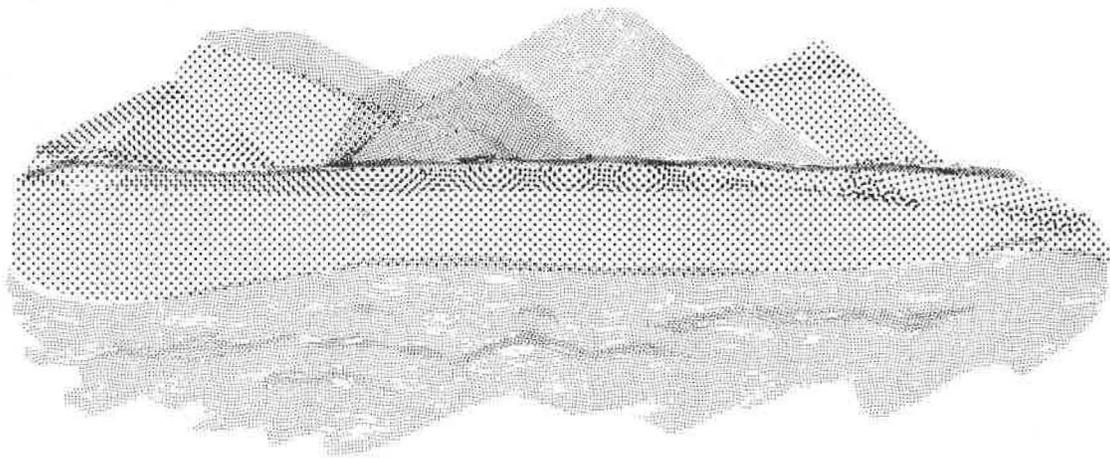


**GEOLOGIC AND HYDROLOGIC
RESEARCH IN GEORGIA**

1983-84

compiled by

Eleanore Morrow



Department of Natural Resources
Environmental Protection Division
Georgia Geologic Survey

CIRCULAR 10

GEOLOGIC AND HYDROLOGIC RESEARCH

IN GEORGIA — 1983-84

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GEORGIA GEOLOGIC SURVEY
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Atlanta

1984

C I R C U L A R 10

FOREWORD

Geologic and Hydrologic Research in Georgia — 1983-1984 attempts to resolve two problems common to large professional communities— duplication and lack of knowledge of current research. Hopefully, this publication of brief descriptions and progress reports on recent investigations in Georgia geology and hydrology will enhance communication among Southeastern geoscientists.

Most of the project summaries in this circular are the response from letters and questionnaires sent to colleges and universities in six Southeastern states (Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee). Other project descriptions were compiled from U.S. Geological Survey documents (Reston, Va., and Doraville, Ga.) and from the Georgia Geological Survey. All summaries are printed here as received, without editing for spelling or grammar.

As an additional research aid for the geoscientist, a list of some recent publications and presentations on Georgia geology and hydrogeology is included in this circular. This list is compiled from the respondents' completed questionnaires and from members of the Georgia Geologic Survey. It is far from exhaustive, however, and represents only the work of those scientists who participated in this publication. Readers may obtain a more complete listing from Bibliography and index of Georgia geology, 1980 through 1982 (Open-file Report 84-5) by writing to the Georgia Geologic Survey, 19 Martin Luther King, Jr. Dr. SW, Atlanta, Ga., 30334.

The cooperation of the geological community in this undertaking was invaluable and is deeply appreciated. Georgia Geologic Survey management anticipates that the usefulness of this compilation will justify updated and more extensive volumes, perhaps on a yearly basis.

Eleanore Morrow
Compiler

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GEOLOGY

AREAL GEOLOGY

▷ GEOLOGY OF THE WESTERN UCHEE BELT, WEST CENTRAL GEORGIA AND EAST CENTRAL ALABAMA. Thomas B. Hanley, Dept. Chem. and Geol., Columbus College, Columbus, GA, 31993. The goal of this project is to produce a geologic map and cross-sections of the Uchee Belt from near Geneva and Talbotton, Georgia to the Cretaceous contact in Alabama. This will be done through mapping at 7½' scale, review of existing mapping and compilation to 15' and 1:100,000 scales. The purpose is to provide better basis for regional structural, metamorphic and igneous histories of the Uchee Belt and to provide a framework for more advanced studies.

▷ SEARCH FOR EXPOSURES OF ULTRAMAFIC ROCKS IN GEORGIA BY LANDSAT IMAGERY. C. O. Pollard, Jr., and Nick Faust, Ga. Tech. Ultramafic rocks have been known in the Blue Ridge Province for some time, but many of the deposits are imperfectly mapped and there may be more to be found. In Georgia alone, two extensive ultramafic complexes have been delineated within the last decade: one is apparently a sill-like layered complex and the other is a pod-like dunite.

Economically, ultramafic rocks are important mainly as sources for olivine (used as a foundry sand and in advanced pyrometallurgy), for nickel, and for chromite (a mineral of chromium). The olivine has been the main material of interest so far in the southeastern U.S., but the other two materials have been evaluated in many ultramafic deposits.

Our proposal is to apply Landsat satellite imagery to the location and delineation of exposures of ultramafic deposits in Georgia.

Thick vegetation has imposed limitations on the usefulness of remote sensing in geological studies and, previously, applications of remote sensing to geological problems in the southeastern U.S. have not been successful. However, the Thematic Mapper (TM) provides advantages for geobotanical investigation that were not available on previous satellites. In addition to the current Landsat capabilities, the TM is characterized by sensors having improved radiometric sensitivity and spatial resolution, allowing much greater detail of the earth's surface. The TM has a seven-channel scanner (versus 4 on the Multi-Spectral Scanner--MSS) designed to maximize vegetative analysis as well as discriminate rock formations. Moreover, the exposures of ultramafic rocks are typically barren or exhibit stunted vegetation; therefore, the rock itself may be characterized by a good signature. Expected completion date: FY 1984.

COASTAL STUDIES

- ▷ GEORGIA SHORELINE STUDY: HISTORICAL CHANGES AND CONTEMPORARY PATTERNS OF EROSION AND ACCRETION. Martha M. Griffin, Ga. Geol. Survey, and V. J. Henry, Ga. State Geology Dept. This project addresses the problem of wise shoreline management by developing a broad coastal geology data base, emphasizing both historical shoreline change and present day patterns of beach erosion and accretion. The historical shoreline change study, which illustrates change on the Georgia coast from the mid 1800's through 1974 or 1982, will be published in FY 1984 as "Historical Changes in the Mean High Water Shoreline of Georgia". An interim report of the results of two year long quarterly shoreline surveillance project (40 sites on 9 islands) will also be published in FY 1984; a final report on this project will be released in FY 1985.

- ▷ COASTAL ZONE STUDIES. Vernon J. Henry, Georgia State University. A number of studies are in progress in the Georgia coastal zone and on the continental shelf. Most of the studies utilize high resolution remote sensing instrumentation to study bedform dynamics, shallow structure and stratigraphy, and the occurrence and distribution of livebottoms and hardgrounds. Other studies relate to barrier island dynamics.

- ▷ THE BEACH EROSION PROBLEM--ANALYSIS OF GEOLOGICAL AND LEGAL SOLUTIONS. Robert P. Lowell, School of Geophysical Sciences, Georgia Institute of Technology. This project involved a study and a legal analysis of the beach erosion problem on the east coast of the United States in light of the geologic evidence that mean sea level is rising and the current feeling among many geoscientists that present beach erosion control and protection policies are inadequate and inappropriate. A review of the geological data and the present federal and state laws with regard to beach erosion was made and an analysis of several key cases involving beach protection laws and policy was undertaken. The results of the analysis suggested that present beach protection policies are inadequate. Several alternative beach protection measures and their legal implications were discussed. The main conclusions of this study were that geological input into present legislation, beach protection policy, and judicial analysis is inadequate. More courageous measures in developing land use regulation and more imaginative approaches to the legal doctrines of eminent domain and public trust are needed if the beach erosion problems are to be alleviated. The project is concluded.

- ▷ STABLE ISOTOPE GEOCHEMISTRY IN GEORGIA ESTUARIES. Evelyn B. Sherr, University of Georgia Marine Institute. Ongoing stable isotope studies were begun in 1975 to determine the sources and fates of organic matter in Georgia salt marsh estuaries. On the basis of the distribution of $^{13}\text{C}/^{12}\text{C}$ ratios in the estuary, it appears that detrital carbon from the marsh plant Spartina alterniflora is not an important source of organic matter in the open estuary, and that phytoplankton production may contribute most of the organic carbon present in estuarine seston and sediments. The research is being expanded to include stable nitrogen and stable sulfur isotope distributions in the estuary, and will next focus on the importance of influx of terrestrial material via river flow to the coastal zone. No completion date.

ENERGY AND MINERAL RESOURCES

- ▷ OPEN-FILE GEOLOGIC ATLAS OF NORTHWEST GEORGIA. Jeane S. Barrett, Georgia Geologic Survey. This atlas is a compilation of data plotted on U.S. Geological Survey 7½ minute topographic quadrangle maps. The data includes mines, prospects, quarries, mineral localities, fossil localities, caves, and measured sections. This information was compiled from all known publications containing information on this area. The study area includes all of Catoosa, Chattooga, Dade, Floyd, Walker and Whitfield counties, and those parts of Bartow, Gordon, Murray and Polk counties that lie north and west of the Cartersville-Great Smoky Fault. The completed atlas will be this series of topographic maps with all localities plotted in permanent ink, and with all references listed to the side and on the back of the maps. These will be bound in one album and will be on file at the Georgia Geologic Survey library only. Expected completion date: July, 1983.

- ▷ ELLICOTT ROCK, SOUTH CAROLINA, NORTH CAROLINA AND GEORGIA. Henry Bell, III. U.S. Geological Survey, Reston, Va. Proj. No. 9360-02031. Start Date: 10/77. Estimated Completion Date: 9/82. This project was completed in FY 1982.

- ▷ LEAD AND ZINC RESOURCES OF THE UNITED STATES. J.A. Briskey, U.S. Geological Survey, Reston, Va. Proj. No. 9320-02121. Start Date: 10/77. Estimated Completion Date: Continuing. Galena-bearing samples from sandstone-hosted lead deposits in the United States will be studied in FY 1983 in order to determine the ore controls of these deposits. The mineralogy and geochemical characteristics of molybdenum mineralization in carbonate-rocks in northern Georgia will be determined, and the petrology and geochemistry of disseminated silver ores from the Taylor district in Nevada will be studied. An empirical model for carbonate-hosted Pb-Zn deposits will be completed, along with a report on the geology of an unexplored horizon of zinc-cadmium mineralization in the Upper Knox Group of the southern Appalachians.

- ▷ GEOLOGY OF THE DAHLONEGA DISTRICT, GA. James R. Burnell and Robert B. Cook, Dept. of Geology, Auburn Univ., Auburn, AL 36849.

This study of the Dahlonega Mining District has thus far involved areal mapping of the contiguous areas of historic gold production in Lumpkin County. Undertaken to evaluate the district in light of current models for sea floor exhalative gold mineralization, we have completed the detailed mapping and sampling within the Dahlonega, Campbell Mountain, Murrayville and Dawsonville quadrangles. (The preliminary work will be published by the GGS). Current work involves the refinement of the stratigraphy of this area by petrographic and petrochemical analysis. Work will continue through detailed investigations of the petrology, petrochemistry and structural relations of the amphibolites and associated rocks immediately NW of Dahlonega.

ENERGY AND MINERAL RESOURCES (Continued)

- ▷ LEAD-ZINC-BARITE-FLUORITE RESOURCES OF THE EAST-CENTRAL UNITED STATES. S.H. Clark, U.S. Geological Survey, Reston, Va. Proj. No. 9360-02972. Start Date: 10/80. Estimated Completion Date: 9/83. A preliminary map of lead-zinc deposits in the Eastern United States is being prepared for open-file release. This map will then be circulated to appropriate State Geological Surveys for their comment and contribution, which will be incorporated in the map prior to formal publication.

- ▷ GEOLOGY AND COAL RESOURCES OF THE SOUTHERN APPALACHIAN BASIN. Thomas J. Crawford, U. S. Geol. Survey, Branch of Coal Resources. This project is designed to determine the quality, quantity, and distribution of coal resources in Georgia, northern Alabama, and southern Tennessee by collecting, integrating, analyzing, and reporting all pertinent data concerning coal and associated strata in the adjoining tri-state area with special emphasis on the correlation and continuity of the coal beds. These objectives will be achieved by collecting and computerizing all available surface and subsurface stratigraphic and analytical data to determine the areal extent, thickness, chemical composition, rank, and lateral changes in the coal beds. Special attention will be given to delineating metallurgical and steam coal deposits. Additional research concerning thickness and lithic variations of associated strata, depositional controls and systems, and post-depositional features will be conducted to develop coal models that will aid the exploration and development of coal resources. Expected completion date: FY 1985 (Georgia portion).

- ▷ GEOLOGY AND COAL RESOURCES OF THE SOUTHERN APPALACHIAN BASIN. K.J. Englund. U.S. Geological Survey, Reston, Va. Proj. No. 9420-02287. Start Date: 5/78. Estimated Completion Date: 9/83. The collection and identification of plant fossils in Georgia will continue in FY 1983. A report on the quality of Georgia coals will be prepared.

- ▷ PENNSYLVANIAN SYSTEM STRATOTYPE STUDY (R). K.J. Englund. U.S. Geological Survey, Reston, Va. Proj. No. 9420-00136. Start Date: 10/80. Estimated Completion Date: 9/83. Chapters on the physical stratigraphy and biostratigraphy of the Lower and Upper Pennsylvanian Series will be completed in FY 1983, along with the selection of key reference sections in Alabama, Georgia, and Kentucky and their correlation with stratotype section. Reports on the geology of the New River Gorge and the stratigraphy of the Lower Pennsylvanian Series in West Virginia will be prepared. A depositional model of the Upper Mississippian and Lower Pennsylvanian rocks of southwestern Virginia will be constructed.

ENERGY AND MINERAL RESOURCES (Continued)

- ▷ RICH MOUNTAIN ROADLESS. M.P. Foose. U.S. Geological Survey, Reston, Va. Proj. No. 9360-03256. Start Date: 10/81. Estimated Completion Date: 9/83.
Geologic and mineral resource potential maps and reports will be completed in FY 1983 and submitted for review and publication.

- ▷ CONSTRUCTION MATERIALS OF THE GEORGIA COASTAL PLAIN. Michael S. Friddell, Ga. Geol. Survey. The purpose of this project is to locate and evaluate aggregate deposits, particularly coarse aggregate, within the Coastal Plain of Georgia. Expected completion date: 1985.

- ▷ GOLD IN GEORGIA. Jerry M. German, Ga. Geol. Survey. This project is an evaluation of the former gold-producing areas of the state to determine the potential for new production in these areas. Work on the project consists of geologic mapping to determine the origin of the gold and its stratigraphic and structural controls. The aim is to highlight areas where additional exploration might be advantageous. Expected completion date: FY 1984.

- ▷ HEAVY MINERALS OF ATLANTIC COASTAL PLAIN. A.E. Grosz. U.S. Geological Survey, Reston, Va. Proj. No. 9360-03293. Start Date: 10/81. Estimated Completion Date: 9/86.
Mineralogic and chemical analyses of Atlantic continental shelf (from New Jersey to Florida) heavy-mineral suites in vibracore samples will be conducted in FY 1983. Analyses of samples from the Altamaha and Lynches Rivers for clarification of the "leached" ilmenite problem will continue. A report on the results of this study will be prepared.

- ▷ DETAILED INVESTIGATION OF THE STRATABOUND GOLD MINERALIZATION, DAHLONEGA GOLD BELT, GEORGIA. Mark J. Johnson, Auburn University. The object of this research is to study the major gold-bearing horizon in the Dahlonega gold belt, informally termed the Singleton Formation (Cook and Burnell, 1983). Mapping will be at a scale of 1:6000. Goals include; 1) defining a detailed stratigraphic section; 2) determining structural relationships; 3) determining protoliths of the metamorphic rocks; 4) determining anomalous gold-bearing lithologies and 5) proposing possible models for host rock and gold deposition: June 1984.

ENERGY AND MINERAL RESOURCES (Continued)

- ▷ CERAMIC AND STRUCTURAL CLAY, SHALE AND SLATE DEPOSITS IN THE VALLEY AND RIDGE PROVINCE OF NORTHWEST GEORGIA. Bruce J. O'Connor, Ga. Geologic Survey. This project is a synthesis of several hundred previously unpublished ceramic firing tests, together with published data, to provide an analysis of the availability of argillaceous materials of potential economic importance in the Valley and Ridge Province of Northwest Georgia. A limited number of new chemical and mineralogical analyses are also included. These argillaceous materials include Tertiary to Recent alluvial and residual clays, weathered Paleozoic shales and clays, as well as some Precambrian to Paleozoic slates and phyllites. Samples are from active as well as inactive mines in addition to numerous undeveloped localities representing nearly all of the appropriate stratigraphic units in the area.

- ▷ SOURCE BED EVALUATION OF MIDDLE AND UPPER ORDOVICIAN BLACK SHALE FACIES OF THE APPALACHIAN BASIN. J.B. Roen. U.S. Geological Survey, Reston, Va. Start Date: 10/81. Estimated Completion Date: 9/85. Subsurface data will be collected in the field in FY 1983 in order to prepare subsurface maps of Ordovician black shale in New York, Pennsylvania, and West Virginia. Reconnaissance fieldwork and collection of outcrop samples will also be underway in West Virginia and Virginia. Stratigraphic and geochemical data from eastern Tennessee will be evaluated, and a report on the hydrocarbon potential of Middle Ordovician black shales and related rocks adjacent to the Blue Ridge allochthon in eastern Tennessee will be prepared.

GEOCHEMISTRY AND GEOPHYSICS

- ▷ CRUSTAL STRUCTURE IN GEORGIA. Anton M. Dainty and Leland T. Long, Georgia Institute of Technology. This ongoing project seeks to determine crustal structure in Georgia and surrounding areas using geophysical means. A major goal is to use this data to elucidate the tectonic history of the region. Seismic methods are being used to determine crustal structure in eastern and northern Georgia and surrounding areas. Extensive gravity surveys have also been used, and show great promise of delineating different elements ("microplates", "suspect terranes") that have been added to the late Precambrian-early Paleozoic craton. Other targets of the gravity survey include unmetamorphosed granite bodies, mafics, and Mesozoic rifted basins under the Coastal Plain. These studies will help decipher both the Paleozoic "collisional" history and the Mesozoic "rifting" history of Georgia. Expected completion date: Ongoing.
- ▷ GEOCHEMICAL SURVEYS OF MARINE SEDIMENTS. W.E. Dean. U.S. Geological Survey, Reston, Va. Proj. No. 9760-02060. Start Date: 10/77. Estimated Completion Date: 9/83.
Reports on the following topics will be completed in FY 1983: diagenesis of organic-carbon-rich sediments from the Atlantic, Indian, and Pacific Oceans; the importance of down-slope transport on the deposition of organic carbon-rich sediments in the deep sea; carbonate cycles on Walvis Ridge, South Atlantic Ocean; the inorganic geochemistry of sediments and rocks recovered from the Angola Basin and Walvis Ridge, South Atlantic Ocean; and the involvement of organisms in the origin and geochemistry of deep-sea manganese nodules.
- ▷ THE DYNAMICS OF INORGANIC SULFIDES IN NEARSHORE SEDIMENTS OF THE GEORGIA COAST. Robert D. Fallon, University of Georgia Marine Institute, Sapelo Island, GA. Concentrations of volatile plus acid volatile sulfides, primarily S^{2-} plus FeS, have been examined in the coastal sediments off Sapelo Island, Georgia. In transects running from 0.25 km to 16 km offshore, peak concentrations generally decreased with distance from shore: $140 \mu\text{g cc}^{-1}$ at 0.25 km and $40 \mu\text{g cc}^{-1}$ at 16 km. Peak values also tended to occur closer to the sediment surface with increasing distance from shore: 20-30 cm at 0.25 and 5-10 cm at 16 km. Such a pattern may result from decreasing organic input and turbulent mixing of the sediment with increasing distance from shore. Changes in the profiles from fall to winter may indicate that mixing by wave action promotes seasonal oxidation of sulfides accumulated in the upper reaches of the sediment during the summer. Expected completion date: August 1983.

GEOCHEMISTRY AND GEOPHYSICS (Continued)

▷ COLUMBUS, GEORGIA, EARTHQUAKES OF OCTOBER 31, 1982

JONES, Frank, Science Department, Georgia Southwestern College, Americus, GA 31709; CHAPMAN, Martin C., Law Engineering Testing Co., 1749 Delk Road, SE, Marietta, GA 30067; LONG, L. T., JOHNSON, Anthony P., LIOW, Jeih-San, and TIE, An, School of Geophysical Sciences, Georgia Institute of Technology, Atlanta, GA 30332

On the evening of October 30, 1982, Columbus, Georgia, experienced two small earthquakes. The first occurred at 11:07pm EDT (03:07:36.72±0.4 U.T., October 31, 1982). The second followed in about 4 minutes (03:12:12.24±0.4 U.T., October 31, 1982). The $m_b(Lg)$ magnitudes as determined from duration measurements were 3.0 for the first and 3.1 for the second. The epicenters were about 10 km north of Columbus at 32°40.29'N, 84°52.36'W. The area of the error ellipse is 8 km². The depth is presumed to be shallow because surface waves were generated and many aftershocks were heard. Aftershocks were heard and occasionally felt near the epicenter for more than 10 days. Some of the events were recorded on portable microearthquake seismographs installed in the vicinity of the epicenter. These are the first earthquakes known to occur in the Columbus area.

▷ CENTRAL AND EASTERN UNITED STATES TECTONICS. M.F. Kane. U.S. Geological Survey, Reston, Va. Proj. No. 9730-03399. Start Date: 10/81. Estimated Completion Date: 9/83.

Two major reports will be prepared in FY 1983. One report will describe a system of crustal structures, based on gravity data and linked to a plate-tectonic framework, that will offer a preliminary explanation for the principal seismicity of the central and eastern United States. The other report will describe the crustal structure of the conterminous United States, based on an analysis of the gravity fields. Final revisions will be made on reports on a model for compressional deformation of crustal rifts, on seismicity and crustal structure in the Eastern United States, and on the crustal structure of the Central United States.

▷ HELIUM EMANOMETRY AND THE ANDERSONVILLE FAULT ZONE. J. P. Manker, Georgia Southwestern College. To evaluate the effectiveness of helium emanometry in detecting subsurface structures, a survey was conducted over a small portion of the Andersonville fault in Macon county. The existence of the fault had been confirmed through examination of drill hole, seismic, and gravity data collected during a previous study. During the present investigation 130 soil-air samples were collected and subsequently analyzed using a modified helium sniffer. Helium concentrations, which are reported in ppb above background, were plotted on a location map and then contoured. The contoured data shows a trend of rising and falling helium concentration values across the Andersonville fault. These anomalies may indicate the existence of a fault zone containing a number of faults as opposed to just a single structure.

GEOCHEMISTRY AND GEOPHYSICS (Continued)

- ▷ RADIOMETRIC AGE DATA BANK (R). R.F. Marvin. U.S. Geological Survey, Reston, Va. Proj. No. 9740-01761. Start Date: 10/80. Estimated Completion Date: 10/85.

The Radiometric Age Data Bank currently contains about 95% of the published radiometric ages for the states of Connecticut, Florida, Georgia, Idaho, Maine, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Hampshire, North Carolina, Oregon, Rhode Island, South Carolina, Utah, Vermont, Washington, Wisconsin, and Wyoming. During FY 1983 data will be entered for the following additional States: California, Missouri, Kansas, New York, Virginia, New Mexico, Colorado, Arizona, Texas, and Oklahoma.

- ▷ SEISMIC MONITORING ALONG THE SAVANNAH RIVER. Leland T. Long, Georgia Institute of Technology. Some earthquakes occurring near recently filled reservoirs in the southeastern United States have been triggered by reservoir impoundment. Georgia Tech is currently monitoring the Richard B. Russell Reservoir area for background seismicity. When the reservoir is filled early in 1984 we will monitor any changes in seismicity that may be induced. We currently operate three stations in the RBR area and three in the adjacent Clark Hill Reservoir area to the southeast. If earthquakes are induced during and immediately following filling, we will increase the number of stations and monitor selected areas in detail with portable seismic systems. The goals of our studies are first, to document the occurrence of induced seismicity and second, to study the spectral properties of the events. The spectral properties can be related to source mechanics and may lead to a method of estimating the largest possible induced earthquake. Expected completion date: FY 1985.
- ▷ SEISMIC MONITORING IN THE SOUTHERN APPALACHIAN SEISMIC ZONE. Leland T. Long and Anton M. Dainty, Georgia Institute of Technology. Georgia Tech operates a 17-station seismic net extending from west-central Alabama to southeastern Tennessee. The net covers the northwest corner of Georgia and is designed to monitor seismicity in the southern Appalachians. The net is a major part of our projects to understand and study the contemporary tectonics of the southern Appalachians. In addition to documenting historical and recent seismic activity, studies are underway to define crustal velocities, crustal thickness (i.e., depth to Moho), precision of locations, and velocity inhomogeneities. Understanding the tectonics and the cause of earthquakes will assist in determining realistic estimates of seismic risk and seismic hazards in Georgia. Expected completion date: Ongoing.
- ▷ STUDIES OF SEISMICITY IN MIDDLE GEORGIA. Leland T. Long and Anthony P. Johnson, Georgia Institute of Technology. On October 31, 1983, the first recorded earthquake near Columbus, Georgia, occurred. There were two main shocks at 03:07:36.7 and 03:12:12.3 (GMT) with magnitudes of 3.0 and 3.1, respectively. Two weeks of aftershock monitoring determined the epicenter to be 32.5977°N and 84.9455°W. On December 5, 1982, an earthquake swarm began in Twiggs County, south of Macon, which has continued to the present. Nearly 100 events greater than magnitude 2.0 have been recorded. Portable seismographs are currently being employed to determine the hypocenter. Some digital data has already been obtained. Also, a gravity survey of the area is being conducted. The approximate epicenter of the swarm is 32.71°N, 83.47°W. Expected completion date: FY 1985.

GEOCHEMISTRY AND GEOPHYSICS (Continued)

- ▷ EASTERN OVERTHRUST GRAVITY AND MAGNETICS. J.D. Phillips. U.S. Geological Survey. Reston, Va. Proj. No. 9730-03067. Start Date: 9/81. Estimated Completion Date: 9/83. Final revisions necessary for the publication of a color residual bouguer gravity anomaly map, with geologic overlay, for the Winston-Salem and Charlotte 2-degree quadrangles will be completed in FY 1983. Regional geophysical data will be interpreted to identify crustal thickness variations, the eastward extent of overthrusting, and the depth to the Precambrian basement beneath the Piedmont and Coastal Plain of the Eastern Overthrust Belt in Virginia, West Virginia, Tennessee, North Carolina, and South Carolina.
- ▷ GEOCHRONOLOGY, RESTON (R). T.W. Stern. U.S. Geological Survey, Reston, Va. Proj. No. 9740-00375. Start Date: 10/80. Estimated Completion Date: 10/85. Geochronologic studies will continue in FY 1983; a brief description of major activities follows. U-Th-Pb geochronology will focus on the Appalachian Piedmont in the Fredericksburg, Virginia, area and on the Atlanta 2-degree quadrangle in Georgia in order to refine the ages of critical units and to develop structural models for these terranes. Rb-Sr geochronology and Sr isotopic studies will focus on the post-tectonic plutons of northern New England, particularly the Derby, Echo Pond, and Willoughby granites of northern Vermont, to determine their age, fractionation history, nature of the source terrane, and isotopic character of the crustal block underlying this portion of the Appalachian orogen. Detailed geochronology is lacking for the Glens Falls 2-degree quadrangle in New York, New Hampshire, and Vermont. Cooperative studies will be conducted to establish the age of critical bodies, using U-Pb zircon dating techniques. Minerals from metamorphic and plutonic rocks from the Glens Falls quadrangle will be analyzed, using the 40-Ar/39-Ar age spectrum technique, to establish the timing of metamorphism, and post-metamorphic and post-plutonic cooling and uplift histories will be measured to evaluate the tectonic history of the area. Argon studies will be completed on an east-west traverse in the Charlotte 2-degree quadrangle, South Carolina/Georgia. The following geochronologic studies will be conducted to establish a temporal framework for the Triassic to Jurassic rift basins of eastern North America: 40-Ar/39-Ar dating of diabasic rocks; U-Th-Pb zircon dating of granophyres; Sr isotopic tracer studies will be conducted on mafic igneous rocks to provide constraints on source materials and magma evolution models; and fission-track ages will be determined on detrital apatites and zircons and 40-Ar/39-Ar ages determined on detrital K-feldspar and authigenic micas to establish time-temperature models for thermal evolution of basin sediments.

GEOCHEMISTRY AND GEOPHYSICS (Continued)

- ▷ METHODS FOR CHARACTERIZATION OF EXTRANEOUS ARGON IN ROCKS. J. M. Wampler, Georgia Institute of Technology. Rocks that crystallize in cooler portions of the earth's crust (e.g., diabase, vein quartz and calcite, limestone) may occlude and retain argon (along with other fluids) in inclusions or in intergranular spaces where it may remain separate from radiogenic argon that later forms by decay of ^{40}K within crystals. Kinetic study of the release of ^{40}Ar and ^{36}Ar as rocks are heated, and measurement of potassium and argon released by selective dissolution of minerals, provide ways to distinguish between radiogenic and extraneous components of argon in rocks. Characterization of extraneous argon can help in understanding the environment of crystallization of rocks and may contribute to potassium-argon geochronological studies. The project is a continuing one with no definite completion date.

GEOMORPHOLOGY

- ▷ FACTORS INFLUENCING THE MORPHOLOGIC DEVELOPMENT OF COASTAL SALT MARSHES. Joe R. Wadsworth, Jr., Dept. of Geology, Univ. of South Florida, Tampa, FL 33620. The influence of natural environmental factors on salt marsh drainage morphology is being assessed through studies of marshes near Sapelo and St. Catherine's Islands, GA. Factors under study include location and exposure, presence of buried relict sand ridges, storm occurrence, development of slump blocks and bioturbation, and elevation. The project includes long-term monitoring of erosion and deposition rates as well as characterization of present-day drainage morphology. Expected date of completion: FY 1988.

- ▷ GEOLOGIC DEVELOPMENT OF OKEFENOKEE SWAMP. Joe R. Wadsworth, Jr., Dept. of Geology, Univ. of South Florida, Tampa, FL 33620. The Cenozoic geologic history of the Okefenokee Basin is under study using a combination of geomorphic, sedimentologic and geophysical approaches. Major thrusts include topographic and remote sensing analyses of relict sand ridges, regional drainage analysis, geophysical investigation of upland stratigraphy, and evaluation of interstratal karst development in the uplands. Upcoming new aspects include sedimentologic analyses of sand ridges within the swamp, characterization of drainage in the Suwannee headwaters and monitoring of erosion/sedimentation rates in the prairie subenvironment. Expected date of completion: FY 1986.

- ▷ FLUVIAL TERRACES AND LATE PLEISTOCENE TECTONISM IN GEORGIA. Robert E. Carver and Susan A. Waters, University of Georgia. There appear to be six fluvial terraces in Georgia, remnants of which are traceable from west of the Barrier Island Sequence District across the Coastal Plain and into the Piedmont. The 10-20 foot terrace correlates with the Princess Anne and Pamlico Coastal Terraces, the 30-50 foot terrace correlates with the Talbot Terrace, the 60-80 foot terrace with the Penholoway, the 110-130 foot terrace with the Wicomico, the 140-160 foot terrace with the Okefenokee, and the 170-190 foot terrace with the Sunderland Terrace. Terrace gradients are consistent with modern river gradients, with the exception of terraces on the Chattahoochee River below Columbus, where 50 to 100 feet of late Pleistocene to Holocene uplift has occurred, and on the Flint River at Pine Mountain, where some southward tilting may have occurred. Expected completion, late 1983.

MARINE GEOLOGY

- ▷ MASS WASTING PROCESSES ON THE EAST COAST CONTINENTAL SLOPE.
J.S. Booth. U.S. Geological Survey, Reston, Va. Proj. No. 9470-030346. Start Date: 3/81. Estimated Completion Date: 9/85.
A sampling cruise in the Baltimore Canyon Slope area is planned in FY 1983 to collect piston and gravity cores for geotechnical and geological analysis, and to determine sediment pressures. Laboratory analyses will help establish the basic surficial sediment properties and provide data for studying surficial geologic processes. The liquefaction potential of slope sediments will be investigated, and the effect of lateral stress gradients on slope stability will be examined. Research on creep susceptibility and rheological behavior of slope sediments will continue in cooperation with the University of Rhode Island. Data on the prevalent types of mass wasting on the East Coast Continental Margin will be compiled, and the causes of this mass wasting will be assessed.
- ▷ ATLANTIC CONTINENTAL MARGIN MAGNETIC STUDIES. K.D. Klitgard.
U.S. Geological Survey, Reston, Va. Proj. No. 9470-01909.
Start Date: 10/76. Estimated Completion Date: 9/83.
Magnetic, gravity, seismic-reflection and seismic-refraction data for the Gulf of Maine-Georges Bank region will be analysed in FY 1983 and compared with subsidence modeling studies to evaluate the tectonic activity, thermal history, and major tectonic boundaries and relate them to the earthquake activity in the region. Magnetic, seismic-reflection, and seismic-refraction data seaward of the paleoshelf edge will also be analysed to evaluate the structure and development history of the Continental Slope and Rise during the Jurassic. Seismic velocity data for the Atlantic Continental Margin will be analysed and basement depths will be compared with magnetic depth estimates.
- ▷ GEOCHEMISTRY AND HYDROCHEMISTRY OF MARINE SEDIMENTS, MINERAL RESOURCES AND GROUND-WATER SYSTEMS. F.T. Manheim. U.S. Geological Survey, Reston, Va. Start Date: 5/77. Estimated Completion Date: 9/83.
The results of an FY 1982 cruise to the Blake Plateau will be evaluated, and the data entered on the mapping grid; a preliminary geological-geochemical map of the Blake Plateau area will be completed. The use of acoustic multifrequency systems for nodule and pavement density measurement will be evaluated, and the results of using a ANGUS-ARGUS wide-range bottom photography system to determine nodule coverage, patchiness of distribution, and relationship of nodules and pavement to the regional geologic local bottom topography will be interpreted. The evaluation of platinum and other chemical concentrations in Blake Plateau ferromanganese phases and the analysis of data on phosphate distribution along the Atlantic Continental Margin and Eastern Gulf of Mexico will continue. Reports on the phosphorite distribution along the Atlantic Continental Margin, on the economic potential of seamount crusts, central Pacific submarine mountain province, and on the occurrence of fresh and brackish waters in vibracores from the Onslow Bay, North Carolina, phosphorite areas will be prepared.

MARINE GEOLOGY (Continued)

- ▷ ATLANTIC PETROLEUM POTENTIAL OF THE UNITED STATES CONTINENTAL MARGIN (R). R.E. Mattick. U.S. Geological Survey. Proj. No. 9470-00512. Start Date 10/80. Estimated Completion Date: 9/85. Mapping of the Atlantic margin where Jurassic reef and forereef facies are preserved, in order to identify particular sites where the rocks may have reservoir potential, is planned in FY 1983. The reservoir rock potential of the lower slope and rise will be studied, and seismic and well data will be analysed.

- ▷ RESOURCE ANALYSIS, SOUTHEAST GEORGIA EMBAYMENT AND BLAKE PLATEAU. Peter Popenoe. U.S. Geological Survey, Reston, Va. Proj. No. 9470-01832. Start Date: 7/76. Estimated Completed Date: 8/85. Analysis of data from the following studies of the Blake Escarpment will be completed in FY 1983: morphology, based on observations, photographs, echo sounding, and GLORIA sidescan data; petrography and paleoenvironments from thin section analysis of ALVIN samples; structure of the Blake Escarpment from common-depth-point seismic profiles related to biostratigraphically dated samples; and analysis of erosional processes from visual observations and photographs. Previously collected profiles off South Carolina define a set of Oligocene submarine canyons that were filled with sediment probably in Miocene. The structure and petroleum trapping potential of these structures will be analyzed. Seismic profiles across the growth fault in the Carolina Trough will be reprocessed in order to identify an associated reverse fault that seems to be inherent, given the geometry of the fault phase interpreted at some locations. An analysis of the distribution of seismic facies in profiles of the Carolina Trough will be initiated.

MINERALOGY, PETROLOGY AND SEDIMENTOLOGY

- ▷ MINERAL MATTER DISTRIBUTION WITHIN OKEFENOKEE SWAMP. Michael J. Andrejko. University of South Carolina. This is a continuing project for evaluating the mineral matter (i.e. inorganic content) distribution throughout the peat deposits of the Okefenokee Swamp. Major emphasis has been on the biogenic, siliceous particles that are quite prevalent throughout the Swamp. Addition research has involved SEM and EDX analyses of significant phytoliths produced by the major peat-forming grasses and sedges. Other research involves the study of bioerosion features which have been observed on silicate substrates in the peat. Work has been in cooperation with Arthur D. Cohen. Project has been financed by NSF.

- ▷ THE RACCOON MOUNTAIN BASIN, AN EXAMPLE OF COAL BASINS IN SOUTHEASTERN UNITED STATES. Richard E. Bergenback and Habte G. Churnet, Department of Geosciences, University of Tennessee at Chattanooga, Chattanooga, Tennessee 37402. Work is in progress and deals with determination of the geographic extent of the Lower Pennsylvanian Raccoon Mountain Coal Basin in southeastern Tennessee, northeastern Alabama and northwestern Georgia. Determination of coal seam correlation within this basin is effected by geologic mapping of unmapped quadrangles as well as utilizing measured section and borehole data. This study is part of a project to supply coal thickness data points to the Coal Section of the U. S. Geological Survey at Reston, Virginia. Expected completion date is during FY 1984.

- ▷ MIDDLE ORDOVICIAN CARBONATES OF NORTHWEST GEORGIA. Brian Caldwell and Dr. William C. Parker, Dept. of Geology, Florida State University. This research is a petrologic and paleontologic survey of the carbonates of the Middle Ordovician period that are exposed in northwest Georgia, and will focus on the earliest known shelf-edge-reef tract (Holston Marble) and associated deposits. Work will entail both field and laboratory analysis. The purpose of the project is to extend our interpretation of the events of the period in the southern Appalachians through an expanded knowledge of paleogeography, paleoecology, general stratigraphy, and aspects of localized sedimentation.

- ▷ PLEISTOCENE EOLIAN DUNES ON THE LEFT BANKS OF GEORGIA RIVERS. Robert E. Carver, University of Georgia. The project is an investigation of the distribution of eolian dune fields that occur near the left banks of Georgia rivers and streams. The dune fields occur sporadically along both large rivers and small streams. The project is directed toward developing a rational explanation of their locations. Report to sponsoring agency (Georgia Geologic Survey), June 1983; completion, December 1983.

MINERALOGY, PETROLOGY AND SEDIMENTOLOGY (Continued)

- ▷ PEAT PETROGRAPHY AND PALEOECOLOGY OF OKEFENOKEE SWAMP. Arthur D. Cohen, University of South Carolina. This is a continuing project of evaluating the peat deposits of the Okefenokee Swamp in terms of their botanical constituents and their application in terms of a modern coal-forming environment. Present work involves sampling along mile long transects, at 100 foot intervals in the major peat-forming environments. The aim is to study the variation within a peat-profile over the transect length in terms of petrology, sedimentology, and geochemistry. This research permits better understanding of variations occurring within ancient analogs in coal seams. Work is cooperation with Michael J. Andrejko. Project has been financed by NSF.

- ▷ AMPHIBOLITIC, CALC-SILICATE AND MARBLE PALEOSOMES IN THE NORTH COLUMBUS MIGMATITE COMPLEX AND THEIR ASSOCIATED LEUCOSOME. Thomas B. Hanley, Dept. Chem. and Geology, Columbus College, Columbus, GA, 31993. Characterize various paleosome masses in the North Columbus migmatite complex to determine their protoliths, and their structural and metamorphic histories. Study the petrography and geochemistry of the leucosome material to determine its source.

- ▷ PETROGRAPHY AND GEOCHEMISTRY OF AMPHIBOLITIC ROCKS IN THE UCHEE BELT NEAR COLUMBUS, GEORGIA. Thomas B. Hanley, Dept. Chem. and Geology, Columbus College, Columbus, GA, 31993. Determine the degree of petrographic and chemical variability of the amphibolites of the Uchee Belt near Columbus in order to establish their metamorphic history, protoliths and their tectonic significance.

- ▷ PETROGRAPHY AND STRUCTURAL GEOLOGY OF GRANITOIDAL ROCKS IN THE UCHEE BELT NEAR COLUMBUS, GA. Thomas B. Hanley, Dept. Chem. and Geology, Columbus College, Columbus, GA, 31993. Determine the relationship between the development of granitoidal rock bodies and the structural development of other Uchee Belt rocks.

- ▷ ALTO ALLOCHTHON. Robert D. Hatcher, Jr., Univ. South Carolina and R. Dallmeyer, Univ. of Georgia. Study of the internal structure, stratigraphy, metamorphism and uplift history of the Alto allochthon. Detailed geologic mapping, in progress, indicates a stratigraphy is present in the allochthon like that in the Blue Ridge and Inner Piedmont. The allochthon rests upon lower grade rocks. National Science Foundation support. Competition FY, 1984.

- ▷ EAST END OF THE PINE MOUNTAIN WINDOW. Robert D. Hatcher, Jr., Univ. of South Carolina and A. L. Odom, Florida State University. Detailed geologic mapping of about 240 mi² has shown that the Pine Mountain belt is terminated to the east by a complexly refolded pre- to synmetamorphic thrust. The Goat Rock and Towaliga faults are later faults not related to each other or to the earlier folded thrust. Mafic rocks in the Piedmont to the east show arc affinities. The Piedmont to the east is equivalent to the Uchee belt. National Science Foundation support. Completed FY 1982.

MINERALOGY, PETROLOGY AND SEDIMENTOLOGY (Continued)

- ▷ DETAILED INVESTIGATIONS OF THE ULTRAMAFIC OCCURRENCES, CAMPBELL MOUNTAIN AND SUCHES QUADRANGLES, LUMPKIN COUNTY, GEORGIA. Nathan E. Heinrich, Graduate Student, Auburn University. This study is being undertaken to determine the nature and occurrence of the two ultramafic bodies in the Campbell Mountain and Suches Quadrangles of northern Georgia. The goals of the research are to determine the origin, stratigraphic position and relationship of these occurrences to other ultramafic rocks in the southeast. Expected completion date: FY 1984.

- ▷ CLAY MINERALOGY OF THE HAWTHORNE GROUP. John H. Hetrick and Michael S. Friddell, Ga. Geol. Survey. This project is an examination of the clay mineralogy of 28 cores containing Hawthorne Group sediments from Georgia, Florida, and South Carolina. The study consists of semi-quantitative measurements of the mineral contents of the clay-size fraction and statistical analysis of the results. The purpose of the examination is to relate the clay mineral distributions to recently revised Hawthorne Group stratigraphy. Expected completion date: 1983.

- ▷ TUSCALOOSA FORMATION: DEPOSITIONAL ENVIRONMENTS. Larry Warren Smith and David T. King, Jr., Department of Geology, Auburn University, AL 36849. The Tuscaloosa Formation (or Group as it is known in Alabama) is the subject of study in outcrops from Macon, GA to Montgomery, AL. The aim of the study is to delineate, define, and describe the sedimentary facies and ancient depositional environments of the Tuscaloosa. Field analysis to date has shown that most of the Tuscaloosa is characterized by a sequence of discontinuous, small fining upward terrigenous clastic units. These deposits are likely channel bars developed in a generally coarse-grained, meandering fluvial system. Interchannel sedimentary facies, dominated by bioturbated fine clastic units or massive claystones with fine gravel dropstones, are interstratified with the fluvial bars. Expected completion date: 9/83.

- ▷ METAMORPHISM OF CONASAUGA FM. Charles E. Weaver, Ga. Tech. Integrated petrographic, mineralogic and geochemical study of the Conasauga shale exposed to burial temperatures ranging from 100° to 400°C. Attempting to develop a paleothermometer and to separate the effects of thermal and dynamic metamorphism. Expected completion date: FY 1983.

PALEONTOLOGY AND PALEOBOTANY

- ▷ SPINY MEGASPORES FROM MISSISSIPPIAN LYCOPODS. Michelle J. Ballard,, Sheila D. Brack-Hanes and Charles J. Mott. Eckerd College, St. Petersburg, Fla. and St. Petersburg Junior College, Clearwater, Fla. The Mississippian megaspore, Echitriletes echinoides, described by Chaloner in 1954 from isolated spores, has been attributed to the lycopod sporophyll, Lepidostrobophyllum fimbriatum (Kidston) Allen. New specimens of Echitriletes spores have been found isolated as well as in sporangia of sporophyll compressions discovered in Mississippian strata of Georgia. The Georgia sporophylls, however, are not Lepidostrobophyllum fimbriatum, but appear smaller with a distinctively narrow lamina that has entire (smooth) margins. Therefore, we believe that the spore Echitriletes echinoides may be produced by more than one kind of lycopod during the Mississippian.
- ▷ THE FISH OF THE EUTAW FORMATION (SANTONIAN) IN WESTERN GEORGIA. Gerard R. Case, 129 Carlton Ave., Jersey City, NJ, and David R. Schwimmer, Dep't. of Geol., Columbus College. The Eutaw Formation is recognized between northeastern Alabama and western Georgia. Whereas the vertebrates, especially fossil fish, of the western Eutaw are well-known, those in the Georgia Eutaw have only been listed by (presumed) name in the literature; no systematics have appeared. A study is in progress to examine the total fish fauna of the Eutaw Formation in the Chattahoochee River Valley. Both mega- and micro-samples are being studied. Preliminary examination shows at least eight shark taxa present, including an oldest occurrence of Protolamna sokolovi and a new species of Plicatolamna. It is expected that microsamples will yield a considerably larger range of chondrichthyes, especially skates and rays, and that additional bony fish will join Xiphactinus, Acipenser, and Enchodus in the faunal list. Work is in progress with completion projected during: FY 1984.
- ▷ A MISSISSIPPIAN LYCOPOD CONE FROM GEORGIA. Thomas R. Lane and Sheila D. Brack-Hanes. Eckerd College, St. Petersburg, Fla. Lycopod cone fragments have been discovered in the late Mississippian (Chesterian) rocks of Northwest Georgia. General morphological features of the cone are discussed and the new material is compared with similar lepidodendroid cones of equivalent age.
- ▷ A DIVERSE, NEW, SCRAP-BONE VERTEBRATE FAUNA FROM THE BLUFFTOWN FORMATION (CAMPANIAN), WITH REPORT OF THE FIRST DINOSAURS FROM GEORGIA. David R. Schwimmer, Dep't. Geol., Columbus College; Donald Baird, Dep't. Geol./Geophys., Princeton Univ.; Gerard R. Case, Jersey City, NJ. A large diverse set of fragmental vertebrate fossils are systematically described from the uppermost beds of the Blufftown Formation in Stewart Co., Georgia. Taxa described include the following numbers of species or non-specifically differentiated higher taxa: sixteen sharks, six bony fish, four crocodiles, four turtles (both marine and freshwater), three mosasaurs, and two dinosaurs. The dinosaur fossils are the first documented and systematically described from Georgia and include fragments of a hadrosaur and a single tarsal from Ornithomimus. Among other highlights are numerous teeth and post-cranial remains from the gigantic crocodile Deinosuchus rugosus, and the complete nuchal and additional bones from a possibly new genus of cheloniid which features a 1.5 m-wide carapace. Field work, curating, and reporting are nearly completed and the paper will be submitted to the Jour. Vert. Paleontol: FY 1983.

PALEONTOLOGY AND PALEOBOTANY (Continued)

- ▷ A POSSIBLY WIDE-RANGING TRILOBITE: RE-EVALUATION OF ELRATHIA GEORGIENSIS: David R. Schwimmer, Dep't. Geol., Columbus College. The Middle Cambrian trilobite, Elrathia georgiensis Resser, from the Conasauga Shale in the vicinity of Rome, GA, appears on preliminary examination to be identical to Ehmania weedi (Resser) from Montana (also Middle Cambrian). These species were described in the mid-1930's when popular notion held was that no trilobite species' range could extend across wide geographical distances. A re-examination of the morphology of Elrathia georgiensis is planned using new specimens from the Coosa River region, and comparisons will be made with Montana Ehmania specimens in my collections. Should these prove conspecific, the implications for Cambrian paleogeography and cratonic environments will be analysed. Collecting, curating and analysis are planned for completion by: FY 1984.
- ▷ REPORT OF THE FIRST PTEROSAURS FROM GEORGIA, OPEN-MARINE FACIES, EUTAW FORMATION (SANTONIAN). David R. Schwimmer, Dep't. Geol., Columbus College; Kevin Padian, Dep't. Paleontol., Univ. Calif. Berkeley. This report describes the first records of flying reptiles from Georgia, based on two bones from calcareous sandstones in the lower Eutaw Formation, Chattahoochee Co., GA (Ft. Benning). The bones are fragmentary but of certain pterosaurian affinities and appear to come from a medium-sized Pteranodon. It is uncertain whether a single individual is represented by the two bones but such is probable. These fossils are also to date the first reptiles described from the Eutaw Formation in Georgia and the southeasternmost occurrence of pterosaurs on the continent. The report is completed and will be submitted to the Jour. Paleontol: FY 1983.
- ▷ TAXONOMY AND BIOSTRATIGRAPHY OF EXOGYRA: COMMENTS ON AN EXAMPLE OF PHYLETIC GRADUALISM. David R. Schwimmer, Dep't. Geol., Columbus College. This project seeks to re-evaluate Exogyra species in the eastern Gulf Coastal Plain. Since Exogyra is an important Cretaceous index fossil, any taxonomic revision should materially affect Cretaceous biostratigraphic interpretations. Further, preliminary work suggests that at least two recognized species, E. upatoiensis and E. ponderosa, are identical and that a variant of E. ponderosa, E.p. erraticostata, may be undifferentiable from variants of E. costata. The implications of these observations are that the eastern Gulf Exogyra population shows gradual morphological change over time and thereby may be exemplifying so-called "phyletic gradual" evolution. Detailed study is beginning in Spring, 1983 and is expected to conclude late in 1983. Reports based on this work will be prepared: FY 1984.
- ▷ ORDOVICIAN STROMATOPOROIDS IN ALABAMA AND GEORGIA. Carl W. Stock, Department of Geology, The University of Alabama, Box 1945, University, AL 35486.
Work has begun on the taxonomy and paleoecology of the stromatoporoids from the Middle Ordovician Chickamauga Supergroup. Except for Chazyan stromatoporoids from the Lake Champlain area of New York and Vermont, no systematic study of Ordovician stromatoporoids from the Appalachian Basin has been conducted. I would appreciate receiving any information regarding stromatoporoid localities in the Chickamauga of Georgia. Completion of the project is not expected for several years.

REGIONAL GEOLOGY

- ▷ MARINE/NON-MARINE CLIMATES, ATLANTIC COAST. T.M. Cronin. U.S. Geological Survey, Reston, Va. Proj. No. 9590-03448. Start Date: 7/82. Estimated Completion Date: 10/86. Efforts during FY 1983 will focus on analyzing cores from several sites in offshore areas of New Jersey and South Carolina; Dare County and Cape Lookout, North Carolina; and the Gulf of Maine.

- ▷ CONODONT-BASED AGE DETERMINATIONS OF LOW- TO MEDIUM-GRADE METAMORPHIC ROCKS, APPALACHIAN OROGEN. A.G. Harris. U.S. Geological Survey, Reston, Va. Proj. No. 9590-02729. Start Date: 10/79. Completion Date: 9/82. This project was terminated at the end of FY 1982. Similar studies will continue under project no. 9590-03511; see status report below.

- ▷ LOWER PALEOZOIC CONODONT STUDIES OF THE APPALACHIAN BASIN. A.G. Harris. U.S. Geological Survey. Proj. No. 9590-03511. Start Date: 2/83. Estimated Completion Date: 1/85. New sections in structural and depositional belts in the Appalachian basin will be sampled in FY 1983 in order to extend and amplify the biostratigraphic framework established under previous projects nos. 9590-02728 and 9590-02729, and to obtain additional conodonts for study. Present plans include fieldwork in Alabama, Virginia, West Virginia, Maryland, and Pennsylvania; however, other States in the Appalachian basin may be visited as the work of other investigators in the USGS and State geological surveys encounter areas where conodont research is needed. Conodont color-alteration maps based on current data will be compiled for the Appalachian basin, and a report on the conodont microfacies of a late Silurian carbonate mudflat in the Tonoloway Formation will be prepared.

- ▷ LATE PALEOZOIC BIOSTRATIGRAPHIC FRAMEWORK OF THE MAJOR COAL BASINS IN THE EASTERN UNITED STATES. T.W. Henry. U.S. Geological Survey, Reston, Va. Proj. No. 9590-02751. Start Date: 10/79. Estimated Completion Date: 9/84. Biostratigraphic framework studies and analysis of brachiopod faunas for the Middle Pennsylvanian Series in an area of the proposed Pennsylvanian System stratotype in West Virginia will be completed in FY 1983. Fieldwork to examine stratigraphic sections of a Middle Pennsylvanian sequence in the central Appalachian basin of West Virginia and Kentucky and in the Upper Mississippian and Lower Pennsylvanian sections of the southern Appalachian basin in Alabama, Georgia, and Tennessee, and the collection of megafauna for biostratigraphic analysis will continue. Studies of brachiopods and ammonoids (goniatites) from Kentucky, Alabama, Georgia, and Tennessee, will be initiated. Research on the fusulinid biostratigraphy and faunas of the Middle and Upper Pennsylvanian of the central Appalachian basin in Kentucky, Ohio, Pennsylvania, and West Virginia and the Eastern Interior basin in Illinois, Kentucky, and Indiana, and biostratigraphic correlation between the two basins and with the type provincial series of the Pennsylvanian in the Midcontinent will also be completed. The biostratigraphy and paleoecology of Upper Mississippian ostracode faunas in an area of the proposed Pennsylvanian System

REGIONAL GEOLOGY (Continued)

stratotype in Virginia and West Virginia will be analyzed, and ostracode samples from selected units in an Upper Mississippian and Lower Pennsylvanian sequence in the southern Appalachian basin of Alabama, Tennessee, and Georgia, will be prepared for analyses.

- ▷ ATLANTA 2-DEGREE QUADRANGLE, GEORGIA AND ALABAMA. M.W. Higgins. U.S. Geological Survey, Reston, Va. Proj. No. 9510-02279. Start Date: 11/78. Estimated Completion Date: 9/83.
A report on the stratigraphy of the Piedmont in the Griffin and Atlanta 1-degree quadrangles and a geologic map of each quadrangle will be prepared.

- ▷ GREENVILLE 2-DEGREE QUADRANGLE, SOUTH CAROLINA AND GEORGIA. A.E. Nelson, U.S. Geological Survey, Reston, Va. Proj. No. 9510-01786. Start Date: 7/76. Estimated Completion Date: 9/83.
Geologic mapping of the Greenville 2-degree quadrangle will be completed in FY 1983. This mapping will cover the eastern part of Lowndesville shear zone, the southwestern part of the Inner Piedmont, and areas north of Anderson, South Carolina, and south of Lake Hartwell in Georgia. Compilation of maps and explanations will continue.

- ▷ OVERFLOW WILDERNESS RARE II. A.E. Nelson. U.S. Geological Survey, Reston, Va. Proj. No. 9510-03264. Start Date: 10/81. Estimated Completion Date: 12/83.
Map compilations and petrographic studies will be completed in FY 1983. The final report, including geochemical data and data supplied by the U.S. Bureau of Mines, on the geology and mineral potential of the Overflow Wilderness area will be submitted for review and publication.

- ▷ SOIL AND SAPROLITE STRATIGRAPHY OF MID-ATLANTIC AND EASTERN GULF COAST STATES. M.J. Pavich. U.S. Geological Survey, Reston, Va. Proj. No. 9510-02627. Start Date: 10/79. Estimated Completion Date: 9/84.
Soils developed on quartzites will be sampled from Georgia to New Jersey in FY 1983. Methods for studying iron coatings on soil quartz grains and for extracting and analyzing amorphous silica from quartzose soils will be developed. A model of the soil genesis of ultisols in the southeastern United States will be constructed.

- ▷ BARNWELL 1-DEGREE QUADRANGLE. D.C. Prowell. U.S. Geological Survey, Reston, Va. Proj. No. 9510-03384. Start Date: 2/82. Estimated Completion Date: 4/84.
Geologic sections of the updip Coastal Plain of Georgia and South Carolina and of the area from Augusta, Georgia, to Parris Island, South Carolina, will be constructed in FY 1983. Field studies to subdivide units delineated in the geologic sections from borehole information are also planned, along with detailed studies of localized areas to determine the effects of tectonism along the Millett Fault and similar structures.

REGIONAL GEOLOGY (Continued)

- ▷ BRITTLE TECTONICS AND RESERVOIR INDUCED SEISMICITY. D.C. Prowell. U.S. Geological Survey, Reston, Va. Proj. No. 9510-02389. Start Date: 8/78. Estimated Completion Date: 9/83.
Detailed geologic mapping in the vicinity of the R. B. Russell reservoir to delineate Cenozoic fractures will be underway in FY 1983. Cores from near the R. B. Russell dam will be examined to determine details of postmetamorphic faulting.

- ▷ WEST GEORGIA COASTAL PLAIN. Juergen Reinhardt. U.S. Geological Survey, Reston, Va. Proj. No. 9510-01910. Start Date: 10/76. Estimated Completion Date: 9/83.
Fieldwork was completed in FY 1982; final reports will be completed and submitted for review and publication.

- ▷ BIOSTRATIGRAPHIC AND DEPOSITIONAL FRAMEWORK OF THE U.S. ATLANTIC CONTINENTAL MARGIN. P.C. Valentine. U.S. Geological Survey, Reston, Va. Proj. No. 9590-02998. Start Date: 10/80. Estimated Completion Date: 9/85.
Biostratigraphic analysis of 19 1000-foot coreholes from the Atlantic shelf and slope from Florida to Massachusetts will be completed in FY 1983. Sediment and rock samples collected with the submersibles Alvin and Johnson Sea Link from Georges Bank and canyons off Massachusetts will also be analyzed. Compilation of a bathymetric map of the slope off Georges Bank adjacent to Oceanographer Canyon will continue, and contributions for inclusion in a publication entitled "Stratigraphy and Depositional History of the U.S. Atlantic Margin" to be published by Hutchinson Ross Publishers will be prepared.

- ▷ GEOLOGIC MAP OF THE SILOAM GRANITE AND VICINITY, EASTERN GEORGIA, Harold R. Vincent, Georgia Geol. Survey, Atlanta, Ga. Start date, 12-82. Currently in review.
This study is a preliminary structural and petrographic investigation of the Siloam pluton and surrounding lithologies emphasizing reconnaissance field mapping of textural phases within the granite. 1:48,000 scale

- ▷ NEOGENE VERTEBRATE BIOSTRATIGRAPHY--ATLANTIC AND GULF COASTAL PLAINS. F.C. Whitmore. U.S. Geological Survey, Reston, Va. Proj. No. 9590-02738. Start Date 10/79. Estimated Completion Date: 9/84.
The vertebrate biostratigraphic study of Mobile County, Alabama, will be completed in FY 1983. The collection and study of Neogene Cetacea of the Atlantic Coastal Plain will continue.

STRATIGRAPHY

- ▷ SUWANNEE STRAIT IN SOUTHERN GEORGIA--STILL ANOTHER EXPLANATION. Howard Ross Cramer, Emory University, Atlanta, and Thomas E. Rice, Texaco, Inc., New Orleans. Evidence is presented to show that the Suwannee Strait is a result of post-Sabinian faulting in which the southern portion, on the downdropped side, has had a thicker section preserved following erosion. Work completed, to be submitted to a major journal in 1983.

- ▷ HUMMOCKY CROSS-BEDDING IN THE EUTAW FORMATION OF WESTERN GEORGIA. William J. Frazier, Department of Chemistry and Geology. The aim of this project is to describe hummocky cross-bedding in the Eutaw Formation and to compare its characteristics and paleoenvironmental occurrence with those of hummocky cross-bedding from other units. The aim of the project is to show that hummocky cross-bedding does not occur uniquely within shallow-marine sequences (as has been reported by other workers) but may also be found in deposits of open bays or lagoons; thus, hummocky cross-bedding may be a process-controlled rather than environmentally-controlled structure and must be used cautiously as a indicator of depositional environment. Expected completion date: 1984.

- ▷ STRATIGRAPHY OF THE GEORGIA COASTAL PLAIN. Paul F. Huddlestun, Ga. Geol. Survey. The goal of this project is to define the stratigraphic framework of the Georgia Coastal Plain, both surface and subsurface. All lithostratigraphic subdivisions will be defined in accordance with the modern codes of stratigraphic nomenclature. This will include definitions of the lithostratigraphic units, their type localities, the lithologic characteristics of the units, and discussions of the ages and pertinent paleontology of the units. Approximately 110 formal and informal units will be included ranging in lithostratigraphic ranking from groups, formations, and members, to informal beds, unnamed units of formation rank, and undifferentiated deposits. Expected completion date: FY 1984.

- ▷ STRATIGRAPHY OF THE BARNWELL GROUP. Paul F. Huddlestun and John H. Hetrick, Ga. Geol. Survey. The goal of this project is to present a detailed and modern stratigraphy of the upper Eocene clastic deposits of Georgia. This involves both lithostratigraphic treatment and biostratigraphic discussion of the Georgia upper Eocene and its relationship with that of the type area and adjacent states. Expected completion date: FY 1983

HYDROGEOLOGY

FLOOD STUDIES

- ▷ ATLANTA METROPOLITAN AREA URBAN FLOOD RUNOFF CHARACTERISTICS. Ernest J. Inman. U.S. Geological Survey, Doraville, Ga. In cooperation with U.S. Army Corps of Engineers, Savannah Distr. Period: 1972-1983.

Objective: To provide a method for estimating the magnitude and frequency of floods for streams in the Atlanta metropolitan area. Also, to collect information on floods as they occur on streams in the area to provide stages at specific locations and to locate chronic or potential flood problems.

Progress: The Distributed Routing Rainfall-Runoff Model Version II and the U.S. Geological Survey rainfall-runoff model were calibrated for 19 basins in the Atlanta area. The models were then used to synthesize long-term flood records for these basins using the long-term Atlanta precipitation record. Flood-frequency data were developed for each basin from these long-term flood-peak records by using the log-Pearson Type III distribution. Multiple-regression analysis was then used to define relations between the flood-frequency station data and drainage area, slope, and impervious area. Using these relations, estimates of the frequency of floods can be made on ungaged urban streams in the Atlanta metropolitan area. Project complete except for report.

- ▷ FLOOD-FREQUENCY CHARACTERISTICS OF URBAN STREAMS IN GEORGIA. Ernest J. Inman. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Dept. of Transportation. Period: 1978-1986.

Objective: The objectives of this study are: (1) to collect hydrologic data for selected urban streams in selected metropolitan areas of Georgia, and (2) to analyze these data to develop relations that may be used to estimate the magnitude and frequency of floods in urban streams throughout the State.

Progress: Data on 113 flood events were collected during 1982 at 30 urban drainage basins. The data were processed and loaded into computer storage on a near-current basis. Topographic maps having a contour interval of 1 ft are almost completed for four urban Savannah basins and will be field checked. This mapping was necessary to accurately determine drainage areas.

- ▷ SOURCES OF FLOOD DATA IN GEORGIA, Donna M. Mack and Sylvie L. Olney, Ga. Geologic Survey. This project compiles the sources of all levels of flood data available in the state. It is organized by county, identifying each stream studied within a county and the engineering source (Federal, State or private). Brief descriptions of the study areas will be included, in addition to the locations of all gauging stations. The goal of the project is to assist interested persons in determining if flood data is available and where it can be obtained. Expected completion date: FY 1983.

FLOOD STUDIES (Continued)

▷ ESTIMATING FLOOD ELEVATIONS IN GEORGIA, Mary Lynne Pate and Katherine Nesbit, Ga. Geologic Survey. This project consists of a comparison of calculator programs and graphical methods for estimating flood elevations in unstudied areas of Georgia. Work will include the research of various approaches for determining flood flows and elevations in pilot areas. These results will be compared to computer analyses and potentially modified to simulate the accuracy of the detailed studies. Final output of the project will be a manual of guidance for application of these methods. Expected completion date: FY 1983.

▷ STATEWIDE FLOOD STUDIES, GEORGIA. McGlone Price. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Dept. of Transportation. Period: continuing.

Objective: To collect supplemental flood data, to analyze the data and to prepare reports describing the hydrologic and hydraulic characteristics of selected stream reaches, and to collect data and prepare reports describing unusual flood events.

Progress: U.S. Geological Survey personnel made indirect determinations of discharge of seven streams in extreme northwest Georgia for the flood of August 17, 1982. Peak discharges for several small streams in Dade County were greater than the 1-percent (100-year) flood. Historical flood data were documented on 60 streams for entry into the U.S. Geological Survey computer file for peak flows. Step-backwater studies were made to determine flooding characteristics on 12 streams. Flood information at 85 miscellaneous sites was furnished to Federal, State, and local agencies and to the general public.

GROUND WATER

- ▷ CRETACEOUS-TERTIARY AQUIFER SYSTEM OF GEORGIA. John S. Clarke. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Geologic Survey. Period: 1978-1983.
Objective: Define the areal extent; hydrologic, geologic, and water-quality characteristics; water-use and long-term water-level trends of the aquifer system.
Progress: The hydrogeology of the Clayton and Providence aquifers of southwest Georgia was defined. Sediments of Tertiary and Upper Cretaceous age in east-central Georgia were divided into a system of 3 aquifers ranging in thickness from 100 to 1,000 ft. The most productive aquifer consists of sediments of Paleocene and Upper Cretaceous age and has a maximum transmissivity of 37,000 feet squared per day.
- ▷ MIGRATION OF PESTICIDES THROUGH THE UNSATURATED AND SATURATED ZONES AT A SELECTED SITE IN SOUTHEAST LEE COUNTY, GEORGIA. Sandra C. Cooper. U.S. Geological Survey, Doraville, Ga. In cooperation with U.S. Environmental Protection Agency. Period: 1983-1986.
Objectives; Collected field data will be used in calibrating, testing, and refining ground-water flow and solute-transport models designed to predict movement of chemicals within the residuum and underlying aquifer. Data collected on soils and ground water will be used to estimate the movement of pesticides from the point of application to the point of intersection with the water-bearing media. Field data will be used to define ground-water quality and aquifer characteristics.
Progress: Geophysical logs were made in five augered test holes. Nineteen temporary PVC piezometers and three deep, steel-cased wells were installed. One deep well was equipped with a continuous recorder. Six soil cores were collected by the Shelby tube method. Two rain gages and two teflon lysimeters were installed. Water-quality samples were collected from one deep well. A topographic base map was constructed.
- ▷ SOUTHEAST COASTAL PLAIN REGIONAL AQUIFER SYSTEM STUDY. Robert E. Faye. U.S. Geological Survey, Doraville, Ga. In cooperation with U.S. Geological Survey - Federal. Period: 1980-1984.
Objective: Study objectives include the determination of ground-water flow patterns and boundaries of the various sand aquifer systems and their simulation through the use of digital models.
Progress: R. E. Faye and G. C. Maver, as part of the Southeastern Coastal Plain Regional Aquifer Systems Analysis (RASA) Studies, have delineated five major Upper Cretaceous and lower Tertiary aquifer systems within the Coastal Plain of Georgia, western South Carolina, and eastern Alabama. Hydrologic and geohydrologic data pertinent to each aquifer have been assembled and applied to a three-dimensional digital model. Calibration of the model is in progress. Geohydrologic studies in eastern Georgia and western South Carolina indicate that geologic structures significantly affect both ground-water flow and the thickness of aquifer sediments.

GROUND WATER (Continued)

- ▷ AN ANALYSIS OF THE EFFECTS OF FAULTING ON FRESHWATER AND SALTWATER MOVEMENT IN THE PRINCIPAL ARTESIAN AQUIFER NEAR BRUNSWICK, GEORGIA. H.E. Gill. U.S. Geological Survey, Doraville, Ga. In cooperation with City of Brunswick, Glynn Co., Ga. Period: 1981-1983.
Objective: (1) To locate and determine the effects of faults on the distribution of saltwater in the principal artesian aquifer system in the Brunswick area. (2) Determine the distribution of saltwater immediately below the freshwater aquifer.
Progress: A total of 16 miles of continuous VIBROSEIS profiling in coastal Georgia was compiled by J. B. Costain, Virginia Polytechnic Institute (VPI) and evaluated by H. E. Gill, U.S. Geological Survey. The targeted reflection layer was the top of the upper Eocene carbonate aquifer. Preliminary analysis of the data indicates that the upper surface of the carbonate aquifer probably has been cut by high-angle reverse faults. A quantitative study of 235 geophysical logs from the Brunswick (Glynn County) area provided evidence that the faults have displaced rocks as young as middle Miocene age. Saltwater contamination of the carbonate aquifer from a deeper brine source has been documented by earlier studies. The upward movement of saltwater has been attributed to local pumping. The geophysical evidence suggests that the conduits allowing the upward movement of saltwater are fracture zones produced by faulting of the carbonate aquifer.
- ▷ THE HYDROGEOLOGY OF RICHMOND AND NORTHERN BURKE COUNTIES. Lee L. Gorday, Ga. Geol. Survey. Ground-water use in Richmond and northern Burke Counties is expected to grow quickly as the population grows, as plants and factories are built or expanded, and as the practice of irrigation becomes more widespread. To adequately plan for this, a better knowledge of the hydrogeology of the area is necessary. This study was undertaken to add to the understanding of the ground-water flow system in this rapidly growing area. The main aquifer is of Cretaceous age and is composed of sands and gravels. The study is being conducted on an available data basis. Driller's logs, along with geophysical logs when available, are being used to delineate the geometry of the aquifer and to characterize the hydrogeologic properties. Expected completion: Summer 1983.

GROUND WATER (Continued)

- ▷ GEOHYDROLOGIC EVALUATION OF THE OCALA LIMESTONE AQUIFER IN DOUGHERTY COUNTY, SOUTHEAST LEE, AND WESTERN WORTH COUNTIES, GEORGIA. David W. Hicks, U.S. Geological Survey, Doraville, Ga. In cooperation with Albany Water, Gas, and Light Commission. Period: 1981-1984.

Objective: The development potential of the Ocala limestone aquifer will be evaluated for the Albany area. Ground-water and surface-water quality will be monitored through a broad range of ground-water and surface-water conditions. Water sampling frequency will enable the evaluation of potential seasonal variations in water quality and the impact of the applications of agricultural chemicals.

Progress: Test wells penetrating the principal artesian aquifer at seven sites and geophysical logs from 44 sites indicate that vertical lithologic zonation is present in the aquifer. The upper zone consists of fractured, indurated limestone that has good primary porosity and well-developed secondary porosity. The lower zone, in places separated by silt or clay strata, consists of sandy limestone that has fair to good primary porosity and poorly developed secondary porosity. Head measurements made throughout the test drilling suggest that a vertical head gradient exists within the aquifer where the lithologic zonation is discernable. Aquifer tests were conducted at six sites and transmissivities determined.

- ▷ URANIUM ISOTOPES IN GROUND WATER IN SOUTHWEST GEORGIA AND NORTHWEST FLORIDA. M.G. Korosy and J.B. Cowart, Department of Geology, Florida State University, Tallahassee, FL 32306. Analysis of ground water from the southwest Georgia-northwest Florida area for uranium concentration and $^{234}\text{U}/^{238}\text{U}$ alpha activity ratio is being carried out. The pattern of the variation of these two parameters can be used to identify recharge areas and locations where active water-rock interactions are occurring. The purpose of this study is to gain a better understanding of the nature and locations of recharge to the Floridan (Principal Artesian) aquifer and to delineate flow patterns.

- ▷ IMPACT OF INCREASED WATER USE ON THE QUANTITY AND QUALITY OF THE GROUND-WATER RESOURCES OF COASTAL GEORGIA. Richard E. Krause. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Geologic Survey. Period: 1981-1984.

Objective: (1) Better define the fresh ground-water flow system; (2) determine the occurrence, flow regimen, and quality of the water underlying the system; and (3) determine the impact of faults on the flow system.

Progress: Nine test/monitor wells were drilled, geophysical well logs run (on these and other wells in the area), and water-level recorders installed. An aquifer test was performed. Water-level measurements were made on all available wells in the area and potentiometric maps were constructed. All available wells in the areas of saline-water contamination were sampled for determination of changes in salinity. A report on the data availability was written and is in review. A three-dimensional ground-water-flow model for the Brunswick area was developed. Preliminary lithologic and stratigraphic data were mapped to determine geologic structure.

GROUND WATER (Continued)

- ▷ DEWATERING OF CLAY MINES IN GEORGIA. Philip E. LaMoreaux, President, P.E. LaMoreaux and Associates, Inc., Tuscaloosa, Alabama. The development of large quantities of ground water for any major use in an area is always of environmental concern to representatives of regulatory groups, citizens, agricultural and industrial users. From these concerns, state and federal congressional representatives receive a variety of impulses from their constituents and in turn begin a series of questions upon which to base appropriate legislative actions. The kaolin industry in Georgia is substantial to the economy and the welfare of an important segment of east-central Georgia. It uses large quantities of water for processing. This constitutes an important source of income and tax revenue. Pumping test procedures to provide an accurate and efficient dewatering scheme have been developed and carried out at a number of mines in the kaolin district of Georgia. This paper highlights one such test and is directed at an assessment of the impact of this industry on ground water supplies of an area. Presented at AIME, March 1983 meeting in Atlanta, Georgia.
- ▷ GROUND WATER RECHARGE POTENTIAL OF FRESH WATER WETLANDS, HILTON HEAD, SOUTH CAROLINA. James P. May, The Citadel, Charleston, S. C. The basic objective of the study is to analyze the relationship between fresh water wetlands and the underlying water table aquifer. More specifically, we are investigating the role of the wetland in the recharge of the shallow ground water aquifer. A secondary objective concerns the relationship between the shallow aquifer and the deeper limestone aquifer from which the island derives its fresh water supply. If it is determined that fresh water wetlands are areas of recharge for the shallow aquifer, the appropriate management methods will be developed. Expected completion date: June, 1983.
- ▷ HYDROGEOLOGY OF THE GULF TROUGH OF GEORGIA. S.S. McFadden, J.H. Hetrick, and S.A. Rodenbeck, Ga. Geol. Survey. Potentiometric maps of the Principal Artesian Aquifer consistently illustrate a series of closely spaced contour lines, a potentiometric anomaly, trending N53°E across the coastal plain of Georgia from Grady to Bulloch Counties. Previous studies indicate a thickening of Miocene and Oligocene strata corresponding to this potentiometric anomaly; the thickening may be a cause of the increased gradient in the direction of flow. The general purpose of this project is to assess the principal controls on the occurrence, availability, and quality of ground water by examining stratigraphic, structural, and hydrologic evidence available. More specifically, the feature named the "Gulf Trough of Georgia" and defined by Herrick and Vorhis (1963) will be investigated. Project objectives include redefinition of the feature as well as estimation of its areal extent and depth. Characteristics of the Gulf Trough tentatively scheduled to be examined include the following: topographic patterns, surface water drainage patterns, magnetic anomalies, gravity anomalies, seismic data, geophysical logs, well cuttings and cores, existing lithologic and paleontologic descriptions, and aquifer test and ground-water quality data. Products will include an extensive data compilation, cross sections, fence diagrams, structure contour and isopach maps, transmissivity, specific capacity, and water quality maps. Three publications, one each on stratigraphy, structure, and hydrogeology are anticipated at this time. Tentative completion date: FY 1985.

GROUND WATER (Continued)

- ▷ GROUND-WATER STATIONS. W. R. Stokes. U.S. Geological Survey, Doraville, Ga. Period: continuing.

Objective: Collect water-level data sufficient to provide (1) a minimum long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and potential problems can be defined early enough to allow proper planning and management, and (2) provide a data base against which the short-term records acquired in areal studies can be analyzed. Such analyses will provide an assessment of the ground-water resource, allow prediction of future conditions, detect and define pollution and supply problems, and provide the data base necessary for management of the resource.

Progress: One hundred and four continuous water-level recorders were operated during the year. Approximately 1,146 periodic water-level observations were obtained at sites throughout the State. The preparation of well-inventory, water-level, and geologic data for entry into the National Water Data Storage and Retrieval System (WATSTORE) was continued. Historic daily water levels for several recording sites were entered in the daily values file. The report "Ground-Water Data For Georgia, 1981", was completed. Four quarterly data reports for sites in Chatham County were prepared and submitted to the cooperator.

- ▷ GEOHYDROLOGY OF GREENE, MORGAN, AND PUTNAM COUNTIES, GEORGIA. Thomas W. Watson, Georgia Geologic Survey. This is a reconnaissance-level investigation of a portion of the West Georgia Piedmont using available ground-water data. The objective of the report is to define the relationship of ground-water availability, chemical quality, and geology. At present, ground water accounts for about 40 percent of the total water use in the three-county area, with the exception of water used for thermoelectric and hydroelectric power production. The water is a moderately soft, slightly acidic, sodium silicate type, with a mean dissolved solids content of 140 milligrams per liter. The report will be completed in F.Y. 83.

SURFACE WATER

- ▷ APPRAISAL OF SEDIMENT SOURCES AND TRANSPORT IN KINGS BAY AND VICINITY, GEORGIA. Dean B. Radtke. U.S. Geological Survey, Doraville, GA. In cooperation with U.S. Navy. Period: continuing.

Objective: (1) Collect basic hydrologic estuarine data that are relevant to the determination of the source and transport of estuarine sediments; (2) evaluate the data to provide information on sediment sources and transport; and (3) document and report the findings of the investigation.

Progress: In November 1981, the U.S. Geological Survey conducted a preliminary investigation of the nature and magnitude of sediment transport in Kings Bay and vicinity for the U.S. Navy. Water-Resources Investigations 83-4060 by McConnell and others (1983) presents total discharge and suspended-sediment concentration and discharge data measured during a period of high tides in November 1981. The data indicate that the area in the vicinity of lower Kings Bay is accumulating deposits of suspended sediment transported from the St. Marys Entrance and Cumberland Sound on the floodtide and from upper Kings Bay and the tidal marsh drained by Marianna Creek on ebbtide. Water-quality, bottom-material, suspended-sediment, and current-velocity data were collected in Kings Bay and vicinity between July 8-16, 1982, to provide additional information on the sources and transport of estuarine sediments. A draft report has been prepared and reinforces many of the conclusions of the preliminary investigation.

- ▷ SEDIMENT STATIONS. William R. Stokes. U.S. Geological Survey, Doraville, Ga. In cooperation with U.S. Army Corps of Engineers, Mobile District. Period: continuing.

Objective: To provide a data base of sediment information for use in broad Federal and State planning and action programs and to provide data for management of interstate and intrastate waters.

Progress: Periodic collection and analysis of sediment samples continued at 23 continuous-record streamflow stations and were discontinued at two streamflow stations and sampling sites in the northwest Georgia coal area. Samples taken primarily during periods of high flow were obtained at additional stations. The storm-event sampling program with the Corps of Engineers (CoE) was maintained at five continuous-record streamflow stations in the vicinity of three major CoE projects. Primarily due to the lack of suitable storms, samples were obtained for only 8 events, instead of 10 as planned. The 1981 Water-Year Data were published and compilation of 1982 data for publication in the annual Water-Data Report was 50-percent completed. Several data requests were answered during the year and work on historic sediment-data compilation continued.

SURFACE WATER (Continued)

- ▷ SURFACE-WATER STATIONS. W. R. Stokes. U.S. Geological Survey, Doraville, Ga. Period: continuing.
- Objective: Collect surface-water data sufficient to satisfy needs for current-purpose uses, such as (1) assessment of water resources, (2) operation of reservoirs or industries, (3) forecasting, and (4) pollution control and disposal of wastes. Collect data necessary for analytical studies to define for any location the statistical properties, of, and trends in, the occurrence of water in streams, lakes, and estuaries for use in planning and design.
- Progress: At the beginning of the year one station was added to and one station was discontinued from the continuous-record network. During the year one discontinued station was reactivated and three other stations were discontinued. At the end of the year five other continuous-record stations also were terminated. Daily discharges were computed for 101 sites, peak stage and discharge were obtained at 105 peak-flow partial-record stations and base-flow discharge measurements were made at approximately 60 low-flow partial-record or miscellaneous sites in northwest Georgia. Final processing of 1981 water-year data was completed and the data report published. Computation and preparation of 1982 water-year data for publication was about 45 percent completed. A large number of miscellaneous requests for streamflow data were answered. In addition to routine operations, several concentrated data-collection, processing, and reporting activities were performed.
- ▷ TRACE METAL CHEMISTRY OF GEORGIA RIVERS AND ESTUARIES. Herbert L. Windom, Skidaway Institute of Oceanography. The objectives of this work are: (1) to precisely determine trace metal concentrations in Georgia rivers emptying into the Atlantic Ocean, (2) determine temporal variability and causes, if possible and (3) investigate how trace metals are transported through estuaries. No estimated completion date.

WATER QUALITY AND WATER USE

- ▷ AVAILABILITY AND USE OF WATER IN THE CHATTAHOOCHEE RIVER BASIN. S. Jack Alhadeff. U.S. Geological Survey, Doraville, Ga. In cooperation with U.S. Army Corps of Engineers, Mobile District. Period: 1982-1984.
Objectives: To compile current information as to water use (both withdrawal and discharge) temporally and spatially. The resulting data base will be merged with existing hydrologic data bases to provide a data base for subsequent low-flow modeling efforts and reports generation.
Progress: Data collected by the Georgia Water Use Project from the U.S. Geological Survey, the U.S. Environmental Protection Agency, the Soil Conservation Service, and the State ground-water and surface-water withdrawal and discharge files have been incorporated into a unified data base. At present the Chattahoochee River basin has approximately 1,400 sites and(or) entity entries, including 519 site-specific withdrawal or discharge entries and 304 site-specific irrigation entries. Of these 823 site-specific entries, 610 have latitudes and longitudes available. These data include municipal, industrial, irrigation, thermoelectric, and hydroelectric site entries, primarily from years 1980 and 1981. Monthly data are available at approximately 50 percent of the sites.
- ▷ EFFECTS OF LEAD SHOT ON WATER QUALITY IN A RESERVOIR AT COVINGTON, GA. H. William Boyd, Oxford College. This project is designed to evaluate the potential hazards to water quality which may exist due to the use of the Covington Reservoir as a skeet shooting range. The project will seek to map the concentration of lead in the reservoir and determine a) the effect of the spring turnover on lead distribution in the reservoir, b) the potential effect of low water levels on lead distribution and c) the efficiency of the water treatment plant in removing lead from the water. Expected completion date: August 1983.
- ▷ COMPARATIVE STUDY OF THE CAUSES AND EFFECTS OF RECENT SOUTHEASTERN DROUGHTS. Mark V. Paris, Carl G. Justus, Ga. Inst. of Tech. The visible effects in Georgia of the 1980-81 drought, such as lower-than-normal lake levels, caused much public concern. This study examines the effects of the 1980-81 drought and compares them to an earlier drought in 1954-55 to determine whether the effects were more severe than precipitation amounts alone would have indicated. The location of high pressure in the Gulf of Mexico is also examined to determine whether precipitation amounts in summer months can be related to changes in normal circulation patterns. Data on precipitation for Georgia cities, regions and the entire state, as well as Texas regional precipitation, are examined. Stream flows and lake levels in Georgia are examined and compared to statewide precipitation. Weather maps are examined for July and August in drought and non-drought years to determine circulation patterns.
The 1980-81 drought is found to be less severe in precipitation deficit than 1954-55 and the effects on stream flows and lake levels are found to be less severe than precipitation amounts alone would have indicated, when compared to 1954-55, with the exception of one lake. A relationship is found between changes in normal circulation patterns and lower-than-normal precipitation in Georgia. Some indications are found that high pressure in the eastern Gulf of Mexico might cause higher-than-normal precipitation in Gulf Coastal Texas, while high pressure in the western Gulf might cause lower-than-normal precipitation in Gulf Coastal Texas.
Key Words: lake levels, stream flows

WATER QUALITY AND WATER USE (Continued)

- ▷ USE OF WATER IN GEORGIA. Robert R. Pierce. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Dept. of Natural Resources, Ga. Geologic Survey. Period: continuing.

Objective: (1) to identify sources of water-use data; (2) to develop and evaluate techniques for collecting water-use data, especially data not in State agency files; (3) to identify requirements for a water-use data handling system; (4) to select and implement a Georgia water-use data handling system; and (5) to develop a system for sample verification of data reported to the State.

Progress: The Georgia Water Use Program has continued to obtain information of water withdrawal and discharge in a format most useful to State and District projects. Toward this goal R. R. Pierce, U.S. Geological Survey, and N. L. Barber, Georgia Geologic Survey, have assimilated site-specific data on municipal, industrial, thermoelectric, and hydroelectric categories for all of Georgia. This information, coupled with the existing site-specific irrigation-use data, will reside on a microcomputer system allowing ease of producing maps, reports, and presentation graphics. Procedures were established for annual updates of all categories of site-specific data. A procedure was designed and implemented to relate irrigation withdrawal data located by latitude and longitude to the oblique cartesian grid format used by ground-water models.

- ▷ QUALITY-OF-WATER STATIONS. William B. Stokes. U.S. Geological Survey, Doraville, Ga. In cooperation with Ga. Environmental Protection Div., Water Quality Section. Period: continuing.

Objective: To provide a data bank of water-quality information for broad planning and action programs and to provide data for management of rivers, lakes, and ground-water systems.

Progress: Continuous chemical-quality monitoring was maintained at five stream sites while periodic quality monitoring was accomplished at 100 sites. These data were furnished to cooperators. During the fourth quarter the periodic network was reduced to 91 sites. Continuous water-temperature data were collected at 13 sites and periodic temperatures were obtained at 101 surface-water sites. Radio-chemical and pesticide data were obtained for one water sample collected at the benchmark station and one bottom-deposit sample from this site was analyzed for pesticides. Two water samples from the Altamaha River at Everett City, one collected at high flow and the other at low flow, were analyzed for radio-chemical data. Pesticide determinations were made on one water sample and one bottom-deposit sample from this site. Periodic samples were collected and analyzed for chloride at water wells and nonrecurring chemical analyses were performed on samples collected from numerous other wells. The 1981 water-year data were compiled and published in the annual Water-Data Report, and preparation of 1982 data for publication was 55 percent completed. Many requests for water-quality data were processed during the year.

RELATED STUDIES

EDUCATION

- ▷ BIBLIOGRAPHY OF GEORGIA GEOLOGY, 1971-1979. Howard Ross Cramer, Geology Department, Emory University, Atlanta, Georgia 30322. Publications by and about Georgia are being identified, annotated, and indexed to county (or part of the state), subject, and geologic age where appropriate. Estimated completion time December, 1983

BIBLIOGRAPHY

- ▷ HISTORY OF GEOLOGICAL EDUCATION IN THE SOUTHERN AND BORDER STATES. James X. Corgan (Editor), Austin Peay State University, Clarksville, Tennessee. Fifteen articles on geological education in Georgia and other states. Spans 1817 through today. Tentatively accepted by the University of Alabama Press. Will probably be available in the summer of 1984.

SOME RECENT PUBLICATIONS AND PRESENTATIONS ON GEORGIA GEOLOGY AND HYDROGEOLOGY

- Abrams, C.E., and Ellwood, B.B., 1981, Magnetization of the Austell Gneiss, northwest Georgia Piedmont: Amer. Geol. Inst. mtg. (Nat'l).
- Abrams, C.E., and McConnell, K.I., 1981, Emplacement of the Austell Gneiss: implications regarding the timing of metamorphism and deformation in the Piedmont of Georgia: Geol. Soc. America mtg. (SE).
- Abrams, C.E., and McConnell, K.I., 1982, Lithologic and stratigraphic indicators for exploration in a high-grade, multiply deformed terrain, western Georgia Piedmont: symp., Exploration for metallic resources in the Southeast.
- Abrams, C.E., and McConnell, K.I., 1982, Banded iron formation: a key marker unit for massive sulfide exploration in the high-grade metamorphic terrane of western Georgia: Geol. Soc. America mtg. (SE).
- Abrams, C.E., and McConnell, K.I., 1983, Geologic setting of volcanogenic base and precious metal deposits of the west Georgia Piedmont: a multiply deformed metavolcanic terrain: Econ. Geology (submitted).
- Abrams, C.E., McConnell, K.I., Sanders, R.P., and Pate, M.L., 1981, Economic potential of a metavolcanic sequence in the Piedmont of northwestern Georgia: Geol. Soc. America mtg. (SE).
- Andrejko, M.J., Contributions of ash and silica by the major peat-producing plants in the Okefenokee Swamp-Marsh Complex, in Okefenokee Swamp: its natural history, geology and geochemistry: Columbia, SC, Wetland surveys (in press).
- Andrejko, M.J., Cohen, A.D., and Gerbeth-Jones, S., Scanning electron microscopy of common Silicophytoliths from the Okefenokee Swamp-Marsh Complex, in Okefenokee Swamp: its natural history, geology and geochemistry: Columbia, SC, Wetland surveys (in press).
- Andrejko, M.J., Cohen, A.D., Raymond, R., Jr., Bardin, S.W., and Knight, R.A., 1982, The stratigraphic distribution of inorganic constituents within Okefenokee peats: a cross-sectional comparison through two major peat-forming environments (abs.): Geol. Soc. America, abs. with programs, v. 14, no. 7, p. 433.
- Andrejko, M.J., Fiene, F., and Cohen, A.D., The comparison of ashing techniques for the determinations of inorganic content of peat, in Jarett, P.M., ed., Testing of peats and organic soils, ASTM-STP 820: Phila., Amer. Soc. Testing and Materials (in press).
- Andrejko, M.J., and Raymond, R., Jr. Occurrence of detrital mineral matter in Okefenokee peats: Microbeam analysis—1983 (in press).
- Andrejko, M.J., Raymond, R., Jr., and Bardin, S.W., Bioerosion of biogenically produced silica substrates in Okefenokee peats, in Okefenokee Swamp: its natural history, geology and geochemistry: Columbia, SC, Wetland surveys (in press).
- Andrejko, M.J., Raymond, R., Jr., and Cohen, A.S., 1982, SEM observation of dissolution features on fresh water sponge spicules: Scanning electron microscopy, 1982/II, p. 629-638.
- Andrejko, M.J., Raymond, R., Jr., Ehrlich, R., and Cohen, A.D., 1982, Evidence for pervasive bioerosion of silica substrates in a freshwater peat environment (abs.): Amer. Assoc. Petroleum Geologists Bull. 66, no. 5, p. 543.
- Arden, D.D., Beck, B.F., and Morrow, E.F., eds., 1982, Second symposium on the geology of the Southeastern Coastal Plain: Ga. Geol. Survey and Ga. Southwestern College, Info. Circ. 53, 219 p.
- Arora, Ram, 1981, Waste disposal effects on ground water in the Coastal Plain of Georgia: Amer. Water Resources Assoc. mtg.

- Arora, Ram, 1982, Ground-water quality in lower Miocene phosphatic zones of the Georgia Coastal Plain: Geol. Soc. America mtg. (Nat'l.).
- Arora, Ram, 1983, Hydrologic framework for Coastal Plain aquifer systems of Georgia: Conf. on the water resources of Georgia and adjacent areas, Ga. Inst. Technology, Oct. 1983.
- Arora, Ram, ed., 1984, Hydrologic evaluation for underground injection control in the Coastal Plain of Georgia: Ga. Geol. Survey Hydro. Atlas 10 (in preparation).
- Arora, Ram, and Gorday, L.L., 1983, An evaluation of the ground-water resources of the Coastal Plain aquifers in Georgia: Geol. Soc. America mtg. (SE).
- Arora, Ram, McFadden, S.S., and Perriello, P.D., 1982, Ground-water monitoring program of Georgia's Coastal Plain aquifers: Nat'l. Water Well Assoc. mtg.
- Atkins, R.L., 1982, Occurrence of sillimanite in Fayette County, Georgia: Ga. Geol. Survey Geol. Rpt. 4.
- Atkins, R.L., and Griffin, M.M., 1984, Geologic guide to High Falls State Park: Ga. Geol. Survey Geol. Guide 8 (in press).
- Atkins, R.L., Higgins, M.W., and Grant, W.H., 1981, Mode of emplacement of granites in the Atlanta area, southeastern Appalachian Piedmont: Geol. Soc. America mtg. (SE).
- Barber, N.L., 1983, A microcomputer-based data system for management of Georgia's water-use information: Conf., Urban and Regional Information Systems Assoc.
- Barber, N.L., 1983, Integrating irrigation water-use information into Georgia's water-management program: Nat'l. Water Well Assoc., East regional conf. on ground-water management.
- Barrett, J.S., 1984, Geologic atlas of northwest Georgia: Ga. Geol. Survey Open-file Rpt. (in press).
- Beck, B.F., 1982, The permeability of the Tallahatta aquifer in its outcrop area: Ga. Geol. Survey Open-file Rpt. 82-3.
- Behrendt, J.C., 1982, Multichannel seismic reflection profiles crossing South Carolina, Georgia, and the adjacent continental margin: description of major features (abs.), in EOS, v. 63, no. 45, p. 1033.
- Bowman, J.K., and Manker, J.P., 1982, Smectite-rich clays associated with an Oligocene algal reef: Ga. Jour of Science, v. 40, p. 20.
- Boyle, J.R., and O'Connor, B.J., 1982, The mineral industry of Georgia: U.S. Bur. Mines Minerals Yearbook, 1980, v. II, p. 139-151.
- Boyle, J.R., and O'Connor, B.J., 1982, The mineral industry of Georgia: U.S. Bur. Mines Minerals Yearbook, 1981, v. II, p. 139-152.
- Carter, R.F., 1983, Average annual rainfall and runoff in Georgia, 1941-70: Ga. Geol. Survey Hydro. Atlas 9.
- Clarke, J.S., Faye, R.E., and Brooks, R., 1983, Hydrogeology of the Providence Aquifer of Southwest Georgia: Ga. Geol. Survey Hydro. Atlas 11.
- Cohen, A.D., and Andrejko, M.J., Premaceral contents of peats correlated with "Proximate and Ultimate Analyses": invited paper, Symposium on chemical constituents in coal (Seattle), Amer. Chem. Soc., (in press).
- Cohen, A.D., Andrejko, M.J., Bardin, S.W., and Knight, R.A., 1982, Using vertical and lateral variations in peat deposits of the Okefenokee Swamp for predicting compositional variations in intershoreline coal seams (abs.): Geol. Soc. America, abs. with program, v. 14, no. 7, p. 465.
- Cohen, A.D., Andrejko, M.J., Casagrande, D. J., and Best, R.G., eds., Andrejko, M.J., coordinator and compiler, Okefenokee Swamp: its natural history, geology and geochemistry: Columbia, SC, Wetland surveys (in press).

- Cohen, A.D., Andrejko, M.J., and Corvinus, D.A., Geometry and developmental history of the Okefenokee peats, in Okefenokee Swamp: its natural history geology and geochemistry: Columbia, SC, Wetland surveys (in press).
- Cook, R.B., and Burnell, J.R., 1983, Geology of the Dahlonega District, Georgia: Geol. Soc. America, abs. with programs, p. 109.
- Corgan, J.X., ed., 1982, The geological sciences in the antebellum South: Univ. Alabama Press.
- Costello, J.O., and McConnell, K.I., 1981, Recumbent folding in the Blue Ridge of northwestern Georgia: implications on the intensity of early deformation in the southern Blue Ridge: Geol. Soc. America. (SE).
- Costello, J.O., McConnell, K.I., and Power, W.R., 1983, Geology of late Precambrian and early Paleozoic rocks in and near the Cartersville District, Georgia: Ga. Geol. Soc., 17th ann. mtg.
- Crawford, T.J., 1983, High Point and Steven Gap Faults, Lookout Mountain, Georgia (abs.): Ga. Jour. of Science, v. 41, nos. 1 and 2, p. 22.
- Crawford, T.J., and Cressler, C.W., 1982, Talladega "Series," Great Smoky fault, and Emerson fault: relationships in the Cartersville area, Georgia: Geol. Soc. America Spc. Paper 191, p. 31-34.
- Cressler, C.W., Thurmond, C.J., Hester, W.G., 1983, Ground water in the Greater Atlanta Region, Georgia: Ga. Geol. Survey Info. Circ. 63, 144 p.
- Dooley, R.E., and Wampler, M.J., 1983, Potassium-argon relations in diabase dikes of Georgia—the influence of excess ^{40}Ar on the geochronology of early Mesozoic igneous and tectonic events, in Gohn, G.S., ed., Studies related to the Charleston, South Carolina, earthquake of 1886—tectonics and seismicity: U.S. Geol. Survey Prof. Paper 1313-M.
- Ellwood, B.B., and Abrams, C.E., 1982, Magnetization of the Austell Gneiss, northwest Georgia Piedmont: Jour. Geophys. Research.
- Frederiksen, N.O., and others, 1982, Paleocene-Eocene boundary in the eastern Gulf Coast: Gulf Coast Assoc. Geol. Socs., Trans. v. XXXII, p. 289-294.
- Gair, J.E., 1982, Mineral resource potential map of the Cohutta Wilderness and Hemp Top roadless area, northern Georgia and southeastern Tennessee: U.S. Geol. Survey Map MF 1415-C, scale 1:48,000.
- Gair, J.E., 1983, Geochemical survey of the Cohutta Wilderness and Hemp Top roadless area, northern Georgia and southeastern Tennessee: U.S. Geol. Survey Map MF 1415-B, scale 1:48,000.
- Gardiner, C.L., 1981, Geohydrologic mapping of aquifers in Georgia for underground injection control: Amer. Water Resources Assoc. mtg.
- Georgia Geologic Survey, 1981, Status report: the accelerated ground-water program: Open-file Rpt. 82-6.
- Georgia Geologic Survey, 1982, Status report: the accelerated ground-water program: Open-file Rpt. 83-2.
- Georgia Geologic Survey, 1982, Status report: underground injection control: geohydrologic mapping of the Georgia aquifers July 1980 through September 1982: Open-file Rpt. 83-3.
- Georgia Geologic Survey, 1983, Bibliography and index of Georgia geology, 1980 through 1982: Open-file Rpt. 84-5.
- Georgia Geologic Survey, 1983, Status report: the accelerated ground-water program: Open-file Rpt. 84-1.
- Gibson, T.G., and Bybell, L.M., 1981, Facies changes in the Hatchetigbee Formation in Alabama-Georgia, and the Wilcox Group-Claiborne unconformity: Gulf Coast Assoc. Geol. Socs., Trans., v. 31, p. 301-306.
- Gorday, L.L., 1983, The hydrogeology of Richmond County, Georgia: Conf. on the water resources of Georgia and adjacent areas, Ga. Inst. Technology, Oct. 1983.

- Gorday, L.L., Hydrogeology of Richmond and northern Burke Counties: Ga. Geol. Survey Info. Circ. 61 (in preparation).
- Grant, W.H., and Atkins, R.L., 1983, Emplacement of the Stone Mountain granite: Geol. Soc. America mtg. (SE).
- Griffin, M.M., 1982, Geologic guide to Cumberland Island National Seashore: Ga. Geol. Survey Geol. Guide 6.
- Griffin, M.M., 1983, Georgia's barrier islands—changelings of the coast, in Coastlines (spring issue): Brunswick, Ga., Ga. Dept. Natural Resources, Coastal Resources Div.
- Griffin, M.M., 1983, Georgia shoreline changes 1857-1974: Geol. Soc. America mtg. (SE).
- Griffin, M.M., and Atkins, R.L., Geologic guide to Cloudland Canyon State Park: Ga. Geol. Survey Geol. Guide 7 (in press).
- Griffin, M.M., and Henry, V.J., Historical changes in the mean high-water shoreline of Georgia, 1851-1982: Ga. Geol. Survey Bull. 98 (in preparation).
- Hack, J.T., 1982, Physiographic divisions and differential uplift in the Piedmont and Blue Ridge: U.S. Geol. Survey Prof. Paper 1265.
- Hanley, T.B., 1982, The Lake Oliver synform and the structure of the Uchee Belt in Columbus, Georgia: Geol. Soc. America, abs with programs, v. 14, nos. 1 and 2, p. 23.
- Hanley, T.B., 1983, Deformed masses in the Uchee Belt: evidence for its early nature: Geol. Soc. America, abs. with programs, v. 15, no. 2, p. 91.
- Hanley, T.B., 1983, Geology of the Uchee Belt, Columbus and vicinity: fieldtrip guide, Columbus, College, Columbus, Ga., 96 p. (available, Columbus College Bookstore).
- Hart, S.W., 1981, Sanitary landfill siting in karst topography, Dougherty County, Ga.: Amer. Water Resources Assoc. mtg.
- Hart, S.W., and Arora, Ram, 1982, Waste disposal siting in the carbonate terrange of southwest Georgia: Geol. Soc. America mtg. (SE/NE).
- Hart, S.W., Olney, S.L., and Robinson, M.F., 1983, Status report: well construction diagrams for the accelerated ground-water program through June 30, 1982: Ga. Geol. Survey, Open-file Rpt. 84-2.
- Hatcher, R.D., Jr., Hooper, R.J., Petty, S.M., and Willis, J.D., 1983, Tectonics of emplacement and origin of Appalachian ultramafic bodies: Amer. Jour. of Science (in review).
- Hatcher, R.D., Jr., and Viele, G.W., 1983, The Appalachian/Ouachiata Orogens: United States and Mexico, in Palmer, A.R., ed., Perspectives in regional geological synthesis, DNAG Spc. Pub. 1, p. 67-76.
- Hauck, M.L., and Pate, M.L., 1982, Flood hazard literature: annotated selections for Georgia: Ga. Geol. Survey Circ. 6.
- Hayes, L.R., Maslia, M.L., and Meeks, W.C., 1983, Hydrology and model evaluation of the principal artesian aquifer, Dougherty Plain, southwest Georgia: Ga. Geol. Survey, Bull. 97.
- Henry, V.J., Giles, R.T., and Harding J.L., 1982, Geological evaluation of potential pipeline corridor sites along the Georgia coast, in Arden, D.D., Beck, B.F., and Morrow, E., eds., Proceedings: Second symposium on petroleum geology of the southeastern Coastal Plain: Ga. Geol. Survey Info. Circ. 53.
- Hetrick, J.H., 1982, Clay mineral distributions in the central Georgia kaolin district: Ga. Geol. Survey Open-file Rpt. 82-4, 57 p.

- Hetrick, J.H., and Friddell, M.S., 1983, A geologic study of the central Georgia kaolin district, Parts I, II, and III: Ga. Geol. Survey, Open-file Rpt. 83-1, 56 p., 22 pl.
- Hetrick, J.H., and Friddell, M.S., Clay mineralogy of the Hawthorne Group: Ga. Geol. Survey (in preparation).
- Higgins, M.W., and Atkins, R.L., 1982, Geology of the Piedmont between the Brevard and Towaliga Fault Zones in the Atlanta and Griffin, Ga., 1° and 30', 1:100,000-scale quadrangles: Geol. Soc. America mtg. (SE/NE)
- Hooper, R.J., and Hatcher, R.D., Jr., Formation mechanisms of mylonites: Towaliga Fault Zone, central Georgia: Geol. Soc. America Bull. (in review).
- Huddlestun, P.F., 1983, The stratigraphy of the marine terrace region of eastern Georgia: Geol. Soc. America mtg. (SE).
- Huddlestun, P.F., 1984, COSUNA correlation charts of Florida and the Coastal Plain of Georgia: Ga. Geol. Survey Info. Circ. 54B (in press).
- Huddlestun, P.F., and Hetrick, J.H., 1984, Stratigraphy of the Barnwell Formation: Ga. Geol. Survey Bull. 95 (in press).
- Hughes, E.H., and Sherr, E.B., 1983, Subtidal food webs in a Georgia estuary: $\delta^{13}\text{C}$ analysis: J. exp. mar. Biol. Ecol., v. 67, p. 1-16.
- Hurst, V.J., 1982, Gold resources of Georgia: phase 1 report on gold in the east-central Georgia district: Ga. Geol. Survey Open-file Rpt. 82-7.
- Lee, C.K., and Dainty, A.M., 1982, Seismic structure of the Charlotte and Carolina Slate Belts of Georgia and South Carolina: Earthquake Notes, v. 53, no. 2, p. 23-37.
- Long, L.T., 1982, Seismicity of Georgia, in Arden, D.D., Beck, B.F., and Morrow, E., eds., Second symposium on the petroleum geology of the southeastern Coastal Plain: Ga. Geol. Survey Info. Circ. 53.
- Lowell, R.P., 1982, The beach erosion crisis: legal solutions to a geologic problem: Woodrow Wilson Jour. of Law, v. 4, p. 83-108.
- Mack, D.M., 1983, Maintaining compliance with the national flood insurance program: Ga. Geol. Survey Circ. 8 (in press).
- Mack, D.M., and Pate, M.L., 1982, Detailed flood studies in Georgia: index map: Ga. Geol. Survey, scale 1:500,000.
- Mack, D.M., Pate, M.L., and Olney, S.L., 1984, Sources of flood data for Georgia counties: Ga. Geol. Survey Open-file Rpt. 84-6, A and B.
- Macda, M., and Windom, H.L., 1982, Behavior of uranium in two estuaries of the Southeastern United States: Marine chemistry, II, p. 427-436.
- Manker, J.P., 1983, Helium emanometry and the Andersonville fault: Ga. Jour. of Science, v. 41.
- Manker, J.P., Harris, R.W., and Able, A.S., 1982, Clay mineralogy of the Flint, Chattahoochee, Apalachicola River system: Ga. Jour. of Science, v. 40, p. 20.
- McConnell, K.I., and Abrams, C.E., 1981, Preliminary geologic maps of the Atlanta regional area, Atlanta, Georgia: Geol. Soc. America mtg. (Nat'l.).
- McConnell, K.I., and Abrams, C.E., compilers, 1982, Geology of the Atlanta region: preliminary maps: Ga. Geol. Survey Open-file Rpt. 82-5.

- McConnell, K.I., and Abrams, C.E., 1982, Geology of the New Georgia Group and associated massive sulfide and gold deposits: west-central Georgia: Symp. guidebook, Exploration for metallic resources in the Southeast.
- McConnell, K.I., and Abrams, C.E., 1982, Geology of the New Georgia Group and associated sulfide and gold deposits: west-central Georgia: Soc. Econ. Geologists, ann. mtg. fieldtrip guidebook.
- McConnell, K.I., and Abrams, C.E., 1983, Geochemistry of metamorphosed banded iron formation and aluminosilicate assemblages associated with stratiform massive sulfide deposits in western Georgia: Geol. Soc. America mtg. (SE).
- McConnell, K.I., and Abrams, C.E., 1984, Geology of the Atlanta region: Ga. Geol. Survey Bull. 96 (in press).
- McConnell, K.I., and Costello, J.O., 1981, The relationship between the Talladega Group and Ocoee Super-group near Cartersville, Ga.: Geol. Soc. America mtg. (SE).
- McConnell, K.I., and Costello, J.O., 1982, Basement-cover rock relationships along the western edge of the Blue Ridge thrust sheet in Georgia: Geol. Soc. America mtg. (SE).
- McConnell, K.I., and Costello, J.O., 1982, The relationship between Talladega Belt rocks and Ocoee Super-group rocks near Cartersville, Ga.: Geol. Soc. America Spec. Paper 191.
- McConnell, K.I., and Costello, J.O., 1983, Basement-cover rock relationships along the western edge of the Blue Ridge thrust sheet in Georgia: Geol. Soc. America Spec. Paper 194.
- McFadden, S.S., 1983, Hydrogeology of the Clayton and Claiborne aquifers, southwestern Georgia: Conf. on the water resources of Georgia and adjacent areas, Ga. Inst. Technology, Oct. 1983.
- McFadden, S.S., and Pate, M.L., 1983, Hydrogeologic interpretation for the Georgia underground injection control program: Geol. Soc. America mtg. (SE).
- McFadden, S.S., and Perriello, P.D., 1981, The hydrology of the Clayton and Claiborne aquifers in southwest Georgia: Amer. Water Resources Assoc. mtg.
- McFadden, S.S., and Perriello, P.D., 1983, Hydrogeology of the Clayton and Claiborne aquifers in southwest Georgia: Ga. Geol. Survey Info. Circ. 55.
- McFadden, S.S., Perriello, P.D., and Rodenbeck, S.A., 1983, Ground-water availability from the Clayton and Claiborne aquifers, southwest Georgia: Geol. Soc. America mtg. (SE).
- McLemore, W.H., 1981, Georgia programs related to ground-water management: Southeastern conf. on ground-water management.
- McLemore, W.H., 1981, Monitoring well construction for hazardous waste sites: Amer. Soc. Civil Engrs. (Nat'l.).
- McLemore, W.H., 1982, Georgia Coastal Plain faults as possible pathways for upward migrating salty connate waters: Geol. Soc. America mtg. (Nat'l.).
- McLemore, W.H., 1983, Accomplishments of the accelerated ground-water program: Conf. on the water resources of Georgia and adjacent areas, Ga. Inst. Technology, Oct. 1983.
- McLemore, W.H., 1983, Interrelationship between Juro-Triassic graben blocks and shallower structures of the Georgia Coastal Plain: Geol. Soc. America mtg. (SE).
- Morris, L.J., 1984, Geologic guide to Providence Canyon State Park: Ga. Geol. Survey, Geol. Guide 9 (in press).
- Nesbit, K., and Olney, S.L., 1983, Guidance manual for flood elevation determination in Georgia: Ga. Geol. Survey Open-file Rpt. 84-4 (in press).

- O'Connor, B.J., 1983, Ceramic and structural clay, shale and slate deposits in the Valley and Ridge Province of northwest Georgia: Geol. Soc. America mtg. (SE), abs. with programs, v. 15, no. 2, p. 101.
- O'Connor, B.J., 1983, General geology of the Atlanta area, in Burden, G.E., ed., 34th ann. highway geology symposium and fieldtrip: Ga. Dept. Transportation, 56 p.
- O'Connor, B.J., 1983, Geology of the Stone Mountain Granite, in Burden, G.E., ed., 34th ann. highway geology symposium and fieldtrip: Ga. Dept. Transportation, 56 p.
- O'Connor, B.J., 1983, Mount Arabia Park, in Burden, G.E., ed., 34th ann. highway geology symposium and fieldtrip: Ga. Dept. Transportation, 56 p.
- O'Connor, B.J., Dooley, R.E., and McConnell, K.I., 1982, Compilation of published isotopic ages in the Atlanta regional map, in McConnell, K.I., and Abrams, C.E., compilers, Geology of the Atlanta region—preliminary maps: Ga. Geol. Survey, Open-file Rpt. 82-5b, 9 p.
- Odom, A.L., Hatcher, R.D., Jr., and Hooper, R.J., 1982, A pre-metamorphic tectonic boundary between contrasting Appalachian basements, southern Georgia Piedmont: Geol. Soc. America, abs. with programs, v. 14, p. 579.
- Pate, M.L., 1982, Federal and state roles in flood plain management: Natural Hazards Observer.
- Pate, M.L., 1982, Insuring the local programs meet federal flood insurance guidelines: Amer. Bar Assoc., Spec. committee on housing and urban development law.
- Pate, M.L., 1983, Introduction to urban stormwater management in Georgia: Ga. Geol. Survey Circ. 9 (in press).
- Pate, M.L., and Mack, D.M., 1983, Low-cost approaches to flood hazard mitigation: case study: Amer. Water Resources Assoc. conf., Analysis and management of land drainage and floodwaters.
- Pierce, R.R., and Barber, N.L., 1981, Georgia water-use data system: Ga. Academy of Science.
- Pierce, R.R., and Barber, N.L., 1981, Water use in Georgia, 1980—a preliminary report: Ga. Geol. Survey Circ. 4.
- Pierce, R.R., and Barber, N.L., 1982, Water use in Georgia, 1980—summary: Ga. Geol. Survey Circ. 4-A.
- Pierce, R.R., and Barber, N.L., 1983, Organizing Georgia's water use data for effective management: Nat'l. Water Well Assoc.
- Pierce, R.R., and Barber, N.L., 1983, Water-use data input for aquifer and streamflow models: Geol. Soc. America mtg. (SE).
- Pierce, R.R., Barber, N.L., and Stiles, H.R., 1982, Water use in Georgia by county for 1980: Ga. Geol. Survey Info. Circ. 59.
- Pierce, R.R., Barber, N.L., and Stiles, H.R., 1983, Georgia irrigation systems 1970-1980: a decade of growth: U.S. Geol. Survey Water Resources Invs. 83-4177 (in press).
- Prowell, D.C., 1982, The effects of Cretaceous and younger faulting on Coastal Plain rocks around Augusta, Georgia (abs.), in Proceedings: Second symposium on the geology of the southeastern Coastal Plain: Ga. Geol. Survey Info. Circ. 53, 219 p.
- Raymond, R., Jr., Gooley, R., Davies, T.D., and Andrejko, M.J., 1982, Electron microanalysis: Providing both quantitative and qualitative answers in the study of peat and coal (abs.): CONFAB '82, Laramie ETC (Saratoga, Wyo.).
- Ripy, B.J., and Gernazian, A.M., 1981, Hydrogeology of the Claiborne and Clayton Aquifers, southwest Georgia: Geol. Soc. America mtg. (Nat'l.).

- Ripy, B.J., and Gernazian, A.M., and Hill., C., 1981, Hydrogeology of the Claiborne and Clayton Aquifers, southwest Georgia: Ga. Academy of Science.
- Robinson, M.F., and Pate, M.L., 1983, Flood hazard priority scores for Georgia communities with flood plain areas: Ga. Geol. Survey Open-file Rpt. 84-3 (in press).
- Scherer, R.P., Cohen, A.D., Andrejko, M.J., Raymond, R., Jr., and Gooley, R., 1982, Freshwater diatom assemblages from surface peats of the Okefenokee Swamp-marsh complex of southern Georgia (abs.): Geol. Soc. America, abs. with programs, v. 14, no. 7, p. 600.
- Schroder, C.H., 1982, Trace fossils of the Upper Cretaceous-Lower Tertiary (formerly Tuscaloosa Formation) and basal Jackson Group, east-central Georgia: Ga. Geol. Survey Bull. 88.
- Sherr, E.B., 1982, Stable carbon isotope composition of organic seston and sediments in a Georgia salt marsh estuary: Geochim. Cosmochim. Acta 46, p. 1227-1232.
- Trout, M.F., and Jones, F.B., 1982, A geophysical investigation of aeromagnetic anomalies in Stewart, Webster, Terrell, Randolph, and Quitman Counties, Georgia: Ga. Jour. of Science, v. 40, p. 18
- Valentine, P.C., 1982, Upper Cretaceous subsurface stratigraphy and structure of coastal Georgia and South Carolina: U.S. Geol. Survey Prof. Paper 1222.
- Vincent, H.R., 1982, Geohydrology of the Jacksonian Aquifer in central and east-central Georgia: Ga. Geol. Survey, Hydro. Atlas 8.
- Vincent, H.R., 1983, Geoscience testing facilities in Georgia, 1982: Ga. Geol. Survey, Circ. 7.
- Vincent, H.R., 1984, Geologic map of the Siloam granite: Ga. Geol. Survey Geol. Map 1.
- Vincent, H.R., and Arora, Ram, 1983, Geohydrology of the Jacksonian-age sediments for central and east-central Georgia: Geol. Soc. America mtg. (SE).
- Wadsworth, J.R., Jr., 1982, Structural control of drainage morphology of salt marshes on St. Catherine's Island, Georgia: Athens, Ga. Sea Grant Program, Tech. Rpt. 82-1, 43 p.
- Wadsworth, J.R., Jr., Brook, G.A., and Carver, R.E., 1983, Surface expression of heavily mantled interstratal karst bordering Okefenokee Swamp, Georgia: Proceedings, 1983 ann. mtg., Amer. Soc. Photogrammetry, Mar. 13-18, 1983 (Washington, D.C.), p. 463-470.
- Watson, T.W., 1981, Geohydrology of the Dougherty Plain and adjacent area, southwest Georgia: Amer. Water Resources Assoc. mtg.
- Watson, T.W., 1983, Geohydrology of the principal artesian aquifer in southwest Georgia: Geol. Soc. America mtg. (SE).
- Watson, T.W., 1984, Geohydrology of Greene, Morgan, and Putnam Counties: Ga. Geol. Survey Info. Circ. 60 (in preparation).
- Weaver, C.E., and others, Shale-slate metamorphism in southern Appalachians: Elsevier (in press).

GEORGIA GEOLOGIC SURVEY

RESEARCH CONTRACTS, 1983—84

- Aral, M.M. (Ga. Institute of Technology) - Technical advice and technical review regarding crystalline rocks in Georgia.
- Allen, Nancy Edwards (Auburn University) - Geology of certain galena-bearing gold deposits in Hall and Gwinnett Counties, Georgia.
- Hartshorn, Truman (Ga. State University) - Evaluation and assessment of the technical feasibility of the storage of high-level radioactive waste in a crystalline rock depository.
- Heinrich, Nathan (Auburn University) - Ultramafic rocks of Lumpkin and White Counties, Georgia.
- Henry, V.J. (Ga. State University) - Services related to marine geology investigations.
- Hooper, Robert J. (University of South Carolina) - Tectonic setting, petrology, and geochemistry of the Gladesville mafic complex, central Georgia Piedmont.
- Hurst, Vernon J. (University of Georgia) - Research services related to mineral resource investigation.
- Jordan, Tony (Emory University) - Mapping of the structural geology of Chestnut Mountain 7.5-minute quadrangle, Georgia.
- Koch, Georgia (University of Georgia) - Geochemical atlas of Georgia.
- Kyle, J. Philip (University of Georgia) - Geology of the southern part of the Dallas 7.5-minute quadrangle, Georgia.
- Lovingood, Daniel (University of Georgia) - The geology of the southern one-third of the Philomath and northern one-third of the Crawfordville, Georgia, quadrangles.
- Parker, William (University of Georgia) - Geology of the Broad 7.5-minute quadrangle, Georgia.
- Rhea, Wendell (University of Georgia) - Comparison of Quaternary shoreline sequences in Georgia.
- Schoenborn, William (Miami University, Oxford, Ohio) - Geologic map of the Gainesville 7.5-minute quadrangle, Georgia.
- Size, William B. (Emory University) - Technical advice and technical review regarding crystalline rocks in Georgia.
- Stieve, Alice L. (Emory University) - Geology of the southern half of the Johnstonville 1:24,000 quadrangle, Georgia.
- Turner, William L., Jr. (University of Georgia) - Geology of the Vesta 1:24,000 quadrangle, Georgia.
- Whitney, J.A. (University of Georgia) - Assessment of Georgia Geologic Survey needs in geochemistry.
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