozoic to Ordovician)

Garnet (small, scarce)- biotite-muscovite-quartz-feldspar gneiss, fine- to coarse-grained; interlayered with garnet-feldspar-biotite-muscovite-quartz schist, medium- to coarse-grained; all gradations from well-developed gneiss to well-developed schist (gneiss, schistose gneiss, gneissic schist, and schist); thin zones contain abundant garnets. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZbg - Biotite gneiss (Proterozoic to Ordovician)

Garnet (small, minor)-muscovite-biotite-quartz-feldspar gneiss, fine- to medium-grained, schistose in part; interlayered with garnet (small,minor)-biotite-feldspar-quartz-muscovite schist, medium- to coarse-grained; some garnet-rich zones, all layered with concordant and discordant pegmatite pods, lenses, and layers up to 10 feet thick; foliation wraps around pegmatite pods/lenses. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZgs - Garnet schist (Proterozoic to Ordovician)

Kyanite-garnet-biotite-quartz-muscovite schist, coarse-grained, sheared, with abundant pegmatite pods and lenses; structurally overlain and underlain by quartzite (OZq), fine- to coarse-grained in layers 1-to 8-inches thick. The quartzite structurally overlying the schist appears to be several 10's of feet thick; while the quartzite structurally underlying the schist appears to be less than 10 feet thick. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZmg - Migmatitic gneiss (Proterozoic to Ordovician)

Muscovite-biotite-quartz-feldspar-gneiss, with scattered small garnets, fine- to coarse-grained; concordant pegmatites and pegmatitic zones are common; quartz veins are small and scattered. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZsh - Muscovite schist (Proterozoic to Ordovician)

Garnet-biotite-quartz-muscovite schist, coarse-grained, with tourmaline and thickly disseminated fine black opaques; sheared, with a button texture. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZgn - Gneissic granite (Proterozoic to Ordovician)

Muscovite-biotite-quartz-feldspar gneissic granite, feldspathic; quartz and feldspar are medium- to coarse-grained; biotite is fine- to medium-grained. Shear foliation is commonly developed. Locally contains schist xenoliths. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZa - Amphibolite (Proterozoic to Ordovician)

Amphibole/hornblende gneiss, thinly laminated, fine- to medium-grained hornblende and plagioclase; and chlorite-actinolite schist, very fine-grained; joints are close-spaced and abundant. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZps - Pappasito Schist (Proterozoic to Ordovician)

Garnet-biotite-muscovite-quartz-schist, coarse-grained, with thickly disseminated fine black opaques; muscovite is generally coarser-grained than biotite; sheared, with a button texture. Joints are poorly developed and scarce; shallow-weathering. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZmu - Mixed schist/gneiss (Proterozoic to Ordovician)

Garnet-muscovite-biotite-quartz-feldspar gneiss, fine- to medium-grained, and garnet (common to abundant) -feldspar-quartz-muscovite-biotite schist, medium- to coarse-grained, interlayered; and all extensively pegmatized with coarse-grained muscovite-quartz-feldspar. Micas in the schist are often

coarse-grained and in part oriented across the compositional layering creating a "tough" rock which resists breaking. This rock unit is very non-uniform. It weathers unevenly, and often in non-planar directions. Where compositional layering and foliations are well-developed, differential weathering produces a slabby outcrop. The thickness of weathering residuum varies from thin to thick over short distances; and thick residuum often contains large boulder masses of relatively fresh rock. Small, apparently ovoid bodies of biotite-quartz-feldspar granite (OZg), medium- to coarse-grained, equigranular, massive, without foliation or with a poorly developed foliation, are scattered in this unit. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

OZog - Orange Gneiss (Proterozoic to Ordovician)

Biotite-quartz-feldspar gneiss, fine- to medium-grained, schistose in part; biotite-hornblende-feldspar gneiss, fine- to medium-grained; and amphibolite, fine- to medium-grained; all are interlayered or intermixed. Together, an in approximately equal parts, these three lithologies make up greater than 90 percent of this rock unit. The rock weathers to a yellow-brown, pink, or brownish gray saprolite/residuum. The remaining part of this lithologic unit consists of small medium- to coarse-grained mafic and ultramafic bodies, apparently ovoid and several feet to a few hundred feet in their longest dimension, and muscovite-quartz-feldspar pegmatites as much as 8 to 12 feet thick. This rock unit weathers deeply to a soft, feldspathic residuum, except for the coarse-grained mafic and ultramafic bodies and the pegmatites. The coarse-grained mafics yield a hard, tough saprolite with well-developed box work; and pegmatites are present in residuum as resistant boulders. (*GRI Source Map ID 75967)* (Sandy Springs Quadrangle).

Sandy Springs Quadrangle Map

Harden, Hailey M., Kasth, Randy L., Crawford, Thomas J., 2013, Geologic Map Illustrating the Tectonostratigraphy and Structural Geology of part of the Brevard Zone in Georgia: Results from Detailed Surface Geologic Mapping in the Chattahoochee River National Recreation Area, Sandy Springs Quadrangle, Georgia, GeoCorp data, University of West Georgia, scale 1:24,000. (*GRI Source Map ID 75967*).

Introduction

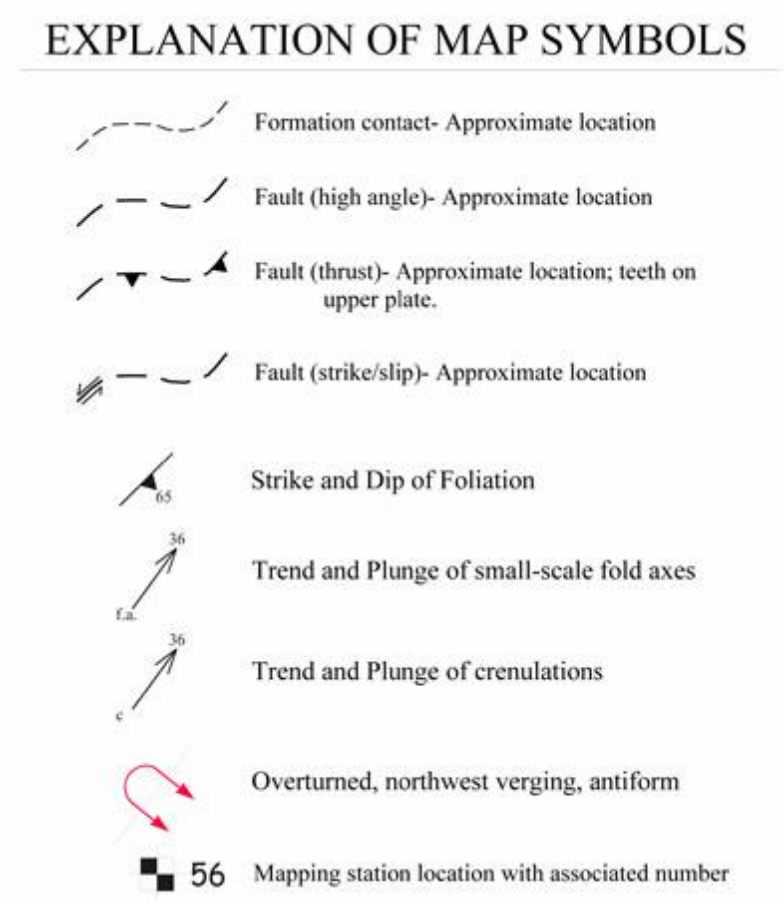
As part of the National Park Service Geologic Resources Inventory, detailed geologic mapping of part of the Sandy Springs, GA, 7.5-minute quadrangle was conducted within the Chattahoochee River National Recreation Area (CRNRA) in Cobb and Fulton Counties, Georgia, between Morgan Falls Dam and Paces Mill Park. This detailed geologic mapping revealed a complex deformational and stratigraphic history within the Brevard Zone. Additionally, this detailed mapping has provided new insight into the physical characteristics of the Brevard Zone in the metro-Atlanta area as recently described by Kath and Crawford (2006).

Exposures within the river corridor show extreme lithologic heterogeneity and structural complexity within the Brevard Zone that has not been previously documented within this area at a 1:24,000-scale. Lithologies range in textural complexity from mylonites to highly sheared schist and gneiss. Locally, retrograde mineral assemblages are present but not ubiquitous. Much previous work on the Brevard Zone defines the zone based on retrograde mineral assemblages; however, exposures along the river corridor illustrate greater textural variability as opposed to mineralogic variability.

Also, much previous work has suggested that the Chattahoochee River follows the Brevard Zone from near Gainesville, Georgia, to the Alabama-Georgia state line. However, detailed mapping within the CRNRA on the Sandy Springs and the northern part of the Northwest Atlanta Quadrangles shows that the Chattahoochee River is mostly sub-parallel (separation angle of nearly 15 degrees) to the Brevard Zone in areas where the rocks are less mechanically/chemically stable. Where the rocks are more mechanically/chemically stable, the Chattahoochee River cuts across the Brevard Zone at high angles forming abundant shoals. These overall trends give a stair step pattern to the river as it crosses the Brevard Zone in the study area.

Extracted from: (Sandy Springs Quadrangle).

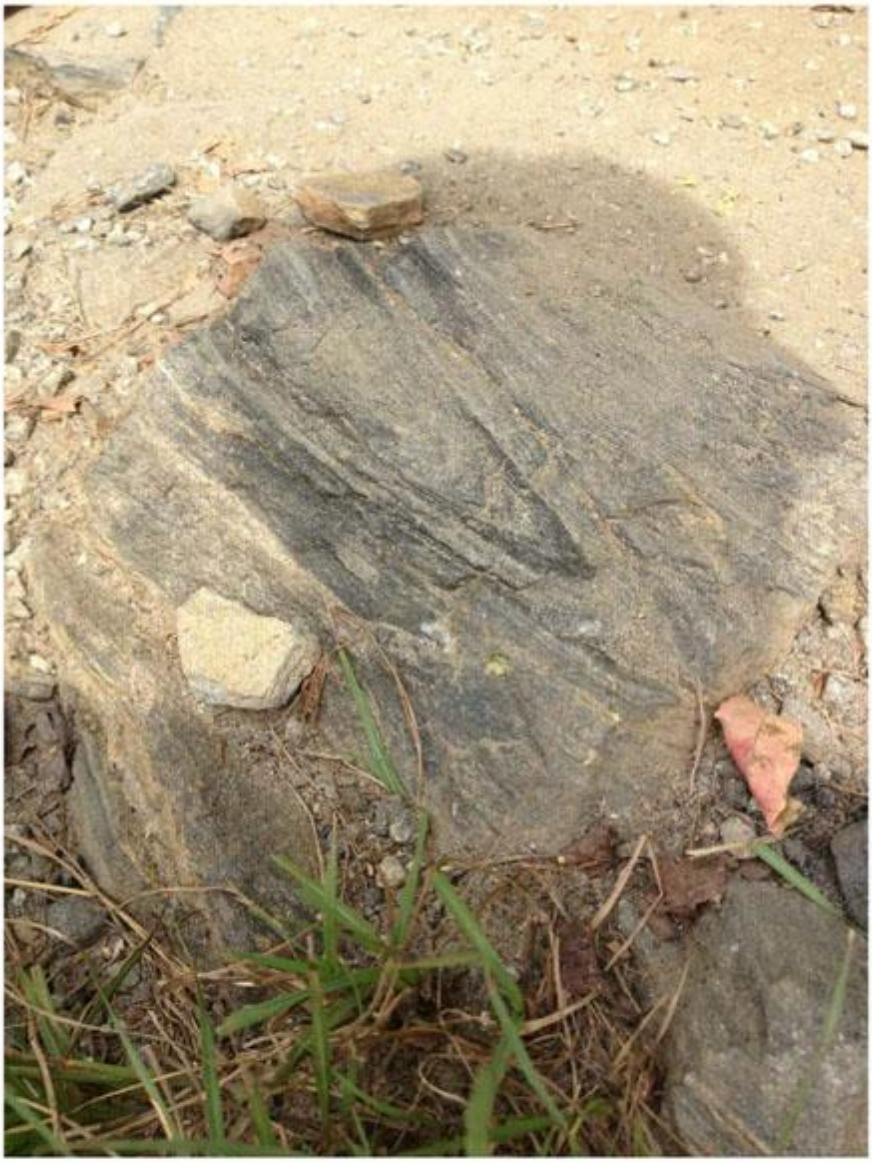
Explanation of Map Symbols



Extracted from: (Sandy Springs Quadrangle).

Of note, although present on the above explanation of map symbols no trend and plunge of small-scale fold axes are present on the source map or in the associated GIS data.

Figure 1: Tight Fold



Nearly upright, gently plunging, tight fold in amphibolite/hornblende gneiss

Extracted from: (Sandy Springs Quadrangle).

Figure 2: Biotite Gneiss

Highly sheared biotite gneiss; note mylonitic texture

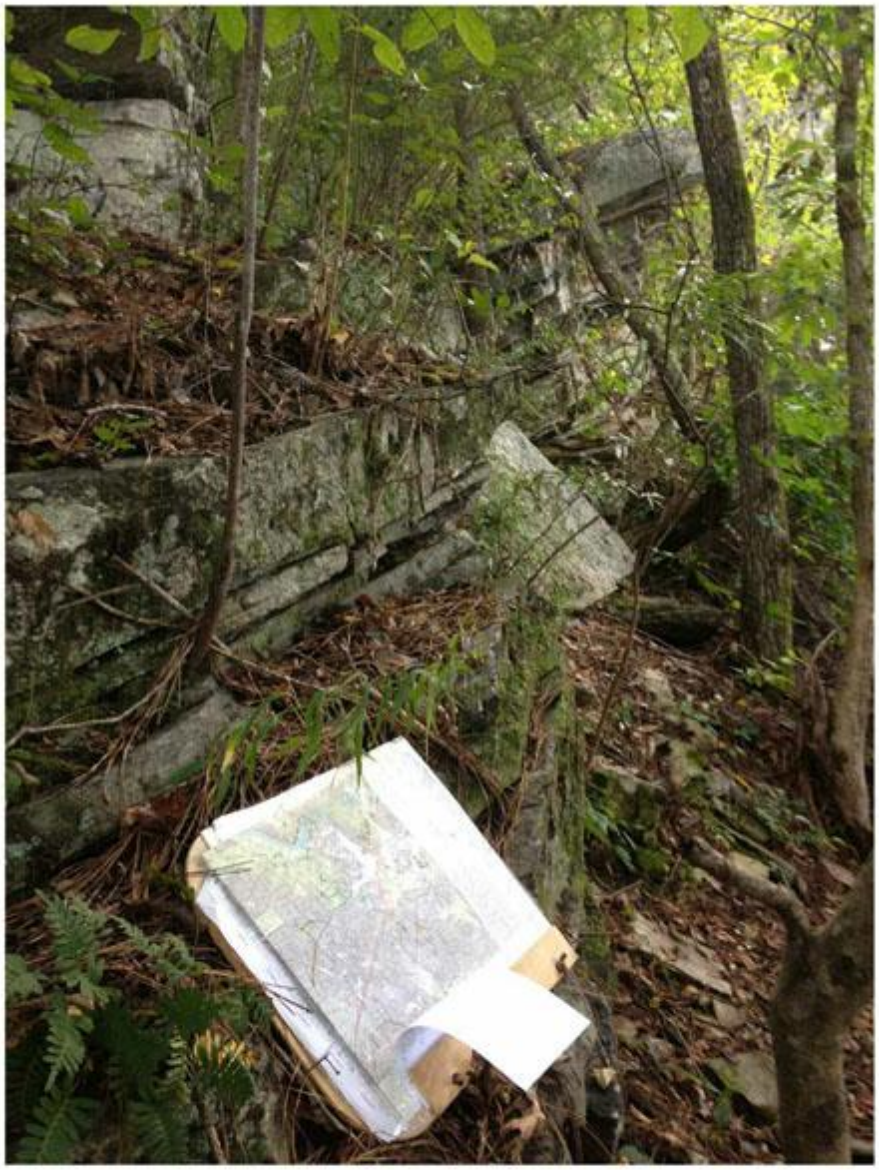
Extracted from: (Sandy Springs Quadrangle).

Figure 3: Brevard Zone

Typical kink/crenulation within the Brevard Zone

Extracted from: (Sandy Springs Quadrangle).

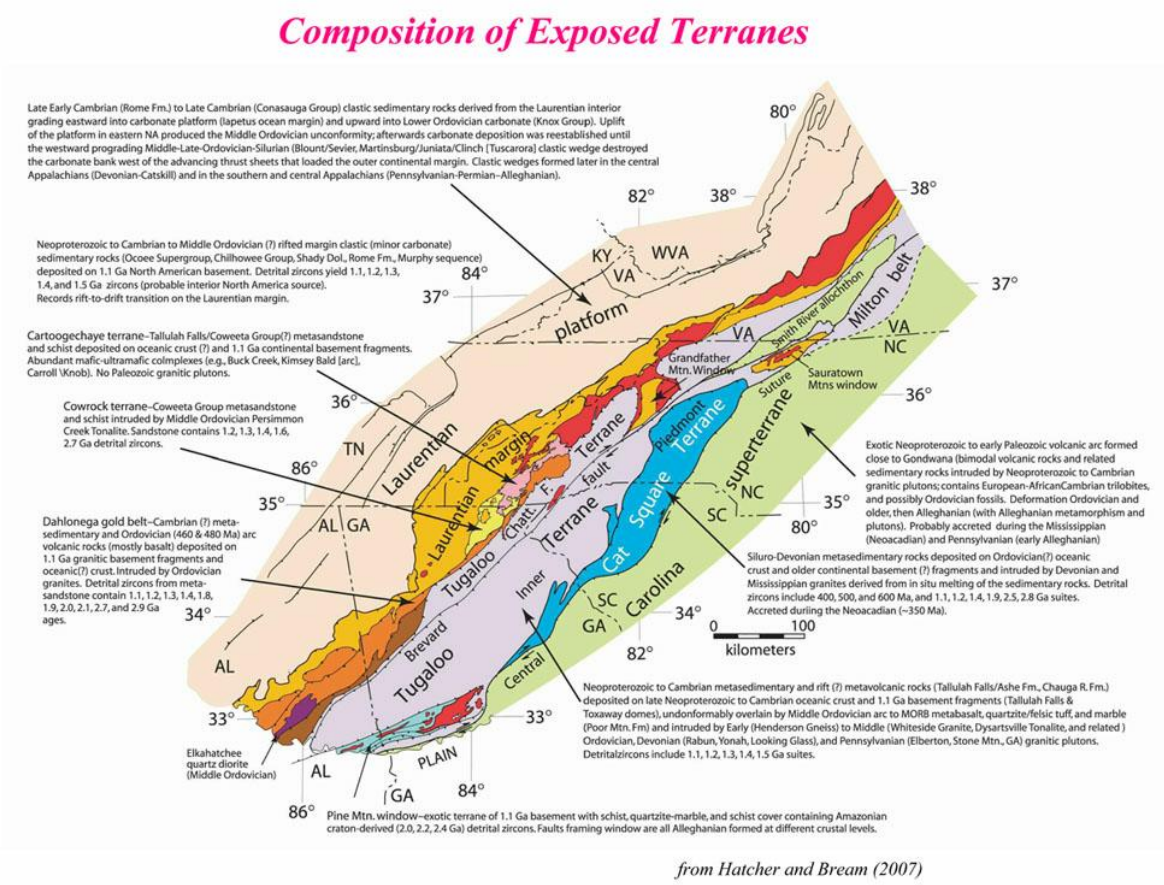
Figure 4: Gneiss/Amphibolite



Common woods exposure of feldspar-hornblende gneiss/amphibolite

Extracted from: (Sandy Springs Quadrangle).

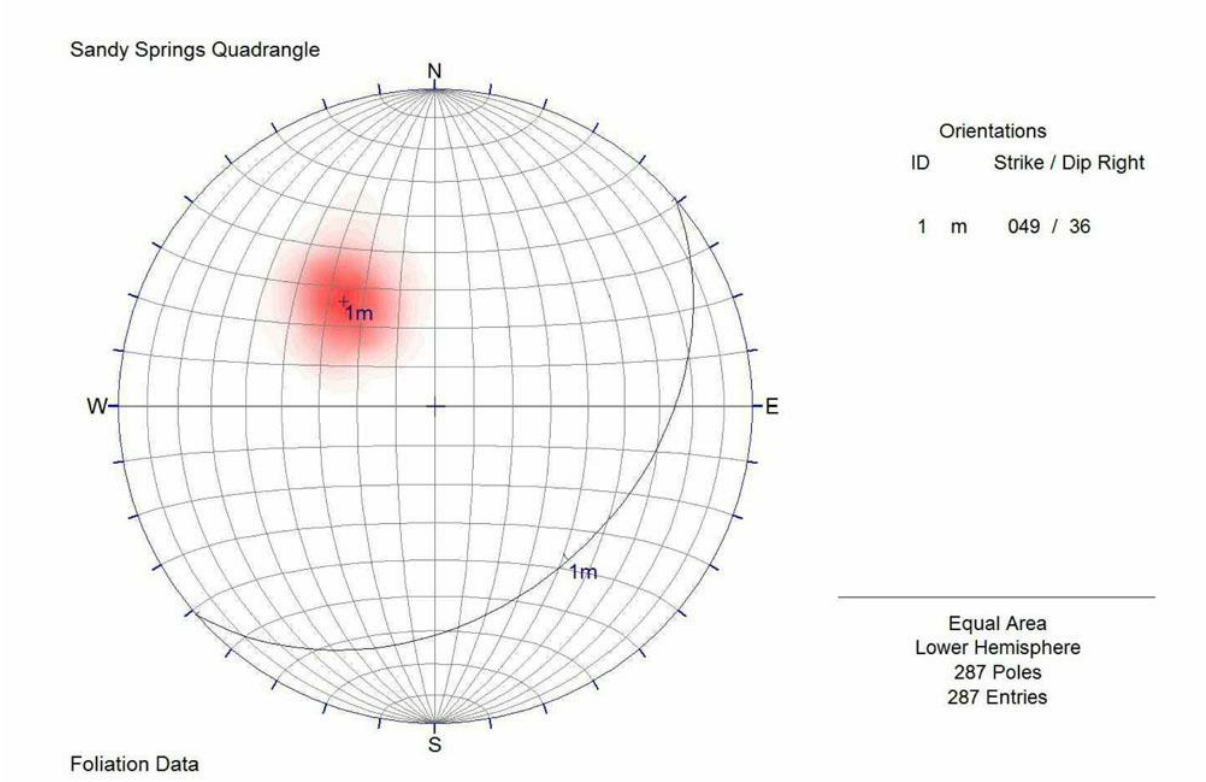
Composition of Exposed Terranes



from Hatcher and Bream (2007)

Extracted from: (Sandy Springs Quadrangle).

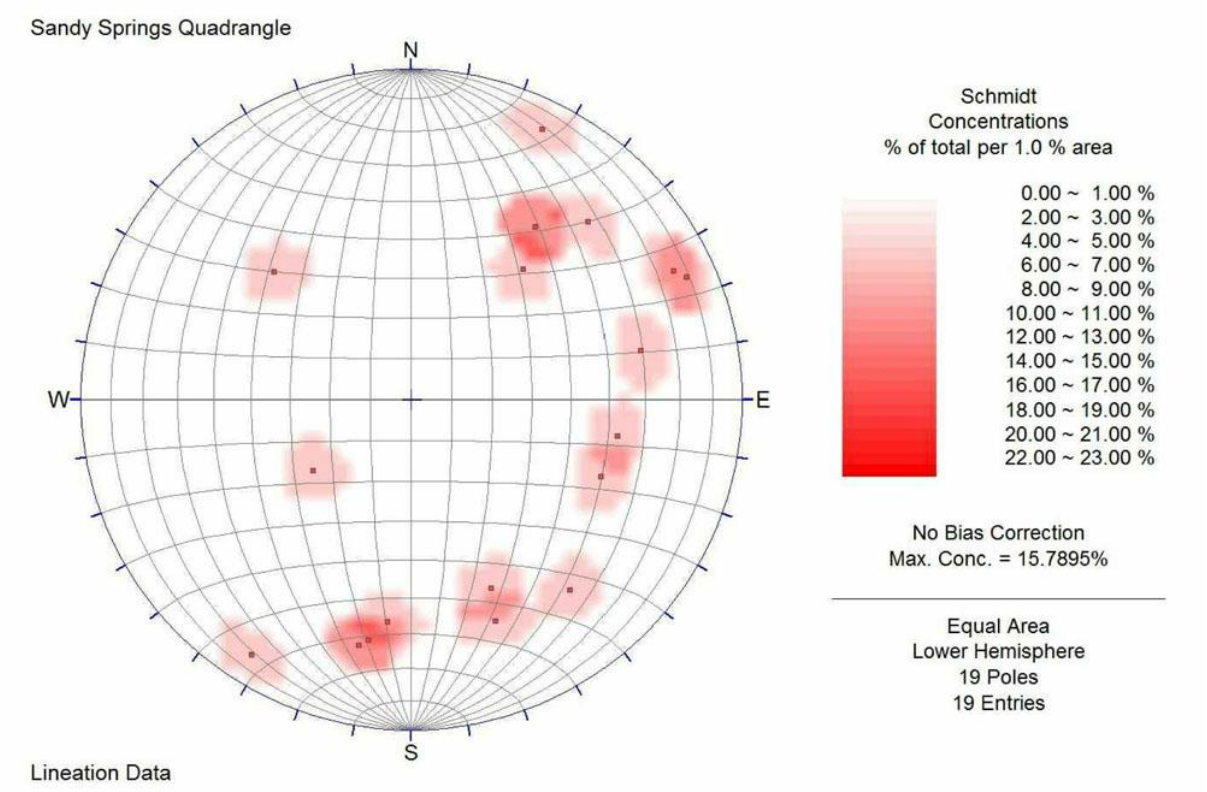
Stereonet of Foliation



Equal Area, Lower-Hemisphere Stereonet of Foliation

Extracted from: (Sandy Springs Quadrangle).

Stereonet of Lineations



Equal Area, Lower-Hemisphere Stereonet of Lineations

Extracted from: (Sandy Springs Quadrangle).

References

Hatcher, R.D., Jr., and Bream, B.R., 2007, New Tectonic Map of the southern and central Appalachians (v. 4.5WIP). Higgins, M.H., 1968, Geologic Map of the Brevard Fault Zone near Atlanta, Georgia: USGS IMAP 511.

Kath, R.L., and Crawford, T.J., 2006, New Insight into the Brevard Zone in Georgia: Results form Detailed Surface and Subsurface Geologic Mapping of Three Large Tunnels in the metro-Atlanta Area: Geological Society of America Abstracts with Programs, vol. 38, pp. 79

Kath, R.L., and Crawford, T.J., 2001, Detailed Geologic Mapping along the Chattahoochee Tunnel, Cobb County, Georgia: in

Kath, R.L., and Crawford, T.J., eds., Across the Brevard Zone: The Geology of the Chattahoochee Interceptor Tunnel, Cobb County, Georgia: Georgia Geological Society Guidebooks, vol. 22, No. 1, pp. 25-38.

Extracted from: (Sandy Springs Quadrangle).

Geologic Mapping Support

Geologic Mapping Supported by-

University of West Georgia, Department of Geosciences, Center for Water Resources

Geological Society of America, GeoCorps America #2013018

Extracted from: (Sandy Springs Quadrangle).

GRI Digital Data Credits

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

The information in this document was compiled from the GRI source map, and is intended to accompany the digital geologic-GIS map for the Sandy Springs 7.5' quadrangle map developed by Georgia Hybels (Colorado State University) (see the GRI Digital Map and Source Map Citation section of this document for all sources used by the GRI in the completion of this document and related GRI digital geologic-GIS map).

GRI finalization by Stephanie O'Meara.

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