BULLETIN 89

ABSTRACTS OF THESES ON GEORGIA GEOLOGY THROUGH 1974

compiled and edited by

Falma Moye

STATE OF GEORGIA
DEPARTMENT OF NATURAL RESOURCES
Joe D. Tanner, Commissioner

EARTH AND WATER DIVISION
THE GEOLOGICAL SURVEY OF GEORGIA
Sam M. Pickering, State Geologist and Division Director

ATLANTA
1976

For convenience in selecting our reports from your bookshelves, they will be color-keyed across the spine by subject as follows:

Red	Valley & Ridge mapping and structural geology
Dk. Purple	Piedmont & Blue Ridge mapping and structural geology
Maroon	Coastal Plain mapping and stratigraphy
Lt. Green	Paleontology
Lt. Blue	Coastal Zone studies
Dk. Green	Geochemical and Geophysical studies
Dk. Blue	Hydrology
Olive	Economic geology Mining directory
Yellow	Environmental studies Engineering studies
Dk. Orange	Bibliographies and lists of publications
Brown	Petroleum and natural gas
Black	Field trip guidebooks.

Colors have been selected at random, and will be augmented as new subjects are published.

CONTENTS

ILLUSTRATIONS

ABSTRACTS FROM DISSERTATIONS AND THESES ON GEORGIA GEOLOGY

compiled by

Falma J. Moye

FOREWORD

This volume represents an attempt to compile abstracts from all graduate theses and dissertations concerned with the geology of Georgia. We have not sought abstracts of papers indirectly related to Georgia. We realize that some theses and dissertations that should have been included may have been left out. Any omissions should be reported to the Georgia Geological Survey so they can be included in the next edition.

Author's abstracts were used when available. In the case of theses without abstracts, the compiler either used the author's summary and conclusions or abstracted the work. These are noted respectively AUTHOR'S CONCLUSIONS and COMPILER'S ABSTRACT.

Publications, either abstracts or complete works, resulting from theses and dissertations have been noted with the abstract. Theses are available through the library of the school at which the work was done. Advisors, when known, are noted in parentheses.

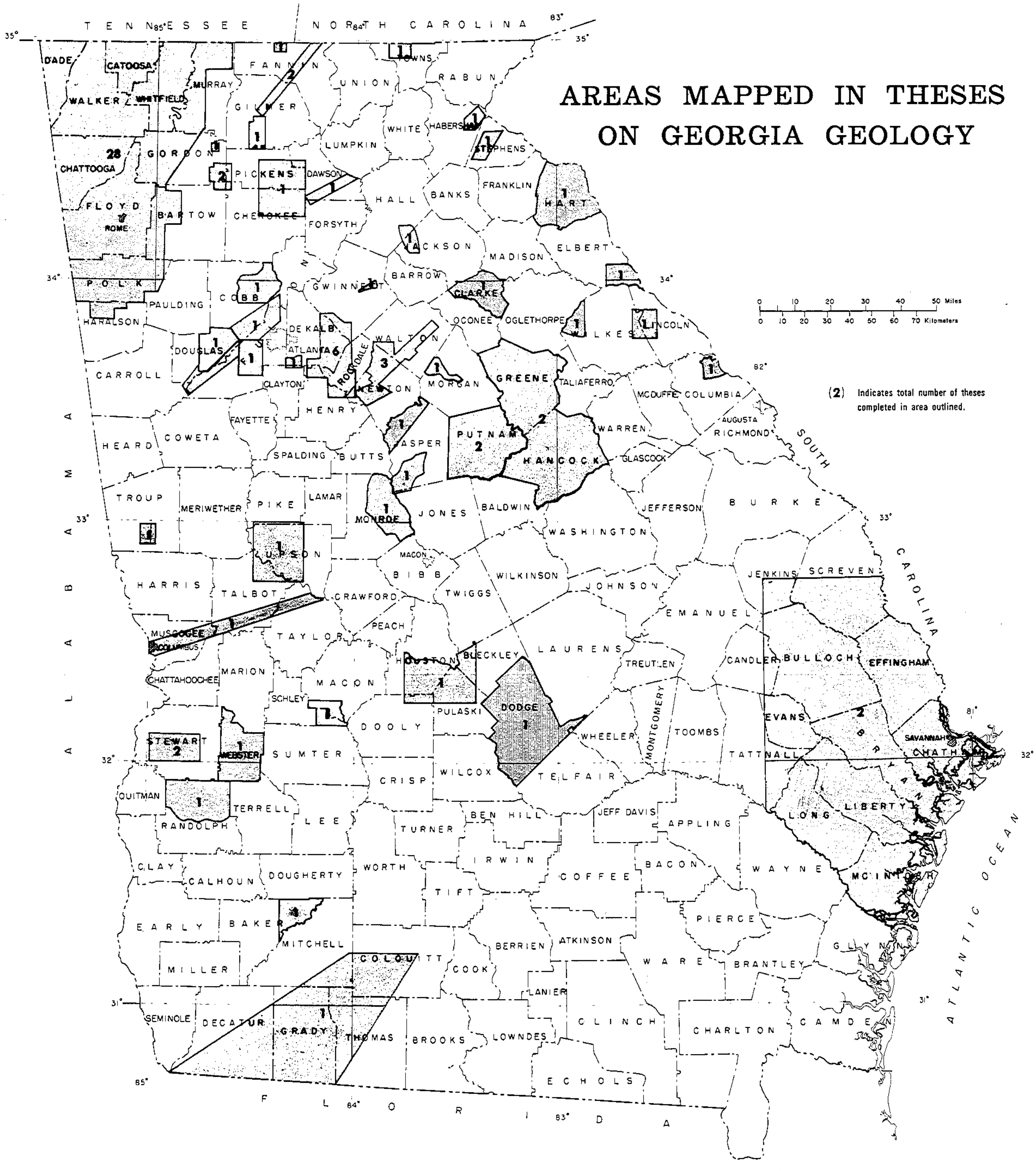
Where necessary, thesis titles have been annotated with county names. No attempt has been made to bring capitalization of stratigraphic terms into conformity with present usage.

We thank all the people who assisted in this work, especially Ms. Eleanore Morrow, who patiently typed and retyped numerous pages, and Ms. Carol White, who assisted in obtaining theses. Dr. Howard Cramer of Emory University gave advice and information on preparing the subject index.

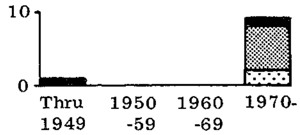
Most deserving of appreciation and recognition are those students who wrote brief, informative abstracts.

Falma J. Moye
Compiler

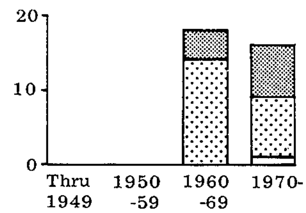
AREAS MAPPED IN THESES ON GEORGIA GEOLOGY



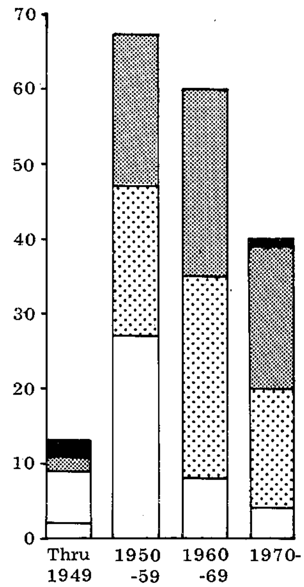
Graphs Showing Distribution of Theses
by School, Decade and Area



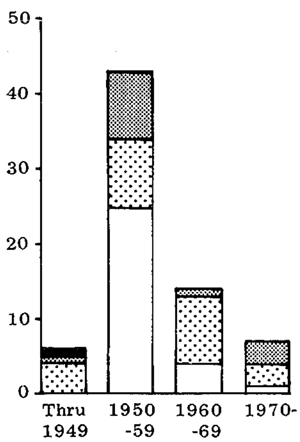
Georgia Institute
of Technology



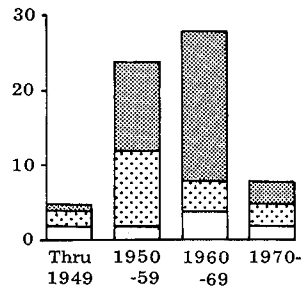
University of Georgia



All



Emory University



Others

Northwest Georgia

Piedmont

Coastal Plain

Miscellaneous

Scale: 1/20 inch = 1 thesis

Albritton, John Allen, 1955, Sedimentary Features of the Sewanee Conglomerate [Pennsylvanian]: Emory University, MS thesis, 52 p. (Arthur T. Allen)

Author's Abstract

The Pennsylvanian Sewanee conglomerate of northwest Georgia is generally correlated with part of the Lee group in central Tennessee and Virginia. This formation consists of massive, conglomeratic, light-gray sandstones with interbeds of varied lithologic types. It has an average thickness of about 150 feet in the area under investigation.

Studies of depositional and petrographic features were made in order to determine the geologic history of the formation.

Results of these studies indicated that the formation was deposited in a flat gently sloping environment and that the source of the sediments was to the southeast. The author concluded that the formation was probably a second cycle orthoquartzite deposited by water currents in an environment similar to a tidal flat.

Allen, Arthur Thomas, Jr., 1950, Geology of the Ringgold, [Catoosa Co.] Georgia Area: University of Colorado, PhD Dissertation, 203 p. (Harold E. Koerner)

Author's Abstract

The geology of the Ringgold, Georgia area was studied to determine the stratigraphic sequence, paleontological characteristics, and structural relations of the exposed sedimentary formations.

The valleys and ridges trend northeast-southwest and parallel the fold axes. The ridges may be divided into two classes: 1) The higher ridges underlain by resistant sandstone strata, and 2) the lower ridges maintained by cherty soil derived from the Knox formations. The valleys are formed on more soluble limestone strata.

Twenty-three formations are exposed, ranging in age from Early Cambrian to Early Pennsylvanian, and have an aggregate thickness of at least 12, 900 feet.

Cambrian formations are, in ascending order: Rome shale; Conasauga shale and limestone; Copper Ridge dolomite. The Ordovician formations are, in ascending order: Chepultepec dolomite, Longview dolomite and limestone, and Newala limestone; Murfreesboro limestone, Mosheim limestone, Lenoir limestone, and Lebanon limestone; Lowville-Moccasin limestone and Trenton limestone; Sequatchie sandstone, shale, and limestone. The entire Silurian sequence is included in the Red Mountain formation. With the possible exception of the lower part of the Chattanooga shale, strata of Devonian age are absent. The Mississippian formations are, in ascending order: Chattanooga shale; Fort Payne chert, St. Louis limestone, and Ste. Genevieve limestone; Gasper limestone, Golconda shale, Bangor limestone, and Pennington shale. The only Pennsylvanian rocks belong to the Lookout formation.

Ordovician and Mississippian strata are more fossiliferous than are the Cambrian and Silurian strata. The Copper Ridge, Chepultepec, and Longview formations [Dolomites] have yielded a few gastropods which occur as replacements in the chert residuum overlying Knox exposures. Fossil remains in the Newala limestone, Murfreesboro limestone, Lenoir limestone, and Mosheim limestone are sparingly present and poorly preserved. The Lebanon fauna includes sponges, corals, graptolites, bryozoans, brachiopods, gastropods, cephalopods, trilobites, and ostracods, which occur as calcium carbonate replacements. The argillaceous limestone and siltstone facies of the Lowville-Moccasin are unfossiliferous. Several corals, bryozoans, brachiopods, gastropods, cephalopods, and trilobites were collected from the normal limestone facies. The Sequatchie formation contains bryozoans, brachiopods, and gastropods. The Red Mountain formation produced bryozoans, brachipods, and trilobites in the upper part of the formation.

All the strata of Mississippian age, with the exception of the Chattanooga shale, Golconda shale, and Pennington shale, contain numerous fossils, most of which have been replaced by silica. The Fort Payne fauna includes various species of crinoid stems, the small, button-shaped coral, *Hadrophyllum ovale*, and colonial corals, brachipods, and pelecypods. The Lavender shale member, basal Fort Payne, contains many fenestrellid bryozoans. The St. Louis is indicated by *Lithostrotionella castelnaui* and *Lithostrotion proliferum* in the soil. The index fossil *Platycrinus pencillus* is found in the Ste. Genevieve. The Gasper limestone is characterized by abundant fauna including the index crinoid fossil *Talarocrinus inflatus.* The Bangor limestone contains large blastoids, bryozoans, and brachiopods. The Pennington shale is unfossiliferous. Pennsylvanian strata yielded no fossil remains in this region.

Detailed structural relations are shown by two cross-sections. Four major thrust faults involving Cambrian and Ordovician beds occur in the eastern one-fourth of the area. Another fault of the same type is found in the western part of the region. Between the eastern and western faulted areas is a major, asymmetrical, southward plunging anticline with a smaller, southward plunging syncline flanking it on the east. A large, broad, southward plunging syncline involving middle and upper Ordovician limestones occupies the extreme western part of the area. Compression affected the flat-lying Paleozoic sediments, while the Cumberland Plateau acted as a buttress.

Almand, Charles William, 1961: The Geology of the Lumpkin Quadrangle, Stewart Co., Georgia: Emory University, MS Thesis, 86 p. (Howard R. Cramer)

Author's Abstract

The Lumpkin quadrangle covers approximately 63 square miles of the Gulf Coastal Plain in southwestern Georgia. Sediments and sedimentary rocks from three Upper Cretaceous, and one Paleocene formation, are exposed.

The Cusseta sand (Upper Cretaceous) is the lowermost unit which crops out. Only the upper beds are exposed; they are loose, tan, coarse-grained sands which contain local beds of pale-gray kaolinitic clay.

The Ripley formation (Upper Cretaceous) overlies the Cusseta; the contact between them is probably conformable and gradational. The Ripley is about 100 feet of fine grained, calcareous, marine sand and gray clay containing abundant fossils. Only the Ripley formation is fossiliferous. The more common mollusks and foraminifera are described systematically and illustrated.

Disconformably above the Ripley is the Providence sand (Upper Cretaceous). It consists of about 100 feet of coarse-grained, cross-bedded, deltaic sand containing minor beds of white, tan and purple kaolinitic clay.

The Paleocene Clayton formation lies disconformably above the Providence. It is a thin, red, sandy residuum from what was probably a sandy limestone.

Recent alluvium from the canyons and deep gullies in the Clayton and Providence formations is present in all the major stream valleys.

There is a great quantity of iron ore in the Clayton formation. It is presently being strip-mined a little west of the Lumpkin quadrangle. Ground water is another important natural resource. Down dip, to the south, the Cusseta, Providence and Clayton formations are all important aquifers.

Arden, Daniel Douglas, Jr., 1949, The Microstratigraphy of a Carolina Bay: Emory University, MS Thesis, 86 p. (A. C. Munyan)

Author's Abstract

The sediments in a Carolina bay located near Shell Bluff in Burke County, Georgia were examined to ascertain if any data could be found which would indicate the probable origin of this depression. Due to its location near Barton Branch, a tributary of Brier Creek, it was named Barton Branch bay. Geologically the bay is located in the Barnwell formation, which outcrops extensively in this area.

Six test holes were drilled with a hand-auger and samples were collected about every six inches to a maximum depth of 54 inches.

A study of fossil pollen grains in the sediments showed that pollen was present in only the top one or two samples of each hole. None of it was from plants not now indigenous to the area, indicating that the age of the depression is not geologically great.

Mechanical analysis was made of samples from two holes. All but the upper one or two samples seem to represent original Barnwell deposition. There was found to be cyclic deposition and graded bedding indicated in this Barnwell material. The conclusion drawn from the mechnical analysis was that the Barnwell sediments in the area studied were deposited by sluggish streams in a quiet lagoon, and that less than one foot of material has been deposited in the bay subsequent to its formation.

Heavy minerals analysis showed only stable minerals and minerals formed *in situ*, indicating probable reworking from older sediments with the Piedmont as the ultimate source area.

It is believed that Barton Branch bay is the surface expression of limesink phenomena, and could not represent a meteorite crater, as proposed for all Carolina bays by some investigators, nor was it formed in the manner postulated in the "artesian-solution-lacustrine-aeolian" hypothesis of Douglas Johnson.

Audesey, Joseph Louis, 1954, Petrographic Analysis of the Beach Sands of Chatham County, Georgia: University of Alabama, MS Thesis, 17 p. (T. N. McVay)

Author's Conclusions

Petrographic analyses show the highest concentration of heavy minerals as well as the highest percentage of opaque minerals to be in the storm line deposits on the south end of Tybee Island. A definite similarity in mineral composition and percentage of heavy minerals can be seen between the sand dunes on the north end and the south end of Tybee Island and the south end of Petit Chou Island (Beach Hammock). Sand dunes constantly have a much higher percentage of heavy minerals than any part of the beaches except where heavy minerals concentrate at the base of the sea wall on Tybee Island.

Epidote is the major constituent of the heavy minerals followed in order of predominance by opaques, collophanite, hornblende, zircon, sillimanite, staurolite, tourmaline, rutile, garnet, muscovite, kyanite, monazite, and sphene. The percentage of epidote in the heavy mineral portion was relatively constant no matter where the sample was selected. Two notable exceptions are Sample C-3 where the percentage of opaques is extremely high, and C-29 where the percentage of zircon and rutile are extraordinarily high.

The beach sands of the Chatham County area are not considered to be of economic importance because of the low percentage of heavy minerals in the sands. Even in places of high concentrations of the heavy minerals the percentage of titaniferous minerals, which generally determine the value of beach sands, is comparatively low. The area is too small for large scale production.

Austin, Roger Seth, 1965, The Geology of Southeast Elbert County, Georgia: University of Georgia, MS Thesis, 68 p. (Vernon J. Hurst)

Author's Abstract

The study area covers 46 square miles in the southeast corner of Elbert County, Georgia, and is just east of the Elberton batholith. The rocks in the area include igneous dikes, volcanic flows, and sediments, which have been metamorphosed to the epidote-amphibolite facies or higher. The units are probably Late Precambrian or younger in age. The dominant rock is a sequence of metadacite flows, overlain by metasediments and other metavolcanics of the Little River Series. Top and bottom criteria including cross-bedding and graded bedding within the metasediments are used to distinguish their relative ages. The metasediments and metavolcanics are cut by numerous metabasic and metadacite dikes. Emplacement of the dikes has been controlled primarily by earlier folding of the Little River Series. The basic rocks have been locally chloritized by a late period of hydrothermal alteration. Economic deposits of dimension stone and clay are described.

Austin, Roger Seth, 1972, The Origin of the Kaolin and Bauxite Deposits of Twiggs, Wilkinson, and Washington Counties, Georgia: University of Georgia, PhD Dissertation, 185 p. (Vernon J. Hurst)

Author's Abstract

Kaolin and bauxite occur in Cretaceous and Early Tertiary sedimentary rocks exposed in the central Georgia Coastal Plain. In this area, two major types of kaolin and bauxite deposits can be recognized: (1) residual deposits formed by weathering of the Cretaceous sediments and (2) sedimentary deposits of Paleocene or early Eocene age, derived from the eroded residual deposits.

The residual deposits have many characteristics of solution and recrystallization, including: extremely embayed quartz grains, kaolinitized micas, authigenic vermicular kaolinite crystals, and pisolites. Many of the smaller sedimentary structures and textures and all fossils have been destroyed. The sedimentary kaolin units are generally better stratified and sorted, contain fossils, and show indication of significantly less diagenesis. Bauxite is present in the Tertiary sediments only as detritus; large residual deposits of bauxite are restricted to the Cretaceous deposits. Heavy minerals include zircon, rutile, tourmaline, limonite, and graphite.

Electron microscopy reveals that clay fractions are largely composed of well-formed kaolinite crystals, minor meta-halloysite tubes, and rarely montmorillonite. The kaolinitic bauxites contain large lath-like kaolinite crystals and "books", possibly related to the vermicular kaolinite crystals. The clay fraction from a lignitic Tertiary kaolin was composed of less well-formed subhedral kaolinite crystals.

X-ray diffraction study of unit-cell parameters of kaolinite revealed no measureable differences among the samples. Factors indicating the degree of kaolinite structural disorder, however, did reveal differences between the Cretaceous and Tertiary kaolinites. Three methods of evaluation showed that a larger percentage of the residual kaolinites were more highly ordered relative to the sedimentary kaolinites.

The origin of the kaolin and bauxite began when Cretaceous sediments were exposed by a retreat of the sea. An episode of intensive and prolonged rainfall began and continued during Paleocene and possibly Early Eocene time. The heavy influx of ground water caused extensive solution and recrystallization of the deposits. Gibbsitic bauxite formed in the upper parts of the deposits where the silica concentration in the ground water was relatively low; and kaolin formed below, where silica concentrations were higher. Portions of the bauxite were subsequently altered to kaolin, apparently due to increased amounts of silica in the ground water. During Middle to Late Eocene time, the sea advanced across the altered sediments. Stream valleys which had developed on the exposed Cretaceous materials, filled with locally derived detritus. Finally, marine sediments covered the area, among which were beds of kaolin.

Bailey, Arthur C., Jr., 1969, Geology of the Smith's Cross Roads Area, Troup County, Ga.: University of Georgia, MS Thesis, 52 p. (Dennis Radcliffe)

Author's Abstract

Smith's Crossroads is approximately six miles south of Lagrange, Troup County, Georgia. The area considered includes 24 square miles. The focal point is the Oxford Mine one mile south of Smith's Crossroads.

The area is underlain by a series of interbedded metasediments and possibly meta-igneous rocks. These consist of biotite gneiss, garnet-sillimanite metaquartzite, garnet-biotite-sillimanite schist, amphibole gneiss and garnet-epidote-plagioclase gneiss. A zone containing gypsiferous quartz-garnet gneiss of restricted areal distribution is in the extreme west-central part of the area. Regional metamorphism has possibly attained the sillimanite-almandite-orthoclase subfacies of the almandite-amphibolite facies.

Granite pegmatites are numerous and vary considerably in size. The Oxford Pegmatite contains rose quartz, muscovite, tourmaline, garnet and some gem quality beryl. Other pegmatites in the area are smaller and contain similar minerals.

Beryl from the Oxford Pegmatite and amphibole from an amphibole gneiss were examined in detail. Statistically precise cell parameters were obtained by processing X-ray diffraction data through a computer using the least squares progressive cycle program of Evans, Appleman and Hardwerker (1963). Five beryl crystals differing in color and habit were investigated including an aquamarine crystal exhibiting fractures filled with colorless beryl. This is the first reported occurrence of this phenomena. A very close similarity of lattice constants for those beryls examined suggests cell parameter variations are not responsible for form and habit variations.

Garnets from the Oxford Pegmatite were found to be principally spessartite. Garnets from the garnet-biotite-sillimanite schist were principally almandite.

The distribution of rock units indicates a synform plunging approximately 25° in the direction of N35°E. Numerous quartz-filled shear fractures parallel the fold axis. Two dominant vertical fracture systems intersect the area in a N65°E and N85°E direction. Foliation strike varies from N88°E to N87°W and dip varies from 10° NW to 16° SE.

Bhate, Uday Ramesh, 1972, Trace Metal Distributions in Natural Salt Marsh Sediments: Georgia Institute of Technology, MS Thesis, 83 p. (Herbert Windom)

Author's Abstract

Sediment core samples were collected from two salt marsh areas of the coast of Georgia (near Thunderbolt, Georgia and Hell Gate in Ossabaw Sound). Samples from channels were also collected from both areas. The marsh sediments show an oxidized upper zone (20-30 cm), with reduced zone below, and an increase in sulfide with depth. The clay mineral composition and the grain size of the sediment cores with depth is fairly uniform.

The distribution of trace metals in sediment cores can be explained by their post depositional mobility and diffusion in the interstitial solutions in the sediments. Elements such as Mn, Ni and Co are enriched in the upper oxidized zone. Redox reactions can account directly for the mobilization of Mn, Ni and Co. Fe and Cu do not appear to migrate significantly. This is probably due to their immobilization by sulfide in the reduced zone. Marsh sediments appear to act as a sink for Zn since it tends to diffuse downward. Hg in the sediments, possibly in a biologically active form, may be released from the sediments either due to volatilization by bacteria or uptake by plants. Marsh plants *(Spartina alterniflora)* play a major role in the uptake and removal of trace metals from the marsh sediments.

Bigham, Gary Neil, 1972, Clay Mineral Transport on the Inner Continental Shelf of Georgia: Georgia Institute of Technology, MS Thesis, 49 p. (Herbert Windom)

Author's Abstract

Ninety-three suspended-matter samples were collected from 52 stations on the inner continental shelf of Georgia during the summer of 1970. Bottom sediment, along with near-surface and near-bottom suspended-matter samples were also taken and salinity, temperature, and current direction and velocity measurements were made to determine the nature of shelf-sediment transport processes on the inner continental shelf of Georgia. Sediments and suspended matter were analyzed by x-ray diffraction to determine clay mineralogy. It has been previously established that the Georgia rivers contribute kaolinite, smectite and minor illite to the coastal region, while a kaolinite-illite clay mineral suite is transported southward by longshore drift so that net transport direction may be inferred from suspended-matter clay mineralogy patterns.

The shelf-water circulation pattern during the summer months appears to be a complex system of tidal-current and wind generated eddies superimposed on a predominantly southward drift.

Clay mineral differential settling characteristics were used to explain the suspended clay mineral distribution and to establish a 'zone of deposition' which extends three to ten miles offshore. The 'zone of deposition' is considered to be the maximum seaward extent of Georgia river-derived detritus.

Bowen, Boone Moss, 1961, The Structural Geology of a Portion of Southeastern Dawson County, Ga.: Emory University, MS Thesis, 45 p.

Author's Abstract

The topography of southeastern Dawson County is in a stage of late youth to early maturity. The drainage is partially controlled by geologic structure.

Lithology consists of members of the Ashland formation (quartzitic and micaceous schists) and the Hightower formation (injection gneiss). These groups are separated by a shear zone with an essentially strike-slip displacement.

Joints are well developed in the area, the best set being those in the *ac* plane. A statistical analysis of these *ac* joints demonstrates that they have undergone a significant rotation in passing through the shear zone. This rotation is attributed to increased rock plasticity caused by higher pressure and temperature conditions during the deformational phase. An attempt to empirically formulate this relationship is made.

Brent, William Bonney, 1952, Toccoa Quartzite and Adjacent Rocks in Stephens County, Georgia: Cornell University, MA Thesis, 42 p. (Charles Nevin)

Compiler's Abstract

A 12 mile northeast-trending ridge was mapped in Stephens County, Georgia to determine the rock types and structure of this feature. The field area is located southeast of the Brevard Zone in northeastern Georgia.

The Toccoa Quartzite is a medium-grained, faintly banded rock. The major minerals are quartz, feldspar, muscovite, biotite and garnet. Feldspars in some places have a long dimension of 1 cm, giving the rock a porphyritic texture.

The two other major rock types in the area are hornblende schist and conglomerate. The hornblende schist ranges from a hornblende schist in the northeast to a granitized hornblende schist in the south. The conglomerate consists of pebbles and boulders in a biotite schist matrix. These pebbles and boulders are mashed and stretched to some extent.

Lithologic and structural data indicates the major structure is an isoclinally folded anticline plunging northeast, with a northwest dipping axial plane.

The hornblende schist suggests an origin with rapid changes in the type of material deposited. The Toccoa quartzite was deposited as a fairly pure quartz sand. The conglomerate was deposited as pebbles in a quartz sand with argillaceous and ferruginous materials.

All of the rocks in the area show effects of granitization to some extent. Feldspar, which was introduced into the rocks in various quantities, is a major result of this process. Granitization becomes more dominant in the southwestern part of the study area.

Brown, Eugene, 1952, The Geochemistry of the Ground Waters of Northeastern Florida and Southeastern Georgia: University of Florida, PhD Dissertation, 151 p. (A. P. Black)

(Abs): Dissert. Abs., v. 14, no. 11, p. 2037, 1954.

Author's Abstract

A study has been made of the geochemistry of the ground waters of northeastern Florida and southeastern Georgia in which the basic topographic, geologic, and hydrologic data are presented. Following a brief review of the history and development of geochemistry there is presented a discussion of the basic principles involved in the migration of the elements in the hydrosphere. Each element commonly occurring in natural waters is considered in regard to its abundance and geochemistry, its minerals, and its cycle in the hydrosphere. This discussion forms the theoretical basis for the evaluation of analytical data gathered during the study. The various topographic areas of the Atlantic and Gulf Coastal Plain lying within the area studied are outlined and described with respect to the influence of geology upon topographic features. The geology and hydrology of the area is presented in some detail with a discussion of formations ranging in age from the Tuscaloosa formation of the Gulf Series (Upper Cretaceous System) to the Hawthorn formation of the Miocene Series. On the basis of analyses of water from representative wells penetrating the various geologic horizons, the waters from these horizons are classified and an attempt made to correlate them with geologic section. The direction of flow of underground water as deduced from chemical considerations was found to agree well with that based upon physical data. The geologic formations underlying the area are shown by cross-section maps drawn in both North-South and East-West directions. Maps are presented illustrating the total hardness, sulfate concentration, and general chemical quality of water throughout the area studied.

Burbanck, George Palmer, 1972, Sediment and Macro-faunal Trends in the Altamaha Estuary, Georgia: Emory University, MS Thesis, 124 p. (Richard D. Hobson)

Author's Abstract

Four sites within the Altamaha River estuary, southeast Georgia, were studied to determine multivariate interrelationships among a group of chemical, biologic and sedimentologic variables.

Sampling at the sites, whose estuarine characteristics range from limnetic to polyhaline (Venice System), was designed to chemically define surface and interstitial waters, as well as to determine physical and biological characteristics of substrate samples from the surface, three and five inches depths. These substrate samples were collected from nine localities per site and were described texturally in terms of the phi mean, phi standard deviation and skewness of their particle-size distributions. Salinity, pH, and Eh measurements were used to characterize overlying and substrate water samples. Biological measurements were obtained that describe the density and distribution of the isopod *Cyathura polita*, a characteristic estuarine form, as well as relationships among other organisms identified. The organic content of substrate samples was also determined.

Several major trends occurred in the parameters from the head to the mouth of the estuary. Mean grain size and standard deviation of surface sediments decrease, reflecting lower energy conditions and increasing distance from the principal coarse-grained sediment source, the Altamaha River. Eh and pH are generally inverse functions with the Eh parameter decreasing at depth, reflecting reducing conditions and the production of H_2S. The occurrence of organisms, although determined partially by substrate conditions, primarily reflects salinity variations within the estuary.

Although there was a high degree of interlock among all variables studied, statistical techniques, especially correlation, were useful for evaluating the importance of individual relationships.

Burnett, Thomas Lawrence, Jr., 1971, Petrology of Southeastern Piedmont River Sands, Georgia, South Carolina and North Carolina: Texas A & M University, PhD Dissertation, 236 p. (Robert R. Berg)

(Abs.): Dissert. Abs., vol. 32, no. 10B, p. 5866, 1971.

Author's Abstract

The petrology of coarse, moderately sorted to moderately-well sorted, sands was examined from six rivers in the southeastern Piedmont Province. The six rivers were the Altamaha River, the Ogeechee River, the Savannah River, the Santee River, the Pee Dee River and the Cape Fear River.

The composition of fluvial sands from the Altamaha River, the Santee River and the Cape Fear River is characterized by: monocrystalline quartz, 42-72 percent; polycrystalline quartz, 1-23 percent; crystalline rock fragments, 1-15 percent; saprolite fragments, 1-8 percent; plagioclase, 0-8 percent; potassium feldspar, 3-17 percent; and "others" (including mica and heavy minerals), 0-16 percent. The majority of these sediments are submature and their components are highly weathered.

In a regional context, the gross lithology of these sands is remarkably uniform. However, trends in sediment composition do occur within rivers. Rock fragments increase in abundance within coarse sands from the upper Piedmont towards the Fall Zone. Within the Coastal Plain, rock fragments and other unstable components decrease in abundance towards the coast. Feldspar contents within the fine sand fraction may drop from above 15 percent to 2 percent.

Provenance indicators from Piedmont sediments have been reduced by weathering in the source area and by transport. Rock fragments and feldspar are effected by these two factors. At this time, polycrystalline quartz is not useful as a provenance indicator of Piedmont rocks, but saprolite fragments are judged to be strongly indicative of highly weathered igneous and metamorphic terrains. Inclusions in monocrystalline quartz are normally vacuoles and, therefore, of limited value in determining provenance.

Hornblende and epidote dominate the non-opaque heavy minerals in all rivers from the Piedmont because of their ubiquity in rocks of this province. Sillimanite, actinolite, garnet, zircon, staurolite, tourmaline, rutile and kyanite comprise the remainder of these suites. The largest quantitative differences in heavy-mineral frequencies observed in the province occurred between rivers.

Observation of mineral frequencies and distribution on heavy minerals within the Piedmont can be used to predict trends in abundance of heavy minerals in the Coastal Plain. The Santee River should deliver the greatest quantity of hornblende and sillimanite to the Coastal Plain. Topaz, piemontite and hypersthene may be useful in tracing sediments to the Pee Dee and Santee Rivers. Piedmont rivers in North Carolina and South Carolina should deliver more staurolite, tourmaline, kyanite, rutile and garnet to the Coastal Plain than Georgia Piedmont rivers.

Butler, Howard P., 1949, The Study and Beneficiation of Georgia Talc: Emory University, MS Thesis, 82 p..

Author's Abstract

A great many impurities occur in ground talc from Murray County, Georgia. Roofing-grade talc from the Georgia Talc Company contains a great deal of these impurities, and consequently the whiteness is very low. This investigation is concerned with methods of beneficiation to remove these undesirable impurities from roofing-grade talc and to achieve an increase in the degree of whiteness.

The main discoloring material was found to be a black, flakey serpentine. Along with the serpentine were found magnetite, chromite, pyrite, and pyrrhotite, all of which contribute to lowering the whiteness of the ground bulk talc.

With the use of a Wilfley table, flotation coil and other ore processing equipment, this roofing-grade talc was cleaned up by separating the heavy minerals from the lighter talc. The best results were obtained from the Wilfley table, by which the bulk material whiteness was increased 16 points.

It was also found that by crushing talc and serpentine to a size less than 325 mesh, the whiteness could be increased 6 points. Very fine talc that floated to the top of a mixture of water and ground talc had a whitness of 81. This foam was the best grade talc obtained in this study, although only a very small amount was gotten in this manner.

The best grade talc obtained in bulk was from crayon-grade talc that was crushed and processed in the laboratory. A bulk talc with a recorded whiteness of 78 was obtained in this operation.

Steel fragments, magnetite, chromite, and pyrrhotite, amounting to one per cent of the bulk material, were removed by a magnetic separation.

Buzarde, Laverne Ernest, 1956, A Study of Upper Ordovician Bryozoa by Zones: Emory University, MS Thesis, 103 p. (Arthur T. Allen)

Author's Abstract

The Ordovician limestones of northwest Georgia have been the subject of intensive stratigraphic and paleontological research in recent years. The strata above the "Green Chert Horizon" have been divided in a manuscript under preparation by Doctors J. G. Lester and A. T. Allen into eight zones.

This study was restricted to the Kensington Ordovician strike belt in which Bryozoa are present in five of the eight zones referred to above. In occurrence they vary from occasional to profuse.

Ten genera and twenty-nine species have been identified by the author, and it is quite possible that as many as twice that number are present.

A possible connection between the Bryozoa of

the +6 zone and those of the Maysville group seems within reason, although adequate proof of correlation is not provided in this work.

Illustrations and detailed descriptions of the Bryozoa are presented, and where possible, the original descriptions are included for each of the various species.

Callahan, James Emmett, 1956, The Structure of Houston Valley [Georgia]: Emory University, MS Thesis, 32 p. (Willard H. Grant)

Author's Abstract

The structure of Houston Valley and adjacent areas consists of three major folds. Houston Valley is a broad, slightly assymmetrical syncline separated from the overturned syncline forming Cherokee Valley by an assymmetrical anticline.

Minor folds are restricted to some small incongruous monoclines on the east limb of the major anticline. Lineations consist of striae in the *a* direction on bedding planes and joint faces. The joint system consists of two sets, *ac* joints normal to the fold axes, and *bc* joints which include the axial planes of the folds. These sets are probably tension joints. A doubtful third set of oblique joints, resulting from shear, may exist.

The stratigraphy of the area includes sediments from lower Silurian to lower Mississippian, which are mainly clastics ranging from a conglomeratic orthoquartzite to shales. The variations in lithology have no visible effect on the structure.

Cappel, Howard Noble, 1957, A Study of Lower Ordovician Bryozoa in Northwest Georgia: Emory University, MS Thesis, 74 p. (Arthur T. Allen)

Author's Abstract

Fossil Bryozoa from portions of two, adjoining strike belts of lower Ordovician rocks in northwest Georgia are studied and identified. Species are located with reference to thirteen lithologic zones.

Forms are found in twelve of the thirteen zones where their occurrence varies from rare to profuse. Specimens from the lowermost four zones are found only in the Durham strike belt.

Fourteen genera and twenty-five species are identified. This may represent little more than half the number present. Original descriptions are included for most of the species identified.

Preservation of fossil Bryozoa by silica replacement is found to be associated with cherty limestones. Evidence points to an environment of relatively clear water, limestone deposition as being most favorable for the forms studied.

A similarity between the Bryozoan fauna of the -6 Zone and that of the Pierce limestone of central Tennessee is striking. A possible correlation of the two rock units is suggested.

Cazeau, Charles J., 1955, An Analysis of Some Chattahoochee River Sediments: Florida State University, MS Thesis, 59 p. (E. H. Lund)

Compiler's Abstract

This investigation was designed to determine the character and distribution of the sediments carried by the Chattahoochee River. Samples were taken from the inside of river bends at the upper edge on the upper section of the river. Below Columbus samples were taken on the downstream end of point bars developed on the river bends.

Based on data gathered, the following conclusions were made:

1. The mode and median diameter of sediment particles decreases downstream.
2. The degree of sorting increases downstream.
3. The river sands are unimodal.
4. The river is carrying a high rank metamorphic suite of heavy minerals.
5. The quantitative amount of heavy minerals decrease downstream.
6. Stable heavy minerals generally increase downstream, realtive to less stable heavy minerals.

Cheetham, Alan Herbert, 1959, Late Eocene Zoogeography of Eastern Gulf Coast Region: Columbia University, PhD Disseration

Author's Abstract

Calcareous upper Eocene (Jacksonian) sediments in southeastern Alabama, southwestern Georgia, and Florida contrast markedly with stratigraphically equivalent terrigenous deposits from central Alabama westward. The enclosed fossils, chiefly marine invertebrates, permit subdivision of the Jacksonian Stage into stratigraphic units (zones) and geographic units (biofacies). The present study is concerned primarily with the abundance and distribution of invertebrate fossils, particularly cheilostome bryozoans, in the four major biofacies of the eastern Gulf Coast Jacksonian.

Biofacies 1, containing abundant mollusks and smaller foraminifers in a matrix of terrigenous

detritus, is characterized by bryozoans having free, discoidal (lunulitiform) zoaria. Biofacies 2 is composed almost entirely of skeletal elements of larger foraminifers and cheilostomes exhibiting erect, branching (eschariform), and encrusting (membraniporiform) zoaria. Biofacies 3, including a fauna dominated by lagenid and buliminid foraminifers, is devoid of bryozoans. Biofacies 4, incorporating abundant echinoids and foraminifers, contains a bryozoan fauna dominated by species having erect, jointed (cellariiform) zoaria.

The boundaries between the major biotopes in which the biofacies accumulated were not stationary during the Jacksonian. In middle Jacksonian time biofacies 1 and 2 adjoined in central Alabama, 2 and 3 in eastern panhandle Florida, and 3 and 4 in northern peninsular Florida.

Categorizing individual cheilostome faunules as associations has made possible reconstruction of the four major biotopes in harmony with known ecological requirements and tolerances of living cheilostomes. On this basis it is concluded that biofacies 1 and 2 accumulated on the continental shelf, biofaces 3 in a channel (Suwannee Strait), and biofacies 4 on a submarine plateau (Ocala Bank).

The cheilostome faunas of shelf and bank were quite distinctive at the beginning of the Jacksonian. A native Gulf Coast fauna inhabited the shelf, and a fauna having many elements in common with western Europe dominated the bank. During Jacksonian time the faunas became increasingly similar through extinction of endemic species and interchange of longer-lived species as the strait became a less effective barrier to migration.

In seeming contradiction to the widely held opinion that faunal migration may be geologically instantaneous where there is no major barrier, radial dispersal of some species within the confines of the Ocala Bank involved at least the amount of time necessary for the accumulation of a biostratigraphic zone.

The Ocala Bank was a submarine feature comparable to the present Great Bahama Bank and was separated from the North American continental shelf proper by the Suwannee Strait, the Eocene analogue of the present Straits of Florida. During the greater part of Jacksonian time, the water covering the Ocala Bank was probably 50-100 feet deeper than the water over the present Bahamian platforms, so the Ocala fauna shows greater similarity to that of the submarine banks of the Gulf of Naples.

Two genera and 18 species of cheilostomes are newly described. An additional 18 species are discussed or figured. The superfamily Microporacea is emended, and the superfamily name Scrupocellariacea is proposed to replace the "division" Cellularina.

Chen, Chih Shan, 1960, The Petrology of Lower Pennsylvanian Sewanee Sandstone, Lookout Mountain, Alabama and Georgia: Florida State University, MS Thesis, 101 p. (H. Grant Goodell)

______ 1964, The Petrology of Lower Pennsylvanian Sewanee Sandstone, Lookout Mountain, Alabama and Georgia: Jour. Sed. Pet., vol. 34, no. 1, p. 46-72.

Author's Abstract

The Lower Pennsylvanian Sewanee sandstone is a quartzose sandstone in the region of Lookout Mountain of northeastern Alabama and northwestern Georgia. A petrologic study was made of texture, including apposition fabric or preferred sand grain orientation, and mineralogical composition in order to deduce petrogenesis. Field studies of stratigraphic and primary structural characteristics supplemented these investigations. Results indicate that the Sewanee sandstone was formed under tectonically rather stable conditions in transitional depositional environments. Its sediments were mainly derived from the east in regions of the present Piedmont by a south-south-westerly regional sediment transport system.

A method for sampling and measuring the preferred orientation of sand grains is described. The statistical study of the variability of the mineral constituents of the Sewanee sandstone, both locally and regionally, shows that the rock body is extremely homogeneous. The mean directions of both preferred grain orientation and cross-bedding are, regionally, fairly consistent and coincident with each other. The variations in the analysis of apposition fabric, however, are rather greater locally than regionally. This is related to the environment of deposition.

Clarke, James Wood, 1950, The Geology of the Thomaston Quadrangle, Georgia: Yale University, PhD Dissertation, 165 p. (Adolph Knopf)

______ 1952, the Geology of the Thomaston Quadrangle, Georgia: Georgia Geol. Survey Bull. 59, 99 p.

Author's Abstract

Within the Thomaston quadrangle are three belts of rocks, each separated from the other by a thrust fault.

Biotite gneiss underlies the area north of the Towaliga fault.

South of the Towaliga fault and north of the Goat Rock fault is the Wacoochee belt. The oldest unit in this belt is the Woodland Gneiss, which is a biotite granite gneiss. The Woodland gneiss is overlain unconformably by the Hollis quartzite and the Manchester formation, metasedimentary formations which together compose the Pine Mountain group.

Intrusive into the Manchester formation is a sill-like batholith of garnetiferous biotite granite for which the name Jeff Davis granite is proposed. Marginal to this batholith is a broad belt of migmatization which is regarded as having been effected by the batholith.

Intrusive into the Jeff Davis granite and surrounding migmatite are rocks of the charnockite series. All members of the series from hypersthene gabbro to hypersthene granite are present. These rocks are characterized by remarkable single and double coronas. The coronas are unique in that they occur not only in basic and intermediate rocks but also in granite, an occurrence not previously reported. Also unique is the occurrence of coronas around apatite.

South of the Goat Rock fault is a terrane made up of biotite-oligoclase gneiss and epidote amphibolite gneiss. Intrusive into these gneisses is a hornblende-biotite granite.

Both the Towaliga fault and the Goat Rock fault are marked by a broad zone of distributive movement along which the rocks have been mylonitized and otherwise deformed. The interpretation is suggested that the Towaliga fault and the Goat Rock fault are parts of the same thrust fault and that the northwest dip of the Towaliga fault is due to subsequent folding. According to this interpretation the Wacoochee belt is a window.

The topography of the Thomaston quadrangle is well-dissected. There are remnants of a post-mature erosion surface younger than the sub-Cretaceous peneplane. The Flint River probably was superposed into its present cross-axial position from a sedimentary cover.

Clement, William Gilbert, 1952, Pre-Pennsylvanian Stratigraphy of the West Half of the Durham Quadrangle, Georgia: Emory University, MS Thesis, 69 p. (Arthur T. Allen)

Author's Abstract

The area of investigation is divided into two major parts: Johnson Crook canyon and Sitton Gulch. These canyons are re-entrants into Lookout Mountain and the topography is a reflection of the underlying structure. In Johnson Crook the topography results from the remains of a plunging anticline in the valley in which the upper part is controlled by the rim rock of Lookout Mountain, whereas the controlling structure in Sitton Gulch is the west limb of the Lookout syncline.

The rocks of the area are sedimentary and range in age from Ordovician to Mississippian in Johnson Crook and from Silurian to Mississippian in Sitton Gulch. The characteristics of the clastic material found in the strata would seem to indicate that the source of the material was to the southeast. The structure resulted from pressure from the same direction. These two factors indicate that during most of Paleozoic time a land mass was present to the southeast which was responsible for clastic sediments and for the pressure brought to bear on the Appalachian Geosyncline. The folding and faulting was confined to a relatively narrow trough, which contained the thick sequence of Paleozoic sediments, between the foreland and what is now the Cumberland Plateau.

The oldest sediments make up the Ordovician System which is represented by the Trenton formation, the Maysville formation, and the Sequatchie formation. The Silurian System is represented by rocks of the Red Mountain formation and the Devonian System by the Chattanooga Shale and the green shale upper member. The Mississippian System is represented by the Ft. Payne formation, the St. Louis limestone, the Ste. Genevieve limestone, the Gasper limestone, and the Pennington Shale. The Golconda formation and the Hartselle Sandstone are not recognized in this area.

Cofer, Harland Elbert, Jr., 1948, Petrology, Petrography, Mineralogy and Structure of the Arabia Mountain Gneiss, DeKalb County, Georgia: Emory University, MS Thesis, 64 p. (James G. Lester)

Compiler's Abstract

The Arabia Mountain gneiss is part of the broad exposure of granitic rocks in the Central Piedmont of Georgia. Detailed mapping and petrologic studies have led to several conclusions on the origin of the rock.

The granitic texture is indicative of an igneous origin. The trend of the major flow structure indicates a force acting northwest-southeast; this is the direction of force that has been related to the intrusion of Stone Mountain; pegmatites are genetically related to the enclosing rocks and were formed contemporaneously with and later than the banding. These pegmatites are variously oriented and transgress or conform to the direction of flow.

Two joint systems are present. The younger of these is thought to be due to shearing forces developed during the final stages of the Appalachian Orogeny. The older and completely sealed system across which the flow structure is continuous is thought to be an early system developed due to tensional stresses caused by contraction of the magma.

Cofer, Harland Elbert, Jr., 1958, Structural Relations of the Granites and the Associated Rocks of South Fulton County, Georgia: University of Illinois, PhD Dissertation, 139 p. GM

Dissert. Abs., vol. 18, no. 5, p. 1768-1769, 1958.

Author's Abstract

Small concordant pods, lenticular masses, and crosscutting, massive granitic rocks occur in the complexly folded metamorphic rocks south of the Brevard Shear-zone in the southern part of Fulton County, Georgia. Irregular shaped masses of dioritic rocks occur and are concordant with respect to the enclosing metamorphic rocks. The metamorphic rocks include sillimanite-graphite-bearing schist and intercalated plagioclase gneiss, biotite-feldspar gneiss, feldspathic amphibolite and diopside-epidote gneiss. The dioritic rocks form a completely gradational series from diorite through quartz diorite to granodiorite. The granitic rocks are microcline-rich rocks which vary in composition from quartz monzonite to granite. They are separated into three types based on textural difference: (1) The Red Oak type, fine-grained and weakly gneissic; (2) the Boat Rock type, medium-grained; and (3) the Ben Hill types, medium-grained, porphyritic-textured.

Minor structures indicate that during regional metamorphism the rocks were deformed to form overturned, nearly isoclinal northeasterly trending folds. These folds were subsequently buckled to form cross-folds which trend approximately at right angles to the major folds. Later movements along the Brevard Shear-zone were accompanied by shearing of the rocks south of the Brevard. The subsidiary shear-zones approximately parallel the axes of both directions of folding.

The mineral assemblage of the rocks indicates that the minimum grade of metamorphism reached corresponds to the amphibolite facies, sillimanite isograd. Recrystallization along the shear-zones has been extensive. No appreciable lowering of the grade of metamorphism as a result of shearing was detected.

The dioritic and granitic rocks are post-shear and their emplacement may be largely controlled by northwesterly trending shear-zones. Microcline-bearing biotite-plagioclase gneisses tend to parallel the northeast trending shear zones. It is proposed that the subsidiary shear-zones served as a localizing feature for potash metasomatism. Potash for microcline formation is probably derived from the destruction of biotite in the metasomatic rocks themselves and from the adjacent schists and gneisses. The occurrence of the more massive granitic and dioritic rocks along the northwest trending shear-zones is thought to be the result of more complete granulation of the host rock and greater degree of "openess of the structure".

Connell, James Frederick Louis, 1955, Stratigraphy and Paleontology of the Jackson Group [Eocene] of Georgia: University of Oklahoma, PhD Dissertation, 348 p. (Carl C. Branson)

______ 1958, Stratigraphy and Paleontology of the Jackson Group of Georgia: Southwestern Louisiana Jour., vol. 2, p. 321-348.

Author's Abstract

The Ocala limestone crops out from the southwestern-most counties in Georgia northeastward to northern Dooly County, and its lower portion, the Tivola member, continues northeastward as a tongue or wedge into the lower part of the Barnwell formation. The Barnwell formation crops out from central Sumter County northeastward to the Savannah River.

The Ocala limestone of Georgia, which is the upper part of the formation known in Florida as the Ocala "restricted" or Crystal River formation, outcrops between the Flint and Chattahoochee Rivers. The rocks consist of white to cream-colored to pink, soft to hard, in places silicified, fossiliferous limestone, containing a prolific fauna of Upper Jackson age.

The Tivola Member consists of soft, fossiliferous, white to cream-colored, limestone, with

sand in its lower portion. The Tivola member underlies the Twiggs clay member of the Barnwell formation from northern Dooly County, northeastward to south of Cordele.

The Twiggs clay member consists of fuller's earth type clay, cropping out from Sumter County to the Savannah River. In east-central Georgia, the Twiggs clay member is overlain by the red to white sands of the Irwinton sand member, which is thickest in east-central Georgia. At a few localities the Irwinton sand member is overlain by coarse, red sand and beach pebbles, referred to as the Upper Sand member. In Washington County, a localized unit, known as the Sandersville limestone member, lies at or near the upper part of the Irwinton sand member, and contains the faunules characterisitc of the Tivola member to the south. Stratigraphically younger Barnwell strata above the Upper Sand and Irwinton sand members occurs in northeasternmost [Coastal Plain] Georgia.

The Ocala and Barnwell formations are contemporaneous deposits of Upper Jackson age. The Ocala represents a shallow water marine, offshore environment, and the Barnwell represents a littoral facies of coarser material, deposited near the Upper Jackson strand line. The Tivola member represents a short-lived advance of the Ocala sea northward into the present area of outcrop of the Barnwell formation.

The majority of the fossils in strata of the Jackson stage are described from the Ocala limestone. The Barnwell formation is practically barren of fossil remains except for the foraminifera described from the Twiggs clay. The Twiggs clay yields a large molluscan fauna at only two localities. The Sandersville limestone member contains echinoids, pelecypods, and gastropods, along with a few bryozoans with Tivola-Ocala affinities.

Fossils described from the Jackson beds of Georgia contain 66 species of pelecypods, two of which are new, 21 species of gastropods, 20 bryozoans, 14 echinoids, 10 shark teeth, one crab, one coral, one orbitoid foraminifer, and two wormlike structures. There remains are illustrated, and included in the Faunal Distribution Chart.

Cook, Robert Bigham, 1967, Geology of a Part of West Central Wilkes County, Georgia: University of Georgia, MS Thesis, 53 p. (Vernon J. Hurst)

Author's Abstract

The thesis area includes approximately 32 square miles of west-central Wilkes County, Georgia. The area is underlain by metasedimentary and metavolcanic rocks of the Little River series, metaquartz latite and metarhyolite, all of which have been metamorphosed to the amphibolite facies. These rocks have been intruded by both felsic and mafic dikes. The age of the major rock units is probably early Paleozoic.

The dominant rock types in the Little River series are hornblende gneiss, sericite-quartz schist and light colored quartz-feldspar-mica metasedimentary rocks. A large body of metaquartz latite is to the south and east of the Little River series rocks. A recent plug of metarhyolite has intruded this unit near the center of the area. Several diabase, aplite and rhyolite dikes are in the area.

Rocks of the Little River series exhibit an east- or northeast-trending foliation, which is best developed in sericite-quartz schists.

Gold was mined in the area as recently as 1965. Other possible economic deposits are copper, zinc, and crushed or dimension stone.

Cook, Robert Bigham, 1970, The Geologic History of the Massive Sulfide Bodies of West-Central Georgia: University of Georgia, PhD Dissertation, 163 p. (Vernon J. Hurst)

(Abs): Dissert. Abs., Vol. 32, no. 7-B, p. 4008

Author's Abstract

The Little Bob, Swift and Villa Rica deposits occur within interbedded sequences of metavolcanics and metasediments which partially constitute the limbs of a major northeast striking and plunging syncline. The dominant rock types are amygdular metabasalt, undifferentiated hornblende gneiss, metatuff, quartzite, metatonalite, kyanite-biotite gneiss and pegmatites. The Tallapoosa deposit is within a northeast-striking sequence of interbedded actinolite-quartz-chlorite schists and quartzites of sedimentary origin. The effects of at least one period of regional metamorphism are indicated mineralogically and texturally.

The effects of wall rock alteration include a major redistribution of elements originally comprising zones of ore emplacement and alteration, and the introduction of H_2O, CO_2, Fe, Zn, Cu, and S into these sites. Propylitic alteration, characterized by the mineral assemblage albite-biotite-chlorite, is evident in the wall rocks of the Little Bob and Swift deposits. Epidotization, sericitization and silicification are locally important beyond the zone of propylitization. A narrow zone of intense alteration, characterized by the assemblage staurolite-gedrite-biotite-chlorite, borders the Villa Rica deposit. Propylitic alteration, identical to that of the Little Bob and Swift deposits, is present beyond this zone. Pegmatization is locally important near the mineralized zone. The Tallapoosa deposit is bounded by a wide zone of relatively mild wall rock alteration. Alteration effects consist mainly of the chloritization of amphiboles, minor desilicification, and the introduction of medium-grained dolomite.

The ore zones of the deposits consist of lenses of both massive and disseminated sulfides which are situated within shear zones conformable with the country rocks. Mineralogically, the ores of the Little Bob, Swift and Villa Rica deposits are of the Ducktown type, consisting of pyrite and pyrrhotite with varying amounts of chalcopyrite, sphalerite and galena. Ores of the Tallapoosa deposit are characterized by the absence of pyrrhotite.

Little Bob, Swift and Villa Rica ores have undergone a complex post-depositional history. Pyrrhotite and sphalerite show the effects of at least partial annealing recrystallization. Post-ore deformation has probably resulted in the minor recrystallization of sphalerite and pyrrhotite by sub-grain formation.

Sulfur isotope analyses show sulfides to be enriched in S^{34} with anomalous concentrations of S^{34} in pyrrhotite. Isotopic fractionation may be the result of slight losses of the more active S^{32} isotope during annealing recrystallization.

The pyrrhotite geothermometer indicates a minimum equilibration temperature of 315°C for Little Bob, Swift and Villa Rica ores. The sphalerite geothermometer places the minimum equilibration temperature at 535°C for these ores.

The deposits are genetically similar to other massive sulfide deposits of the southern Appalachians as described by Ross (1935) and originated by hydrothermal replacement along zones of shearing, subsequent to an initial period of regional metamorphism.

Crawford, Thomas Jones, 1957, The Gêology of the Indian Mountain Area, Polk Co., Georgia: Emory University, MS Thesis, 57 p. (Willard H. Grant)

——— 1957, Geology of Parts of Indian Mountain, Polk Co., Georgia and Cherokee Co., Ala.: Georgia Mineral Newsletter, vol. 10, p. 39-51.

Author's Abstract

Due primarily to the large amount of brown iron ore in this district, the Indian Mountain area has long been of interest to geologists. The area was mapped by Hayes in 1902. Since that time little attention has been given to the age, lithology, or structure of the rocks.

The Knox formation, Newala limestone, and Floyd shale were identified by fossils. That portion previously mapped as Weisner, reportedly unfossiliferous, was found to contain fossils. Those have been tentatively identified as *Soolithus linearis*, which, in themselves, are not sufficient for dating the formation.

Detailed lithologic description indicates that the Weisner formation is composed of fine- to coarse-grained quartzite interbedded with shale and slate. A large lens of conglomerate, which grades laterally into quartzite, was mapped near the top of the exposed section.

The strata have been closely folded and are intersected by numerous faults. Fault zones are indicated by brecciation, iron deposits, quartz-filled fractures, and omission of strata.

The area contains a large number of iron deposits, from which brown ore is currently being mined.

Cribb, Robert Eugene, 1953, Areal Geology of the Northern Half of Calhoun Quadrangle, Georgia: Emory University, MS Thesis, 47 p. (Arthur T. Allen)

Author's Abstract

The area of investigation is the northern half of the Calhoun (15 minute) quadrangle and is located in the Paleozoic area of northwest Georgia.

The Cambrian, Cambro-Ordovician systems and possibly the Tertiary, have been recognized in the area. The Cambrian system is represented by the Rome and the Conasauga formations while the Cambro-Ordovician is represented by the Knox formation of which only the Copper Ridge member was identified. The Tertiary (?) system is represented by an alluvium composed of rocks ranging from boulder to sand size which is believed to represent an old surface of peneplanation and came from a source in the Cohutta mountains to the east.

Tests were conducted on the shales and argillaceous limestones of the Conasauga formation revealing the shales to have been leached of their carbonate content. The clay in these shales is

illite and increases in percentage from the depths to the surface.

Structurally the area is largely isoclinal folds and small synclines with the crests eroded away and one major thrust fault that moves the Conasauga up on the Knox.

Darby, David Grant, 1964, Ecology and Taxonomy of Ostracoda in the Vicinity of Sapelo Island, Georgia: University of Michigan, PhD Dissertation, 202 p.

(Abs): Dissert. Abs., vol. 25, no. 12, p. 7202.

Author's Abstract

The purpose of this study is to describe the podocopid ostracod fauna and its environmental relationships in a complex estuarine-lagoonal area between the mainland and Sapelo Island, Georgia, and the benthic and planktonic myodocopid ostracods offshore from the island.

New techniques for dissecting, staining, and mounting the appendages permit detailed descriptions of internal morphology and carapaces. Internal anatomy and tests, including hingement and pore canals, are shown in photo-micrographs.

One extremely euryhaline species, *Cytheromorpha curta*, completely dominates the estuarine-lagoonal facies. Substrate relationships appear subsidiary to those of hydrography. Salinity is the principal limiting factor governing the relatively distinct demarkation lines between populations.

Data on hydrography, sedimentation, breeding habits and food of certain species, etc. are included.

Twenty-four species belonging to thirteen genera were found, of which thirteen species are new: *Macrocypris Sapeloensis*, *Rutiderma mollita*, *Asteropteron oculitristis*, *Cylindroleberis psitticina*, *Sarsiella nodimarginis*, *S. pilipollicis*, *S. radiicosta*, *S. georgiana*, *S. rousei*, *S. angusta*, *S. greyi*, *S. tubipora*, and *S. disparalis*. All described species were placed in the University of Michigan Museum of Paleontology.

Darling, Robert William, 1952, Geology of the Eastern Half of the Durham Quadrangle, Northwest Georgia: Emory University, MS Thesis, 107 p. (Arthur T. Allen)

Author's Abstract

The results of this investigation are threefold: the areal geology is described and mapped, structure is interpreted, and the economic aspects of the geology of the area are evaluated with particular emphasis upon deposits of shale and clay.

The area is completely underlain by Paleozoic sedimentary rocks ranging in age from Cambrian to Pennsylvanian, and with an aggregate thickness of approximately 4,000 feet. Individual formations are separated and plotted upon a base map. Descriptions are presented with emphasis upon distinguishing characteristics evident in the field.

Major structures present include the Lookout Mountain syncline and the adjacent Chattanooga Creek anticline. Minor structures associated with the major structures are described and interpreted in relation to the original compressional forces causing Appalachian warping and in relation to subsequent forces.

Clay and shale deposits are considered with a view toward commercial exploitation. Differential thermal analysis curves of shale and clay samples are presented along with standard comparison curves.

Darrell, James H., Jr., 1966, The Palynology of Lignite in Northwest Georgia: University of Tennessee, MS Thesis, 83 p. (Robert E. McLaughlin)

Compiler's Abstract

Lignitic clay is associated with bauxite near Hermitage, Floyd County, Georgia. The lignite is found in a pocket-like deposit in the bauxite pit; the blocky, fibrous lignite and the surrounding regolith appear to be a slump structure.

Approximately 95% of the forms present are sporomorphs representing pollen from dicotyledonous angiosperms. On the basis of morphological similarities, almost 50% of the pollen was produced by plants which may be related to genera which today are in the order *Amentiferae.*

There are two environmental elements indicated by the plant microfossils. An authochthonous element which grew within the deposition basin during the sedimentary period is represented by the lignite sample. These include non-aboreal groups such as thallophytes, pteridophytes, small herbaceous plants and shrubs. An allochthonous element grew some distance from the margin and probably was composed of aboreal types such as *Juglandaceae* and *Bethalaceae.*

The most abundant sporomorph is of the genus *Extratriporopollenites.* This form is the stratigraphic index to the Paleocene of Europe, which indicates the Hermitage lignite is of the same age.

David, Louis Lloyd, 1974, Petrology of the Claiborne Group [Eocene] and Part of the Wilcox Group [Paleocene], Southwest Georgia and Southeast Alabama: University of Texas, MS Thesis, 215 p. (Robert Folk)

Author's Abstract

Sediments of the Claiborne Group cropping out in southwest Georgia and southeast Alabama were probably deposited in a complex of fluvial and marine environments. The sediments of the upper part of the Tuscahoma Formation and the Hatchetigbee Formation, both of the Wilcox Group, are probably marine to marginal marine (tidal flat) deposits.

The boundary between the Wilcox and Claiborne Groups in this area is difficult to define, for there is locally a layer of sediment with intermediate characteristics. Attempts to subdivide the weathered, up-dip deposits of the Claiborne Group in Georgia into Formations equivalent to the Lisbon and Tallahatta Formations of Alabama proved futile. Probably a completely different nomenclature should be used in Georgia.

Sands of the Tuscahoma Formation are litharenites, with some phyllarenites. The sands of the Hatchetigbee Formation and also of the Claiborne Group are predominately quartz-arenites, with slight feldspar content. One sample of the Hatchetigbee (?) is a borderline subarkose.

Polycrystalline quartz grains in the Claiborne Group show evidence of disaggregation to single grains of common quartz, probably mainly through solution, but apparently aided by formation of cutanic matrix in soil zones. That cutanic matrix tends to form spherical shells, thereby coating sharp and protruding corners less thickly than other parts of the nucleus, is submitted as an icarian alternative to Crook's (1968) physiochemical explanation of his obervation that quartz becomes round in soil zones.

Heavy minerals in these sediments are dominantly stable forms, such as zircon, tourmaline, rutile, staurolite, kyanite, and sillimanite. This suite is similar to others found in the southeast, and also to that found in the Middle Eocene sediments of the Texas Coastal Plain. The lack of garnet in my suite may be a result of outcrop weathering.

A thick trend of Claiborne Group clastic sediments extends from southwest Georgia into panhandle Florida, parallel to and approximately coincident with the northwest border of the South Georgia Graben of Tanner (1966). This is interpreted as evidence that the graben was active during the Middle Eocene, as Tanner suspected.

Denman, Harry Edward, Jr., 1974, Implications of Seismic Activity at the Clark Hill Reservoir: Georgia Institute of Technology, MS Thesis, 103 p. (Leland Timothy Long)

Author's Abstract

On November 1, 1875 at 21:55 GMT east-central Georgia experienced an earthquake which produced a maximum Modified Mercalli Intensity of VI in the Washington-Lincolnton, Georgia area. This shock was felt over an area of 25,000 square miles and is reported to have lasted approximately thirty seconds in the epicentral area. The earthquake was felt from Atlanta, Georgia to Columbia, South Carolina and from Gainesville to Savannah, Georgia. This event ranks as one of the four significant earthquakes which have occurred within the state.

Examination of seismograph records from the ATL WWSS station revealed thirteen seismic events of local magnitude (M_L) between 2.5 and 3.6 which have occurred in the Clark Hill area over the past ten years. Relocation of these epicenters places the earthquakes in central and southern Lincoln County between the Savannah River and the Little River in Georgia. These locations indicate a localized zone of low level seismic activity at Clark Hill. The most recent event associated with this zone occurred on February 13, 1974 with local magnitude of 2.7 and epicenter located at 33.62° N, 82.48° W.

Local microearthquake surveys conducted between September 1973, and April 1974, recorded nine seismic events which could not be ascribed to local quarry activity and must therefore be considered as microearthquakes. Recording of a microearthquake on January 4, 1974, at 18:30 GMT with an epicenter at 33° 39.63', 82° 24.12' represents the first well located microearthquake detected in Georgia.

Bouguer anomalies computed from 311 gravity measurements reveal a breached, linear NE-SW trending ridge of anomalies in southern Lincoln County near Amity, Georgia which corresponds to the area of microearthquake locations. A right lateral strike slip displacement of approximately 2000 feet (0.6 km) is indicated by offset of these anomalies along a possible NW-SE striking fault. Velocity data from local quarry blasts indicate an average compressional wave velocity of 5.8 ± 0.5

km/sec for the Clark Hill area and a shear wave velocity of 3.4 ± 0.5 km/sec to a distance of 40 km.

Dicus, Joseph Martin, 1952, The Geology and Stratigraphy of the Cedar Grove Quadrangle of Northwest Georgia: Emory University, MS Thesis, 55 p.

Author's Abstract

The area of investigation is located in the heart of the Paleozoic region of northwest Georgia. The rocks are sedimentary and range from the Knox dolomite, Cambrian in age, up to and including the Bonair sandstone, Pennsylvanian in age.

The three outstanding structural features in the Cedar Grove quadrangle are the Pigeon Mountain syncline, which is a spur of Lookout Mountain, the Chattanooga Valley anticline which separates Lookout and Pigeon Mountains, and the Lookout Mountain syncline.

Formations were located, plotted on a map, and described as to lithology, texture and paleontology. Formations were measured and the relation to the underlying and overlying beds described.

Stratigraphic columns of the various geologic systems present in the Cedar Grove quadrangle were made, the rocks of Pigeon Mountain were correlated with those of Lookout Mountain.

Drennen, Charles William, 1950, Geology of the Piedmont-Coastal Plain Contact in Eastern Alabama and Western Georgia: University of Alabama, MS Thesis, 42 p.

Author's Conclusions

The purpose of this work was to map the contact of the Piedmont and Coastal Plain rocks in east Alabama and west Georgia, a contact difficult to identify at some places because the rocks have been intensely weathered. Local faulting has involved both the Piedmont and Coastal Plain rocks, and at places the Coastal Plain strata have been disturbed by slumping and soil creep. Faulting was observed in a structurally disturbed area south of Wetumpka, and in areas of subsidence underlain by Chewacla Marble. Since the Coastal Plain rocks are not of simple homoclinal structure at all places, the structure of the contact was mapped in order to determine local strike and dip and to facilitate the stratigraphic mapping. At the outcrop, structural control was obtained by determining the elevations of numerous points on the contact; in the subsurface, dips on the contact were determined by means of well information. At the surface in Alabama the contact strikes slightly south of east, and in Georgia slightly north of east. On the outcrop, dip ranges from 45 to 100 feet per mile, and appears to be greater in the subsurface than on the outcrop.

The basal Coastal Plain beds are generally of Tuscaloosa age; however, outcrops of Coastal Plain material, possibly pre-Tuscaloosa in age, were found beneath typical Tuscaloosa strata. In the past terrace deposits have often been confused with Tuscaloosa strata, but in this work certain distinguishing characteristics of each were found, and most of the terrace deposits were delimited.

Drummond, Kenneth McCoy, 1962, Zircon Studies in the Southeastern Piedmont: University of South Carolina, MS Thesis, 27 p. (J.F. McCauley)

Author's Abstract

The morphological characteristics of eight zircon concentrates have been studied by measuring the length and breadth of two hundred doubly terminated zircons for each sample. Measurements thus tabulated were analyzed by the reduced major axis method by which each sample may be statistically described and compared.

Granites intrusive into both the Carolina Slate and Charlotte Belts were chosen for sampling. Zircons were separated from granitic saprolite, eliminating the necessity of preliminary crushing, by heavy liquid and acid digestion techniques.

The results of statistical comparison indicate that each phase or intrusive pluton here studied originated from a separate and distinct magma. This indicates that the plutons of the Carolina Slate Belt are not the exposed roofs of the same magma chambers which are now seen in the mesozonal plutons of the Charlotte Belt, in spite of their textural and mineralogical similarity. It is probable that each of the sampled bodies originated from a different chamber either contemporaneously or more probably over a considerable span of time.

Edwards, James Michael, 1973, Sedimentological and Environmental Analysis of a Holocene Salt Marsh, Sapelo Island, Georgia: University of Georgia, MS Thesis, 79 p. (Robert Carver)

Author's Abstract

Eight subenvironments of a coastal Georgia Holocene salt marsh vary conspicuously in grass types present and elevation with respect to mean sea level. However, sedimentological parameters in general do not show such conspicuous variations between habitats. The vast majority of the marsh, the normal or low marsh, reflects uniformity in grain-size distribution, organic content, and physical and biogenic sedimentary structures. Samples from this habitat are silty clays or clayey silts, have an organic content averaging 3.4% that decreases with increasing depth, and have a substrate biogenically reworked by burrowing organisms and (or) disturbed by plant activity. This habitat shows an intergradational relationship with the natural levee and high marsh subenvironments which adjoin it.

Noticeable variations do occur in subenvironments where silt and sand predominate over clay-sized materials and where tide and current fluctuations are dominant. Tidal creek banks and point bars show laminations, discontinuous to contorted bedding, shell remains, and bioturbation to be present in the subsurface. Where terrestrial influence is strong, there is a notable increase in the sand content as reflected in parts of the high marsh and some of the barren habitats, and in the *Salicornia-Distichlis* and *Juncus* subenvironments.

Comparison of x-ray radiographs depicting subsurface habitat characteristics of the study area with radiographs of a presently exposed ancient marsh environment on Cabretta Island suggests that it may not be possible to clearly distinguish habitats similar to those found in the Holocene salt marsh environment. Rather, those features depicted in the Cabretta Island radiographs suggest that broad subzones of the marsh are more likely to be potentially recognizable in the ancient environment: The creek subzone, consisting of tidal point bars, creek banks, and natural levees; the central core marsh subzone, consisting of low marsh and tall *Spartina* high marsh; and the high marsh subzone, consisting of dwarf *Spartina* high marsh, *Salicornia-Distichlis* marsh, barrens, and *Juncus* marsh.

Erwin, James Walter, 1956, Contributions to the Paleontology of the Northern Part of Randolph County, Georgia: Emory University, MS Thesis, 34 p. (Arthur T. Allen)

Compiler's Abstract

Mapping in Randolph County was undertaken to divide and define the three formations exposed in the area, the Paleocene Clayton, the Eocene Wilcox and the Oligocene Flint River.

The Clayton is divided into three zones based on lithology. The lower 12 feet consists of yellow sand and silt overlain by six feet of carbonaceous micaceous shale; the uppermost zone consists of 112 feet of hard, sandy, fossiliferous limestone.

The Wilcox of lower Eocene age is divided into seven distinct zones. The Wilcox is generally composed of sand, some of which is glauconitic and some of which is lignitic. The thickness is estimated to be 150-200 feet.

The Oligocene Flint River Formation is distinguished in this area by chert residuum. Originally it was composed of limestone, but has since been replaced by silica.

This area in Randolph County is composed of semiconsolidated sand, shale and limestone with numerous facies changes across the area.

Evenden, Leonard Jesse, 1962, Quantitative Characteristics of Drainage Basins in the Delimitation of Geomorphic Regions: University of Georgia, MA Thesis, 111 p. (James F. Woodruff)

Compiler's Abstract

The Piedmont is usually considered a uniform physiographic area because of apparent similarities in rock type and topography. The quantitative study of drainage basins is used to develop criteria to delineate geomorphic regions. These studies take several approaches.

The most promising approach is the analysis of stream lengths. The classification of stream types according to deviation from the mean channel lengths within each subdivision would provide the basis for grouping drainage basins and noting the areal associations involved.

Another approach is to divide the major physiographic divisions according to differences in areas of drainage basins. It has been established that the mean areas of sample basins within each of the main divisions are of such a magnitude that they are related exponentially.

Results show that there is a marked relationship between area and stage of development of Piedmont drainage basins. These relationships are direct, such that with increasing maturity, total length of channels increases

The parameters used are valuable due to simplicity of measurement and analysis and their potential in contributing to comparison of terrain features among various areas.

Fairley, William Merle, 1962, Murphy Syncline in the Tate Quadrangle [Pickens and Cherokee Counties], Georgia: Johns Hopkins University, PhD Dissertation.

——— 1965, The Murphy Syncline in the Tate Quadrangle, Georgia: Georgia Geol. Surv. Bull. 75, 71 p.

Author's Abstract

The Murphy Syncline in the Tate quadrangle of the Georgia Piedmont exposes 10,000 feet of metasediments. The Great Smoky, Nantahala, Brasstown, Murphy, Marble Hill and Andrews Formations were mapped in this structure. Facies changes from schist to marble and from graphitic to non-graphitic schist complicate the stratigraphy. Pegmatites and uralitized gabbro cut the metasedimentary rocks of the syncline.

The syncline is folded, overturned to the west, and shows an arcuate trend across the quadrangle. Oblique to the syncline are cross-folds with axes that plunge to the southeast. The largest cross-fold forms the east-west belt of marble between Tate and Marble Hill. Lineations of several kinds parallel the axes of the cross-folds. Joints lie in the *ac* plane of both the major fold and the largest of the cross-folds.

Most of the rocks of the Murphy Syncline within the quadrangle belong to the almandine amphibolite facies. Reconnaissance showed that the greenschist facies is developed to the west.

West of the Murphy Syncline is the Salem Church Anticline. The west limb of this anticline is the east limb of a large syncline mapped by Smith in the Waleska quadrangle.

Flock, William Merle, 1966, Mineralogy and Petrology of the Andersonville, Georgia, Bauxite District: The Pennsylvania State University, PhD Dissertation, 228 p.

(Abs): Dissert. Abs., vol. 27, no. 9B, p. 3205.

Author's Abstract

The chemical, mineralogical, and textural variability of three kaolin-bauxite deposits in the Andersonville, Georgia bauxite district was studied. The objectives were to determine the variability of each deposit, the spatial distribution of ten selected variables within the deposits, and to relate this information to possible modes of bauxite origin. To fulfill these objectives a mineralogical model was formulated and an experimental design capable of testing the model constructed.

The investigation entailed the study of 230 kaolin and bauxite samples obtained on a predetermined sampling plan from 16 cores in three deposits. Ten variables, which best fulfilled the requirements of the proposed model, were selected and were measured quantitatively by x-ray fluorescence, x-ray diffraction and thermogravimetric techniques. Optical and electron microscopy as well as electron microprobe x-ray analysis were performed on a few specially selected samples.

The experimental design employed was a two-way classification with replications. Physically this corresponds to a vertical grid in which the columns are drill cores, the rows are elevation planes, and replicates are subsamples taken two each at each row by column intersection. The data were evaluated by analysis of variance and component analysis.

All variables tested with respect to the two-way classification are randomly distributed. Differences between the means of variables in the upper and lower kaolins of the same deposit were evaluated by a single classification—analysis of variance model and shown to be significant. With the aid of graphical analysis, these differences were interpreted as indicating an altered kaolin surrounding the bauxite. The variations between deposits were studied and were found to be significant for all variables which estimate detrital processes (TiO_2, ZrO_2, K_2O, Fe_2O_3, and montmorillonite). The results appear to fit a general trend in which variables estimating coarser detritus (TiO_2 and ZrO_2) are more abundant in the deposit furthest up dip i.e., towards the source material while variables reflecting the finer detritus (montmorillonite) and reducing conditions (ferrous iron) are more abundant in the seaward deposits.

Component analysis employing the R technique was used to estimate the importance of the various geological processes on the history of the deposits and to evaluate the behavior of the major chemical constituents during bauxitization. The expected mobilities of the major chemical constituents were considered in light of a chemical model constructed from theoretical data and based on the assumption that aluminum was not removed from the system. On the basis of this model the suggested pH limits of the system during bauxitization are 4.5 to 7.0. Within these limits ferric iron, aluminum, titanium, and zirconium are expected to be concentrated and silica, which has a solubility independent of pH, leached. This theoretical model was compared with the empirical data obtained and the differences are discussed.

Titanium is shown to have been mobilized during bauxitization and concentrated in soft, brown, concretionary structures which have properties commonly attributed to leucoxene (opaque and yellow-white in reflected light). On the basis of electron microprobe analysis and electron and x-ray diffraction analyses, the concretions are shown to contain titanium in the form of minute anatase crystals (0.1 to 1.0). A mechanism for the formation of these concretions and the pisolites in the bauxite is given.

On the basis of the statistical results the hypothesis that bauxitization was due to internal variations in mineralogy or texture of the original kaolin was rejected. A theory is proposed for the bauxite origin which is in accord with the known geological data and the chemical and mineralogical results obtained during this investigation. The hypothesis is that bauxitization occurred in the larger kaolin lenses which formed topographical highs due to their non-compactibility and greater resistance to erosion than the surrounding unconsolidated sands. Hence these lenses were the sites of maximum leaching. It is proposed that bauxitization occurred just above the water table and that fluctuations in the water-table level, coupled with leaching, produced the features observed in the present bauxite-kaolin lenses.

Fountain, Richard Calhoun, 1961, The Geology of the Northwestern Portion of Jasper County, Ga.: Emory University, MS Thesis, 65 p.

_____ 1961, The Geology of the Northwest Portion of Jasper County, Ga.: Georgia Minerals Newsletter, vol. 14, no. 4, p. 119.

Author's Abstract

Northwestern Jasper County, topographically youthful to early mature, is underlain by metamorphic rocks which were raised by regional metamorphism to the sillimanite-almandine subfacies of the almandine amphibolite facies as defined by Fyfe, Turner and Verhoogen (1958). Presence of relic cross-bedding, mineralogical composition and foliation which parallels the compositional banding throughout the metamorphic sequence indicates the sedimentary classification of these rocks.

The predominant rock type is biotite-plagioclase gneiss, garnet-biotite-plagioclase gneiss and sillimanite-mica schist. Also present are biotite granite gneiss, sillimanite-feldspar schist, muscovite-feldspar schist, biotite granite, minor pegmatite and diabase. The three latter rock types are of igneous origin and have been injected into the metamorphic sequence.

There has been two definite periods of deformation. The latest one formed the major fault which trends N 35° E. Pods of flinty crush rock, which are resistant to weathering and form small monadnocks on the present day erosion surface, characterize this fault trace.

Fouts, James A., 1966, The Geology of the Metasville Area, Wilkes and Lincoln Counties, Georgia: University of Georgia, MS Thesis, 61 p. (Charles O. Salotti)

Author's Abstract

The Metasville area includes approximately 27 square miles in eastern Wilkes and western Lincoln Counties, Georgia. The rocks in the area include metasedimentary and metavolcanic rocks of the Little River Series, biotite gneiss and metadacite, all of which have been metamorphosed to the almandine-amphibolite facies. These rocks have been intruded by both felsic and mafic dikes and one small adamellite body. The age of the rocks is probably late Precambrian or early Paleozoic.

The dominant rock types in the Little River Series are hornblende gneiss, sericite-quartz schist, light colored quartz-feldspar-mica rocks, which represent metamorphosed sedimentary rocks, and light colored meta-igneous rocks. A large body of metadacite is near the center of the area and a small adamellite body has intruded hornblende gneiss near the northwestern boundary of the area. Numerous mafic dikes and a few aplite dikes cut these units. One small lamprophyre dike cuts the metadacite and shows no evidence of metamorphism.

Most of the rocks exhibit a northeast-trending foliation, which is best developed in the schists.

Possible economic deposits are gold, copper and stone for crushed aggregate.

Gardner, Charles Harwood, 1961, The Geology of Central Newton County, Georgia: Emory University, MS Thesis, 53 p. (Willard H. Grant)

_____ 1961, The Geology of Central Newton County, Georgia: Georgia Mineral Newsletter, vol. 14, nos. 2-3, p. 73.

Author's Abstract

Most of the rocks of central Newton County were originally sedimentary and were regionally metamorphosed to the sillimanite-almandine subfacies of the almandine-amphibolite facies. The major rock types are biotite-plagioclase gneiss and sillimanite-mica schists with minor mica schists and amphibolites, and biotite-granite gneiss (migmatite).

Igneous rocks are represented by pegmatites, a small granite body, and two diabase dikes.

Two major deformational periods are well defined, each period having several recognizable phases. During the first period, which accompanied metamorphism, north trending, south plunging, asymetrical folds usually overturned to the west were developed. The second major period caused wrench faulting and shearing, producing mylonites, cataclasites, and rotation of previous rocks and structures.

The only post-faulting rocks present are diabase dikes.

Gergel, Thomas Joseph, 1964, Morphometric Analysis of Drainage Basin Characteristics on the Georgia Piedmont: University of Georgia, MA Thesis, 178 p. (James F. Woodruff)

Compiler's Abstract

This work is a correlative investigation into basin morphology based on the detailed examination of fifth-order basins considered representative of three physiographic subdivisions of the Georgia Piedmont. Of primary concern is the study of the regional geomorphology of an area which has homogeneity of rock structure, geomorphic features and history.

Fifth-order basins are characterized by a striking amount of similarity. Third-order basins, however, when measured and indices analyzed, show an easily discernible trend.

Comparison of third- and fifth-order basins of chosen drainage systems comprises the main body of the text. Two types of measurements were used: 1) dimensional land form properties (those having length or length products); and, 2) measurements of dimensionless properties of land (those in which units of measure negate each other and leave only an index number). The various components were systematized and the relationships used to compare history, and developmental stages of drainage basins.

Giles, Robert Talmadge, 1966, Petrography and Petrology of the Rabun Bald Area, Georgia - North Carolina: University of Georgia MS Thesis, 71 p. (Charles O. Salotti)

Author's Abstract

The Rabun Bald area lies in the north-central part of Rabun County, Georgia and extends for about one-third mile into Macon County, North Carolina.

Biotite gneiss with varying size lenses of hornblende gneiss, quartzite, feldspathic quartzite, and muscovite-biotite schist, underlies most of the area. A locally porphyroblastic quartzose paragneiss, strongly foliated in places, underlies the northwest part of the area and a medium-grained slightly foliated quartzose paragneiss underlies the area to the southeast. Both the biotite gneiss and the quartzose paragneiss are crosscut by a hornblende gneiss dike, which is probably a metamorphosed andesite.

Small pegmatites of simple mineralogy, usually containing only biotite, muscovite, garnet, quartz, and feldspar, occur throughout the area.

Jointing is not well developed in any locality. Exfoliation joints parallel to the foliation of the gneiss are predominant. No faulting of larger scale than bedding plane slip was observed.

Petrofabrics analyses show all of the rocks in this area to be B-tectonites. In addition to the *ac*-girdle, 1-2 well defined maxima of quartz optic axes and biotite cleavage poles have developed at a high angle to the rock foliation.

Dimension stone, crushed stone, and road fill, along with a small amount of mica and feldspar are the only materials of economic value produced in this area.

Goldstein, Robert Fritz, 1970, Comparison of Silurian Chitinozoans from Florida Well Samples with those from the Red Mountain Formation in [Northeast] Alabama and [Northwest] Georgia: Florida State University, MS Thesis, 90 p. (Fritz Cramer)

Author's Abstract

Silurian chitinozoans have previously been described by Goldstein *et al.* (1969) from four wells in north-central Florida. The youngest assemblage is Ludlovian in age; the oldest is of Upper Llandoverian age.

Outcrop samples were collected from the Red Mountain Formation in Alabama and Georgia. On the basis of megafossil evidence, the Red Mountain Formation has been dated as Llandoverian.

The Florida wells have previously been correlated (Goldstein *et al.*, 1969) with each other as well as with known Silurian sections. Four Red Mountain

Formation sections are divided into zones based on chitinozoan assemblages. Attempts at correlating the well and outcrop samples based on the frequency distribution of chitinozoan taxa proved unsuccessful because only a few taxa are abundant throughout the sections. Instead, correlations are based on first or last occurrences of certain taxa. A comparison of the assemblages in the youngest (Upper Llandoverian) portion of the Red Mountain Formation and the oldest (Upper Llandoverian) Florida well section indicates that they have only two taxa in common. Correlations between the other portions of the Florida and Alabama-Georgia sections was not possible due to greater age differences.

One problem encountered in this study was that only three of the Florida wells penetrated as deep as the Upper Silurian, of which only one went as deep as the Lower Silurian. Future work by biostratigraphers in correlating the Silurian rocks from these three states must depend on new wells being drilled to greater depths in Florida.

Gould, Joseph Charles, 1957, A Study of the Ordovician Ostracoda below the Green Chert Horizon in Northwest Georgia: Emory University, MS Thesis, 47 p. (Arthur T. Allen)

Compiler's Abstract

Ostracoda below the green chert horizon were identified in three Ordovician strike belts in northwest Georgia. The recognition of the Ostracoda and their stratigraphic position are used in correlation of Ordovician rocks.

Thirteen species representing six genera occur in the Lower Ordovician of northwest Georgia. *Eoleperditia fabulites* is the most abundant species. The Ostracoda are most abundant in shales and shaley limestone, indicative that the Ostracoda lived in a near-shore silty environment. The Ostracoda are oriented with their carapaces lying parallel to the bedding. Preservation generally is as calcite, except for those Ostracoda near the green chert zone which are replaced by silica, and generally are poorly preserved.

Two persistent zones of Ostracoda were noted: 1) *Isochilina* cf. I. *ovalis* zone in the lower one-third of the -10 zone, 2) *Eoleperditia fabulites* found in the -1 and -2 zones.

A systematic study of the Ostracoda forms the main part of the text.

Graham, Robin Spear, 1967, Structure and Stratigraphy of a Portion of the Murphy Marble Belt in Gilmer County, Georgia: Emory University, MS Thesis, 59 p. (Willard H. Grant)

Author's Abstract

The area is located in the Piedmont upland. The topography is controlled by the lithologies and structure.

There are eleven lithologic units in the area. All but three are traceable from the Whitestone area to the Cartecay Road at East Ellijay, a distance of 9¼ miles. Most units show no noticeable change along strike. All units dip to the east.

Four hypotheses are considered for the major structure. The monoclinal hypothesis appears the most logical, but it does not correlate with the structure described by previous writers. Schistosity and joints are well developed in all units. A major thrust fault extends the length of the area.

Marble and iron have been mined in the area. Further marble deposits may be worked in Talona Valley with the removal of overlying alluvium.

Grant, Willard Huntington, 1949, Lithology and Structure of the Brevard Schist and the Hornblende Gneiss in the Lawrenceville, [Gwinnett County] Georgia, Area: Emory University, MS Thesis, 45 p. (James G. Lester)

Author's Abstract

The paper deals with a small portion of the crystalline area of Georgia, located between Lawrenceville and Dacula in Gwinnett County. The drainage of the area forms a dendritic pattern. The topography is manifested by low, rolling hills. The valleys are thought to be the result of stream erosion.

The petrography of the granite gneiss, both the chlorite and biotite phases of the lower schist, the hornblende gneiss, and the various rock types included in the upper quartzitic schist are discussed, both megascopically and microscopically.

Hypotheses of origin derived from a study of the rocks in both the field and the laboratory are presented. The origin of the granite is thought to be primary igneous. The lower schists are believed to be the result of contact metamorphism and shearing. The hornblende gneiss is thought to have been derived by hydrothermal metamorphism from an arenaceous, calcareous shale. The upper quartzitic schists have been somewhat metamorphosed and silicified by the same silicic solutions and vapors

which are thought to have produced such a profound effect on the shales which formed the hornblende gneiss.

The structure of the rocks is exceedingly complex. The major force in the generation of the existing structure is believed to have been shearing. The nature of the shearing force is comparable to the effect of a couple on a deck of cards. Drag folds and thrust faults are the most obvious observvable effects of the shearing force.

Appended to the main body of the paper is a description of the apparatus used and the results obtained from the production of a synthetic gneissic banding.

Grant, Willard Huntington, 1955, The Geology of Hart County, Georgia: Johns Hopkins University, PhD Dissertation, 96 p. (Ernst Cloos)

——— 1958, The Geology of Hart County, Georgia: Georgia Geol. Survey Bull. 67, 75 p.

Author's Abstract

Hart County is in northeastern Georgia, where the Seneca and Tugaloo Rivers join to form Savannah River.

The area is topographically mature and the rocks are deeply weathered.

Most of the rocks are either metasedimentary schists and gneisses or granitic rocks. Feldspathic amphibolite gneiss of uncertain origin also appears. The rocks are mainly in the amphibolite facies, although some retrograde assemblages occur.

The metasedimentary rocks include biotite-plagioclase gneisses, sillimanite-graphite schists, sillimanite-mica schists and gneisses, and staurolite-mica schists. Two varieties of granitic rocks occur: a biotite granodiorite gneiss and a slightly foliated to massive muscovite and/or biotite granodiorite. The latter rocks contain many textural variations such as pegmatitic, porphyroblastic and graphic types. Between the biotite granodiorite gneiss and the metasedimentary rocks, there is a wide contact zone containing a mixture of granite and country rock.

The structural development is divided into two periods. The earlier is characterized by folding of variable intensity. From south to north the trend of the fold axes changes from N20E to NW. The later period is characterized by a northeasterly trending shear zone. Structural features connected with this period are crossfolding, cleavage, small faults and in thin sections cataclasis. Metamorphic effects are confined to the chloritization of biotite.

A systematic statistical relation exists between lineation and jointing. Changes in the strike of one structure is accompanied by a sympathetic change in the other.

Microscopic studies show that metamorphism was accomplished in three overlapping phases; regional metamorphism, contact metamorphism and kinetic metamorphism. Metasomatism also occurs.

The evidence favors the idea that the biotite granodiorite gneiss was formed by metasomatic processes. The muscovite and biotite granodiorites may have formed by anatexis of the biotite granodiorite gneiss.

Gremillion, Louis L. Ray, 1965, Origin of Attapulgite in the Miocene Strata of Florida and Georgia: Florida State University, PhD Disseration, 188 p. (J. K. Osmond)

(Abs): Dissert. Abs., vol. 26, no. 3, p. 1590.

Author's Abstract

The physical, chemical, optical, physiocochemical, D.T.A., and X-ray properties of attapulgite are well documented, and Bradley's interpretation of the structure of attapulgite can best account for its known properties.

Attapulgite has been reported from North America, Central America, Africa, Europe, Asia, and Australia. No less than seven hypotheses have been proposed to explain the origin of attapulgite.

After investigating the geologic and geographic distribution of attapulgite, its environment of accumulation, chemical stability, inorganic associations and composition of equivalent rocks in the Coastal Plain, the author attempted to deduce the origin of attapulgite which occurs in the Miocene strata of the southeastern United States.

The Florida-Georgia attapulgite occurs in the Hawthorn (Middle Miocene) and Tampa (Early Miocene) Formations which have an areal extent of approximately 60,000 square miles. The association of attapulgite with marine dolomites, limestones, diatoms, foraminifera, and marine pelecypods and gastropods shows conclusively that attapulgite accumulated in a marine environment. Its geologic and geographic distribution, its occurrence in the thick, pure, clay beds and its inorganic associations suggest that it did not form by the alteration of another mineral, particularly a nonclay mineral; nor is it likely to have formed after deposition by the synthesis of its constituent elements derived from the breakdown of minerals within the same bed. Its instability in the weathering zone shows that it is not a product of weathering and, thus, not likely to have accumulated as a detrital mineral. The fact that attapulgite is the principal constituent in some clay pebbles is evidence that it did not form as a chemical precipitate.

The most tenable hypothesis, based on the association of attapulgite with opal cristobalite and fragments of attapulgite with optical continuity and resembling structures of volcanic glass is that it is a product of the altered volcanic ash. This hypothesis is supported by the occurrence of stratigraphically equivalent volcanic ash (more than 500 feet thick in south Texas) and montmorillonite clays throughout the Gulf Coastal Plain.

Grumbles, George Robert, 1957, Stratigraphy and Sedimentation of Wilcox Formation in Andersonville Bauxite District, Georgia: Emory University, MS Thesis, 115 p. (Harland E. Cofer)

Author's Abstract

The Andersonville Bauxite District lies entirely within the limits of the Coastal Plain Province of Georgia. The sediments of the area range in age from Paleocene to Quaternary.

The stratigraphy and sedimentation of the Wilcox Formation was studied in detail. This was accomplished by determining the age of the formations above and below the Wilcox formation.

Mapping was done on the basis of lithology because each formation of the area has its own unique sedimentary features.

Standard laboratory and field techniques were used; and many sedimentary features were revealed only by laboratory methods, which were subordinate and conjunctive to field methods.

Unconformities, cross-bedding, and solution phenomena have been described and their genesis has been inferred.

Micropaleontology served as an important tool in dating the Clayton formation and the McBean formation.

Second cycle sedimentation for the Wilcox formation has been suggested by its clean, non-feldspathic, well-sorted character.

A coastline of emergence is suggested for Clayton and Wilcox depositional environments, and a coastline of submergence is suggested for McBean environments.

Hall, Donald D., 1965, Paleoecology and Taxonomy of Fossil Ostracoda in the Vicinity of Sapelo Island, Georgia: University of Michigan, PhD Dissertation, 239 p. (Abs): Dissert. Abs., vol. 26, no. 5, p. 2687.

Author's Abstract

An investigation of ostracods has been made to test the premise that paleoecology can be interpreted by a comparison of Pleistocene-near Recent species to those living today. Twelve cores, each penetrating approximately 50 feet of Pleistocene-Recent sediments of Sapelo Island, Georgia, were analysed for their ostracod content. Fifty-four species and two subspecies are described and illustrated. The following species are new: *Cushmanidea glabra, Cushmanidea magniporosa, Cytherura vestibulata, Tringiglymus sapeloensis, Cyprideis swaini,* and *Pellucistoma atkinsi.*

Literature dealing with studies of ostracod ecology in the northern Gulf of Mexico and the vicinity of Sapelo Island, Georgia, were evaluated to determine which species can be used as diagnostic indicators of depositional environments. It is concluded that, at the present state of knowledge, only a few ostracod species in the area indicate a depositional environment which is sufficiently limited in physical characteristics to be distinct, and with assurance to be designated as an estuary, for example. A few species do seem to be restricted to a particular physical environment, and upon these the paleo-environmental interpretations are based.

Two primary assemblages of ostracods, A and B, are distinguished. Assemblage A is interpreted to be reworked Miocene ostracods. Subassemblage B-1 was deposited in an estuarine environment; subassemblage B-2 was deposited in either an inner neritic or open lagoonal environment, probably in less than 60 feet of water.

Deposition of the samples studied took place in two marine transgressions in the past 35,000 years. Based upon radio-carbon dating, assemblage A was deposited at about 29,000 years Before Present, sometime within the marine transgression responsible for the formation of the Silver Bluff shoreline. Assemblage B was deposited within the last major marine transgression which took place about 18,000 years B.P. The latest advance to affect Michigan was 11,400 years B.P.

Hanson, Hiram Stanley, 1958, A Study of the Relative Frequency of Feldspar Twin Types in Crystalline Rocks: Emory University, MS Thesis, 46 p. (Willard H. Grant)

Author's Abstract

The occurrence of plagioclase twin types in

Stone Mountain and Panola granites, Lithonia gneiss, and various feldspathic country rocks, has been investigated, following the method proposed by Gorai. Mineralogical compositions of the various rocks, and feldspar twin data are given. On the basis of the information derived from this study, both Stone Mountain and Panola granites are considered as igneous, and are classified as quartz monzonites. The Lithonia gneiss and feldspathic country rocks appear to be closely allied with metamorphic rocks, with no difference in the plagioclase twinning in the different phases of the Lithonia gneiss.

Harriss, Robert Curtis, 1965, Geochemical and Mineralogical Studies on the Weathering of Granitic Rocks: Rice University, PhD Dissertation, 130 p.

Dissert. Abs. vol. 26, no. 5, p. 2688.

Author's Abstract

Chemical, mineralogical, and autoradiographic techniques have been applied to the study of five weathering profiles developed on granitic rocks. Two profiles from the Tishomingo granite, Oklahoma, two profiles from the Mount Scott granite, Oklahoma, and a single profile from the Elberton granodiorite, Georgia, were investigated.

The relative mineral stabilities in the three granites under investigation generally follow the expected sequence: plagioclase feldspar, biotite, potassium feldspar, quartz, from least to most stable respectively. This relative stability sequence is consistently observed regardless of climatic and/or local physiochemical variations. Kaolinite is the predominant clay mineral present in the Elberton profile from Georgia. Illite and kaolinite are both present as major constituents in the four Oklahoma profiles.

The largest physical and chemical changes occur in the transition from the C-horizon (weathered rock) to the B-horizon (soil). Mineralogy is the predominant factor controlling the relative mobility of calcium, sodium, potassium rubidium, and thorium during weathering. Calcium and sodium are concentrated in the plagioclase feldspars and mafic minerals and are released and mobilized during the early stages of weathering. Potassium and rubidium are concentrated in the relatively stable orthoclase feldspars and thorium in the resistate minerals. These three elements are mobilized only in the intermediate and final stages of weathering. Lithium, copper, and zinc are generally enriched in the soil portion of the weathered mantle as a result of adsorption and surface exchange with clay minerals.

Stability diagrams indicate that the natural surface waters of east-central Georgia are in equilibrium with kaolinite, the major clay mineral present in the soils. In contrast, the surface waters of southern Oklahoma are in equilibrium with kaolinite and montmorillonite, but not illite which is a major constituent of the Oklahoma soils. Combined field and theoretical evidence indicates that the Georgia soils have reached maturity and are probably the result of extensive weathering early in the post-glacial period. The Oklahoma soils are very immature and are presently undergoing active alteration.

Preliminary experimental studies indicate that the initial stages of mineral leaching closely approximate a zero-order reaction. After several hours of dissolution in distilled water rims of hydrous aluminum silicate apparently form on minerals undergoing leaching and become the rate limiting factor. The formation of alteration rims occurs in both open and closed systems and is not an equilibrium process.

Hartley, Marvin Eugene, III, 1971, Ultramafic and Related Rocks in the Vicinity of Lake Chatuge, Clay County, North Carolina and Towns County, Georgia: University of Georgia, MS Thesis, 99 p. (Robert Carpenter)

_____ 1972, Ultramafic and Related Rocks in the Vicinity of Lake Chatuge, Towns County, Georgia, and Clay County, North Carolina: Georgia Geol. Survey Bull. 85.

Author's Abstract

Ultramafic and related rocks in the vicinity of Lake Chatuge occur as a sill between a biotite gneiss sequence and a garnet muscovite schist sequence. The area is located in the Blue Ridge thrust sheet in the sillimanite zone of mid-Paleozoic metamorphism. Structurally the sill occurs along the limbs of an anticlinal saddle. The foliation and jointing of the sill, and the country rock, previously termed Carolina Gneiss, are parallel suggesting contemporaneous deformation.

The sill is generally concentrically zoned. Dunite occurs in the center and is locally surrounded by coronite troctolite. Rhythmic banding consisting of alternating olivine and bytownite layers separated by a reaction zone of orthopyroxene-amphibole-spinel is present in several of the ultramafic units. These units are locally surrounded by olivine gabbro. Both troctolite and olivine gabbro are gradational into amphibolite toward the sill and show a progressive alteration into an assemblage of hornblende-andesine-clinozoisite-corundum as the margin of the sill is approached. In addition, a garnet-pyroxene gneiss occurs locally within the sill.

Evidence that the amphibolite margin, previously termed Roan Gneiss, is orthoamphibolite (metagabbro), consists of gradational boundaries with the olivine gabbro and mantle values of 0.7031 and 0.7047 for the Sr^{87}/Sr^{86} ratio. The coronite troctolite, olivine gabbro, and garnet-pyroxene gneiss also have mantle values for their ratios.

It is proposed that the sill was emplaced in the early stages of regional metamorphism as a gabbroic magma transporting olivine crystal mush. Bhattacharji's model of magmatic flowage differentiation may be applicable in explaining the concentric zoning of the sill. Information from this study may have a bearing on the origin of other Alpine intrusions.

Herrmann, Leo Anthony, 1951, Structural Geology and Petrology of the Stone Mountain-Lithonia District [Georgia]: Johns Hopkins University, PhD Dissertation, 111 p. (Ernst Cloos)

______ 1954, Geology of the Stone Mountain-Lithonia District: Georgia Geol. Survey Bull. 61, 139 p.

Author's Abstract

The Stone Mountain-Lithonia district, Georgia, lies fifteen miles east of Atlanta in the Atlanta plateau and Midland slope divisions of the Central Upland physiographic province of Georgia. The metamorphic and igneous rocks of the district have been weathered to a red or brown saprolite except for the more resistant bosses of gneiss and granodiorite. Of these latter bosses or monadnocks, Stone Mountain is the most prominent.

The chief rocks of the district include the Lithonia gneiss (migmatite), the Norris Lake schist (mica schist and quartzite), and the Georgia complex, composed of interlayered biotite gneiss, amphibolite, biotite-hornblende gneiss, mica schist and porphyroblastic biotite gneiss. These metamorphic series have been intruded by the Stone Mountain granodiorite (Permian?) and diabase dikes (Triassic?).

Deformation produced flow folds and shear zones in the Lithonia gneiss. The Norris Lake schist and Georgia complex were uplifted on the western flank of the Lithonia Gneiss, and folded into broad, northwest trending transverse folds. Longitudinal folds of the Norris Lake schist were refolded parallel to the transverse folds during the uplift. A very pronounced mica lineation was formed in the Lithonia gneiss, Norris Lake schist and Georgia complex, parallel to minor northwest trending fold axes. In addition, garnet prophyroblasts in the Norris Lake schist were elongated parallel to the mica lineation. The Stone Mountain grano-diorite contains pronounced flow structures which include flowage foliation, mica fluctuation about an axis of rotation, and parallel orientation of micaceous autoliths.

The regional axis of uplift, *b*, of the Lithonia gneiss trends in a northeasterly direction, approximately parallel to the axis of the Appalachian Mountains. The minor axes of uplift (axes of transverse folds), *b*', are parallel to the regional direction of transport, *a*. The major set of joints of the district are cross joints perpendicular to the mica lineation.

The Lithonia gneiss was highly migmatized (and granitized) by concordant, syntectonic aplite which altered the rock into a biotite granite-gneiss. Relic bedding is found in the form of quartz-rich garnetiferous layers which are conformable with the gneissic banding. Drag-folded layers may also be relic [to] beds.

Amphibolites form conformable layers (small and large) within the Norris Lake schist and Georgia complex. They have the composition of meladiorites, but show no evidence of intrusive origin. They are considered to be either volcanic or sedimentary in origin.

The rocks of the district have been regionally metamorphosed to the level of the amphibolite facies. Two subfacies are distinguished; the sillimanite-almandine subfacies is developed near the boundary of the Lithonia gneiss, and the staurolite-kyanite subfacies is developed over the remainder of the district. The boundary between the two subfacies is marked by the change from epidote to diopside in the amphibolites.

The age of the metamorphic rocks is considered to be Pre-Cambrian. The latest deformation of the district is believed to be Appalachian in age because of the northeast trending axis of uplift. The migmatization of the Lithonia gneiss apparently took place at this same time. At a late stage of the Appalachian orogeny, the Stone Mountain granodiorite (Permian?) was intruded. Finally, Mesozoic diabase dikes were intruded along northwesterly joints.

Hester, Norman Curtis, 1968, The Origin of the Cusseta Sand [Cretaceous]: University of

Cincinnati, PhD Dissertation, 219 p. (W. A. Pryor)

Author's Abstract

The Upper Cretaceous Cusseta Sand occurs in eastern Alabama and western Georgia, outcropping in a slightly arcuate pattern paralleling the inner margins of the coastal provenance. Based upon small evidence this sand is Campanian in age occurring entirely in the *Exogyra ponderosa* zone.

The general stratigraphic relationships show that this unit undergoes distinct lithologic changes from a coarse grained non-marine clastic in the east to a finer grained marine sand in the west.

Thickness distribution map shows a trough trending east-west through southern Georgia and southwest through Alabama thickening to the southwest. A "depo-center" for Tuscaloosa time was located in southcentral Georgia and migrated southwestward through time to the present location of the Appalachicola delta. Subsurface data from well logs and lithologic descriptions illustrate that the clastic character of the Cusseta Sand and underlying Blufftown and Demopolis Formations change facies to chalk in a down-dip direction to the south and southwest.

The average cross-bedding direction is 185 degrees azimuth with considerable dispersion in the southeast and southwest quadrants. A mode trending north-north-west is present in the Chattahoochee River area, suggesting long-shore drift in this direction. Measurements of median diameter of largest grains demonstrate a slight reduction in grain size to the southwest in Georgia and then a distinct reduction of grain size westward into Alabama to Montgomery County.

Heavy mineral analyses show no distinct regional variation in the outcrop area of the Cusseta Sand. However, the following four provenances in the Upper Cretaceous outcrop delta for synchronous units of the Cusseta Sand can be differentiated: 1) kyanite-zircon, McNairy Formation of Tennessee; 2) epidote, Ripley Formation of Mississippi; 3) zircon-tourmaline-staurolite, Cusseta Sand of Alabama and Georgia; 4) staurolite, Middendorf Formation of central and eastern Georgia.

Intensive post-deposition, sub-aerial weathering has altered the heavy mineral assemblage so that garnet and hornblende have been destroyed and the surfaces of epidote and staurolite have been altered. The assemblage in order of relative abundance is tourmaline, rutile, zircon, staurolite, kyanite, epidote, sillimanite, hornblende, titanite and monazite. This assemblage characterizes a metamorphic source with minor contributions from acid igneous and pre-existing sediments.

The average light mineral constituent percentage is 82 percent quartz, 10 percent feldspar and 8 percent muscovite. Extremely low feldspar percentages in most upland areas are attributed to post-depositional, sub-aerial weathering. Using Folk's classification the sediment is classified as a sub-graywacke or sub-arkose. 98 percent of the quartz grains were found to be angular and approximately 68 percent were elongate. The feldspar is composed predominantly of microcline and orthoclase.

Textural analysis of the Cusseta Sand demonstrated that this sand is moderately to poorly sorted in most areas and ranges in grain size from fine to coarse. A general reduction in mean grain size takes place in going from east to west.

The clay minerals present are montmorillonite, kaolinite and minor amounts of illite. Through use of these mineral assemblages the Blufftown Formation and Cusseta Sand could be separated into distinct facies which demonstrate that a definite trend exists for the Cusseta Sand which shows a reduction in kaolinite and increase in montmorillonite in a westerly direction. The kaolinite and montmorillonite are considered to be detrital in origin with minor contributions from sub-aerial, post-depositional weathering and from volcanism.

The Cusseta Sand occurs in three major facies which are deltaic in origin. On a regional scale they are 1) fluviatile, an upper delta in the uplift area of western Georgia; 2) delta front and inter-neritic in Chattahoochee River area; 3) pro-delta and outer-neritic generally west of Russell and Barbour Counties, Alabama. The source area for these sediments is in the Appalachian Mountains and Piedmont Plateau to the north and northeast. The general direction of major transport of sediment is down the paleoslope to the south. The strand line in Georgia is generally east-west. Offshore currents transported sand to the west-northwest where it was deposited as barrier bars and marginal shelf sand. In a westerly direction the barrier sands continue to appear higher in the section until in Montgomery County, Alabama (the distal margin of the Cusseta Sand) barrier bar sands appear at the top of the Cusseta Sand.

The absence of a restricted mineral environment in the Cusseta Sand of Alabama is attributed to the destruction by the transgressive phase of the Ripley Formation. Later up-tilting resulting from southward migration and down-warping of the thick wedge of sediments, followed by truncation would serve to further obliterate any shoreward facies of

the Cusseta Sand. The deposition of the Cusseta Sand and clay from Alabama took place in a shallow inter-neritic and out-neritic environment where the depth of water ranges from less than 10 feet to no greater than 100 feet.

The regional environmental setting for formations synchronous and diachronous with the Cusseta Sand are 1) the inshore formation representing the fluvial environment, 2) the Blufftown Formation representing the delta front silted sand, 3) the Demopolis Formation representing the pro-delta, open shelf.

It has been determined from this study that the Cusseta Sand is not the basal transgressive sand of the overlying Ripley Formation, but rather the Cusseta Sand is genetically related to the underlying Blufftown and Demopolis delta front silted sands. The Cusseta Sand represents the final stage (destructional in great part) of the coarsening upward cycle of a deltaic sedimentary sequence.

An investigation into the usefulness of X-ray analysis of heavy mineral assemblages demonstrates that it can be applied semi-quantitatively and that regional differences in heavy mineral suites can be distinguished.

Higgins, Michael Wicker, 1965, The Geology of a Part of Sandy Springs Quadrangle, Georgia: Emory University, MS Thesis, 141 p. (Willard H. Grant)

Author's Abstract

The area studied lies along the Chattahoochee River about 15 miles northwest of Atlanta, Georgia.

The area is crossed by three valleys with adjacent ridges topped by resistant quartzite. The rocks are metasedimentary and metaigneous and have been metamorphosed to the kyanite-staurolite subfacies of the amphibolite facies. Potash metasomatism and boron metasomatism affected some rocks.

Two different periods of faulting are indicated by blastomylonites and mylonites.

Evidence suggests a stratigraphic sequence formed in a geosyncline pre-dating the Appalachian Geosyncline.

Hill, Raymond Leslie, 1966, Pleistocene Terraces in Georgia: University of Florida, MS Thesis, 155 p. (Casper Rappenecker)

Author's Conclusions

The Princess Anne terrace at an elevation of approximately 12 feet above sea level is believed to be a Recent marine surface.

The following terraces are considered to be of marine origin and laid down during the Pleistocene:

272 feet	Brandywine
215 feet	Coharie
170 feet	Sunderland
100 feet	Wicomico
70 feet	Penholoway
42 feet	Talbot
25 feet	Pamlico

Studies show that there are other depositional surfaces in widely separated regions which have approximately the same altitudes. In addition to the topographic similarity, there is considerable biologic evidence for correlating these surfaces. The only satisfactory explanation for the correspondence is eustatism.

Since Pliocene time, the ocean surface has been falling progressively. This absolute marine regression has been brought about by a diastrophic eustatism, resulting from subsidence and enlargement of the ocean basins.

During the Pleistocene, glacial control caused an oscillation of sea level to be superimposed upon the continuous, diastrophic fall of base level. The succession of terraces formed during interglacial periods, therefore, descends progressively to lower elevations as one goes seaward.

Hinckley, David Narwyn, 1961, Mineralogical and Chemical Variations in the Kaolin Deposits of the Coastal Plain of Georgia and South Carolina: The Pennsylvania State University, PhD Dissertation, 215 p. (Thomas Bates)

(Abs): Dissert. Abs., vol. 22, no. 7, p. 2412.

Author's Abstract

This investigation entailed a study of 311 kaolin samples from 18 cores taken in pairs from 9 clay deposits, and 32 additional samples from other deposits. The deposits are of so-called hard and soft types and are located in the Atlantic Coastal Plain between Macon, Georgia and Langley, South Carolina. The purpose of this investigation was to obtain and evaluate precise data on selected mineralogical and chemical properties in order to better understand the nature of the deposits, their variability and possible modes of origin.

Thirteen variables were measured on 307 samples and an additional twelve variables were measured on smaller groups of samples. Samples were taken largely according to predetermined sampling plans associated with specific experimental designs. Methods of laboratory analysis include x-ray fluorescence, x-ray diffraction, emission spectrographic, and optical and electron microscopic. A method was developed for measuring the small amounts of montmorillonite associated with the kaolin clays based on fluorescent x-ray analysis of exchanged Sr^{++}.

A quantitative measure of the relative degree of crystal perfection among kaolin samples was accomplished by use of x-ray diffractometer tracings. The method consists of measuring the combined heights of the $1\bar{1}0$ and $11\bar{1}$ diffraction maxima above a base line, (drawn from the trough between the 020 - $1\bar{1}0$ peaks to the background at $22° 2\Theta$) and forming a ratio with the total height of the $1\bar{1}0$ peak above general background. Two methods used to keep preferred orientation of the kaolinite particles at a minimum are, (a) the slab method, consisting of preparing an appropriately smoothed raw clay slab, and (b) the Lakeside method, consisting of mixing, heating, and grinding 30 per cent Lakeside cement by weight with the clay, and handling thereafter by the usual powder methods.

Data analysis consisted principally of analysis of variance, paired t tests, Chi square tests for independence, and simple correlation.

All variables tested by statistical methods are shown to be nonhomogeneously distributed within the deposits. The hard and soft clay types can be distinguished by an analysis of variance in terms of the variables Al_2O_3, Fe_2O_3, and kaolinite crystallinity; and possibly by several other variables which, although not shown to be statistically different, are strongly characteristic of one of the types. Al_2O_3 and crystallinity have greater values in the soft, and Fe_2O_3 has consistently higher values in the hard type. Larger particle sizes are associated with the soft type in the samples studied, and microscopic examination of thin sections shows that the hard type has feathery-patches of parallel-aligned flakes, in contrast to books interspersed in an isotropic matrix for the soft type.

In the soft type, positive correlations between Fe_2O_3 and mica, Fe_2O_3 and K_2O and mica, and the negative correlations between mica and books, and Fe_2O_3 and books suggest that this type of clay may have been affected by leaching processes. The abundance of authigenic kaolinite books also contributes to the negative correlation between mica and books.

A possible explanation of the differences observed in the hard and soft kaolin deposits is that they may have been deposited in saline versus fresh water environment respectively. The influx of a clay suspension into a saline environment resulted in a face-to-face type flocculation with attendent higher compaction, less permeability, and because of higher pH, more hydroxides of iron than would result from a fresh water environment. In the hard type the lack of permeability may have been the cause of relatively less recrystallization and crystal growth activity during and shortly after deposition. Similarly, this would account for less leaching action following uplift than was able to occur in the more permeable soft type.

Hisey, William M., 1952, Preliminary Faunal Study of the Providence Sand [Cretaceous]: University of Alabama, MS Thesis, 284 p.

Compiler's Abstract

This work was begun as part of an effort to provide paleontological data for subdividing the Providence Sand. This unit, to date, has been divided by lithology into the Perote Member and Providence Sand. The Perote, lower portion of the Providence, is a dark gray, carbonaceous, micaceous, clayey silt and fine sand; the Providence is a coarsely cross-bedded, coarse to fine sand.

This preliminary work indicates several guide fossils for the unit. Three echinoids, *Hardouinia subquadrata* (Conrad), *Hardouinia subconicus* Clark and *Hardouinia porrecta* (Clark) appear to be restricted to the upper portion of the Providence Sand. The gastropod *Turritella bilira* Stephenson is found in the Perote Member.

The major portion of the thesis consists of sample collecting localities and systematic descriptions of fossils. Numerous illustrations are included.

Holland, Willis A., Jr., 1954, The Geology of the Panola Shoals Area, DeKalb County, Georgia: Emory University, MS Thesis, 92 p.

Compiler's Abstract

The Panola Shoals area in the Central Piedmont of Georgia has a wide variety of metamorphic and igneous rocks with a complex history.

The Panola Granite is a weakly foliated granite that has homogeneous texture and composition throughout. Based on the following observations, the granite appears to be derived from an intrusive magma:

1. The northwest arm cuts across the regional structural trend of country rocks.

2. The granite contains inclusions which appear to be country rock.

3. There are sharp contacts between the granite and the country rock.

4. The rock is similar in composition, texture, structure and apparent age to other (Stone Mountain) granites of the Piedmont which are accepted as having a magmatic origin.

There are three other major rock types in the area: muscovite quartzite, amphibolite and migmatite. The muscovite quartzite is interbedded in the country rock and dips to the west; it apparently overlies the Lithonia gneiss. The amphibolites are of two origins. 1) They are metamorphosed calcareous sediments. This is based on four observations: a) amphibolites which parallel the strike of the country rock; b) plagioclase feldspar is a minor constituent; c) quartz is a major constituent; d) diopside and epidote occur in abundance.

The second origin is that they are derived from basic igneous injections. Criteria which suggest this are: 1) amphibolites which cut across the structure of the country rock; 2) plagioclase and other feldspars are quite abundant; 3) quartz and biotite are minor constituents.

Migmatites, the last major rock type are injected equivalents of the country rock.

Humphrey, Ronald C., 1970, The Geology of the Crystalline Rocks of Greene and Hancock Counties, Georgia: University of Georgia, MS Thesis, 57 p. (Dennis Radcliffe)

Author's Abstract

Greene and Hancock Counties consist for the most part of igneous and metamorphic rocks. The latter are biotite gneiss, hornblende gneiss, interbanded hornblende and biotite gneiss, quartz muscovite schist, coarse-grained hornblende gneiss, and chlorite schist. Statistical analysis of the structure elements of the metamorphic rocks of Greene County is consistent with a series of upright, recumbent cylindrical folds with an average strike of N44° E, and an average dip of 32° SE. Similar analysis of the metamorphic rocks of Hancock County indicates an average strike of N41° E, and two dip maxima of 39° SE and 64° SE, indicating overturned fold geometry.

The Siloam granite, a coarsely-porphyritic, unmetamorphosed, oval-shaped pluton, approximately 100 square miles in area, cuts the metamorphic rocks in Greene County. Computer refined x-ray diffraction data on the microcline megacrysts in the granite show that the pluton is thermally zoned from intermediate microcline ($\alpha = 90° 11'$) at the margins to maximum microcline ($\alpha = 90° 53'$) at the center. Electron microprobe analysis of the megacrysts reveals albite zoning and cryptoperthite exsolution lamellae (2 microns wide) of albite in a host of almost 100% pure potassium feldspar.

Pink biotite granite, gray biotite granite and leucocratic adamellite are found in Hancock County. These rocks are concordant with the trend of the metamorphic rocks. Computer refined x-ray diffraction data on the potassium feldspars in these granites show a rough zoning from south to north of intermediate to maximum microcline. The leucocratic adamellite is in the center of the body of pink biotite granite and is almost entirely biotite-free.

Economic deposits in Greene County include sand and granite. Potential deposits include iron ore, gold, copper and columbite-tantalite. Granite is the only current economic deposit in Hancock County. The investigation of Greene and Hancock Counties has revealed some 1500 acres of exposed, unweathered granite, and field mapping has revealed approximately 140,000 acres of granite.

Hurst, Vernon James, 1952, Geology of the Kennesaw Mountain-Sweat Mountain Area, Cobb County, Georgia: Emory University, MS Thesis, (J. G. Lester)

Author's Abstract

The Kennesaw Mountain-Sweat Mountain area has been selected and studied as a "type" area for rocks and structures common to the Georgia Piedmont.

The metamorphic rocks in this area are metasediments in which the stratigraphic succession is still decipherable. The igneous-looking rocks are migmatites formed by metasomatic alteration of the metasediments.

All the structures in the area are related to stresses from the southeast. The stresses resulted first of all in the folding of the rocks, then in tight folding and schistosity, and finally in overthrusting. The folds are asymmetric and overturned; the faults mostly low-angle thrust faults.

Metamorphism occurred prior to the last stages of thrusting, migmatization mainly during the final stages. Probably the Appalachian Revolution was the time when folding, metamorphism, and much of the migmatization occurred.

Detailed petrographic data on the common minerals in the amphibolitic rocks and migmatites are given.

Hurst, Vernon James, 1954, Stratigraphy and Structure of the Mineral Bluff Quadrangle [Georgia]: Johns Hopkins University, PhD Dissertation, 179 p. (Francis Pettijohn)

_____ 1955, Stratigraphy, Structure and Mineral Resources of the Mineral Bluff Quadrangle, Georgia: Georgia Geol. Survey Bull. 63, 137 p.

Author's Abstract

The 7½-minute Mineral Bluff quadrangle lies mainly in Fannin County, Georgia, but extends into Cherokee County, North Carolina, and the Ducktown Basin of Tennessee.

The rocks of the area are medium-grade metamorphic rocks, and are of sedimentary origin, except for numerous quartz veins and two epidote-amphibolite sills. The oldest rocks belong to the Great Smoky group, a sequence of graywacke-type metasediments at least 15,000 feet thick of probable pre-Cambrian age. This group is divided into four new formations: the Copperhill formation, which includes the oldest rocks in the quadrangle but is not the base of the sequence, the Hughes Gap formation, the Hothouse formation, and the Dean formation. Overlying the Great Smoky group with possible unconformity are 4000-6000 feet of metasediments of probable Cambrian age. The stratigraphic succession from oldest to youngest is: Nantahala slate, Tusquitee quartzite, Brasstown formation, Murphy marble, Andrews formation, Nottely quartzite, and Mineral Bluff formation. The principal rock types of this series are black slate, feldspathic quartzite, metasubgraywacke, marble, and sericite schist.

Bedding, graded bedding, and scour channels are well preserved in both the Great Smoky group and the younger series; X-bedding is preserved in the younger series.

The folds trend NE-SW and are overturned to the NW. The major fold is the Murphy syncline, a bent fold, whose axis passes through Mineral Bluff and Blue Ridge. An anticlinorium of comparable size lies to the northeast. The folds in the Copperhill area are second-order folds on the east limb of this anticlinorium. Axial plane flow cleavage is well developed to the northwest, weak toward the southeast. Bedding-plane foliation is well developed in the Murphy syncline.

The metamorphic history includes two periods of deformation. The major folds and cleavages originated during the first period. The rocks completely recrystallized before the last period, which is marked by the tightening of the old folds, the formation of many new folds on the limbs of the old folds, the rumpling of the earlier cleavages, and much local faulting. Subsequent to the last period, the rocks were pervasively altered.

The intense crinkling of flow cleavage in the northwest part of the quadrangle is an incident in the tightening of earlier folds. The local crinkling of bedding-plane cleavage in the Murphy syncline correlates with crowding movements in the trough.

On the east limb of the Murphy syncline, the micas are nearly equidimensional, coarsely porphyroblastic, and mainly unoriented except by movements subsequent to their growth; on the west limb, the micas are small, markedly tabular, and well oriented. This habit difference may be due to an earlier beginning of crystallization, preceding the first period of deformation, on the east limb, or to strong penetrative stress in the NW and not in the SE during the micas' growth.

Husted, John Edwin, 1970, Factors Influencing Occurrence of Phosphorite on Georgia's Coastal Plain Sediments: Florida State University, PhD Dissertation, 93 p. (B. F. Buie)

(Abs): Dissert. Abs., vol. 32, no. 1B, p. 378.

Author's Abstract

Data show both matrix sediments and phosphorite increase in particle size toward the crests on both sides of upwarped areas of the Miocene sea floor. Phosphorite concentrations of 4.1% or higher P_2O_5 are found associated with these upwarped areas and in some instances shoreward from the upwarps. Phosphorites in lesser amounts are found throughout the marine Miocene of Georgia. The nearly ubiquitary presence of phosphorite in the Miocene of Georgia is attributed to unique Miocene downwarping of the continental margin that permitted cool waters heavily laden with phosphorus to cross the then submerged Georgia Coastal Plain. This cool water increment increase of phosphorus is considered to have disturbed equilibriums in the direction of precipitation of and replacement by phosphorites. Greatest concentrations of phosphorite are along the Beaufort Arch in the Duplin Marl (late Miocene) formation of eastern Chatham County, Georgia, and in Duplin Marl equivalent and Hawthorn (middle Miocene) formations along anticlinal structures of South Georgia. These concentrations along anticlinal upwarping of the sea floor are attributed to warming water, higher pH, increased salinity, lessened pressure, low rate of sedimentation, and in some instances to biogenic recycling of phosphorus. Color of phosphorite, as determined over a 12,000 square mile area of Georgia, is considered to result from paleo-environment of deposition. Phosphorite has been identified as francolite.

Ingram, Frank Thompson, 1954, The Stratigraphy and Paleontology of the Ordovician System in Lookout Valley, Georgia: Emory University, MS Thesis, 93 p. (Arthur T. Allen)

Author's Abstract

Ordovician rocks crop out in the extreme northwestern portion of Georgia known as the Cumberland Plateau. Two areas of outcrops are recognized, those along the northern end of the Wills Creek anticline and along the Lookout Creek anticline. Both areas are considered in this investigation as part of Lookout Valley.

Ordovician rocks above the Knox Group and below the Red Mountain Formation have been divided into twenty-five zones. These zones have been investigated in the field and in the laboratory. Emphasis has been placed on changes along strike for each zone as well as changes between Lookout Valley and other Ordovician exposures east of Lookout Valley. The average thickness of all twenty-five zones is 1535 feet.

Twenty-one of the zones can be easily correlated with zones in Chattanooga Valley and three correlated with some doubt. One zone, zone 19, has no correlative east of Lookout Valley.

The two major structures along which outcrops occur are the Wills Creek anticline and the Lookout Creek anticline. Strata along the Lookout Creek anticline have low dips, small, localized drag folds, and saddles. Beds in the Wills Creek anticline are characterized by high dips and drag folds of large magnitude.

Jackson, Lawson Erwin, Jr., 1951, The Study of the Blackford Breccia [Ordovician] in the Dalton Quadrangle [Georgia]: Emory University, MS Thesis, 44 p. (A. C. Munyan)

Author's Abstract

The Blackford breccia is a member of the lower Middle Ordovician in the Dalton quadrangle. There are two distinct and different zones of breccia in the quadrangle. The zone on the west side of Sumac Ridge on the east side of the quadrangle is a limestone breccia lying upon Newala limestone. The zone on the west side of the quadrangle is cherty conglomerate which rests upon Chepultepec rocks.

Exposures were located, plotted on a map, and described as to lithology, texture, and paleontology. Measurements and orientation of blocks were made and the relation of the formation to the underlying and overlying beds described. Heavy mineral and insoluble residue analyses were also made for correlation purposes.

It is concluded that there is no orientation of the blocks with respect to each other, and that the majority of the blocks were derived from the underlying bed. The evidence, secured by field and laboratory investigations, seems to support the idea that an angular unconformity exists between the Knox and lower Middle Ordovician beds. Furthermore an important interruption to deposition at the end of Knox time can be demonstrated.

Jones, Donovan Deronda, 1970, Petrofabric and Movement Study of Faults in Newton and Walton Counties, Georgia: Emory University, MS Thesis, 28 p. (Willard H. Grant)

Author's Abstract

Study of the quartz fabric in flinty crush rock of faults indicates movement was largely horizontal. Joint studies of the flinty crush rock confirms this and suggests right-lateral movement. Displacement of a dike also supports this conclusion.

Evidence shows that Triassic diabase dikes were intruded while the fault was in an active state.

Jordon, Larry Eugene, 1971, The Geology of the Kelleytown Quadrangle, Georgia: Emory University, MS Thesis, 69 p. (Willard H. Grant)

Author's Abstract

The Kelleytown Quadrangle is approximately two miles south of Conyers, Georgia. It is underlain by highly folded metasedimentary, metaigneous, and migmatitic rocks. Mineral assemblages indicate that the area has been regionally metamorphosed to the sillimanite-almandine-muscovite subfacies of the almandine-amphibolite facies.

The map area divides naturally into two structural sub-areas which appear to be the result of the same movement picture. Several isotopic dates obtained from the general area of the Kelleytown Quadrangle suggest that most deformation and resulting metamorphism occurred during the Taconic Orogeny. Subsequent deformation occurred during the Appalachian Orogeny.

The interpretation of petrologic data indicates that a gradation from the metasedimentary rocks into the migmatite exists. The gradation is possibly the result of the injection of late-stage, potash-rich aplitic and pegmatitic juices, which alter the pre-existing rocks.

Julian, Louise Chandler, 1972, The Elberton Orbicular Adamellite, Elbert County, Georgia: North Carolina State University, MS Thesis, 65 p. (William H. Spence)

Author's Abstract

The Elberton granitic batholith contains an orbicular facies in Elbert County, Georgia. The elongated orbicular facies, which covers an area of approximately 19,000 square feet, has been mapped and sampled using a fifteen square foot grid system. The matrix containing the orbicules and the country rock surrounding the orbicular area are both medium grained biotite adamellites with oligoclase (33 to 34 percent), microcline (31 to 32 percent), and quartz (25 percent) as the major minerals. Biotite is present in slightly higher amount in the matrix (9 percent) than in the country rock (7 percent).

The orbicules are single-shelled with a dark core and a light shell. Single orbicules are roughly prolate spheroids with an average length of ½ to ¾ inch. The long dimensions of the orbicules are roughly parallel to each other, to the length of the orbicular area, and to a faint alignment of biotite flakes.

The orbicules vary in spacing density across the width and length of the exposure, being most numerous in the central areas, where up to 50 orbicules per square foot occur. Orbicules are especially numerous in rare biotite-rich areas in the matrix, where they number as many as 85 per square foot.

Most orbicules occur as isolated individuals but some overlap one another in pairs, triplets, and even larger groups forming irregular strings of orbicules having shells that merge. A few patchy, plate-like masses of orbicular shell material of limited extent have "cores" scattered throughout.

The overall average modal composition for single orbicules is approximately 39 percent oligoclase, 28 percent microcline, 28 percent quartz, 4 percent opaques, and 1 percent other minerals. The orbicule shells consist mainly of oligoclase, microcline, and quartz; the cores are mainly magnetite grains with varying amounts of exsolved ilmenite and thin secondary coronas of sphene. Other minor minerals in the cores include biotite, allanite, apatite, quartz, oligoclase, microcline, zircon, hematite, muscovite, and chlorite.

Orbicules and surrounding adamellite matrix are compared in modal analyses. The overall differences are: (1) Microcline is usually present in greater percentage in the adamellite matrix (30.7 percent) than in the orbicules (27.8 percent); (2) Oligoclase is generally present in higher percentage in the orbicules (38.8 percent) than in the adamellite matrix (33 percent); (3) Quartz is present in slightly higher percentage in most of the orbicules (27.8 percent) than in the adamellite matrix (25.7 percent); (4) Biotite is always higher in the matrix; (5) Magnetite is always higher in the orbicules; and (6) Sphene occurs almost exclusively in the orbicules. Plagioclase compositions and structural states have been determined by universal stage methods for orbicule-adamellite matrix pairs and for country rock samples. The plagioclase is generally around An_{21} and it has an ordered structural state in all samples studied.

X-ray diffraction techniques were used to determine that microcline in orbicules and adamellite matrix has an ordered structural state.

Partial chemical analyses were done by X-ray fluorescence on orbicule-adamellite matrix pairs and country rock samples. In orbicule-adamellite matrix pairs, CaO and SiO_2 are present in slightly higher weight percentage in the orbicules, while K_2O is present in higher percentage in the matrix. No significant differences could be detected in the percentages of Al_2O_3 and Fe_2O_3 between the orbicules and matrix.

The suggested origin or the orbicular adamellite is that the orbicules may have crystallized from drops of immiscible liquid, with the liquid forming the orbicules being richer in titanium. Another possible origin is by reaction between early formed crystals of titaniferous magnetite and the surrounding magma to form orbicules.

Kaplan, David Mark, 1971, Sources of Holocene and Late Pleistocene Sediments on the Continental Shelf off Georgia: University of Georgia, MS Thesis, 57 p. (Robert Carver)

Author's Abstract

Study of the 2 phi - 3 phi fraction of samples from the Georgia shelf indicates that the most diagnostic heavy mineral is hornblende. Hornblende comprises more than 30 percent of the heavy mineral suite in three areas of the shelf, and shows significant correlation with grain size, heavy-

mineral content, feldspar percentage and ZTR index.

Hornblende concentration and other sediment parameters indicate two sand types on the Georgia shelf. High-hornblende sands form distinct linear bands approximately parallel to the shoreline in the nearshore, central shelf, and shelf break areas, and are separated by low-hornblende sands in the inner and outer shelf areas. Within-sample correlations and hornblende versus position correlations indicate that major variations in hornblende concentration are not random.

The high-hornblende sands are similar to Georgia beach-dune sands. Their origin is the Santee River in South Carolina, and the method of transportation to the Georgia shelf is longshore drift, during periods of stillstand in the Pleistocene. Low-hornblende sands are similar to Georgia river sands and were derived from the local rivers during regression or transgression in the Pleistocene.

It is proposed that high-hornblende sands on the central shelf and shelf-break areas are remnants of barrier island systems formed during low stands of the sea in Pleistocene time and submerged during subsequent transgressions.

Kiefer, John David, 1970, Pre-Chattanooga Devonian Stratigraphy of Alabama and Northwest Georgia: University of Illinois at Urbana-Champaign, PhD Dissertation 181 p.

(Abs): Dissert. Abs., vol. 31, no. 12B, p. 7370.

Author's Abstract

Rocks of Devonian age have been known in Alabama since 1894 but little was known of their extent or lithologic character. This work is based on descriptions of 65 measured stratigraphic sections and numerous partial exposures along the Devonian outcrop belt of Alabama and northwest Georgia. Pre-Chattanooga Devonian strata are absent in much of the Devonian outcrop belt, notably north of a line from Tarrant in Jefferson County to Gaylesville in Cherokee County, with the exception of two isolated exposures near Blountsville and Fort Payne. The Frog Mountain Formation also is absent in parts of Shelby and Talladega counties.

Devonian sandstone of Onondaga age in Alabama was designated as the Frog Mountain Sandstone by C. W. Hayes in 1902. In 1927 Charles Butts named sandstone which he considered to be of Oriskany and of Hamilton age as the Clear Branch and the Ragland Sandstones respectively, but these names have little significance today when we distinguish between litho-stratigraphic units and time-stratigraphic units. All of the sandstone is lithologically similar and in lithostratigraphic terms, the formation name, "Frog Mountain Formation," is appropriate.

The Frog Mountain Formation is an orthoquartzite, locally hematite stained, well-sorted sandstone. It is 6 to 24 feet thick in the Birmingham area, 40 to 50 feet thick in St. Clair and Calhoun counties, 6 feet thick at Gaylesville, but is about 230 feet thick at the type section in eastern Cherokee County, Alabama. It is about 30 feet thick in western Floyd County, Georgia. The Frog Mountain Formation lies stratigraphically beneath the Chattanooga Shale, or beneath Maury Shale where the Chattanooga Shale is absent. The Frog Mountain Formation rests unconformably on formations ranging in age from Early Ordovician to Early Devonian.

Maximum grain size, as determined in thin section, generally increases towards the north, thus suggesting a source or sources of sand. Presumably this source was a land area on the south edge of the Nashville Dome. Silurian detrital rocks apparently served as parent material.

Palinspastic reconstruction of the region is useful in studying stratigraphic trends because superimposed, post-depositional deformation greatly distorts original patterns of deposition. Thus the restored northern edge of the Frog Mountain Formation wedge trends nearly east-west rather than east-northeast as currently observed.

The porous Frog Mountain Formation, which thins to a wedge edge beneath the impermeable Chattanooga Shale and is bounded both below and above by unconformities, is potentially an excellent reservoir for hydrocarbons.

Kilbourne, Richard T., 1970, Holocene Foraminiferal Zonation on the Continental Shelf off Georgia: University of Georgia, MS Thesis, 141 p. (Vernon J. Henry)

Author's Abstract

148 species were identified from fifteen petri dish (uniform area and volume) samples of undisturbed surface sediment from the continental shelf off Georgia. Based on the Foraminiferal assemblage, sixteen statistical parameters were computed for each station.

From the species distribution three faunal zones are distinguished. The near-shore (1-15 meters) *Ammonia-Elphidium* zone is defined by the abundance (greater than 20%) of the genera *Ammonia* and *Elphidium;* the middle-shelf (15-35 meters) *Asterigerina-Planorbulina* zone is defined by the abundance (greater than 10%) of the genera *Asterigerina* and *Planorbulina;* the outer-shelf (35-100 meters) *Placopsilina-Textularia* zone is defined by the abundance (greater than 15%) of the genera *Placopsilina* and *Textularia.*

King, Elbert A., Jr., 1962, Geology of Dodge County, Georgia: Harvard University, MS Thesis, 17 p.

Compiler's Abstract

Dodge County, in the Coastal Plain of Georgia, was mapped to determine stratigraphic units with reference to tektite localities. Tertiary rocks mapped are of Oligocene and Miocene ages.

The Flint River Formation (Oligocene), outcropping in southwestern Dodge County, is a silicified fossiliferous rock, thought to be a carbonate that has been replaced by silica. Fragments of *Pecten* were identified.

The Miocene is represented by a dark olive-brown to medium gray, sandy clay. Limestone beds occur in the lower part of the unit, and the clay tends to be calcareous. This unit is unfossiliferous for the most part. The total thickness in Dodge County is 80 feet.

Pleistocene (?) sand and gravel underlie most of the surface of Dodge County. This rests unconformably on the Miocene. No fossils have been found to date this unit. This is mostly medium- to coarse-grained, angular to subrounded quartz with lenses and placers of gravel.

Localities of tektites were plotted and found to be on the surface of Pleistocene sand and gravel.

King, James A., V, 1957, The Petrology and Structure of a Portion of Soapstone Ridge, DeKalb and Clayton Counties, Georgia: Emory University, MS Thesis, 34 p. (Willard H. Grant)

Author's Conclusions

1. The Soapstone Ridge ultramafic is a shallow, saucer-like body underlain by a shear zone. Complex fracturing found within the ultramafic body suggests that it was intimately involved in the shearing.
2. The ultramafic mica schistosity corresponds to the granite mica schistosity.
3. Relationships between lineation, various fracture systems and movement directions need further study.
4. The Soapstone Ridge ultramafic body is composed mainly of actinolite-chlorite schist with minor amounts of hornblendite, hornblende-actinolite schist, anthophyllite schist, and chlorite-magnetite schist.
5. Associated with the ultramafic in minor quantities are a diopside gabbro and a feldspathic amphibolite. The feldspathic amphibolite is an alteration product from, and geologically equivalent to, the diopside gabbro.
6. The question of whether the ultramafic body is an independent intrusion or bears a differentiation relationship to the feldspathic amphibolite can only be answered after more study.
7. A comprehensive structural study is necessary for complete understanding of the Soapstone Ridge ultrabasic body.
8. The present petrographic character of the ultramafic is the result of progressive hydrothermal metamorphism.

Kirkpatrick, Samuel Roger, 1959, The Geology of a Portion of Stewart County, Georgia: Emory University, MS Thesis, 79 p. (Howard R. Cramer)

Author's Abstract

The Lumpkin SW quadrangle is a map of an area in the Coastal Plain of southwest Georgia. This area is underlain, in ascending order, by the Upper Cretaceous Blufftown formation, Cusseta sand, Ripley formation, and Providence sand, and by the Paleocene Clayton formation. These represent at least five distinct advances of the sea.

The Blufftown formation is a medium to fine, deltaic sand. Only the upper 50 feet of this formation reach the surface in this area. No fossils were found in the Blufftown.

The Cusseta sand unconformably overlies the Blufftown and is about 160 feet thick. It is mainly a coarse to medium, cross-bedded, marine sand. No fossils were found in the Cusseta.

Conformably overlying the Cusseta is the Ripley formation, which consists of about 75 feet of marine sand and clay. The Ripley contains abundant marine fossils.

The Providence sand, unconformably overlying the Ripley, is split into two members, the Perote member and an upper member. The Perote consists of thin-bedded slits and fine sands with which much pollen and lignitic material were deposited. The upper member is about 125 feet of cross-bedded, deltaic sand. No fossils were found in the upper member.

The Clayton formation overlies the Providence. The Clayton consists mainly of residual material from previously existing limestone or lime-rich sands. Abundant marine fossils were identified from this formation.

At present, there is a large amount of iron ore being mined from the Clayton formation. The ore is strip-mined and shipped by rail to Birmingham, Alabama. Also, there is a considerable amount of clay present in this area, mainly in the Providence. An investigation of this clay might find it to be of economic value.

Klett, William Young, 1969, The Geology of the Talmo Area, Jackson and Hall Counties, Georgia: University of Georgia, MS Thesis, 66 p. (Giles O. Allard)

Author's Abstract

The Talmo area includes approximately 32 square miles in southcentral Hall and northcentral Jackson Counties, Georgia. The rocks in the area include sedimentary and possibly plutonic and/or volcanic rocks which have been metamorphosed to the almandine-amphibolite facies and subsequently retrograded to the greenschist facies. The only definite igneous activity in the area has been the intrusion of a diabase dike. The age of this sequence has not been determined.

The dominant rock types are muscovite-biotite gneiss, quartzite, hornblende gneiss, and muscovite-garnet-tourmaline schist. A large diabase dike traverses the area perpendicular to the regional foliation. A quartz breccia cuts the muscovite-biotite gneiss and parallels the trend of the diabase dike, N42° W.

The rocks exhibit a northeast-trending foliation which averages N45° E with a 22° dip to the southeast. Isoclinal folds are distinctly visible in the hornblende gneiss and in the muscovite-biotite gneiss and indicate the probable regional style of deformation.

Lamb, George Marion, 1954, Depositional Features of the Silurian Red Mountain Formation in Northwest Georgia: Emory University, MS Thesis, 45 p. (Arthur T. Allen)

Compiler's Abstract

The purpose of this paper was to determine the environment of deposition of the Red Mountain Formation by interpretation of rock type and sedimentary structures and features.

The lower Red Mountain (Mendian Age), which is limestone and shale, shows both horizontal and vertical changes. These grade upward into coarse massive crossbedded sandstone. The sections measured are from west to east: Lookout Mountain - limestone facies, Pigeon Mountain - shale facies, Taylor Ridge sandstone. This sequence indicates a source area to the east. Ripple marks bear this out as they tend to parallel a northeast-southwest shoreline.

The upper Red Mountain (Niagaran beds) represent deposition on a steeper slope. To the east at Taylor Ridge the section is represented by sandstone and shale; to the west at Pigeon Mountain and Lookout Mountain the unit represents a typical shale environment.

Seven measured stratigraphic sections are included in this thesis.

Lawton, David Edward, 1969, Geology of the Hard Labor Creek Area in West Central Georgia: University of Georgia, MS Thesis, 51 p. (Giles O. Allard)

Author's Abstract

The study area comprises a portion of west-central Morgan County, Georgia, located in the Piedmont province.

Field and laboratory investigation indicate that the area is composed of isoclinally folded layers of biotite gneiss and amphibolite, derived from shales and basaltic flows, respectively. Metamorphism of these rocks attained the sillimanite-almandine subfacies of the Amphibolite facies.

A major fault, of unknown displacement, is inferred to cross the area in the vicinity of Hard Labor Creek along a line trending N80E.

Lerman, Abraham, 1963, Evolution and Environment of Exogyra in the Late Cretaceous of the Southeastern United States: Harvard University, PhD Dissertation, 152 p. (B. Kummel)

Author's Abstract

Morphological variation in three species of the ostreid lamellibranch *Exogyra* - *E. ponderosa* Roemer 1849, *E. cancellata* Stephenson 1914 and *E. costata* Say 1820 - occurring in the Late Cretaceous (Late Campanian - Early Maastrichtian) marine sediments of the southeastern United States was investigated and interpreted in terms of its relationships to the nature of the sediment and evolution of the species. The stratigraphic succession of

the species has been established by Stephenson (1914) as *E. ponderosa* (the lowest) - *E. cancellata*, *E. costata* - *E. costata*. Variation in the following characters was studied: (1) Extent of the ornamentation of the left (lower) valves. Development of a costate ornamentation terminates in ontogenetically younger stages in *E. ponderosa* than in *E. cancellata* and *E. costata*. The macro-lithology of the sediment has apparently no effect on the development of the ornamentation which follows in main the stratigraphic sequence. (2) The height of the left valve (the dorso-ventral distance) varies linearly with depth (convexity of the left valve, or its inflation). The profile of the valve, as expressed by the height/depth ratio varies only little from population to population and from species to species. (3) The number of costae increases in the sequence from early *E. cancellata* to late *E. costata*. (4) The size of the attachment area of the shell suggests relationships to both the mode of life (larger attachment areas in individuals growing in clusters) and factors specific to a species.

A relative degree of similarity between the sampled populations from different localities within a species, as well as between the species, was studied in terms of a "statistical distance" function (Mahalanobis D^2). Statistical distance between any two groups is interpreted as a direct measure of morphological affinities between them. Such an analysis reveals that the differences between conspecific populations from widely spaced localities within one stratigraphic zone are small. The main differentiation between the populations arises through time. Different sedimentary facies within one zone have thus relatively little effect on geographic variation within the species studied.

The rates of evolution, expressed as an increase in the statistical distance between populations with time (D/t), suggest that within the lineages *E. ponderosa* - *E. cancellata* and *E. ponderosa* - *E. costata* the rates at the transition from one species to another were higher than during the period when a species became established. A relationship between D/t and Haldane's (1949) expression of a rate of evolution is discussed.

The very good state of preservation of the calcareous shells at a number of localities warranted inquiry into the chemical composition (Ca, Mg, Sr) of the calcitic exoskeletons of *E. cancellata* and *E. costata*, and its relationships to some of the physicochemical parameters of the environment. The amount of Mg in exoskeletons of the two species of *Exogyra* and of Recent *Crassostrea virginica* (taken for comparison) is virtually independent of the amount of Sr. With respect to Mg, the above three species (and, probably, calcitic Pelecypoda as a whole) are at equilibrium neither with sea water nor with an "average" river water. On the other hand, the Sr content of the analyzed samples can be accounted for by equilibrium relationships between the exoskeleton and Sr/Ca ratio in the environment as in the Recent seas. The differences in the Sr contents of *E. costata* and *Belemnitella americana* are in apparent agreement with the differences in the paleo-temperatures recorded for these two forms by Lowenstam and Epstein (1954).

Possible effects of salinity on the Sr/Ca ratio in biogenic calcites are considered. Treatment of the biogenic calcites secreted by *E. cancellata* and *E. costata* in terms of the Gibbs function of mixing (estimated approximately) suggests that differences might have existed between populations from different geographic localities. Such differences, expressed in the chemical composition but not in the morphology, were interpreted as somewhat analogous to the differences between the "physiological races" within the Recent species of oysters.

Lester, James George, 1938, The Geology of the Region around Stone Mountain, Georgia: University of Colorado, PhD Dissertation, 147 p. (C. F. Worcester)

Compiler's Abstract

The study area includes part of Dekalb, Gwinnett and Rockdale Counties in the central Piedmont of Georgia. This investigation is a detailed study of the geography and geology of the region. An extensive discussion of topographic features and soils is included.

The geology is primarily a discussion of the rock types with detailed descriptions and structural relationships in the area. The units described in detail are the Stone Mountain Granite and the Lithonia Gneiss and diabase dikes. An extensive study of joint patterns and pegmatite patterns is accompanied by illustrative diagrams.

The author extensively discusses weathering in the region. Many features such as solution pits, pot holes and exfoliation are discussed. This section describes the general weathering phenomena of the southeast United States.

Economic geology, mineralogy and geologic history are also described in the text. Stone for building and aggregate is the main mineral commodity in the area. An index to minerals of the region along with detailed descriptions is included.

The geologic history is not definitely established. Roan series and Carolina Series rocks, the oldest in the region, have been extensively metamorphosed. The accepted age for the granite batholiths is late Carboniferous. Diabase intrusions are generally Early Jurassic or Late Triassic. The Tertiary represents a period of peneplanation and deep weathering.

Levy, John Sanford, 1968, Suspended Sediment Distribution of Doboy Sound, Georgia: University of Georgia, MS Thesis, 102 p. (Vernon J. Henry)

Author's Abstract

Doboy Sound, Georgia represents a mixed estuary during the summer months, June-August. The permanent suspended load for the flood was 5 mg/l, and that of the ebb varied from 10 to 350 mg/l, depending upon its proximity to a source of suspended material. Four major sources of suspended material are: sediment from coastal plain rivers; material transported from the nearshore Continental Shelf; resuspension of material previously deposited in the salt marsh; organic detritus. Clay mineralogy of the suspended sediment indicates its source. Various water masses with similar salinity and temperature have a varying suspended sediment load moving throughout the estuary with response to the tides. Foam or turbidity lines are present at the convergence of two differing water masses. The classical salt wedge is not developed at the inlet of the Sound to the ocean but is formed seaward between less saline longshore drift and open ocean water. This wedge moves landward with the flood tide carrying a large suspended load. Settling of suspended clays and silt may be aided by flocs having organic detritus as their nucleus.

Libbey, Stephan Charles, 1971, Petrology of the Igneous Rocks of Putnam County, Georgia: University of Georgia, MS Thesis, 99 p. (Dennis Radcliffe)

Author's Abstract

The igneous rocks of Putnam County are intruded into Charlotte Belt metasediments, including quartz muscovite schist, biotite gneiss, and hornblende gneiss. These latter are metamorphosed to the kyanite-almandine-muscovite subfacies of the almandine-amphibolite facies of regional metamorphism. Locally the rocks have been adjusted to the orthopyroxene hornfels facies of thermal metamorphism by the intrusion of mafic plutons. Statistical analysis of the structure reveals an asymmetric, northeast-plunging anticline modified by a series of cross folds with northwest trending axes.

Mafic igneous rocks include pyroxenite, metagabbro, hornblende gabbro, and mafic tonalite. The plutons are generally elongated parallel to the regional strike and occur in a belt extending across the northwest half of Putnam County, forming a part of the Charlotte Belt suite of mafic plutons. A second belt of mafic granophyric gabbros occurs in the southeast part of the county. The plutons range in area from 20,000 square feet to approximately 1.1 square miles. Several diabase dikes are distributed throughout the county.

Magnesium and iron distribution coefficients between coexisting clinopyroxenes and orthopyroxenes indicate crystallization temperatures of 620-800° C. for the hornblende gabbro, and of 1000-1200° C. for the pyroxenite. Coexisting pyroxenes in the other plutons appear to be in disequilibrium.

Logan, Thomas Francis, 1968, Pleistocene Stratigraphy in Glynn and McIntosh Counties, Georgia: University of Georgia, MS Thesis, 103 p. (Vernon J. Henry)

Author's Abstract

Fifteen borings in Glynn and McIntosh Counties, Georgia cored late-Pleistocene sediments of the Talbot, Pamlico, Princess Anne and Silver Bluff formations. These formations occur in an offlap sequence, at successively lower elevations, from the Talbot on the west to the Silver Bluff on the east.

At least three facies exist in each formation: (1) the barrier island facies (averaging 20 feet thick); (2) the back barrier-lagoon facies (averaging 30 feet thick); and, (3) the lagoon-salt marsh facies (averaging 20 feet thick). A fourth facies, the offshore facies, may occur locally.

Pleistocene deposits of the Altamaha River occur in western and southern McIntosh County.

The preservation of graded, horizontal, and cross-bedding, *Ophiomorpha nodosa* (burrows), estuarine and marine fossils, and alluvial sands and gravels in these formations illustrates the barrier island and lagoon-salt marsh character of the Pleistocene depositional environments. Formation of humate and oxidation of heavy minerals in the barrier island facies, and the color-mottled, oxidized clay, greatly leached shell remains, and the local occurrence of Jarosite in the lagoon-salt marsh facies are indicative of weathering of the

Pleistocene sediments. Diagenetic activity in the lower part of lagoon-salt marsh sediments is shown by the presence of pyrite.

Each Pleistocene formation in the Glynn-McIntosh area disconformably overlies sediments of upper-Miocene age. In the western half of the study area the disconformity may be the result of subaerial erosion; in the eastern half of the area, it is apparently the result of channel scour or wave scour and/or submarine erosion although evidence is not conclusive.

No sediments that could be identified as Pliocene in age were encountered although they may occur locally. Pliocene sediments may have been removed by erosion during low stillstands of the sea during the Pleistocene, or there might have been topographically high areas of the upper-Miocene surface upon which no Pliocene deposition occurred.

Madeley, Hulon Matthews, 1972, Petrology of the Tuscaloosa Formation in West Central Georgia: Ohio State University, PhD Dissertation, 89 p. (George E. Moore)

Author's Abstract

The primary objective of this study was to determine the environment of deposition of the Tuscaloosa Formation, of Late Cretaceous age, where it is exposed in parts of Muscogee, Chattahoochee, Marion, and Talbot Counties in west-central Georgia. A secondary objective was to determine whether Folk's Empirical Quartz Classification System could be profitably used in such a study. Field, thin-section, X-ray diffraction, and statistical methods were used in the course of this study.

In the study area, a few feet of the Eutaw Formation locally overlies the Tuscaloosa Formation. No field or microscopic features were found in the Eutaw Formation that were not also present in the Tuscaloosa. There are some local unconformities between the Tuscaloosa and the Eutaw Formation, but many of these also exist within the Tuscaloosa Formation. For these reasons, the Tuscaloosa and basal Eutaw Formations are thought to have developed in the same environment.

The environment proposed is a subaerial deltaic plain. Cross-bedding measurements confirm that the major directions of sediment transport were toward the south. The Georgia Piedmont existed during the Late Cretaceous and therefore could have been the northern source area from which the sediments of these units were derived. The Tuscaloosa and Eutaw Formations in the area studied are appreciably thicker than they are along strike to the east.

The facies normally associated with subaerial deltaic plains are present. The largest number of cobbles and pebbles are along the northern-most part of the Tuscaloosa Formation in Talbot County. For this reason, this area is thought to be the former head of the deltaic plain. Distributary channel bars are identified by (1) their abrupt erosional contacts with the underlying siltstone and claystone deposits of possible intra-distributary origin, (2) their pebbly, coarse sandy bases with clay-gall concentrates, and (3) their tabular, large-scale trough or small-scale trough (festoon) cross-bedding. Two directional modes exist for these beds, a primary one toward the southwest to west and a secondary one toward the southeast to south. There are many directional axes of cross beds between these two primary directions. Collectively, these channel bars seem to indicate a distributary channel pattern. South of the study area, the basal Eutaw Formation has lithologic and faunal attributes of delta front deposits.

The proposed delta began to form at a time during the Late Cretaceous when the northern shore of the sea was some distance of the study area as indicated by marine Tuscaloosa rocks in the subsurface. As sediments were delivered to this area, the delta thickened and prograded seaward.

Thin-section analysis indicates that (1) the roundness of quartz grains is low, (2) phi-standard deviations are mostly moderate, with only five possible channel samples being well sorted, and (3) the largest median grain-sizes are in channel deposits in the lower half of the Tuscaloosa Formation. This decrease in grain size suggests a general decrease in competence of the streams with time, which in turn could be explained by a gradual reduction of the slope of the deltaic plain as deposition continued.

The basal Tuscaloosa contains the more weathered quartz and microcline grains. This suggests that the earlier deposits were derived from the erosion of weathered soil in a quartz and microcline-rich source area, with less-weathered material being supplied by the source area as erosion progressed.

Each of Folk's extinction types in quartz grains is present in a variety of igneous and metamorphic rocks in the Georgia Piedmont. Furthermore, many of his type VI grains become type III grains during transport. Consequently, the use of quartz extinction types in sedimentary rocks as indicators of provenance is not justified.

Marquis, Urban Clyde, 1958, The Relationship between the Fort Payne Formation and the Floyd Shale [Mississippian] in Northwest Georgia: Emory University, MS Thesis, 111 p. (Arthur T. Allen)

Author's Abstract

An area of approximately 1,600 square miles in northwest Georgia and northeast Alabama has been studied to determine the stratigraphic relationship between the Fort Payne formation and the Floyd shale in northwest Georgia. Descriptions of twenty-five measured sections of Mississippian strata immediately overlying the Maury shale are included and most of them are compared in correlated columnar sections using the top of the Maury shale as a common datum plane.

Determining the relationship between the Fort Payne and the Floyd involved the identification and definition of the two formations. A large part of the thesis is concerned with the identification, description, weathering habits, and diagenesis of the strata of the Fort Payne formation, which manifests itself in many forms at its outcrops. Much of the Fort Payne is described as being diagenetic products consisting of dolomite and chert that have replaced beds of limestone and argillaceous limestone.

The Lavender shale member of the Fort Payne is redefined after Butts to be the dark-colored, slightly siliceous, argillaceous and nonargillaceous, calcareous and noncalcareous dolomitic phase of the Fort Payne. It interfingers with the remainder of the Fort Payne and occurs at all horizons from the base of the formation to the top and appears to grade into the overlying Floyd shale, but it does not form a continuous sequence of beds at any one location.

The Floyd shale appears to overlie the Fort Payne and its Lavender shale member if the Lavender shale is not considered to be a part of the Floyd shale. The thesis suggests that the term "Lavender shale member of the Fort Payne formation" be dropped from usage; that the term "Taylor dolomite" be used to designate the entire dark phase of the Fort Payne formation (including the dark siliceous dolomite at Taylor Ridge in Chattooga County, Georgia); and that the Taylor dolomite be considered a member of the Floyd formation in conformance with the dark color of the Floyd and the similar geographic relationship to the light-colored phase of the Mississippian formations above the Fort Payne. If these suggestions are accepted, the Floyd formation will represent the dark-colored facies of all the Mississippian formations in northwest Georgia including the Fort Payne formation.

Martin, Benjamin Frank, 1974, The Petrology of the Corbin Gneiss: University of Georgia, MS Thesis, 113 p. (Vernon J. Hurst)

Author's Abstract

The Corbin gneiss, exposed in parts of Bartow and Cherokee counties, Northwest Georgia, was intruded in excess of 1000 my ago (zircon and whole rock Rb-Sr dates - Odum, *et. al.*, 1973) as a magma of quartz monzonite modal composition. Differentiation of the magma followed the calc-alkaline trend, and produced a zoned rock mass characterized by large (up to 10 cm in diameter) microcline phenocrysts, blue quartz, and biotite, as well as an unknown ferromagnesian phase antecedent to the garnet now found in the rock.

The chemical composition of the garnet suggests that it may have formed under conditions of very high grade, possibly granulite facies metamorphism which preceeded the Barrovian type metamorphic event which left its imprint on the Corbin gneiss and surrounding late Precambrian-Lower Paleozoic sediments about 400 my ago (biotite K-Ar and 40Ar/39Ar dates- Smith, *et. al.*, 1969; Dallmeyer, 1974). The lenticular texture of the quartz and the garnet texture are similar to those of granulites. The original pattern of zoning has been complicated by deformation that may have been associated with this postulated granulite facies metamorphic event.

The Corbin gneiss was uplifted and eroded prior to the deposition of the Ocoee Series. Ensuing sedimentation was followed by metamorphism and folding in the Paleozoic. The Corbin gneiss is now exposed at the core of the Weisner-Salem Church anticline.

Mathur, Uday Prakash, 1971, Study of the Continental Structure of Southeastern United States by Dispersion of Rayleigh Waves: Georgia Institute of Technology, MS Thesis, 167 p. (Timothy Long)

Author's Abstract

Phase velocity dispersion curves for fundamental mode Rayleigh waves are calculated for the portion of the Southeast United States between the Atlantic Coastal Plain and the Appalachian Plateau. Four WWSSN stations (ATL, SHA, OXF, and BLA), which fall within this area, were used.

The arrival times of the various phases were smoothed and then fitted to a linear epicentral distance versus arrival time curve by the method of least mean squares. The effects of curvature and diffraction, at different periods, were accounted for by computing the standard deviation of the least mean squares fit for "false" epicenters. Phase velocities were then calculated for periods from 20 seconds to 45 seconds by the method of least squares from the "false" epicenter which gave minimum standard deviation.

The dispersion curves showed little variation throughout the area, indicating a uniform crustal structure. By comparison to theoretical dispersion curves a crustal model consisting of four layers with shear wave velocities of 3.30 km/sec, 3.47 km/sec, 3.58 km/sec, 3.75 km/sec, and 4.56 km/sec, and thicknesses of 1 km, 15 km, 15 km, and 10 km (total crustal thickness of 41 km) was considered the best fit. However, a number of models with velocity of 3.34 km/sec in the upper crust increasing to 3.75 km/sec in the lower crust could satisfy the observed data.

The crustal thickness of 41 km is consistent with an analysis of unreversed travel times in the Southeast United States. The refraction analysis indicates a velocity structure consisting of a 5.3 km layer with shear and compressional wave velocity of 3.21 km/sec and 5.77 km/sec respectively over a 34.7 km thick lower crustal layer with shear and compressional wave velocities of 3.78 km/sec and 6.75 km/sec respectively.

Matthews, Vincent, III, 1967, Geology and Petrology of the Pegmatite District in Southwest Jasper County, Georgia: University of Georgia, MS Thesis, 68 p. (Charles O. Salotti)

Author's Abstract

The studied area covers 47 square miles in southwestern Jasper County, Georgia and lies within parts of the Oconee National Forest and Piedmont National Wildlife Refuge. The area is underlain by a series of intimately interlayered hornblende gneiss, quartzo-feldspathic gneiss, and migmatite. Most of these rocks show metasedimentary features and a few show meta-igneous features. The series has been regionally metamorphosed to the kyanite-almandine-muscovite subfacies of the almandine-amphibolite facies. After regional metamorphism, these rocks were intruded by the Gladesville norite which displays rhythmic banding and igneous lamination. The gneisses along the margin of the norite have been baked to the pyroxene hornfels facies of contact metamorphism. Numerous mafic dikes and granite pegmatites intrude the Gladesville norite and the pegmatites have developed hydrothermal alteration aureoles in the norite. Three northwest-trending diabase dikes crosscut all of the other crystalline rocks.

Foliation in the gneisses is parallel to the layering which has a northeast regional strike and vertical dip. Rhythmic banding in the norite strikes N90E and dips 60°N. indicating a large-scale, post-metamorphic tilting.

Feldspar is presently being mined from the pegmatites. Anthophyllite asbestos, sillimanite, and dimension stone are potentially economic rocks and minerals which are present.

Maye, Peter Robert, 1972, Some Important Inorganic Nitrogen and Phosphorous Species in Georgia Salt Marsh: Georgia Institute of Technology, MS Thesis, 60 p. (Kevin Beck)

Author's Abstract

Thirteen cores were taken at various locations in the marshes in the Savannah River, Ogeechee River, and Skidaway Island areas of Coastal Georgia. Sediments and interstitial waters from the cores were analyzed for the important inorganic nitrogen and phosphorus species.

The interstitial waters contained ammonium and phosphate in varying concentrations and in general the concentrations increased with depth in core.

Both exchangeable and nonexchangeable ("fixed") ammonium were found in the marsh sediments. The amount of exchangeable ammonium was very low in all cases. The fixed ammonium was more abundant and averaged about five times greater than the exchangeable form. As expected, both exchangeable and fixed ammonium present in the sediment were dependent on the amount of clay present.

The three important inorganic phosphorus species $Al\text{-}PO_4$, $Fe\text{-}PO_4$, and $Ca\text{-}PO_4$ were found in the marsh sediments in varying abundances. It is apparent that both grain size and salinity may influence the relative amounts of the phosphate species present in a given sample.

The major source of both inorganic nitrogen and phosphorus in the sediments is the marsh grass *Spartina alterniflora.*

McClain, Donald Schofield, Jr., 1953, Geophysical Exploration on the Coastal Plain of Georgia, in Baker County, Georgia: Emory University, MS Thesis, 41 p. (James G. Lester)

Author's Conclusions

The results of the gravimeter survey show no indications of structure favorable for the accumulation of oil either in the basement or in the sediments above it. The survey indicates that the basement slopes steadily and uniformly southward. The anomalies appearing on the isogalic map are due to near-surface causes.

Environmental conditions were not favorable for the accumulation of large quantities of oil. Furthermore, the type of trap most likely to occur on the Coastal Plain—the stratigraphic type—is the most difficult to locate by either surface or subsurface means.

McClellan, Guerry Hamrick, 1964, Petrology of Attapulgas Clay in North Florida and Southwest Georgia: University of Illinois, PhD Dissertation, 127 p. (R. E. Grim)

(Abs): Dissert. Abs., vol. 25, no. 1, p. 6539.

Author's Abstract

The attapulgite-bearing Hawthorn Formation (Middle Miocene in age) was sampled in three separate geographic areas to obtain material that might present interesting areal mineralogical variations. Preliminary X-ray diffraction studies of all the samples collected showed no useful lateral variations, but showed that sepiolite was more stable than attapulgite under weathering conditions with montmorillonite representing the alteration product. The environment is saturated with respect to silica, as is shown by the presence of the silica polymorphs, opal, beta-cristobalite, alpha-cristobalite, chalcedony, and quartz. The deposits of attapulgite commonly have calcite, dolomite, and various phosphate minerals associated with them.

Six samples were selected on the basis of the amount of attapulgite present for detailed study using quantitative X-ray diffraction determinations, thin section studies, electron microscopy, differential thermal analysis, cation exchange capacity measurements, and X-ray fluorescence analysis. These techniques were also used to study samples containing sepiolite and montmorillonite that were associated with the attapulgite. The data from these investigations and study of the literature indicate that the material from which the attapulgite clay formed was deposited in an elongate, graben-like marine basin. This material was a sol of very fine-grained clastics with diatom valves composing a significant part of the deposit. It is considered that before compaction a submarine spring introduced large quantities of magnesium and sulfate into the siliceous deposit. The subsequent structural substitutions and diagenesis of the deposit resulted in the formation of attapulgite. The broad structural similarities between diatoms and attapulgite are thought to have favored the formation of attapulgite in the magnesium-rich environment.

McKniff, Joseph Michael, 1967, Geology of the Highlands-Cashiers Area, North Carolina, South Carolina, and Georgia: Rice University, PhD Dissertation, 167 p.

(Abs): Dissert. Abs., vol. 28, no. 4B, p. 1580.

Author's Abstract

The Highlands-Cashiers area is underlain by a thick sequence of interlayered mica gneiss and schist, hornblende gneiss and schist, felsic gneisses ranging in composition from quartz diorite to granodiorite, and intrusive ultramafic rocks and pegmatites. The metamorphic sequence probably originated as a thick series of interbedded sedimentary and volcanic rocks. Mica gneiss and schist correspond to graywacke-sub-graywacke and shaley sedimentary rocks, respectively. Hornblende gneiss and schist were probably basalt flows or sills prior to metamorphism and the composition of the felsic gneisses corresponds to arkosic sedimentary rocks and Na-rich volcanic rocks. The felsic gneisses have undergone varying degrees of anatexis, remobilization and K-metasomatism which has probably altered the original composition of these rocks.

Two periods of metamorphism have been recognized, both falling within the Barrovian type metamorphic facies series. The first regional metamorphic event attained maximum temperature-pressure conditions in the kyanite-almandine-muscovite subfacies of the almandine-amphibolite facies and occurred concomitantly with deformation although maximum thermal conditions were later or post-tectonic. The second metamorphic event reached conditions of the greenschist facies of regional metamorphism and produced cataclastic features, particularly in the rocks of the southeastern portion of the map area.

At least two and possibly four periods of folding can be recognized. The first of the two dominant periods of deformation is characterized by large-scale isoclinal recumbent folding about northeast trending fold axes. The development of nappe-like tectonic units is also recognized in connection with this episode of folding. Transposition of compositional layering (sedimentary bedding ?) resulted in the production of a dominant axial plane foliation. A second period of deformation has folded this axial plane foliation into broad, more upright, shallow plunging folds. The fold axes of this later deformation also trend northeast and approximately parallel those of the previous episode of folding. In the more schistose rocks the crinkly folding associated with this second period of folding produces a new foliation; crenulation foliation grades into an axial plane foliation in the hinge zone of tight folds of this generation of folding. Linear structures produced during the earlier period of folding are folded about the later fold axes. Both flexural-slip and slip mechanisms of folding were operative during this later episode. It is suggested that mantle gneiss dome tectonics were developed in certain sections during this event.

The rocks of the Highlands-Cashiers area closely resemble rock sequences from other orogenic belts and were probably deposited during late Precambrian to early Paleozoic time in the eugeosynclinal portion of the Appalachian orogenic belt. Subsequent to deposition, the rocks were subjected to two periods of folding and metamorphism. It is suggested here that the orogenic events may have developed as one thermal episode which in turn was punctuated with at least two episodes of deformation with thermal conditions attaining peak intensity closely following the first period of folding. This orogenic episode probably corresponds to the Taconic Orogeny recognized throughout the entire Appalachian Mountain system.

McLemore, William Hickman, 1965, The Geology of the Pollard's Corner Area, Columbia County, Georgia: University of Georgia, MS Thesis, 149 p. (Vernon J. Hurst)

Author's Abstract

The study area covers 35 square miles in Columbia County, Georgia. The principal rock unit is the Kiokee series which is equivalent to the Carolina series and is a layered sequence of metasediments and coarse-grained adamellites. Ultrabasic rocks have intruded the Kiokee series and have been serpentinized and steatitized. Steatitization came after serpetinization. Magnetite gneiss is intimately associated with the ultra-basic rocks. Mafic rocks are interlayered with the Kiokee rocks and probably are sills. Overlying the Kiokee series is the Little River series which is mainly sericite schist. Finer-grained adamellites have intruded the Kiokee rocks and have steatitized pre-existing serpentines. The age of the rock units is probably late Precambrian except for the Little River series which may be younger. There have been two periods of metamorphism; the first was of highest intensity and probably was late Precambrian and the second of lower intensity, probably late Paleozoic. Potential economic resources of granite, serpentine, talc, manganese, gold, platinum, chronium, nickel, and corundum are discussed.

McLemore, William Hickman, 1971, The Geology and Geochemistry of the Mississippian System in Northwest Georgia and Southeast Tennessee: University of Georgia, PhD Dissertation, 251 p. (Robert Carpenter)

(Abs): Dissert. Abs., vol. 32, no. 7B, p. 4011.

Author's Abstract

The general stratigraphy of the Mississippian System in northwest Georgia and southeast Tennessee is as follows:

Pennington Shale
Bangor Limestone
Hartselle Sandstone
Monteagle Limestone
Floyd Shale
Tuscumbia Limestone
Fort Payne Chert
(including the Lavender Shale Member)
Maury Shale

The Mississippian thickens to the south and southeast and carbonates are replaced by clastics. These clastics had a southern source area which probably served as an interconnecting link between the Appalachian and Ouachita tectonic belts.

Most of the carbonate rocks are represented by eight broad micro-facies, which closely reflect environments of deposition, and, to a lesser extent, subsequent diagenetic and epigenetic changes. The eight microfacies appear to have been deposited in an environment similar to that of the present-day Bahama Islands and Florida Bays.

Energy relationships of the depositional environment strongly affect microfacies types and the major-element chemical composition of the carbonates. For all of the limestone rock types, the major oxides (CaO, MgO, Fe_2O_3, SiO_2, and Al_2O_3) approximate a normal distribution. Mode, median, and mean values for CaO are greatest in limestone rock types indicative of higher energy environment; whereas for MgO, Fe_2O_3, SiO_2, and Al_2O_3, the mode, median, and mean values are greatest for limestones deposited under lower energy conditions. The CaO, MgO, and Al_2O_3 contents of

Mississippian limestones can also be correlated with oolite and bryozoan abundances. Limestones with high CaO values are associated with abundant oolites and scarce bryozoa; whereas limestone with abundant bryozoa and scarce oolites tend to have higher MgO and Al_2O_3 and lower CaO concentrations. Echinoderm clasts, which are the most common allachemical constituent in Mississippian limestones, can not be correlated with rock chemistry.

For both the Monteagle and Bangor Limestones, highest CaO values occur in the areas of highest energy. Areas with high CaO values have low Al_2O_3 values and vice versa. MgO values show a general east to west increase.

Unweathered Mississippian shales are calcareous and carbonaceous. Two distinct clay mineral facies are recognized: (1) an illite-kaolinite facies and (2) an illite facies. Illite is relatively more abundant in shales interbedded with carbonates; whereas shales deposited closer to paleoshorelines contain relatively higher proportions of kaolinite.

Areas favorable for the occurrence of Mississippian limestones suitable for both chemical and structural purposes are as follows: for the Monteagle Limestone—Lookout and Raccoon Mountains near Chattanooga, Pigeon Mountain, West Armuchee Valley, and the Grindstone Mountain-Little Sand Mountain strike belt; for the Bangor Limestone—Lookout and Raccoon Mountains near Chattanooga, Fox Mountain and Johnson Creek near Rising Fawn, Pigeon Mountain and Dougherty Gap, and the Grindstone Mountain-Little Sand Mountain strike belt. These areas were delineated by determining those areas where the values of $CaO \geqslant 50.0\%$, $MgO \leqslant 2.50\%$, and $Al_2O_3 \leqslant 1.50\%$.

Mississippian shales with an economic potential are as follows: the Floyd Shale for structural clay products; both the Floyd and Pennington Shales for portland cement; and the Pennington Shale for lightweight aggregate.

A stream-sediment geochemical investigation of cobaltiferous and nickeliferous deposits in the Fort Payne Chert on Whiteoak Mountain in Tennessee reveals distinct cobalt and nickel anomalies in streams in the vicinity of old prospect pits.

Medlin, Jack Harold, 1964, Geology and Petrology of Bethesda Church Area, Greene County: University of Georgia, MS Thesis, 100 p. (Vernon J. Hurst)

Author's Abstract

The 40 square mile Bethesda Church area lies in Greene County, Georgia, northeast of Union Point. This area lies on the eastern flank of the northeast-southwest trending metamorphic belt of the Piedmont.

The rocks are predominately hornblende gneiss and amphibolite with a lesser abundance of biotite gneiss, schist, quartzite, metapyroxenite, and granite. Cross-cutting these rocks are diabase dikes and slightly metamorphosed rhyolite dikes. Quartz veins and pegmatites occur both roughly parallel and perpendicular to the trend of the rocks.

The dominant rock types represent metamorphosed basic volcanic and intrusive rocks. The biotite gneiss, schist, and quartzite are of sedimentary origin.

Two periods of metamorphism are present. The hornblende gneiss, schist, and biotite gneiss were the first to be implaced and metamorphosed to the amphibolite facies, with the subsequent development of foliation which trends northeast-southwest and dips vertically. Pyroxenite and gabbro, whose present metamorphic equivalents are non-foliated, were then intruded. A second period of less intense metamorphism followed causing cataclastic and retrograde effects. The rhyolite dikes were emplaced in waning stages of this metamorphic period or in a possible third metamorphic period. The diabase dikes are post-metamorphic.

The saprolite mineralogy of the major rock types includes kaolinite, chlorite, vermiculite, quartz and minor amounts of montmorillonite.

Possible economic deposits of feldspar, iron ore, mica, quartz and gold are present.

Mellen, James Vedrey, 1956, Pre-Cambrian Sedimentation in the Northeast Part of Cohutta Mountain Quadrangle, Georgia: Cornell University, MS Thesis, 42 p. (Charles Nevin)

Compiler's Abstract

The purpose of this thesis on the sedimentation of the Great Smoky Group is to discuss:

1. nature of the transporting currents.
2. origin of primary sedimentation features.
3. reliability of top bottom criteria.
4. nature and location of the source of sediments.

Petrologic analysis determined that graywacke is the predominant rock type, comprising about 75% of the section. Dark phyllite and slate units are irregularly interbedded with the phyllite. The graywackes are thought to be the result of rapid deposition from turbidity currents on the basis of several criteria: 1) grading, 2) abundant clay matrix, 3) a lack of bedding and lensing. The phyllites were

formed from mud slowly settling in a reducing environment.

Reliable top-bottom criteria, grading, truncated crossbedding, and flame structures are all useful in this area when many beds are overturned. The sediments appear to be from an acidic igneous rock source to the northeast.

Millians, Robert Wilson, 1963, Drainage Basin Shape as a Measurement of Physiographic Differences: University of Georgia, MA Thesis, 103 p. (James F. Woodruff)

Compiler's Abstract

This study examined variations in drainage basins by use of certain parameters to determine their application in delimiting physiographic provinces. Standard basin shape was established in areas without apparent structural control. This normal shape was developed as tear drop or pear shape.

Comparison basins were selected from 3 areas with either strong structural control or distinct topographic development. Certain aspects of these basins were measured and subdivided into component parts.

Circularity ratio is used to distinguish areas of distinctly different basin shape. This parameter measures compactness of the basin rather than actual shape.

Elongation index is the most useful measurement as it is very sensitive and easily used in a large number of measurements. K-value expresses basin shape more realistically than other parameters, because it is based on the tear-shaped basin.

The result showed that the attempt to distinguish among basins of the comparison areas was unsuccessful. The variations between the means were not large enough to be significant. Geomorphic regions might be delimited on the basis of basin shapes if the differences were distinct enough. Basin shape might be used as a basis for broad regional differentiation but not for sub-regional delimitation.

Mitchell, Jeffery Leonard, 1972, Sediment Differentiation in the Altamaha River Estuary Marine System: Emory University, MS Thesis, 74 p. (Richard D. Hobson)

Author's Abstract

Measures of sand texture, mineralogy and grain morphology are used to identify five distinct sedimentary environments in the Altamaha River-estuary-marine system. These include the river, the northern marine beaches, the off-shore sand flats, the tidal inlets, and areas of sand accumulation within the estuary.

The same sedimentary parameters are used to identify marine and river-derived sands and to delineate four realms of depositional influence: a marine regime; a river regime; and two areas of mixing, marine greater than river and river greater than marine. River sedimentary processes dominate the deposition down to a point approximately three miles landward of the estuary mouth. Seaward of this point, marine processes become increasingly important.

Characteristic river and marine sand end-members are defined using diagnostic values for several of the parameters. The hornblende-epidote ratio is the most useful heavy mineral measure with a value in the river greater than 1.0 and a marine value of less than 1.0. Also, the sands found in marine-dominated areas have: a high zircon content (greater than 10%); high carbonate content (greater than 0.50%); low microcline feldspar content (less than 2%); phosphorite present; shell fragments present; biotite absent; and a roundness value than .260 [sic]. A scheme is presented to combine these end-member data in order to illustrate the areal distribution of the four realms of deposition.

Sediment dispersion routes are suggested based on the distribution of the marine and fluviatile sands and on the orientation of the island bars located in the lower estuary.

Mitchell, Lane, 1941, Mineral and Colloidal Constitution of Some Georgia Kaolins: Pennsylvania State University, PhD Dissertation, 115 p. (E. C. Henry)

Author's Conclusions

Kaolinite is the principal constituent of a series of Georgia kaolins which are typical of commercial clays mined along the Georgia Fall Line. The hardness of a kaolin as determined by the producers is shown to be directly related to particle size, with finer grain sizes producing harder clays. However, if hardness is assumed to include erratic collodial behavior, then factors other than grain size may be of great importance, because admixture of other minerals and the presence of organic matter greatly affect viscous properties. Two kinds of hard kaolin are recognized: those which are hard because of fineness of grain alone, and those which are hard also because of the presence of organic matter or clay minerals of high base-exchange capacity.

The kaolins are different, therefore, chiefly because of a different degree of development, the soft clays showing a greater crystallization of kaolinite. If the amorphous material contains excessive amounts of ions which cannot fit into the kaolinite lattice, other minerals may develop and remove these excess ions. There is an excellent correlation between the hardness of the clays and their grain size, mineralogical nature, and colloidal behavior, if one classifies the clays as either soft or hard, and groups the semi-hard clays with the hard kaolins.

Mitchell, William Louis, 1950, A Detailed Study of the Silurian Stratigraphy in Walker County, Georgia: Emory University, MS Thesis, 71 p.

Compiler's Abstract

Five sections of Silurian rocks in Walker County, Georgia were measured and studied to interpret local facies changes as part of the depositional environment.

The Cooper Heights section (445 feet), the western limit of the study area, consists primarily of shale. The upper part contains thin stringers of limonite within the shale. The middle portion of the section is composed of shale with relatively thin layers of interbedded sandy siltstone and sandstone; the lower portion is shale in which is found small overturned folds and minor faults.

The western Pigeon Mountain section (724 feet) is composed largely of shale and scattered layers of sandstone in the basal section. In the middle section, the amount and thickness of sandstone increases; it is in these that hematite layers are located. The upper section is mostly shale with some sandstone.

The eastern Pigeon Mountain section (405 feet) is composed almost entirely of shale. The lower one-fourth of the section contains some sandstone; severe folding and faulting is also present.

The west Taylor Ridge section (829 feet) contains limey material in addition to sandstone and hematite. Shale predominates in the middle layer with sandstone layers and hematite still present. The upper section is shaley with little sandstone and hematite.

The eastern Taylor Ridge section (350 feet) consists of a thick bedded, coarse, basal sandstone. In the middle of the section, this changes to shale with widely scattered sandstone layers. The upper section is predominately shale with a few thick sandstone layers.

The importance of iron ores in Silurian rocks is discussed extensively and the origin is determined to be "diagenetic replacement".

Mohr, David Wildred, 1965, Regional Setting and Intrusion Mechanics of the Stone Mountain Pluton: Emory University, MS Thesis, 68 p. (Willard H. Grant)

Author's Abstract

The Stone Mountain pluton underlies an area of 5 by 2 miles east of Atlanta, Georgia.

The internal flow foliation of the granite is shown to be a primary plastic flow foliation formed by continuation of intrusion stresses after much of the granite was solid. New data shows that the pluton deformed the rocks to the south by tilting and folding, and to the north and west by faulting and wedging. To the east, the rocks were not deformed by the granite. Structural maxima of pegmatite dikes, granite dikes, and faults caused by the intrusion show deformation patterns explained by doming of foliated rocks over a rising massif. This data fits the shape of the massif as determined by flow foliation: a large dome to the west, a flat to slightly domed, xenolith-filled phacolith to the east.

The most likely source of the magma is a dike running east-southeast of the pluton, as shown by fracture patterns explainable as shear caused by the flow of magma into the pluton through the dike. If this dike is the source, the granite intrusion is a phaco-laccolith with a blister to the west. If is is not, the pluton is likely to be a stock with a sill-like extension to the east.

Pegmatite, aplite, and granite dikes are shown to have been formed by the Stone Mountain granite; quartz veins are shown, for the most part, to have preceded the time of intrusion.

Thin layers of amphibole-microcline gneiss occur northwest of the granite. The occurrence of a 3" dike of this rock containing relict igneous phenocrysts in a granoblastic matrix, and a suitable chemical composition, show that the rock may have been a rhyodacite.

Moore, John Byron, 1954, The Structure and Stratigraphy of the Ordovician Limestones in Mill Creek Valley, Georgia: Emory University, MS Thesis, 55 p. (Arthur T. Allen)

Compiler's Abstract

The Mill Creek Valley in Whitfield County,

Georgia, a one and one-half mile wide strike belt of Middle and Upper Ordovician limestone and mudstones, was studied to determine the structure, lithology and thickness of units. This belt, with a measured thickness of 2360 feet, was divided into 9 general zones, which are correlated with Munyan's work in the Dalton Quadrangle (GGS Bull. 57, 1951). The bentonite zone, a main marker bed, is correlated with Munyan's Zone G. The correlations are based on fossils and lithology.

Deformation has produced numerous structures in the area. Drag folds overturned to the west are the dominant type of flexure. Two sets of tension joints persist throughout the sandstone unit. One set parallels the strike, the other set parallels the dip.

A geologic map, structure sections and detailed stratigraphic sections are included.

Moore, William Halsell, Jr., 1954, The Detailed Stratigraphy and Paleontology of the Mississippian System of the Area between Cooper Heights and Trenton, Georgia: Emory University, MS Thesis, 53 p. (Arthur T. Allen)

Author's Abstract

The Mississippian system, which is eight hundred and ten feet thick in the area between Cooper Heights and Trenton, has been divided into fifteen lithologic and faunal zones. Some zones are difficult to recognize, but zones nos. 1, 2, 5, 7, 9, 11, and 15 contain lithologic traits which make them distinctive.

Zones with distinctive fauna which are useful in correlation, are zones nos. 4, 11, 12, and 15. Seven of the zones contain foraminifera as nuclei of oolites, but no effort has been made to differentiate zones on the basis of foraminifera.

With the exception of zone no. 15, the zones thicken to the west, but there is no great change in lithology.

The major structure in the area is the Lookout Mountain Syncline. Several small structures are also discussed, particularly the one on the east side of Lookout Mountain, above Cooper Heights.

Munyan, Arthur Claude, 1931, The Geology of the Dalton Quadrangle, Georgia-Tennessee: University of Cincinnati, PhD Dissertation, 179 p.

______ 1951, The Geology of the Dalton Quadrangle, Georgia-Tennessee: Georgia Geol. Survey Bull. 57, 128 p.

Author's Abstract

The Dalton quadrangle (Ga. - Tenn.), located in northwest Georgia within the Ridge and Valley province, is a fifteen-minute quadrangle with topographic base by the U. S. Geological Survey. Because of the excellence of the base map and the location of the quadrangle in an area of lower Paleozoic rocks, it was selected as a beginning point for a re-investigation of the geology of northwest Georgia.

Study of the quadrangle, primarily concerned with the stratigraphy and structure of exposed Cambrian and Ordovician strata in it, has resulted in a map showing the areal geology in considerably greater detail than has been done formerly. Some modifications and revisions of previous work have been established and suggested.

Outcropping formations of the Cambrian system consist, at least in part, of the following, described in ascending order: Weisner (?) quartzites and conglomerates, Rome sandstones and siltstones, Conasauga shales and limestone, and the lower part of the Knox dolomite.

The upper part of the Knox and the overlying Newala formation, previously assigned to the Lower Ordovician, may more properly belong with the Cambrian, because of the absence of a detectable interruption between the lower and upper Knox. On the other hand, a probable unconformity, which is thought to truncate the Newala as well as part of the Knox, seems to be a more natural and logical surface of separation between the two systems. This tends to confirm similar observations in east Tennessee and Virginia. The relative uniformity and persistence of Cambrian strata seem to be in sharp contrast to the apparently inconstant character of some of the Ordovician formations in the area.

Exposed formations of the Ordovician present varying aspects on the eastern and western sides of the quadrangle because of facies differences. Some of the formations could be mapped separately in some areas, but general poorness of outcrop combined with lack of fossils and absence of determined strike continuity required that judgment of their exact equivalencies be reserved until adjacent areas are studied. Nevertheless, certain suggestions are presented and provisional names assigned to some units, but all are presently grouped as "post-Knox Ordovician".

Primary structural features of the quadrangle were simultaneously investigated with the stratigraphy, and are described and interpreted. Faulting and folding are demonstrated to be the chief cause of outcrop lineation. Several types of faults are discussed.

The mineral resources of the quadrangle are described and evaluated insofar as possible. Some recommendations for their future development are also made.

Tentative suggestions are offered to explain the geologic history of the area, in an attempt to stimulate future investigations in the Paleozoic area in Georgia.

Murphy, Robert Edward, 1953, Paleontology and Stratigraphy of Middle and Upper Ordovician Limestone in Rabbit Valley, Georgia: Emory University, MS Thesis, 96 p. (Arthur T. Allen)

Compiler's Abstract

This 1½ mile wide strike belt of Middle and Upper Ordovician limestones in Catoosa County, Georgia, was divided into 26 zones in a study of thickness, lithology and faunal assemblages. The average thickness of the section is 1950 feet. These zones can be accurately correlated with zones mapped in Chattanooga Valley (Vest, Emory Univ. thesis, 1952) and the Kensington Quad (Wright, Emory Univ. Thesis, 1952).

Correlation was made with Butts' work (1948) in northwest Georgia. Zones 1 through 24 are equivalent to the 8 formations described as "Chickamauga" and zones 25 and 26 are equivalent to the Sequatchie Formation. Zone 19 contains two bentonite beds in which drag folds have developed.

The base of the Middle Ordovician system in this area is at the contact of the chert-bearing calcilutites of Zone 1 and underlying light-gray, dense dolomite of the Longview formation. The top of the Ordovician System is at the contact of the limestones in Zone 26 and sandy shales in the Red Mountain Formation.

Myers, Carl Weston, III, 1968, Geology of the Presley's Mill Area, Northwest Putnam County, Georgia: University of Georgia, MS Thesis, 67 p. (Giles Allard)

Author's Abstract

The study area, covering 18 square miles in northwest Putnam County, Georgia, consists of a sequence of gneisses which have been intruded by a gabbro, herein termed the Presley's Mill gabbro.

Close correlation between soils and rock types facilitates delineation of rock units where outcrops are scarce.

The gneisses strike northeast and dip steeply to the southeast and northwest. Mappable units include banded biotite gneiss, quartzo-feldspathic biotite gneiss, quartz oligoclase orthoclase gneiss, and interlayered hornblende gneiss. These rocks are interpreted to represent a sequence of predominately sedimentary rocks which were metamorphosed to the amphibolite facies during regional metamorphism. Quartz veins, aplites, and pegmatites probably formed at this time.

The Presley's Mill gabbro was probably emplaced along a zone of deformation. Contact metamorphism is indicated by the presence of hornblende hornfels and pyroxene hornfels along the intrusive contact. Limited data on the composition variation of plagioclase and orthopyroxene suggest that the crystallization sequence is from south to north. Locally, chlorite-tremolite schist, chlorite-talc schist, and epidote-rich rocks occur within the gabbro and formed by later alteration.

Retrogressive metamorphism of the gneisses is indicated by sericitization along cataclastic zones. The Presley's Mill gabbro is thought to have intruded prior to or during this retrograde event.

Nance, Steven William, 1974, The Role of Suspended Matter on Trace Metal Transport in an Estuarine Environment: Georgia Institute of Technology, MS Thesis, 36 p. (Herbert Windom)

Author's Abstract

Suspended sediment collected during August, October, December, 1973, and April, 1974, from the estuarine zones of two major southeast Georgia rivers (Savannah and Ogeechee) were analyzed by radioisotope tracers (^{54}Mn, ^{65}Zn, ^{109}Cd, and ^{203}Hg) and a selective chemical leaching technique to determine the role of suspended material on metal transport in a Southeast Atlantic estuarine environment. The metal concentrations (Cu, Cd, Pb, Zn, Mn, and Fe) in the leached fractions, (adsorbed, reduced, oxidized, and residual) of suspended sediments from fresh water and saline environments were compared. Results indicated that suspended sediment can account for a significant portion of these metals in natural waters. Generally, the residual fraction (metals in lattice sites of crystalline detrital material) and the reduced fraction (metals precipitated and coprecipitated as metallic coatings) were the major sources of the trace metals in suspended sediment. The effect of a salinity change on the metal concentrations of the leached fractions was a function of the specific metal, season, and area of study. Comparison with the results of similar studies indicated the importance of regional differences in the

character of suspended matter on the transport of trace metals.

Needham, Robert Edmund, 1972, The Geology of the Murray County, Georgia, Talc District: University of Georgia, MS Thesis, 107 p. (Vernon J. Hurst)

Author's Abstract

The Murray County area in Georgia is characterized by Precambrian and younger rocks of both metasedimentary and metaigneous origin. The older metaigneous rocks have been thrust faulted to a position overlying parts of the younger metasedimentary rocks. Both types of rocks have been moved towards the west into juxtaposition with younger Cambrian rocks of lower metamorphic grade.

Ultramafic rocks have been intruded into the metaigneous rocks (Fort Mountain Gneiss) and less commonly into the metasedimentary rocks. Because ultramafic intrusions into metasedimentary rocks are limited to areas adjacent to thrust emplaced metaigneous rocks, it is believed that the ultramafic intrusions are related to, and were emplaced during, thrust faulting.

Serpentinization and later metasomatism and metamorphism have altered the ultramafics into an assemblage of soapstone and other talcose rocks. Deformation has acted on the resulting complex mineral assemblage to produce a variably layered rock unit.

Nettles, James Edward, 1959, Study of Foraminifera in the Clayton Formation [Paleocene] Near Fort Gaines, Georgia: Florida State University, MS Thesis, 52 p. (Lyman Toulmin)

Author's Abstract

Four zones are postulated in the Clayton formation near Ft. Gaines, Georgia, on the basis of abundance and restricted ranges of certain key Foraminifera. The total thickness of the Clayton formation is about 123 feet—considerably less than that calculated from the outcrop along the Chattahoochee River by some geologists.

No new species were identified.

An attempt was made to correlate the Clayton formation with the Cedar Keys formation and Oldsmar limestone in the subsurface of Florida, but the Foraminifera of the Oldsmar do not match those of the Clayton, and only a few Foraminifera of the Cedar Keys have been described. Therefore, correlation has not been possible with the information available.

Nikravesh, Rashel, 1967, The Foraminifera and Paleoecology of the Blufftown Formation [Upper Cretaceous] of Georgia and Eastern Alabama: Louisiana State University, PhD Dissertation, 159 p. (H. V. Anderson)

(Abs.): Dissert. Abs., vol. 28, no. 7-B, p. 2902.

Author's Abstract

The Upper Cretaceous shale units recognized as Blufftown Formation exposed in eastern Alabama and western Georgia have been sampled for foraminiferal content. The lower 150 feet of the section is represented by unfossiliferous sandstone; the upper 220 feet of the section consists of argillaceous, fossiliferous marl.

Fifty two species of foraminifers belonging to 31 genera are herein described, illustrated, and their stratigraphic ranges determined. Of these, one subspecies, one genus, and three species are described as new.

Two distinctive foraminiferal groups are recognized: one consisting of only bentonic forms (upper and lowermost Middle Blufftown), the other of associated benthonic and planktonic foraminifers (middle and upper part of Middle Blufftown). Arenaceous families Lituolidea and Ataxophragmiidae constitute a smaller number of benthonic individuals, whereas calcareous families Anomalinidae, Cibicididae, and Nodosariidae constitute the greater number.

It is believed that the Blufftown Formation represents a deposit formed under fluctuating marine conditions, wherein only the more tolerant species could survive. Thus, the distribution of the foraminiferal assemblages is not uniform throughout the section.

On the basis of lithologic and biologic characters, three different zones can be recognized within the Blufftown Formation: (1) the Lower Blufftown consisting of unfossiliferous, cross-bedded, coarse sand; (2) the Middle Blufftown consisting of glauconitic and/or calcareous silty shale containing *Lenticulina pseudosecans* and other planktonic and benthonic forms; and (3) the Upper Blufftown consisting of lignitic silty shale containing *Lenticulina pseudosecans* with *Ammobaculites subcretaceus* and lacking other benthonic and planktonic foraminifers.

Foraminiferal assemblages indicate that the sands of Lower Blufftown were deposited in water from 0 to 35 feet deep, with temperatures

ranging, probably, from 30° to 35° F, and salinity ranging from 18 to 20 parts per thousand. The clayey Middle Blufftown is believed to represent deposition in a transgressive sea, from 35 to 600 feet deep, with temperatures that ranged from 40° to 50° F, and with salinity of 35 to 36 parts per thousand. The silty Upper Blufftown is believed to have been deposited in a regressive area.

On the basis of foraminifers and diagnostic megafossils, the age of the Blufftown Formation is considered to be Upper Santonian to Lower Campanian.

Noble, David Frederick, 1962, Origin of the Expandable Clay Minerals in the Twiggs Clay of Eocene Age: Florida State University, MS Thesis, 85 p. (John K. Osmond)

Author's Abstract

The Twiggs clay member of the Upper Eocene Barnwell formation crops out along a zone extending from the central part of Houston County, Ga. northeastward to Wrens, Ga., and probably into South Carolina. This member contains expandable clays of two derivations. One of these, degraded illite, has been derived from muscovite, the other, "true" montmorillonite, from nonmicaceous materials.

Identification of the two types of clay is based on their reactions to K-saturation. The degraded illite contracts to 10 A on K-saturation; the "true" montmorillonite does not contract to less than 12.4 A and continues to expand after K-saturation. Potassium saturation was effected by soaking for 15 hours in 1 N. KOH solution, or by heating at 98° C for 1, 6, or 12 hours in a 1 N. KOH solution. Fifty-nine samples from eight exposures extending along the strike and up and down dip were analyzed.

The increase in kaolinite from 2% to 14% up dip from Rosebud Church northwestward to Pitts Chapel - Mixon is the result of the differential settling of the clays during deposition. A similar increase, in the same direction, in degraded illite from 35% to 44% within the lower sandy sections of the member probably resulted from more rapid erosion of the source area. The increase in kaolinite from 2% to 17%, in illite - muscovite from 1% to 10%, and in degraded illite from 11% to 55% N.E. along the strike from Rosebud Church to Wrens is thought to be due to derivation from different source areas.

The presence of pebbles indicates a source area with relief which, when inundated by a transgressive sea, formed an embayed coastline. Expandable clay which can be contracted to 10 A by K-saturation, plus interbedding and lensing of the clay and sand, suggest a near shore, low energy, brackish water depositional environment.

The results indicate that the degree of degradation of muscovite, illite, and contractible expanded clay may be used as a key to the rate of erosion and severity of weathering in the source area.

Nunan, Walter Edward, 1971, Stratigraphy of the Lower Devonian Rocks of Northwest Georgia: Emory University, MS Thesis, 89 p. (Howard Cramer)

Author's Abstract

The Armuchee formation (heretofore called Armuchee Chert) of northwestern Georgia is found in several belts exposed on the flanks of a number of ridges in Floyd, Chattooga, Gordon, Whitfield, and Walker counties. Structural boundaries of the outcrop area are the Rome Fault on the east and south, and the Peavine Anticline to the west. The northern boundary is stratigraphically controlled and represents the northern extent of an Early Devonian trough in which the Armuchee sediments accumulated. The Armuchee is separated from the underlying Red Mountain Formation (Niagaran Series) and the overlying Chattanooga Shale (Late Devonian) by paraconformities. The variations in thickness of the Armuchee strata are believed to be the result of synclinal warping of the sedimentary trough during the time of deposition. The Armuchee Formation consists of a chert facies, a sandstone facies, and a distinct sandstone marker bed herein named the Calhoun Gap Sandstone Bed. Fossils indicate an Onesquethaw Age for the Armuchee.

Nuttall, Brandon D., 1951, The Nantahala-Ocoee Contact in North Georgia: University of Cincinnati, MS Thesis, 32 p.

Author's Abstract

The contact between the Ocoee schists and the Nantahala slate is critical to the geology of north central Georgia. Little detailed information is available on the interrelations of these metamorphosed sediments and their interpretation is one of the major geologic problems of that area.

Five detailed stratigraphic sections were measured across the contact of the Ocoee and the

Nantahala. The contact is conformable in all the sections and is gradational in three of the five sections shown. The sections present a gradational change in lithology and in composition between the two beds.

The sediments which formed the Ocoee schists were deposited in an area undergoing orogenic movement. Slates of Nantahala-type can be deposited in a variety of environments. It is not necessary to postulate a break in the sequence of deposition between Ocoee schists and Nantahala slates.

Difference in their original composition has caused these two formations to respond differently to the same metamorphic history. The north Georgia Nantahala slate shows no evidence of notable retrogressive metamorphism.

Oertel, George F., Jr., 1971, Sediment-Hydrodynamic Interrelationships at the Entrance of the Doboy Sound Estuary, Sapelo Island, Georgia: University of Iowa, PhD Dissertation, 187 p. (Keene Swett)

(Abs): Dissert. Abs., vol. 32, no. 58, p. 2800.

Author's Abstract

Hydrographic and sedimentologic research was conducted during the summer of 1970 in order to analyze the sediment budget at the entrance of the Doboy Sound estuary, Georgia.

Dynamic diversion of wind, wave and tidal currents results in a predictable sand-shoal geometry at the entrance of the Doboy Sound estuary. Patterns of dynamic diversion develop in response to seasonal fluctuations in wind and wave approach. Dominant winds (high velocity winds) impinging on the shoreline are from the east-northeast, and predominant winds (greatest occurrence) are from the southeast. During the summer months, southeasterly winds produce onshore currents and longshore currents which divert the ebb-tidal jet of Doboy Sound to the north. The interaction of these currents with sediment laden longshore currents results in the development of shoals at the entrance of the Doboy Sound estuary.

Shoals at the entrance of Doboy Sound are partially exposed at low water and exhibit two trends. Some shoals have an elongate-offshore orientation and extend several miles seaward of the entrance. Another elongate shoal is parallel to the beach about one-quarter mile offshore. During the summer months, sediment is transported in a closed system within these shoals, and there is no sediment by-passing of the entrance. This condition results in lateral and vertical attenuation of shoals and in sediment "starved" areas adjacent to shoals. Tidal current energy is an important mechanism of sediment transport into the shoal system, whereas wave energy is the important mechanism of sediment dispersion and deposition on and around the exposed (mean low water) areas of the shoals. This pattern of shoal deposition at estuary entrances is believed to be directly related to the development and seaward progradation of Pleistocene and Holocene barrier islands along the Georgia coast.

Subenvironments between the estuary entrance, the entrance shoals and the shoreface have sediments with distinct textural and structural characteristics. These distinctions result from relative-intensities of wave and tidal current energy with respect to changing water depths. Sedimentary sets diagnostic of these subenvironments are recognizable in the sedimentary record and may be used in paleoenvironmental interpretations.

Owen, Vaux, Jr., 1957, The Stratigraphy and Lithology of Webster County, Georgia: Emory University, MS Thesis, 82 p. (Romeo Martin)

Author's Abstract

A sequence of formations ranging in age from upper Cretaceous to Oligocene is exposed at surface outcrops in Webster County.

Each formation is marked by distinct characteristics which enable identification. Most of these are best observed in the field and most commonly relate to lithology, sedimentary features, and relations to underlying and overlying formations.

Some formations have features susceptible to identification by laboratory methods. For example, feldspar is found in only the Clayton sand, glauconite in only the Tuscahoma sand, kaolin in only 1 zone of the Nanafalia formation, and fuller's earth in only 1 zone of the Nanafalia formation. In addition, 2 clays of the Clayton formation have particular thermal properties which appear to be distinctive.

All the aforementioned characteristics constitute valuable criteria which may be used in correlating 1 formation through many outcrops over a wide area. They are also useful in regional correlation outside the county.

The usefulness of paleontology is confined to the regional correlation of the upper Cretaceous and the Clayton formation, locations with identifiable fossils being too rare for local correlation. The upper Tuscahoma sand and the Oligocene contain poorly preserved fossils but they are not easily identifiable.

The relationships between formations are varied, some are conformable and some unconformable, either by inference or direct evidence. Direct evidence for unconformities is demonstrated in 2 ways, (1) overlap, and (2) condition of the contact. The former situation is illustrated in the contact between the fuller's earth clay of the Nanafalia formation and the Clayton residuum. The latter situation is illustrated in the contact between the Nanafalia formation and the Tuscahoma sand.

Interpretations may be drawn as to the depositional environment in some cases. For example, a density current deposition of the glauconitic sand is proposed.

Parks, William Scott, 1971, The Clay Minerals of the Ocmulgee River: Emory University, MS Thesis, 82 p. (Willard H. Grant)

Author's Abstract

The Ocmulgee River crosses the Fall Line which separates the crystalline Piedmont from the sedimentary Coastal Plain. With this change in rock types, the clay mineral suites begin to change from recent weathering alteration products to material of ancient depositional origin. This change is from a clay mineral suite of kaolin, illite, and vermiculite to a suite of kaolin and montmorillonite.

Samples were taken at twenty mile intervals along the river from both the bank and bottom. Creeks which have large drainage areas were also sampled. Samples were obtained by means of a grab sampling device and were analyzed by x-ray diffraction, DTA, colorimetry, and atomic absorption.

It was found that the percentage of kaolinite (average 55%) remained quite high throughout the area of study (40-70%). The largest concentration appeared below the commercial clay belt. This concentration was in Pulaski County about sixty miles south of the clay belt. The kaolinite shows an overall trend increasing upriver toward the Fall Line.

The occurrence of illite, (average 15%) was quite limited, appearing only in a few of the creeks draining the sedimentary area. There was a small amount in the river (<10%) where it crossed the Fall Line, and this amount decreased downstream. Vermiculite (average 15%) was found at the Fall Line and the amount decreased steadily downriver. Its occurrence in the creeks draining the sedimentary area indicated that part of the material found in the river was sedimentary in origin. Its rapid disappearance indicated the stability was not very great in the river.

The occurrence of montmorillonite (average 20%) was restricted to the sedimentary Coastal Plain region. The clay did not appear in any large quantities until the Flint River (Oligocene) and the Hawthorn (Miocene) Formations were crossed. The percentage of montmorillonite rose to a high of about 50% near the confluence of the Ocmulgee and the Oconee.

Gibbsite and iron (?) occurred in nearly all of the samples. The amount of gibbsite was about one percent; however, the percentage of iron expressed as Fe_2O_3 made up an unusually large part of the total clay size material, approximately 15%. This large percentage of iron could not be correlated with any known mineral. The most probable sources of the iron were either organic complexes or amorphous material.

Pferd, Jeffery William, 1970, Engineering and Related Physical Properties of the Coastal Salt Marsh in McIntosh County, Georgia: University of Georgia, MS Thesis, 91 p. (Robert Carver)

Author's Abstract

Shear strength, consolidation character and strength-related physical properties were determined for sediments from five environments in the Georgia coastal marsh, i.e., normal marsh, low marsh, *Juncus* marsh, tidal channel levee and encroached barrier island. The average values in gm/cm^2 obtained from *in situ* field vane tests were 27.2, 22.5, 35.5, 43.0 and 68.7, respectively. Laboratory unconfined-compression tests on undisturbed samples yielded generally lower average values, i.e., 22.7, 10.2, 41.0, 54.5, and 61.4 gm/cm^2, respectively.

Consolidation tests showed all but low-marsh sediment to be overconsolidated. Normal and *Juncus*-marsh sediment possessed added strength due to periodic exposure and an extensive root network. Tidal-levee samples are over-consolidated due to desiccation. Encroached-barrier-island samples have been desiccated and possibly have had overlying strata removed. Extreme conpressibility upon loading was exhibited by normal and low-marsh samples. These environments have compression index values of 2.21 and 2.14, respectively. The compression index for the tidal-levee sample was 1.08. Both the *Juncus*-marsh and encroached-barrier-island sediments provide a relatively incompressible base for loading with compression index values of 0.350 and 0.300, respectively.

Average wet-unit-weight values ranged from 1.78 gm/cc for encroached-barrier-island sediment to 1.19 gm/cc for low-marsh sediment. The water

content for the sediments of the five environments ranged from 70.4% to 27.3%, by weight. Normal and low-marsh sediments exhibited similar organic contents of 13.8% and 14.0% by weight, respectively. *Juncus*-marsh, tidal-levee and encroached-barrier-island sediments possessed organic weight percent values of 4.0, 7.3 and 2.6, respectively. The density of solids ranged from 2.15 gm/cc to 2.55 gm/cc.

All environments showed similar relative proportions of the clay-sized layered minerals. All normal and low-marsh samples except one were silty clays, based on the classification of Shepard (1954). The exception was a clay. The tidal-levee samples were sand-silt-clay and both *Juncus*-marsh and the encroached-barrier-island samples were clayey sands.

The sensitivity of these sediments based on vane shear is quite high, i.e., on the order of 10. The unconfined-compression test yielded sensitivities on the order of 3.5. Both values indicate a significant reduction of strength upon remolding or disturbing of the sediment.

Excessive volume change, or settling, due to loading, would be severe in the area. Only the *Juncus*-marsh and the encroached-barrier-island environments would support permanent loads without major planning and special design, however the low shear strength value of the *Juncus* marsh would prohibit large loads.

Maximum allowable bearing capacities for square footings at the sediment surface average approximately 200 gm/cm^2 for normal marsh, 150 gm/cm^2 for low marsh, 300 gm/cm^2 for *Juncus* marsh, 375 gm/cm^2 for the tidal levee and 525 gm/cm^2 for the encroached barrier island.

Piccola, Larry J., 1972, Feasibility of Developing Sanitary Landfills at Abandoned Surface Mines in Georgia: Georgia Institute of Technology, Civil Engineer Research, 36 p. (F. G. Pohland)

Author's Conclusions

1. The availability of surface mines for use as sanitary landfills depends upon the character of the individual mine, its location and potential for reactivation of the mine once mining operations are terminated.

2. It is difficult to generalize on the suitability of surface mines to be used as sanitary landfills. Therefore, each possible site requires a geological and hydrological study to determine the possibilities of ground water pollution or other problems which would prevent its use as a landfill.

3. The majority of the miners contacted in Georgia considered the use of surface mines as sanitary landfills as a means of land reclamation of the mine areas in accordance with the Georgia Surface Mining Act of 1968.

4. The major areas in Georgia which would probably give best results when locating surface mines for use as sanitary landfills for the disposal of large quantities of solid waste include:

the area southwest from Augusta to Macon;
the area in and around Elbert and Oglethorpe counties; and
the mines in the Rome area.

5. Based on the present cost of solid waste disposal employed by Atlanta, it would be more expensive for Atlanta to consider rail or truck transport of its solid waste to any of the three major surface mine areas.

6. Some of the surface mines in the Atlanta area may be used to replace present sanitary landfill operated by the city once the sanitary landfill sites are depleted.

7. Due to the location of one of the major surface mine areas between Augusta and Macon, the prospects of Macon using surface mines as sanitary landfills appear good. The solid waste could be transported by tractor-trailer or collection trucks economically. The type of truck used will depend upon the haul distance involved.

8. Savannah will have to continue its present disposal method since there are no economical means presently available for it to transport its solid waste to any of the three major surface mine areas.

9. The scattering of surface mines throughout the state provides possibilities for many areas to develop county-wide disposal systems with the use of surface mine-sanitary landfills as the means of disposal.

10. The use of surface mines as sanitary landfills has proven successful in Georgia. Their continued use will depend on locating and obtaining additional suitable sites and the associated economics of transporting the solid waste to these sites.

Pickering, Samuel Marion, Jr., 1966, Stratigraphy and Paleontology of Portions of Perry and Cochran Quadrangles, Georgia: University of Tennessee, MS Thesis, 89 p. (Robert E. McLaughlin)

______ 1970, Stratigraphy, Paleontology and Economic Geology of Portions of Perry and Cochran Quadrangles: Georgia Geol. Survey Bull. 81, 67 p., 6 maps.

Compiler's Abstract

The Tertiary rocks in the study area may be divided into seven distinct formations. These units in ascending stratigraphic order are: McBean Formation, Clinchfield Sand, Ocala Limestone, Twiggs Clay, Cooper Marl, Byram Formation and Flint River Formation. Regional dip is 10 to 15 feet per mile.

The Clinchfield Sand has been dated by late Eocene fauna. This unit was deposited in a shallow water, high energy environment. Sandy limestone beds near the top indicate a change to lower energy environment. Several new species were reported: *Periarchus lyelli, P. lyelli pileus-sinensis, Laganum floridanum, Chlamys spillmani clinchfieldensis* and *Crassostrea gigantissima.*

The Ocala Limestone is mapped as a distinct formation. It is shown to be a high-energy bioclastic accumulation of transported organic debris.

The Cooper Marl shows facies change from clastic clay marl updip to fine-grained limestone downdip and may possibly be correlated with the Sandersville Limestone of east-central Georgia. The echinoids *Paraster americanus, Periarchus quinquefarius, P. quinquefarius kewi* and *Brissopsis blandpiedi* represent new species found in the Cooper Marl. Substantiation is added to an early Oligocene age for the Cooper Marl.

The Flint River Formation, represented by the cherty residual remnants of an Oligocene limestone, is the updip faunal equivalent of the Suwannee Limestone. The Flint River Formation is represented in the study area by a sandy facies along the northwest, a coarse bioclastic facies across the central portion and a compact, fine-grained facies to the southwest.

Economic possibilities for high silica sand, agricultural lime and cement, and iron mining are described.

Pierson, Richard Edwin, 1951, Possible Stratigraphic Relationships of the Sandersville Limestone to the Ocala Limestone of West Georgia: Emory University, MS Thesis, 98 p.

Author's Abstract

There are two main divisions of the Upper Eocene in Georgia, the Ocala limestone and the Barnwell formation. The Ocala limestone is well developed west of Flint River; the Barnwell formation is best developed east of Flint River. These two formations merge in Twiggs and surrounding counties. The Sandersville limestone is a member of the Barnwell formation and best known from exposures in Washington County, where the type locality occurs. The Sandersville limestone is equivalent, at least in part, to the Upper Ocala limestone as developed in Houston and Bleckley Counties.

Fossils from six localities (in six counties) are illustrated as fossil plates.

The shore line of the Eocene as reflected by strikes of upper Eocene strata, trends northeast-southwest, but local variations are common and should be considered when working with littoral facies.

That there were several transgressions and regressions of the Upper Eocene sea, is demonstrated by depositional cycles interpreted from well logs.

Pinson, William Hamet, Jr., 1949, Geology of Polk County, Georgia: Emory University, MS Thesis, 178 p. (A. C. Munyan)

Compiler's Abstract

The metamorphic and sedimentary rocks in Polk County are complexly related both stratigraphically and structurally. The sedimentary rocks are found north of the Cartersville Fault, which trends generally west-southwest through the southern part of the country. The metamorphic rocks all lie south of the fault on a line of hills known as Dugdown Mountain.

The Talladega Series of low grade metamorphic rocks ranges from silvery-yellow and gray to dark bluish-gray sericite phyllites and schists in eastern Polk County to sandstone, conglomerates, slate, and marbles in the west. The Talladega rocks, thought to be older than the sedimentary rocks, have been thrust over the Rockmart rocks.

Of the sedimentary rocks in Polk County, Ordovician Knox Dolomite underlies the greatest area. It is typically a grey-blue, medium-grained dolomite with lenses of chert and calcite. The Newala Limestone, which overlies the Knox, is a fine-grained, thick bedded dove-blue to white, low-magnesia limestone.

The Rockmart Slate (?) overlies the Newala Limestone nonconformably. Shales and slates predominate in the formation. The upper part of the formation is composed primarily of thick bedded sandstones. The Rockmart has been isoclinally folded, thus it is difficult to determine stratigraphic thickness.

The report includes a geologic map, measured stratigraphic sections and detailed petrographic analyses. A description of the economic prospects in Polk County is included.

Pirkle, Earl Conley, Jr., 1947, The Penetration of Gamma Rays through Various Soil Materials: Emory University, MS Thesis, 32 p.

Author's Conclusions

Tests showed that the noticeable degree of penetration of the gamma rays through the different soils was between three and five feet. The depth of penetration appeared to be directly dependant upon the density of the different substances. In decreasing order of density and gamma ray absorption, the materials tested were (1) nearly pure silica sand, (2) creek sand, (3) sandy clay, (4) kaolin, (5) water and (6) air.

Since naturally occurring soils are more closely packed than the materials used in these tests, the absorption of gamma rays by naturally occurring soil mantles should be of greater magnitude than that observed in laboratory tests such as these. Therefore, the depth of penetration of from three to five feet observed in these experiments represents a distance slightly in excess of that which would be obtained in the field through the same type of soil.

It appears that subsurface geologic features cannot be determined by direct surface readings of gamma rays being emitted from concealed materials unless the overburden is very thin. If a large percentage of the radioactivity of a rock is concentrated as inclusions in some resistant minerals comprising the rock, then a residual mantle formed from such a rock should include the resistant minerals. It might be possible under such conditions to establish a relationship between the underlying rock and surface readings by recording the radioactivity of the inclusions in the resistant minerals. In regions similar to the Piedmont of the southeastern states, where the soil mantle is predominantly residual and contains some concentration of radioactive mineral derived from the underlying rocks of igneous or metamorphic origin, the Geiger-Mueller field counter, combined with petrographic examination in the laboratory, could be used to correlate the residual mantle with the underlying rock types for mapping formation contacts and areas. Allowance for creep, downslope migration, and disturbance due to cultivation, could easily be made.

Pirkle, William A., 1972, Trail Ridge, a Relic Shoreline Feature of Florida and Georgia: University of North Carolina at Chapel Hill, PhD Dissertation, 90 p. (William A. White)

(Abs): Dissert. Abs., vol. 33, no. 43, p. 1621.

Author's Abstract

Trail Ridge is a long, linear sand ridge that extends from Georgia southward into northern Florida. Studies of field relations and sedimentary features show that Trail Ridge cannot be a residual ridge developed *in situ* as a simple insoluble residue from weathering, nor can it be a residual ridge left standing through processes of weathering and erosion. Rather the ridge is shown to be a depositional landform in which the sediments accumulated as a ridge. Relationships with other landforms indicate that this depositional ridge is a beach ridge that formed at the cresting of an eroding transgressing sea. In some parts of Georgia this sea eroded into an oldland area. In other parts of Georgia and in northern Florida the sea eroded into the high terrace sediments that underlie much of the Northern Highlands of Florida. Still further south in Florida the sea eroded into the Lake Wales Ridge. The broad westward arc of Trail Ridge centering in the region of the high terrace sediments may reflect the greater ease of erosion of these terrace sediments. This origin for Trail Ridge is consistent with physiographic evidence, with sedimentary features of the landform, and with the geological history of the region.

Pooley, Robert Neville, 1960, Basement Configuration and Subsurface Geology of Eastern Georgia and Southern South Carolina as Determined by Seismic-refraction Measurements: University of Wisconsin, MS Thesis, 47 p. (Robert Meyer)

Author's Conclusions

The following significant geologic conclusions may be drawn from correlation of the new information disclosed by this study of the Yamacraw Ridge area with previous theories and studies of the area.

1. The sub-surface topographic feature first postulated and named the Yamacraw Uplift by Meyer exists substantially as first reported.

2. There is essentially no contour closure around the Yamacraw Ridge since it presents itself as one lobate ridge the crest of which gradually decreases in elevation to the southwest, where it bifurcates, with a smaller parallel sub-ridge which lies about nineteen miles to the northwest.

3. The basement structure does not have a very

appreciable effect upon the Bouguer anomalies in the area of study. The major gravity control comes from more than ten times the depth of basement.

4. The structure appears to be of tectonic origin but probably originated before the advent of Cretaceous time since none of the overlying sediments show evidence of structural derangement.

Potluri, Ramamohan Rao, 1971, Petrology of the Atlantic Coastal Plain Phosphate Deposits: University of Georgia, MS Thesis, 76 p.

Author's Abstract

Phosphate-bearing sediments from Atlantic Coastal Plain localities: Echols County, Georgia; Petit Chou Island, Georgia; and Beaufort County, North Carolina; were examined petrologically. The phosphorite consists of feldspathic quartz sand containing rounded, polished, pebble to coarse-silt size phosphate pellets, with minor amounts of clay, and dolomite. The Echols County sediment (mean size 1.8 mm) is coarser than sediment (0.8 mm) from the other two localities. The Petit Chou Island and Beaufort County, North Carolina phosphorites are similar in particle size, sediment color and percentage of other minerals. In general the pellets are smaller than the associated quartz grains because the phosphate is softer than quartz.

The average percentage of phosphate pellets in Echols County, Georgia is 9.0; Petit Chou Island, 48.4; and Beaufort County, North Carolina, 48.7. The average percentage (5.4) of bone fragments is highest in Petit Chou Island phosphorite samples.

Quartz is principal impurity in pellets, present as elongated silt-sized grains, ranging in amount from 1 to 15 volume percent. Organic matter and other minerals, pyrite, glauconite and feldspar are present in phosphate pellets. Pellets also contain radiolaria, diatoms and foraminifera. The fossils show varying degrees of phosphatization and pyritization.

X-ray diffraction indicates that the principal phosphate mineral present in pellets and bone fragments is carbonate-apatite, which is in agreement with reports by Rooney and Kerr (1967), South Georgia Mineral program, Project Report No. 10 (1968) and Simmons (1968).

The high percentage of sillimanite, staurolite, kyanite and garnet from heavy mineral analysis indicates a high rank metamorphic source for the sediment.

Quartz, pyrite and glauconite percentages vary from locality to locality. Glauconite (6 percent) and pyrite (8 percent) are present in Petit Chou Island, Georgia; and Beaufort County, North Carolina pellets. The abundance of dark-colored pellets, greenish-black sediment, and high percentage of glauconite and pyrite may be due to reducing conditions during deposition. Whereas Echols County sediment is light colored and consists of abundant amber pellets, abraded bone fragments, high polished surfaces of quartz and pellets and lower percentage of glauconite and pyrite indicates considerable wave action and oxygen is comparatively high. Glauconite and abundance of bone fragments are evidence of slow deposition. The depositional environment may have been a shallow lagoon or estuary. Warm temperature at shallow depths increases pH of water and decreases solubility of CO_2 and leads to precipitation of phosphate.

From the petrography of phosphate pellets and bone fragments, it is concluded, that these phosphorite deposits possibly originated by direct chemical precipitation.

Pound, James Hannon, 1957, Recent Stream Sedimentation in the Vicinity of Stone Mountain, DeKalb County, Georgia: Emory University, MS Thesis, 75 p. (Willard H. Grant)

Compiler's Abstract

The purpose of this investigation was to examine the factors which determine the sedimentary characteristics of the material deposited in Stone Mountain Creek and Crooked Creek in the area of Stone Mountain, Georgia.

Size and sorting varies widely from stream to stream and within each stream. Sorting is usually better in stream bank sediments than in stream bed sediments due to their deposition from suspension during high water. Five factors were cited as cause of variation in sorting and coarseness.

1. Type of drainage area, determining volume and velocity of water in main stream and tributaries.
2. Character of rock determines size range.
3. Cross section of stream channel at any particular location influences sorting and size.
4. Position within rapid-pond sequence.
5. Any major change in the velocity of the stream.

Quartz is the principal light mineral derived from igneous and metamorphic rocks and saprolite. Potassium feldspar is abundant in sediments derived from Stone Mountain Granite.

One characteristic which seems to be limited to streams on crystalline rocks is the existence of

"rapid", "intermediate" and "ponded" areas. These features are the result of the "damming" effect by quartz veins, pegmatites and other resistant rocks common to crystalline provenances.

Prather, Jesse Preston, 1971, The Geology of Eastern Monroe County, Georgia: University of Georgia, MS Thesis, 82 p. (Dennis Radcliffe)

Author's Abstract

Eastern Monroe County is located in the south-central portion of the Piedmont Plateau of Georgia. The southern portion of the area is located about 8½ miles north of the Fall Line and the Coastal Plain, and 10 miles NW of Macon, Georgia.

The area of study, which covers about 160 square miles, is underlain by three major gneissic units. The oldest unit, which outcrops in the central portion of the area, consists of interlayered quartzo-feldspathic gneiss and amphibolite (Map Unit 1). This unit is structurally overlain by hornblende gneiss (Map Unit 2), which is in turn overlain by biotite gneiss (Map Unit 3 and 3A). This latter unit comprises the predominant lithology in the northern and southern portions of the area.

These gneisses originated from sedimentary and igneous rocks and have been metamorphosed to the sillimanite-almandite-muscovite subfacies of the almandine-amphibolite facies of regional metamorphism. The resultant gneissic foliation, which probably parallels original bedding, has an average strike and dip of N15° E/50° E.

A geanticlinal series of large, isoclinal folds, which have been overturned to the northwest, trend N15° E with an apparent southwestward plunge of 10° or less. Later cross-folds, developed locally, trend approximately N52° W.

The Goat Rock Fault zone transects the area in the south, and the Towaliga Fault crosses immediately north of the area. The area therefore contains essentially the structure and stratigraphy of the region between these major fault systems.

Five norite bodies (Map Unit 5) which are probably the surface exposure of a larger subsurface mass, have intruded the cores of anticlines in the east-central part of the area. Two of the bodies are olivine crystals. The three remaining bodies, which contain pyroxene phenocrysts up to several centimeters in diameter, are devoid of either olivine or corona texture. Gneisses surrounding the norites have been altered to the hornblende-hornfels facies of contact metamorphism.

Igneous layering is present in two of the porphyritic norite units. This strikes N22° W and dips 46° S-SW in the larger layered unit and in the smaller body strikes N14° W and dips 42° E-NE. These attitudes indicate that the norites have undergone rotation en masse after crystallization, perhaps associated with cross-folding.

Crushed stone is currently being quarried in southeastern Monroe County. Sand and muscovite mica were mined sporadically during the first half of this century.

Preston, Charles Dean, 1965, The Paleocurrents of the Red Mountain Formation [Silurian] of [Northwest] Georgia: Emory University, MS Thesis, 45 p. (Arthur T. Allen)

Author's Abstract

A study of the paleocurrents of the Red Mountain formation of Georgia was made at 18 localities and the results plotted on a palinspastic map. The current structures studied were cross-bedding, ripple marks, flute casts, current crescents, and brush marks. The paleocurrents of both Medinan and Niagaran Epochs are shown to have had a general direction to the northwest although important exceptions are noted.

Basin analysis indicates a very shallow sea with an undulating bottom. Possible Medinan and Niagaran shore lines are postulated and a process for the formation of alternating beds without turbidity currents is advanced.

Prowell, David Cureton, 1972, Ultramafic Plutons in the Central Piedmont of Georgia: Emory University, MS Thesis, 83 p. (Willard H. Grant)

Author's Abstract

This paper deals with a portion of the central Piedmont of Georgia located approximately between the Brevard and Towaliga faults. Most of the known ultramafic rocks in this area were located and examined, and four were selected for detail study.

The plutons were examined by geologic field mapping, petrofabric analyses, and petrographic methods. Evidence indicates mineralogic and structural relationships between all of the plutons.

Geochemical and field evidence suggests the original peridotite emplacement was as a semi-solid intrusion at 500-650° C. The plutons are concordant, sill-like bodies occupying the apical

low pressure areas in regional folds.

Metasomatism and hydrothermal metamorphism has altered the minerals in the ultramafic bodies to amphibole-chlorite assemblages. Petrofabrics suggest that the amphibole reflects emplacement or some early tectonic environment. Chlorite fabric correlates with mica fabric in the country rock and reflects regional tectonics.

Pruitt, Robert Grady, Jr., 1952, The Brevard Zone of Northeasternmost Georgia: Emory University, MS Thesis, 71 p. (James G. Lester)

Author's Abstract

The thesis area is located in northern Stephens and eastern Habersham counties where deep cutting streams have exposed fresh rocks of the Brevard series adjacent to South Carolina, as mapped on the 1939 Georgia Geologic Map.

These rocks show strongly the effects of shear and mylonitization. As a result of disequilibrium extensive alteration has taken place, producing chlorite-sericite schists and modifying the mineral constituents of the adjacent biotite gneiss. The marbles show strong shearing, but little observable alteration.

The major structure is dominated by a broad shear zone in which a moderately developed mylonite is found. Bedding in the Brevard zone is essentially isoclinal, dipping 30° to the southeast. A tentative structural diagram based on the possibility of a continuous bed of marble shows overturned isoclinal folding, with anticlines plunging to the northeast. Apparently many of the smaller beds are sheared out at the ends of their outcrops.

The geomorphology of the area is directly related to differential weathering of the northeast trending rocks, especially the dolomitic marbles. A swarm of diabase dikes, trending northwestward, cut across the area and seem to have an effect on pecularities in topography. The most obvious of these pecularities is the abrupt change in direction of flow of Davidson Creek near its junction with Panther Creek.

Reade, Ernest Herbert, 1960, The Geology of a Portion of Newton and Walton Counties, Georgia: Emory University, MS Thesis, 65 p. (Willard H. Grant)

Author's Abstract

This portion of Newton and Walton Counties is topographically youthful to early mature.

Many of the rocks were originally sedimentary and were regionally metamorphosed to the sillimanite-almandine subfacies of the almandine-amphibolite facies. The presence of relic pebbles in the biotite-plagioclase gneiss supports this origin on a local basis.

The predominent rock type is biotite-plagioclase gneiss. Other metamorphic rocks are quartz-amphibole gneiss, amphibole-plagioclase gneiss, microcline-amphibole gneiss, biotite-granite gneiss, garnet quartzite, sillimanite-feldspathic schist, muscovite-feldspathic schist, muscovite-biotite schist and cataclasites.

Granitic materials, granodiorites, and late diabase dikes have been injected into the country rock.

There were two major periods of deformation. The first developed a N 5 E trending fold system. The major structures associated with this are probably anticlinoria and synclinoria. The second period of deformation, which is late or post-metamorphic, formed wrench faults which rotate the older structures near these faults. The flinty crush rock, which fills these wrench faults, rises above the surrounding country as monadnocks.

Reighard, Kenneth Frederick, 1963, A Portion of the Rome Fault of Northwest Georgia: Emory University, MS Thesis, 65 p. (Arthur T. Allen)

Author's Abstract

The area studied is located in the Ridge and Valley Province of Northwest Georgia and includes portions of Floyd, Gordon and Whitfield Counties.

Structural and stratigraphic studies were made in the vicinity of the Rome fault.

The Cambrian period is represented by the interbedded sandstones, siltstones and shales of the Rome Formation and the illite-bearing Conasauga shales and limestones with interbedded kaolinitic layers. The Conasauga Formation was subdivided into 3 units on the basis of lithology and apparent stratigraphic position. The Cambro-Ordovician period is represented by the lower Knox chert characterized by its oolitic zone. The Devonian Armuchee Chert is exposed in an anticlinal fold in the west central portion of the area. The Chattanooga Shale is also present in this fold and proved invaluable in determining stratigraphic relationships. The Mississippian period is represented by the Fort Payne Chert and Floyd Shale outcropping west of the fault trace.

Studies of joints and drag fold axes indicate that the overthrust and these minor structures are essentially contemporaneous.

Renshaw, Ernest Wilroy, 1951, Pennsylvanian Sediments in Northwest Georgia: Emory University, MS Thesis, 66 p. (Arthur T. Allen)

Author's Abstract

The Pennsylvanian strata on Sand Mountain and Lookout Mountain are represented by five formations which are correlated with the Lee Group in central Tennessee and Virginia. These formations, the Lookout sandstone, Whitwell shale, Bonair sandstone, Vandever shale, and the Rockcastle sandstone, have a total thickness of approximately 1000 feet in the area under investigations.

Petrographic studies were made of the formations containing sandstones to establish criteria for correlation and to aid in determining the geologic history of the area.

Results of these studies show the Lookout formation to be of coarser texture and more poorly sorted than the other sandstones. From statistical information and field studies the writer concludes that this formation is a deltaic deposit. The Bonair sandstone and the Rockcastle sandstone are fine-grained, well-sorted and contain original sedimentary features which may indicate that these deposits had a beach origin.

Rife, David Leroy, 1969, Barite Fluid Inclusion Geothermometry, Cartersville Mining District, Northwest Georgia: University of Tennessee, MS Thesis, 69 p. (L. T. Larson)

Author's Abstract

A temperature range of from 150° to 240°C (uncorrected for pressure) is indicated by fluid inclusion geothermometry, for barite mineralizing solutions in the Cartersville District of northwest Georgia during their emplacement. This distribution is well within the temperature range expected for hydrothermal fluids and is therefore an argument for hydrothermal deposition of barite in the district. The total range of temperatures is from 120° to 270°C, but is believed to be not as reliable an index for mineralization as the above restricted range because of possible primary inclusion misidentification and leakage.

To account for the estimated 5000 to 8000 foot depth of burial and present cooled condition, a correction for pressure of 25° to 40° should be added.

Rihani, Rushdi F., 1971, Geochemistry of Holocene Salt Marsh Deposits in the Vicinity of Sapelo Island, Georgia, U.S.A.: University of Georgia, PhD Dissertation, 223 p. (Vernon Henry)

(Abs): Dissert. Abs., vol. 32, no. 10B, p. 5873.

Author's Abstract

Ten cores were obtained from the Mid-Georgia Coast salt marshes. The sediment from the cores was squeezed to obtain interstitial water which was analyzed for pH, chlorinity and the major cations Mg, Na, K, and Ca using emission and absorption spectrophotometry. The sediment organic matter was removed, using H_2O_2, and subsequently the sediment was fractionated into sand, silt, coarse clay, and medium and fine clay. A portion of the total clay was used to determine the exchangeable cations Mg, Na, K, and Ca. Another portion of the clay was used to determine the chemical composition while a third portion of the clay was used to determine the mineralogy by x-ray diffraction and proportions of clay minerals were determined.

The pH of the interstitial water increased with depth while chlorinity decreased. The major cations, as absolute values, also decreased with depth. Ratios of major cations to chlorinity, however, yielded mixed trends, increasing in some cases and decreasing in others. Ca exhibited marked increase at depths where shell material was present. Magnesium and sodium showed a general decrease while K exhibited an increase with depth.

The mineralogical analysis showed no systematic variation with depth. The average mineralogical composition of the clay portion, excluding quartz, was 35.0% montmorillonite, 16.5% illite, and 49.0% kaolinite. The exchangeable cations exhibited an increase with depth with an order of abundance as follows: Mg>Ca>Na>K. Most of the increase in the exchangeable cations is attributed to the presence of shell material. The chemical analysis showed that the oxides of Na_2O, K_2O, Al_2O_3, CaO, MgO and total iron increased with depth in some cases, decreased in others, and were constant in other cores. K_2O, MgO, and iron, however, showed a general increase with depth.

No concrete evidence was seen to support post-depositional changes but preliminary phases of equilibrium are suggested.

Roberts, William B., 1958, A Study of River Terraces of the Chattahoochee River, Chattahoochee, Florida and Fort Gaines, Georgia: Florida State University, MS Thesis, 47 p. (Lyman Toulmin)

Author's Abstract

The Chattahoochee River flows south to southeast through the Coastal Plain Province (Fenneman, 1938) and joins the Flint River at Chattahoochee, Florida, to form the Apalachicola River. This study is concerned with the areal distribution and relative altitudes of terrace surfaces along the Chattahoochee River from Fort Gaines, Georgia, to Chattahoochee, Florida.

Four terrace surfaces were mapped above an arbitrarily selected flood plain (the overbank extent of the 1929 flood) and were designated by their respective heights above the 1929 flood datum. The four terraces are the 10- to 20-foot surface, the 30- to 50-foot surface, the 70- to 110-foot surface, and the 135- to 160-foot surface.

Correlation of the terraces with Cooke's marine terraces was based on a correlation with Vernon's fluvial terraces in adjacent Holmes and Washington counties, Florida. The marine terrace equivalents and the fluvial terraces of the Chattahoochee River are: Pamlico marine terrace and the 10- to 20-foot fluvial terrace, Wicomico marine terrace and the 30- to 50-foot fluvial terrace, Sunderland marine terrace and the 70- to 110-foot fluvial terrace, Coharie marine terrace and the 135- to 160-foot fluvial terrace.

Rosenfeld, Sigmund Judith, 1955, A Study of the Pleistocene Shore Lines Between the Altamaha and Savannah Rivers in Georgia: Emory University, MS Thesis, 51 p. (Arthur T. Allen)

Author's Abstract

The Okefenokee, Wicomico, and Pamlico formations of Pleistocene age appear to be of marine, fluvial, and fluvio-marine origin. These Pleistocene sediments well illustrate the complex history of the depositional environment during that age. The sorting becomes poorer and the mean grain size becomes larger from the youngest to the oldest terrace. Comparison of these parameters with similar measures from modern beach environments indicates that at least part of the material comprising these deposits is of marine origin.

Fisher's *t* gives evidence that there is a significant difference between the means of the phi mean and the mean of the phi standard deviation of the Okefenokee and Pamlico formations. There is, however, no significant difference between the Wicomico and Pamlico formations and the Okefenokee and Wicomico formations. The phi means of the Pamlico and Wicomico formations indicate a decrease in mean grain size oceanward from their respective shore lines.

Petrologic studies show that the heavy mineral content is relatively uniform throughout the three terraces. Epidote and actinolite, however, show a marked percentage increase in Pamlico deposits. The mineralogy and physical characteristics of the sands point to crystalline rocks as the original source of the sediments, which have passed, at least in part, through more than one cycle of erosion.

Rothe, George Henry, III, 1973, Geophysical Investigation of a Diabase Dike: Georgia Institute of Technology, MS Thesis, 78 p. (L. Timothy Long)

Author's Abstract

Analysis of gravity, aeromagnetic, ground-level magnetic, paleomagnetic, and high altitude infrared data has revealed a complex injection zone of diabase in central Meriwether County, Georgia. This zone, which previously was considered to be a single large (30-40 meters wide) diabase dike, has been found in places to reach a width of one kilometer.

A simple Bouguer gravity map of the area shows the dikes, which compose the injection zone, to be responsible for an anomaly in the regional gravity trend of about one to two milligals. Combined results from five gravity and three total-field magnetic traverses has suggested the dikes to dip at about 70° toward N70°E. The mean of the observed ground-level magnetic anomalies for the dikes is a 1000 γ positive anomaly (total field).

On the basis of observed paleomagnetic data and computed bulk susceptibilities the ratio of the remanent to induced magnetizations (Koenigsberger's ratio, Q) has been calculated to be between 0.25 and 0.5. However, the shapes of the observed ground-level magnetic anomalies suggests a Q value of 1.0 or slightly higher for the Meriwether dike.

The total-field magnetic map based on already existing aeromagnetic data has been recontoured under the assumption that the Meriwether dike is continuous, as suggested by ground-level data taken during this investigation.

On the recontoured map the dike is the most prominent magnetic feature of the area which suggests that the spacing and direction of the aeromagnetic flight lines is inappropriate for correlating dike caused anomalies of limited extent, even though the dike anomalies are large in magnitude.

High altitude infrared photographs show a change in intensity of reflected infrared radiation from vegetation growing on diabase derived soils suggesting that such pictures can be used to map the outcrop pattern of the dike in heavily wooded, highly weathered, and other inaccessable areas. It is suggested that this technique be applied to other areas of eastern North America to determine outcrop patterns of the dikes in areas not yet geologically mapped.

Saffer, Parke E., 1955, A Preliminary Investigation of River and Beach Samples Collected in the States of Florida, Georgia, and Alabama: Florida State University, MS Thesis, 59 p. (Ernest H. Lund)

Compiler's Abstract

Samples taken from river and beach sands were examined to determine physical and mineralogical characteristics. Emphasis in the study was placed on sedimentary character and heavy mineral content. River samples were collected from slip-off slopes and river bars; where this was not feasible bottom samples were taken. Beach samples were spaced from Fort Walton Beach, Fla. to Bald Point, Fla.; these were obtained at an approximate distance of two feet below the mean high tide zone.

River samples were widely separated geographically but showed distinct trends. The degree of sorting increases with downstream distance, and the mode decreases in size downstream. The beach samples were very well-sorted. There is a smaller amount of sediment present in the 1/16 mm and finer pan fraction of the beach samples than the river samples.

Heavy mineral content of the samples was computed. The beach samples contain less heavy minerals than the river samples. Ilmenite magnetite comprised about 23% of the heavy minerals in river samples. Hornblende was found to be 18.7% of the heavy minerals in beach samples.

The main body of the paper consists of charts and graphs which present the data.

Salisbury, John William, Jr., 1959, Geology and Mineral Resources of the Northwest Quarter of the Cohutta Mountain Quadrangle [Murray County]: Yale University, PhD Dissertation, 95 p. (John Rodgers)

______ 1961, Geology and Mineral Resources of the Northwest Quarter of the Cohutta Mountain Quadrangle: Georgia Geol. Survey Bull. 71, 61 p.

Author's Abstract

The northwest quarter of the Cohutta Mountain quadrangle falls almost entirely within Murray County, Georgia, except that along the northern boundary it includes a narrow strip of Polk County, Tennessee. It is bounded by parallels 34°52'30" and 35°N. and meridians 84°37'30" and 84°45'W.

The rocks of the area are divided structurally into three main fault blocks by the Great Smoky and the Alaculsy Valley faults. The Great Smoky fault runs approximately north-south near the western margin of the area, and the Alaculsy Valley fault runs from the northeastern corner of the area southwestward to its junction with the Great Smoky fault. West of the Great Smoky fault lie unmetamorphosed Paleozoic rocks of the Valley and Ridge province, ranging in age from middle Cambrian to middle Ordovician. The sequence, oldest to youngest, is: Conasauga shale, Knox dolomite, Newala limestone, Athens shale, and Chota formation. The Conasauga shale and Knox dolomite are thrust over the Athens shale and Chota formation by a minor fault. Other than the minor fault, there is little deformation of the Paleozoic rocks, which maintain a relatively constant NNE. strike and 25° to 75°SE. dip.

East of the Great Smoky fault lie the metamorphosed Precambrian rocks of the Blue Ridge province. A sequence composed of phyllite, quartzite, and metasubgraywacke crops out north of the Alaculsy Valley fault. The rocks are tightly folded; the folds trend NE.-SW., plunge NE., and are overturned to the northwest. The quartzite and metasubgraywacke are two facies of the same unit, and the whole sequence (approximately 1700 feet thick) is designated as the Sandsuck (?) formation.

A sequence composed of phyllite and metagraywacke crops out south of the Alaculsy Valley fault. The rocks are less tightly folded than those north of the Alaculsy Valley fault and, although the folds trend NE.-SW. and plunge NE., they are commonly not overturned. Slaty cleavage maintains a relatively constant strike and dip independent of the folding, except locally where the rocks are highly contorted. The sequence is divided into two formations. A phyllite section at the base, ranging in thickness from 2000 to 6000 feet, is designated the fine-grained part of the Ocoee series. The overlying section of interbedded phyllite and metagraywacke, ranging in thickness from 2900 to 5100 feet, is designated the coarse-grained part of the Ocoee series.

Sedimentary structures preserved in the metamorphic rocks were instrumental in determining structure and sequence of the units. Graded bedding, cross-bedding, and scour channels were observed in the rocks.

No rocks or minerals in the area appear to merit present or future exploitation.

Sandlin, Walter Lee, 1960, A Facies Study of the Red Mountain Formation [Silurian] of Northwest Georgia: Emory University, MS Thesis, 78 p. (Arthur T. Allen)

______ 1960, A Facies Study of the Red Mountain Formation of Northwest Georgia: Georgia Mineral Newsletter, vol. 13, no. 2, p. 106-107.

Author's Abstract

The Silurian System in Georgia is represented by the Red Mountain formation. The formation is divided into units and zones on the basis of distinctive lithologic groups and faunal assemblages.

The Lower division of the Red Mountain formation is of Lower Silurian or Medinan age. The Upper division is of Middle Silurian or Niagaran age. The highest bed of the formation is probably not later than Early Niagaran.

Facies changes are more abrupt in the Medinan than in the Niagaran. At the easternmost measured section at Horn Mountain the Medinan is in general composed of coarse sandstone while the Niagaran is predominantly sandstone and shale. Central outcrops at Dick Ridge and Taylor Ridge - Whiteoak Mountain show a decrease in sandstone and an increase in siltstone and shale of Medinan age. Niagaran deposits of the outcrops are mainly siltstone and shale. Medinan and Niagaran deposits in the western strike belts of Pigeon Mountain and Lookout Mountain are predominantely shale. The westernmost outcrop of the formation in Lookout Valley is composed of shale and limestone.

Thickness of the Red Mountain decreases from 1293 feet at Horn Mountain to 514 feet in Lookout Valley. Decrease in thickness is greater in the Medinan than in the Niagaran.

Pentamerus oblongus and *Anoplotheca hemispherica* occupy zones which may be readily correlated. The fossils appear to be reliable time-stratigraphic indicators for Niagaran deposits since their stratigraphic level in measured section follows the contact of the Medinan and Niagaran. Other Silurian fossils are discussed, and all specimens are deposited in the Emory Geology Museum.

Deposition of the Red Mountain formation took place in a shallow, epicontinental sea whose floor sloped gently from the shoreline to the area of Pigeon Mountain and then probably flattened. Luxuriant bryozoan growth occurred in the calcareous, offshore facies of the early Medinan in Lookout Valley. Agitation of the sea caused turbidity currents and other gravity phenomena to occur on the slope. The common alternation of lithologies of the Red Mountain formation is in part a reflection of these phenomena.

During Medinan deposition the source area stood in moderate relief. Less coarse facies of the Niagaran suggest waning erosion of the source area.

Schepis, Eugene Lewis, 1952, Geology of Eastern Douglas County, Georgia: Emory University, MS Thesis, 56 p. (James Lester)

Author's Abstract

This paper presents a reasonably harmonious description of the main rock types in eastern Douglas County, Georgia. The area under investigation is composed entirely of crystalline rocks, mainly quartz-biotite-feldspar-gneisses, graphitic and micaceous schists in part garnetiferous, amphibolitic rocks, and quartzite.

Metasomatic alteration is responsible for the granite-like appearance of the high rank metamorphics. Retrogressive and progressive alteration accounts for the condition of many of the metasediments.

Stratigraphic relationships are based on lithologic characteristics and outcrop patterns to aid in interpreting structure and locating horizons. Overthrusting with shear and drag folds and low angle glide planes are the major attributing factors of displacement.

Petrographic information is offered for most of the common minerals contained in the rocks.

Metamorphism presumably occurred before, during, and after deformation; deformation is considered to have occurred largely during the Appalachian revolution.

Schultz, Roger Stephan, 1961, The Geology of Northwestern Newton and Southwestern Walton Counties, Georgia: Emory University, MS Thesis, 46 p. (Willard H. Grant)

______ 1961, The Geology of Northwestern Newton and Southwestern Walton Counties, Georgia: Georgia Mineral Newsletter, vol. 14, no. 4, p. 119.

Author's Abstract

This portion of the Piedmont is topographically mature with moderate relief and dendritic drainage pattern.

The major rock types are biotite-plagioclase gneiss, biotite granite gneiss, siliceous and feldspathic amphibolites, muscovite and biotite schists, muscovite-sillimanite schists and cataclasites.

The rocks are thought to have been originally sedimentary and volcanics which have been metamorphosed to the sillimanite-almandine subfacies of the almandine-amphibolite facies. Migmatization produced the biotite granite gneiss.

Regional deformation produced major anticlinoria and synclinoria whose axes trend N30W, N5E and N30E.

Faulting produced flinty crush rock, sheared quartz and cataclastic country rocks. Joint poles plotted on equal area net diagrams indicate wrench faulting.

Scrudato, Ronald John, 1969, Kaolin and Associated Sediments of East Central Georgia: University of North Carolina at Chapel Hill, PhD Dissertation, 97 p. (Daniel A. Textoris)

(Abs): Dissert. Abs., vol. 31, no. 1B, p. 256.

Author's Abstract

Lower Upper Cretaceous clastic sediments of east-central Georgia are characterized by coarse, cross-bedded, kaolinitic sands and gravels and high-quality, commercial, massive kaolin deposits. These deposits extend from Columbia, South Carolina, to the Ocmulgee River of central Georgia.

Pollen indicate that major kaolin deposition was not restricted to early Late Cretaceous but also occurred during Middle(?) Eocene. Associated pollen and spores indicate climatic conditions were tropical to subtropical and, therefore, probably conducive to extensive laterization of source Piedmont igneous and metamorphic rocks.

Thin section study of massive Middendorf and Eocene kaolin deposits indicates postdepositional diagenesis was extensive in the formation of these high-quality deposits.

Opaline sponge spicules in the upper part of flint kaolin suggest these sediments were not deposited during early Late Cretaceous, but Middle Eocene. Postdepositional diagenesis was extensive in the formation of these variably indurated sediments.

Lower Middle and Upper Eocene sediments disconformably overlie massive kaolin deposits. These predominantly marine sediments represent a transgressive phase, indicating shallow seas covered east-central Georgia during Middle and Late Eocene time.

Highly siliceous character of associated McBean and Barnwell carbonates proves silicification throughout east-central Georgia was extensive. McBean and Barnwell carbonates become progressively more calcareous downdip, suggesting silica source was in close proximity to the Fall Line.

Diverse mineralogy and shard-like character of associated coarse detritus of Twiggs Clay Member of the Barnwell Formation suggest volcanic ash as a source for these sediments. They are rich in radiolarians, diatoms and other opaline microfossils. Percentage of opal (uni-dimensional disordered cristobalite) appears to be directly related to abundance of opaline microfossils.

Wavellitic cherts occur in Barnwell sediments. This is the first report of these rocks in east-central Georgia.

Clay mineralogy of weathered igneous and metamorphic Piedmont rocks and lower Upper Cretaceous, Middle and Upper Eocene and Quaternary rocks differs significantly. Piedmont clays are predominantly kaolinite with lesser amounts of illite, montmorillonite and 14A hydroxy interlayer clay. Middendorf and Eocene massive kaolin deposits are usually composed of greater than 90 percent kaolinite. Locally, illite and montmorillonite comprise up to 20 per cent of the clay fraction.

Clay minerals of Twiggs Clay Member of Barnwell Formation are composed of admixtures of illite, montmorillonite and kaolinite. Relative percentages vary considerably in short lateral and vertical distances.

Quaternary alluvial clay minerals reflect a Piedmont source and are composed predominantly of kaolinite with lesser amounts of illite, 14A hydroxy interlayer clay and montmorillonite.

Comparison of Quaternary and massive Middendorf and Eocene kaolin deposits indicates that deposition of ancient massive kaolin beds was not restricted to alluvial cycles. Deposition of these units probably occurred in coastal backswamp, swamp, marsh or fluvial environments.

Thin section study revealed presence of non-marine opaline sponge spicules and diatoms in Quaternary Savannah River clays.

Sheridan, John Thomas, 1951, Paleontology and Stratigraphy of Known Outcrops of the Holston Formation [Ordovician] In North Georgia: Emory University, MS Thesis, 55 p. (A. C. Munyan)

Compiler's Abstract

Vertical sections of the "Holston" formation were measured, studied, and correlated at three sites. Detailed analysis of the structure, stratigraphy and paleontology were made at each of three stations to derive basic information about the lithology for future studies.

The author concluded that the "Holston" represents two facies, a true reef and a calcarinite. The true reef contains whole bryozoans, and other biohermal forms. The calcarenite is composed of detrital material.

Field observations indicate a localized syncline in the vicinity of Mt. Olive Church with a small anticline on the Seton property.

Detailed stratigraphic sections and petrographic analysis are included in the text.

Simmons, William Bruce, 1968, Mineralogy of South Georgia and North Carolina Phosphorite: University of Georgia, MS Thesis, 77 p. (Vernon J. Hurst)

Author's Abstract

Individual sedimentary units of phosphorite from stratigraphic sections in Echols County, Georgia and Beaufort County, North Carolina were sampled. The phosphorites of both sections consist of phosphate pellets, silt- and sand-sized quartz grains, clay, and beds of phosphatic dolomite. The percentage phosphate pellets for the larger than 62 micron size fraction was determined. The pellets averaged 45% for the Beaufort County, North Carolina phosphorite and 9% for the Echols County, Georgia phosphorite.

The clay minerals montmorillonite, illite, and palygorskite are associated with both phosphorites. The zeolite clinoptilolite was found only in the North Carolina phosphorite.

The phosphate pellets contain quartz grains, organic carbonaceous matter, pyrite, and glauconite. Pellets from both localities were found to contain inclusions of numerous fragmented diatom and radiolarian tests.

X-ray data indicate that the phosphorite mineral is carbonate-apatite. X-ray analysis also indicates that Echols County, Georgia phosphorite contains up to 0.3 mole more CO_3 + F per ten moles Ca substituted in the apatite than the North Carolina phosphorite.

The origin of the phosphorite is suggested to have been phosphate replacement of carbonate sediments, perhaps augmented by volcanic activity, in a restricted marine basin. The phosphorite appears to have been reworked during replacement and two or three times after replacement. The Georgia phosphorite probably formed from waters of lower phosphate concentration than that of North Carolina.

Sinha, Evelyn Zepel, 1959, Geomorphology of the Lower Coastal Plain from the Savannah River Area, Georgia to the Roanoke River Area, North Carolina: University of North Carolina at Chapel Hill, PhD Dissertation, 141 p. (William A. White)

(Abs): Dissert. Abs., vol. 20, no. 7, p. 2759.

Author's Abstract

Differences among some geomorphic features permit dividing the lower Coastal Plain into three physiographic sections. The Sea Island section lies between the Altamaha River, Georgia and the Santee River, South Carolina. The Arcuate section lies between the Santee and the Neuse River of North Carolina. The Embayed section lies between the Neuse and the James River of Virginia.

Characteristics of the transitional and marine sedimentary environments in the present shore zone serve as criteria in the recognition and interpretation of relict features as far inland as the 100 foot contour.

Systematic differences between the Sea Island and the Arcuate sections express the different response of these sections to the Wicomico and later marine transgressions. Nonsystematic differences in the Embayed section suggest that erosion following deformation has either obscured or obliterated the effects of one or more marine transgressions.

Barrier bars, barrier islands, and lagoons developed repeatedly in the transitional environments in response to the gentler slopes of the coastal plain in the Sea Island and southern Arcuate section, while beach plains and wave-cut cliffs developed on the steeper slopes of the northern Arcuate section. Characteristic soil types in the transitional environment vary from clay to clay loam; those in marine environment are dominantly sand.

Soil types and land forms in the Embayed section vary. Sandy loam, the dominant soil of the Wicomico level, is either continental or paralic in origin. The presence of sandy loam on the Wicomico level may be the result of local deformation. The slope of the Embayed section in Wicomico or Pamlico time cannot be deduced. But the change in orientation of the coastal plain between Pamlico time and the present is indicative of significant changes in sea bottom topography. Such changes may have engendered reciprocal changes in the wave refraction pattern and the eddy current system providing the conditions for the evolution of this coastal salient.

The master streams responded individually to the marine transgressions. The Sea Island and Arcuate sections have a sub-parallel drainage pattern. Their master streams were not dismembered, but the Roanoke River, the master stream of the Embayed section, was dismembered. The Savannah River (Sea Island section) braids and a part of its load accumulates in its vicinity. The Cape Fear River meanders (northern Arcuate section) and its load is dispersed. In its lower course the Cape Fear is deflected southward by the growth of sand spits or bars. The Roanoke River has a youthful or rejuvenated meander pattern and part of its load accumulates within the transitional environment of the Embayed section.

Differences in the geomorphic features of the lower Coastal Plain between the Altamaha and James Rivers are the effects of systematic differences between the slopes of the Sea Island and Arcuate sections, but the features of the Embayed section differ because local deformation took place during or after the Wicomico marine transgression.

Smith, James William, 1959, Geology of an Area along the Cartersville Fault near Fairmount, Georgia: Emory University, MS Thesis, 41 p. (Willard H. Grant)

______ 1960, Geology of an Area along the Cartersville Fault near Fairmount, Georgia: Georgia Mineral Newsletter, vol. 13, no. 2, p. 107.

Author's Abstract

This project was undertaken to study the geology astride the disputed Cartersville fault in the vicinity of Fairmount, Georgia.

The area west of the fault is composed of limestone, dolomite, and slate. These rocks are Cambrian and belong to the Rome or Conasauga formation. East of the fault are phyllite, metagraywacke, metasiltstone, and schist. They probably belong to the Ocoee series which is most likely Precambrian.

Major structures west of the fault are poorly understood. Variable bedding attitudes indicate a high degree of folding. East of the fault there is a broad syncline. Flow cleavage and lineations indicate that movement was northwest-southeast.

The intensity of regional metamorphism increases eastward from the chlorite to the staurolite zone. The presence or absence of a metamorphic break at the fault has not been proven.

Along the fault are truncated beds, abrupt change in tectonic rock fabric, mineralization, mylonite, cataclasites, and an escarpment. Direction of faulting is implied from the strong lineations and flow cleavage.

Precambrian strata overlying Cambrian is indirect evidence of major thrust faulting.

Smith, Leon Perdue, 1915, The Alteration of Diorite by Weathering: University of Chicago, MS Thesis, 17 p. (Albert Brokaw)

Compiler's Abstract

Investigation of igneous dikes in the area of LaGrange, Georgia, were made to compare fresh and altered rock. The samples were taken from north-south trending dikes that cut the gneisses and granites in the area.

The results of laboratory tests led the author to make the following conclusions:

1. When igneous rocks decay by weathering the combined silica is released in a soluble form and is removed with comparative rapidity.

2. Alumina is regarded as the most constant resultant of rock weathering and if circumstances favor the practically complete removal of the other constituents, a hydrated alumina oxide, bauxite, remains.

3. Iron is the next most abundant rock material and may be concentrated by weathering. Should the amount of original alumina be low, a high-grade iron ore might result from weathering.

4. All of the other constituents are removed in the order of their solubilities; generally lime, then magnesia, soda, potassium, manganese, and titanium dioxide, followed by silica.

5. Of the more soluble materials resulting from weathering, potassium stands highest in persistence, a fact of economic importance in its relation to plant life.

Smith, William LaRue, 1958, The Geology of the Conasauga Formation [Cambrian] in the Vicinity of Ranger, [Gordon Co.] Georgia: Emory University, MS Thesis, 27 p. (Arthur T. Allen)

Author's Abstract

The thesis area covers approximately 6 square miles in the southwest portion of the Talking Rock Quadrangle in Gordon County, Georgia.

The rocks found in the area are shale and limestone. The shale is a dense, green, sericitic rock which exhibits a well-developed cleavage and weathers reddish yellow. It is composed of two similar units which are separated by a bed of dark-gray to black finely crystalline dolomitic limestone.

The structural interpretation of this area is made by using the dolomitic limestone as the structural horizon and by comparing the bedding-cleavage relationship of the limestone and shales along with certain minor structures which were recorded in the area.

Snipes, David Strange, 1965, Stratigraphy and Sedimentation of the Middendorf Formation Between the Lynches River, South Carolina, and Ocmulgee River, Georgia: University of North Carolina, PhD Dissertation, 140 p. (Roy Ingram)

(Abs): Dissert. Abs., vol. 27, no. 1-B, p. 213.

Author's Abstract

The outcropping basal Upper Cretaceous beds between the Lynches River, South Carolina, and the Ocmulgee River, Georgia, are assigned to the Middendorf Formation. These beds, which are very similar to strata exposed at the type section of the Middendorf Formation, near Middendorf, South Carolina, previously have been referred to as the Tuscaloosa Formation (Group), but their lithology differs appreciably from typical Tuscaloosa strata exposed near Tuscaloosa, Alabama.

The Middendorf Formation of East Central Georgia, is a non-marine facies of a dominantly marine Upper Cretaceous sequence of West Central Georgia, which includes the following stratigraphic units: the Tuscaloosa Group, the Eutaw Formation, the Blufftown Formation, the Cusseta Sand, the Ripley Formation and the Providence Sand. East of the Ocmulgee River, Georgia, the lower part of the Middendorf Formation grades downdip into partly marine and partly non-marine beds of the Tuscaloosa Group, and the upper part of this formation is an updip facies of marine, undivided Upper Cretaceous beds. The above stratigraphic relationships are analogous to that of the Middendorf and Black Creek Formations of North Carolina, where the upper part of the Middendorf is a landward facies of the lower part of the Black Creek.

Evidence obtained from studies of sedimentary structures, clay minerals and heavy minerals indicates that the Middendorf clastics were derived from the Piedmont Province. These studies, together with studies of size analyses and thin sections, indicate that the Middendorf is dominantly fluvial. It was deposited by streams of high viscosity and density on the upper part of river flood plains, which were located immediately south of the Cretaceous Fall Line.

The Middendorf Formation consists of argillaceous sand with lenses of pure to sandy clay and discontinuous gravel beds. The clay lenses attain their maximum purity between the Ocmulgee River, Georgia, and New Holland, South Carolina (about 33 miles northeast of Augusta, Georgia), where they are mined extensively for commercial kaolinite. The formation is characterized by rapid lateral and vertical changes in lithology.

The sands are mostly quartz wackes. The framework consists of quartz (26-50 percent), irregular flakes of muscovite (3-10 percent), K-feldspar (0-6 percent), and heavy minerals (1 percent or less). The matrix consists of detrital kaolinite plus fine shreds of mica (34-58 percent), authigenic kaolinite (1-18 percent), and a trace of iron oxide, probably hematite and goethite.

Semi-quantitative clay mineral analyses of 11 Piedmont saprolites and 94 Coastal Plain sediments were made. The average clay mineral content of the Piedmont saprolites consisted of kaolinite (8.9 parts in 10), illite (0.8 parts in 10) and traces of the chlorite-like intergrade mineral plus montmorillonite. Kaolinite was the dominant clay mineral in all of the non-marine sediments. The montmorillonite content was dominant to intermediate in the marine sediments. Glauconite occurred in a few of the marine sands. An intermediate to minor amount of illite occurred in all the sediments except the marine marls, which contained only montmorillonite, and a few of the non-marine clay, which contained only kaolinite. The association of dominant kaolinite with non-marine sediments and intermediate to dominant montmorillonite with marine sediments is believed to be caused by segregation, which is a physical-chemical "sorting" process. The chlorite-like intergrade mineral occurred in minor amounts in nearly all of the Recent sediments and in the Piedmont saprolites. It was virtually absent from the ancient sediments. The paucity of this mineral

in ancient sediments may be due to epigenetic chemical alteration.

Four representative cross-sections and a geologic map of the Middendorf Formation are presented.

Spalvins, Karlis, 1967, The Stratigraphy of the Conasauga Group in the Vicinity of Adairsville, Georgia: Emory University, MS Thesis, 62 p.

Author's Abstract

The mapped portion of the Adairsville Quadrangle is located in the Valley and Ridge province of northwest Georgia.

The Conasauga Group was divided and mapped on the basis of apparent stratigraphic position, lithology and continuity. The units are the Maryville l

Maryville Limestone, Nolichucky Shale, and the Maynardville Formation.

The exposure is an overturned anticline with a reverse fault near its southern end.

All three units have economic potential.

A geologic map is included.

Stephens, Raymond Weathers, 1960, Stratigraphy and Ostracoda of the Ripley Formation [Cretaceous] of Western Georgia: Louisiana State University, PhD Dissertation, 85 p. (Grover Murray)

(Abs): Dissert. Abs., vol. 20, no. 11, p. 4372

Author's Abstract

The Ripley Formation (Gulfian) and its bounding formations in western Georgia were studied stratigraphically from the Chattahoochee River on the west to the Ocmulgee River on the east. Surface exposures were measured and described in detail and ostracod samples and rocks for thin sections were collected for study. An outcrop map of the Ripley Formation with the geographic location of the measured sections and a stratigraphic cross section with the position of all ostracod samples and rock thin sections are enclosed in the pocket.

The Ripley extends eastward into Georgia from Alabama and crops out from the Chattahoochee River to the Flint River where it is overlapped by the more northerly striking Providence Sand. In western Georgia, the Ripley is composed of a nearshore marl that predominates downdip. The offshore sand and clay extend eastward to the Flint River with very little facies change but thin from approximately 150 feet in the Chattahoochee River valley to approximately 50 feet in the area of the Flint River.

East of the Flint River, the Provindence Sand overlaps the Ripley and lies unconformably upon the Cusseta Sand. In Twiggs County, evidence suggests that the commercial kaolin is in beds of Cusseta and Providence ages where the Tertiary has overlapped both formations.

A total of 37 species of ostracoda have been found in the Ripley as a result of this investigation. Twenty-seven of these species have been reported previously. Of the remaining 10 species four are described as new in this dissertation. On the basis of the ostracods, the Ripley of Georgia can be correlated with the Saratoga formation of Arkansas and the Peedee formation of North Carolina.

Stonebraker, Jack Douglas, 1973, The Potassium-Argon Geochronology of the Brevard Fault Zone, Southern Appalachians: Florida State University, PhD Dissertation.

Author's Abstract

A potassium-argon geochronological study of the Brevard fault zone was undertaken in order to investigate the radiogenic argon retention pattern across a major post-metamorphic shear zone and to determine the effect of cataclasis and retrograde metamorphism upon the potassium-argon isotopic system. Over 140 new K-Ar mineral retention ages from 92 sampling localities along 9 traverses which transect the Brevard fault zone and the adjacent crystalline rocks of the Blue Ridge and Piedmont geological provinces were determined during the course of this investigation.

The majority of the biotite and muscovite retention ages fall in an interval of 280-320 m.y. Hornblende retention ages from both the Blue Ridge and Piedmont average 426$\pm$37 m.y. Older biotite retention ages which are concordant with the hornblende retention ages are found in the vicinity of the Grandfather Mountain window. Younger biotite and muscovite retention ages are found in the cataclastic and retrogressively metamorphosed rocks of the Brevard fault zone and in the Tablerock and Blue Ridge thrust sheets near the Grandfather Mountain window. The mica retention age pattern demonstrates that no K-Ar retention age discontinuity exists across the Brevard fault zone.

The K-Ar age discordancies of 46 coexisting muscovite-biotite pairs were examined. Normal discordancies (muscovite retention age older than biotite retention age) were found to predominate in the Blue Ridge province and average 19$\pm$4 m.y. Reverse discordancies in the Piedmont province were found to average 30$\pm$10 m.y. The normal discordancy in the Blue Ridge province is attributed to cooling associated with slow isostatic uplift. The reverse discordancy in the Piedmont is ascribed to excess argon associated with 300 m.y. plutonism in this province. This excess argon was probably introduced into biotite after argon retention in muscovite had begun. Average muscovite retention ages on both sides of the Brevard fault zone are analytically indistinguishable, which supports the hypothesis that excess argon was introduced after muscovite had begun to retain argon. The absence of excess argon in Blue Ridge biotites is attributed to a reduction in the argon partial pressure in the vicinity of the Brevard fault zone which resulted from extensive argon migration to the surface along this shear zone.

A potassium-argon isochron diagram of biotite and muscovite data from the Brevard fault zone indicates that the most recent recrystallization along this feature took place 337±7 m.y. ago. The negative intercept of this isochron suggests that a systematic loss of radiogenic argon occurred along this shear zone after potassium fixation. A potassium-argon isochron with a negative intercept for 5 muscovites present in retrogressively metamorphosed cataclastic rocks in the Tablerock and Blue Ridge thrust sheets near Grandfather Mountain window suggests that the most recent recrystallization in these rocks took place 415±11 m.y. ago.

The K-Ar isochrons for these cataclastic rocks in the vicinity of the Brevard fault zone and within the Blue Ridge and Tablerock thrust sheets near the Grandfather Mountain window were undisturbed by the non-systematic thermal diffusion of radiogenic argon which produced the observed 40 m.y. scatter in the K-Ar retention ages from the Blue Ridge and Piedmont provinces. This observation is postulated to result from a depression of the geothermal gradient in the vicinity of the Brevard fault zone resulting from groundwater along these shear planes.

A zero intercept K-Ar isochron for prograde metamorphic biotites in upper Precambrian stratified rocks of the Blue Ridge thrust sheet near Grandfather Mountain window shows that these biotites began to retain radiogenic argon simultaneously with metamorphic hornblendes from both southeast and northwest of the Brevard fault zone. It is suggested that the rapid cooling of these biotites is related to either tectonic emplacement of the Blue Ridge thrust sheet with which the muscovites from cataclastic and retrogressively metamorphosed rocks of the Blue Ridge and Tablerock thrust sheets are associated, or to general depression of the geothermal gradient near these sheared rocks.

Stuart, Alfred Wright, 1956, A Detailed Petrographic Study of the Paleozoic Sediments in the Area of Fairmount [Gordon Co.], Georgia: Emory University, MS Thesis, 33 p. (Arthur T. Allen)

Author's Abstract

The thesis area covers 12 square miles of the northwest corner of the Waleska Quadrangle and is in Gordon County, Georgia. The sericitic shale and dolomitic limestone of the area have been complexly folded, with many of the folds overturned and dipping to the east.

Dolomite forms thin laminae in the limestone and is of primary origin. The petrography of the carbonates suggests that they were deposited in a shallow basin which had conditions suitable for the precipitation of calcium carbonate and its subsequent partial replacement by dolomite.

X-ray analysis shows that the shale is composed of quartz, sericite, and chlorite with the relative amounts of chlorite increasing to the west. The analyses indicate that no clay minerals are present in the shale.

Tingle, Woodrow Wilson, 1957, Geology of the Clay of Twiggs County, Georgia: University of North Carolina, MS Thesis, 71 p.

Author's Abstract

Coastal Plain sediments of central Georgia have presented geologists and other workers of the southeast with problems that heretofore were not encountered. The close relationship of heterogeneously arranged sands with homogeneous bodies of almost pure clays have produced many diverse explanations.

In Twiggs County, lenses of relatively pure kaolin occur in the upper limits of the Upper Cretaceous sands, which are separated by an unconformable surface from the crystalline rocks below. A more gentle unconformity, which shows alternating periods of subaerial erosion and deposition, marks the Cretaceous sediments from the overlying Tertiary beds. Marine sands and adsorbent clays, which grade laterally into limestone, compose the sedimentary beds of the Tertiary Series.

Kaolinitic clays formed in the Piedmont region from feldspathic rocks, which were slowly eroded, and the particles were subsequently deposited in non-marine basins. Interformational erosion truncated the clay deposits and removed the adjacent contemporaneous materials. Subsequent deposition of land deposits filled the eroded areas between the clay bodies.

Adsorbent clays formed in the Piedmont region from the weathering of more basic rocks which were exposed by post-Cretaceous erosion. The depositional areas for these sediments were in a transgressing sea which made many oscillatory movements during its land invasion.

The economy of Twiggs County is almost wholly dependent on the operations of the clay industry. Reserves of the clays in Twiggs County are not unlimited, for the industry in central Georgia first developed here; however, it has been estimated that clay reserves are still greater than the clays that have been mined. There are a few possibilities of future developments of other mineral industries.

Traylor, Henry Grady, 1951, Geology of a Portion of the Kensington Quadrangle [Walker Co.], Northwest Georgia: University of Iowa, MS Thesis, 122 p. (A. C. Trowbridge)

Compiler's Abstract

The Kensington Quadrangle, Walker County, Georgia, lies in the Valley and Ridge Province. All of the major systems of the Paleozoic except the Pennsylvanian are represented in the area.

The Cambrian is represented by the Conasauga, an argillaceous shale 1,500 to 4,000 feet thick. The Ordovician units in the area include Knox Dolomite, Newala, Murfreesboro, Mosheim, Lenoir, Lebanon, Lowville, Trenton Group and Sequatchie. New names were proposed for the Murfreesboro, Mosheim, Lenoir and Lowville; respectively these are Hall Mill Formation, Kensington Calcilutite, Ridley Formation and Pond Spring Formation. The Ordovician rocks are 6,500 feet thick. Silurian rocks, in the Red Mountain Formation are chiefly shale and siltstone approximately 674 feet thick. Mississippian strata include Chattanooga Shale, Maury Shale, Fort Payne Chert, St. Louis Formation, and St. Genevieve Limestone.

The major structures on the Kensington Quadrangle are an asymmetrical syncline, with a complimentary anticline to the west, and a thrust fault along the eastern flank of the syncline.

The primary emphasis is on the stratigraphic relationship and correlation. Several measured sections are included.

Truxes, Lee Sayles, 1956, The Geology of the Silurian Red Mountain Formation from Taylor Ridge to Horn Mountain: Emory University, MS Thesis, 50 p. (Arthur T. Allen)

Compiler's Abstract

The Silurian rocks of northwest Georgia were measured and described in six sections from Taylor Ridge to Horn Mountain. Medinan and Niagaran rocks were distinguished in the section by difference in grain size. Medinan rocks are medium to coarse-grained sandstone, while Niagaran rocks are silty sandstone or very fine grained sandy siltstone.

These rocks are classified as orthoquartzites due to lack of other minerals. Sorting is good in both Medinan and Niagaran rocks. The Medinan rocks are well rounded or subrounded and show increase in grain size vertically toward the base and toward the east. The Niagaran sandstones are usually subangular.

The Medinan increases in thickness to the east, thus showing that the shoreline was to the east. It is interpreted that the Medinan was a deltaic shelf and the Niagaran was a deltaic slope.

Six measured stratigraphic sections are included in the thesis.

Turner, Philip Ambrose, 1959, Sedimentation in the Upper Cretaceous of East-Central Georgia: Cornell University, MS Thesis, 30 p. (Charles Nevin)

Compiler's Abstract

This study of the Upper Cretaceous sands was made to determine:

1. Location of source area,
2. Direction of movement of the transporting currents,
3. Trend of the Upper Cretaceous shore line and
4. Environment of deposition.

The area studied lies south and east of Macon and extends from the Ocmulgee River on the west to the Oconee River on the east.

Upper Cretaceous sediments were derived from the crystalline Piedmont. The lower section was transported and deposited rapidly on a flood plain close to the shore line. The upper section was deposited in a lagoonal environment separated from the ocean by barrier beaches that extended approximately east-west through Georgia.

Vest, Ernest Louis, Jr., 1952, Paleontology and Stratigraphy of the Ordovician Limestones in Chattanooga Valley, Georgia: Emory University, MS Thesis, 127 p. (Arthur T. Allen)

Author's Abstract

The Ordovician limestones in Chattanooga

Valley are 1353 feet thick. They have been divided into twenty-nine zones, and throughout the sequence zones nos. 2, 4, 6, 7, 11, 12, the Sowerbyella beds in 16, the Homotrypa bed in 16, 18, 19, 23, 24, 27, and 28 are the most valuable as "key horizons". Others can be used as "locators" with a reasonable degree of accuracy, but often they are not recognizable in limited, isolated outcrops. The above mentioned zones can be recognized at almost any type of exposure.

Nine faunal zones have been recognized throughout the sequence of rocks and include the following: zones nos. 1-6, 8-10, 11, 12-14, 16-17, 22, 23, 25, and 27. Zones not included in these are unfossiliferous for the most part.

Facies, since the thesis area is so limited in areal extent, are not easily studied, but variations have been noted in zones nos. 1, 10, 11, 17, and 19 (also the red bed within this zone).

Three major high angle thrust faults within the Fort Oglethorpe Quadrangle have been mapped and described. These include the Missionary Ridge thrust, the Hawkins Ridge backthrust, and the Chattanooga Valley thrust. Minor structure is also discussed briefly.

Vickers, Michael A., 1967, Paleontology of the Blufftown Formation [Upper Cretaceous] Chattahoochee River Region, Georgia-Alabama: Florida State University, MS Thesis.

Author's Abstract

The Blufftown Formation of Upper Cretaceous age is well exposed in a narrow band in the Chattahoochee River Region. The foraminifera and larger invertebrate fossils and stratigraphy were studied on both sides of the river. Fifty-three species of foraminifera belonging to thirty-two genera are described. Forty-two species of macrofossils belonging to twenty-nine genera are described.

The foraminiferal fauna consists mainly of benthonic species, and calcareous forms are much more abundant than arenaceous forms. However, planktonic species are present in most samples and certain species are very abundant in some samples. Twelve species of planktonic foraminifera are described.

The mollusks are the dominant macrofossils. Among these are Bivalvia and especially the oysters are very abundant. The most diagnostic fossil of the Blufftown Formation in this area is *Exogyra ponderosa.*

On a lithological basis the Blufftown can be divided into three units; a basal, coarse, cross-bedded sand; a middle silty, sandy, glauconitic, fossiliferous shale; and an upper fine sand. The lower and upper Blufftown were deposited by a regressive sea. The middle Blufftown was deposited by a fluctuating transgressive sea.

On the basis of the described fauna, the age of the Blufftown is considered to be Upper Santonian to Lower Campanian.

Walter, Kenneth Gaines, 1958, A Study of the Pegmatites of the Stone Mountain-Lithonia-Panola Shoals Area: Emory University, MS Thesis, 61 p. (Willard H. Grant)

Author's Abstract

The distribution, structure, mineralogy, and petrography of pegmatites from Stone Mountain, the Panola area, and the Lithonia gneiss was studied.

Several types of pegmatites occur. They are classified according to internal structure, structural characteristics of the country rock, and external relations, such as types of contacts.

The pegmatites at Stone Mountain are of two types, zoned unit and fracture filler. Their mineralogy and structural relations are markedly different from those of the Lithonia gneiss. The Lithonia gneiss pegmatites of Arabia Mountain are of three main types, replacement, recrystallization, and secretion. The Panola pegmatites appear to be joint fillers and pods, but there are too few of them to permit generalization.

There is evidence at Stone Mountain for intrusion of pegmatites. Most important are their enclosure of xenoliths, formation of graphic intergrowths, and deflection of foliation trends inside the dike borders.

Webb, James Edward, 1957, Reconnaissance Survey of the Talladega Series in Parts of Polk and Haralson Counties, Georgia: Cornell University, MS Thesis, 35 p. (Robert A. Christman)

Compiler's Abstract

This study in Polk and Haralson Counties was made to determine the age of the Talladega Series and the metamorphic gradient to the southeast. Petrographic analysis showed phyllite and metagraywacke to be the most abundant rock types. The phyllite consists of sericite, chlorite and quartz. It is a grayish-green rock that is finely to moderately foliated. The metagraywacke is a bluish-gray, medium grained rock. Quartz, feldspar, sericite and chlorite are the major constituents.

The rocks have been assigned to a low rank metamorphic grade; the presence of biotite suggests the possibility of a thermal gradient. Mappable units in the Talladega were not readily apparent in the area. The diversity of lineation directions, enormous thickness (25,000 feet), and similarity of lithology lend credence to the idea that the Talladega is isoclinally folded.

Webb, Lyndall Charles, 1974, The Evaluation of Cementation Mechanisms in Kaolinite: Georgia Institute of Technology, MS Thesis, 41 p. (Charles Weaver)

Author's Abstract

Solutions of aluminum in varying concentrations were used to alter the particle-size distribution of a kaolinite and produce a coarser product. The kaolinite sample, obtained from the Thiele Kaolin Company at Wrens, Georgia, is noted for its unusually fine-grained texture. The character of the clay was evaluated using x-ray powder diffraction, scanning and transmission electron microscopy, atomic absorption spectrophotometry, differential thermal analysis and centrifugation. A size analysis of the kaolinite indicates a large percentage of the sample is included in the size range 1-0 microns. Treated samples were examined to determine the percentage finer than 0.5 micron. Percentages obtained were compared to an untreated counterpart and also to a kaolinite sample possessing a typical size distribution. The evaluation of treated samples at 0.5 micron provides a gauge for treatment efficiency.

The kaolinite was treated with solutions of $AlCl_3$, $Al(NO_3)_3$, and $Al_2(SO_4)_3$ and dried at temperatures ranging from 50-300°C. Drastic reductions in the percentage finer than 0.5 microns were noted using $AlCl_3$ and, to some extent, $Al(NO_3)_3$.

The primary factor in the cementation mechanism seems to be an increased concentration of Al^{+3} ions prior to drying. During drying, kaolinite particles apparently aggregate about highly charged aluminum polymers created as a result of increased temperature. The polymerization of aluminum increases with temperature (Rich, 1960).

Aggregates produced were stable enough to withstand attempted dispersion using sodium polyphosphate and a high-speed 250 ml blender.

Aluminum sulfate was inefficient at producing aggregates other than floccules. Floccules are defined here to be reversible combinations of clay flakes. The formation of extremely stable alumium hydroxy-sulfates is thought to be responsible for the lack of cementation using aluminum sulfate. Complexes of aluminum sulfate would effectively reduce the amount of Al^{+3} available for interaction with the clay.

Examination of cemented particles using electron microscopy reveals aggregates which are constructed by the accumulation of small flakes onto the surface of larger particles. The small flakes appear to be concentrated on the basal surfaces; however, a few were noted adhering to edge sites. Nondispersive x-ray analyses in the scanning electron microscope demonstrate that in fact the large aggregates have higher Al-Si ratios than typical non-treated kaolinite.

Wheeler, Garland Edgar, 1954, Zonation of Mississippian Strata in Vicinity of Pigeon Mountain in Northwest Georgia: Emory University, MS Thesis, 58 p. (Arthur T. Allen)

Compiler's Abstract

Pigeon Mountain is an asymmetrical syncline which is overturned to the east and plunges to the southwest.

On the basis of lithologic and faunal assemblages, the Mississippian strata are divided into 14 zones; 12 represent a limestone sequence and the upper two zones mark a transitional sequence. The presence of chert and oolites are discussed in detail in reference to the depositional history. It is found that chert is most abundant in older strata, which were deposited in deep seas. As the sea became more shallow, oolites were deposited in the agitated seas.

Corals are the megascopic faunal forms with most significant possibilities of correlation. Small solitary zaphrentid corals are found in the lower section; massive reef corals are abundant in the upper zones.

Six measured sections are included in the text.

Wilson, Robert Lake, 1967, Pennsylvanian Stratigraphy of the Northern Part of Sand Mountain, Alabama, Georgia, and Tennessee: University of Tennessee, PhD Dissertation, 135 p. (Harry Klepser)

(Abs): Dissert. Abs., vol. 28, no. 6B, p. 2488.

Author's Abstract

From the results of detailed mapping of the northern end of Sand Mountain, correlations have been established with the strata of contiguous areas in Tennessee. Previous workers have recognized the presence of two major rock units on Sand

Mountain. These have usually been identified as the Upper and Lower "Conglomerates," respectively. Since in the better known Tennessee section the two lowermost formations are the Warren Point and Sewanee, these names have commonly been applied to the extensions of Pennsylvanian age rocks southward into Georgia and Alabama.

This study shows that the upper major sandstone is the Warren Point and that the Pennsylvanian section expands and thickens southward into Alabama and Georgia so that the Lower "Conglomerate" is the equivalent of only a part of the lower sandstones of the Raccoon Mountain Formation in Tennessee. It seems advisable, therefore, to provide two new stratigraphic units to sub-divide the lower Pennsylvanian rocks in the northern portion of Sand Mountain. These are the Norwood Cove and the Flat Rock Members.

The boundary between the Mississippian and Pennsylvanian systems, as seen in the area discussed, indicates a gradual change from the marine conditions which dominated the area during most of Mississippian time to non-marine conditions during the Pennsylvanian. Thus the systemic boundary between the Mississippian and the Pennsylvanian in the Sand Mountain area shows no evidence of the unconformity which is present between these two units in other areas.

The Parkwood Formation on Sand Mountain represents a sequence of transitional strata which formed in a more actively subsiding part of the miogeosyncline and is only partially present or represented by thinner accumulations of the rocks formed in a more stable area which is now the northern part of Sand Mountain.

Windham, Steve R., 1956, Stratigraphy, Paleontology and Structure of the Mississippian System in Ringgold Quadrangle, Georgia: Emory University, MS Thesis, 92 p. (Arthur T. Allen)

Compiler's Abstract

Mississippian strata is found in a northeast-southwest belt, one to two miles wide in the Ringgold Quadrangle, Catoosa County, Ga. Lithologic and faunal associations were studied to determine the depositional environment.

Abundant chert is found in the lower two zones in the form of small nodules in fine-grained limestones. Observations indicate that the origin of the chert is of a secondary nature. Crinoid stems are the dominant fauna associated with bedded chert, therefore it is postulated that the chert is a result of silica replacement in crinoidal siltstone.

The following depositional history is suggested by observations noted. In Zone 1 and 2 compound corals grew in shallow warm seas. Oolites and fossils in Zone 3 indicate the sea to be extremely shallow. Zone 4 consists of siltstones, which may have meant deeper seas or change of source area. The seas again became shallow as indicated by the oolites and fossil hashes of Zone 5. Zone 6, the last depositional period studied, indicates deeper water conditions as shales are deposited.

Measured sections are included in this work.

Woollard, George Prior, 1934, A Report on the Building and Ornamental Stones of Georgia: Georgia Institute of Technology, MS Thesis, 150 p.

Author's Introduction

This report has been written with the ultimate aim of being published in whole or in part by the State Department of Geology. Although there are in existence state bulletins describing and locating the big majority of the building and ornamental stones of the state, there is little or no information available as to the physical characteristics of these stones. At the suggestion of Dr. Geoffery Crickmay, Assistant State Geologist, and with the approval of the late Dr. S. W. McCallie, State Geologist, and Prof. C. D. Gibson of the Geology Department of Georgia Tech, the author began assembling material and obtaining specimen for test purposes in the summer of 1932 for the preparation of a report relating particularly to the strength and durability of those stones found in Georgia that are used for building purposes.

In conducting the experimental work of their report, the material had to be obtained wherever possible. Many of the quarries were not operating. Of those quarries that were in operation it was found difficult to obtain specimens that could be used for tests. This was due as much to lack of equipment on the part of some of the quarrymen as to lack of interest on the part of others. As there was no fund for conducting any of this work, the collecting of suitable specimen from the quarries and various stone yards as well as the making of test specimen was at the author's expense. In a work of this type where so many specimen are required on which tests are made to furnish the basis for conclusions, the cost of having parties equipped to make the test specimen was found to be prohibitive. The result was that the specimen had to be worked out with whatever equipment that could be obtained. Through the cooperation of the Department of Civil Engineering and the Department of Geology along with the aid of what was then the Department of Experimental Engineering at Georgia Tech a limited number of test specimen of the various stones collected was worked out. The equipment was entirely unorthodox and not intended for the class of service for which it was used. The result was that the entire summer of 1933 was consumed in making these test specimen from the material which had been gathered during the preceding year.

Wherever possible specifications as laid down by the American Society of Testing Materials were followed in conducting tests. Where no set method of test existed, the author was guided by previous work done by other investigators along the same line. Some radical changes in test methods were made in regard to frost action and methods of determining the modulus of elasticity which have since been justified by the work of D. W. Kessler, Research Associate, and W. H. Sligh, Associate Physicist, of the Department of Commerce, Bureau of Standards, in their work on the physical properties of commercial limestones.

Woolsey, James Robert, Jr., 1973, The Geology of Clarke County, Georgia: University of Georgia, MS Thesis, 109 p. (Giles O. Allard)

Author's Abstract

Clarke County is situated in the Piedmont province of northeast Georgia. The region is characterized by a rolling topography developed on deeply weathered metamorphic rocks. Few outcrops of fresh rock occur outside of stream beds. Major rivers flow southeast across the area, fed by well-developed, dendritic, tributary streams. Stream courses are commonly modified by structural features and lithologic variation. Relict stone layers commonly occur at the interface between saprolite and a discontinuous, overlying mantle of colluvium. They are considered products of one or more periods of accelerated erosion attending denudation of protective vegetation. Semi-arid climatic conditions associated wth Pleistocene glacial substage maxima are suggested as a possible prime mechanism of denudation.

The rocks of Clarke County are largely the products of high grade regional metamorphism with minor occurrences of igneous varieties. Metamorphic lithologies are characterized by an extensive sequence of migmatite and subordinate interlayered sequences composed of paragneiss, schist, quartzite and amphibolite. The bulk of these rocks are considered the derivatives of geosynclinal (flysch) deposits with some basic volcanic contributions. The period of deposition is regarded as extending from late Precambrian to early Paleozoic. Respective periods of metamorphism ranged from late Precambrian to late Paleozoic. At least two, and possibly as many as four, major events are suggested for this time span. Migmatites, comprising approximately 75% of the exposures, are interpreted to be mainly derivatives of the paragneisses through recrystallization, differentiation and an undetermined degree of K-metasomatism. Resistor inclusions such as quartzite, mica schist, and biotite paragneiss, relicts of the interlayered sequences, are characteristically associated with the migmatites and support this hypothesis of genesis.

Igneous rocks are mainly restricted to small bodies of granitic pegmatoid and pegmatite of apparent local derivation which typically pervade the metamorphic rocks. In addition, northwest-trending olivine diabase dikes and massive quartz veins occur throughout the region and possibly occupy genetically related fracture systems.

The main structural feature of the region is a complex system of folds, mesoscopic to macroscopic in scale. Fold styles are mainly subisoclinal and recumbent. Some evidence suggests that nappes or thrust sheets are associated with the megascopic folds. The fold systems are grouped statistically into three regimes oriented NE/SW, NNE/SSW and NW/SE respectively. Correlations with metamorphic episodes are considered. Fracturing on both mesoscopic and macroscopic scales are common in the area but subordinate to folding in magnitude and extent. A NE/SW oriented system, occupied by granitic pegmatoid and pegmatite, is regarded as pre- to syn- metamorphism (late event). The NW/SE system occupied by diabase, or vein quartz, is considered to post-date the main period of metamorphism as are the majority of mesoscopic faults and joints.

Crushed rock (migmatite) is the only mineral resource currently exploited in Clarke County. A potential exists for alluvial sand and gravel as well as sillimanite and monazite.

Wright, David Craig, 1952, Stratigraphy of the Chickamauga Limestone [Ordovician] in the Kensington Quadrangle: Emory University, MS Thesis, 44 p. (Arthur T. Allen)

Compiler's Abstract

The Kensington Quadrangle is located in the Valley and Ridge Province of northwest Georgia.

Detailed stratigraphic studies were made of the Chickamauga Limestone where it occurs in this quadrangle.

The unit was measured to be 1369 feet thick in this area. Stratigraphic analysis revealed four distinct rock types:

1. Crystalline limestones which contain fossil debris as their principle constituent.
2. Calcilutites which contain fine lime mud as the principle constituent.
3. Blue, limey siltstones which are clay-free and contain silt-sized quartz and calcite as the principle constituent.
4. Yellow and red limey mudstones which contain clay and lime as their principle constituent.

The unit was divided into 26 zones of which detailed measured sections were made.

Wright, Nancy Elin Peck, 1963, Compositional Variation in the Stone Mountain Granite: Emory University, MS Thesis, 53 p. (Willard H. Grant)

Author's Abstract

A small area underlain by the Stone Mountain granite, located in the Central Piedmont of Georgia and including the monadnock known as Stone Mountain, was studied in some detail to determine compositional variation (differentiation) in the mass, and to clarify the petrographic and petrologic classification of the rock.

An orthogonal grid was used to provide a statistical basis for sampling. Four mineralogical variables—quartz content, total feldspar content, microcline/oligoclase ratio, and muscovite/biotite ratio—were separately contoured in their original locations on the grid, and the resulting isopleth maps compared as to direction and significance of large-scale trends.

The maps of the first three variables showed a differentiation trend paralleling the predominant east-west structural direction and divided into two arms occupying the northern and southern halves of the mass, suggesting emplacement in two nearly simultaneous intrusions. The northern half appears to have been the earlier of the two. The isopleth map of the muscovite-biotite ratio shows a relationship of some sort to the present bulbous shape of this part of the granite mass, with a higher biotite content at the edges of the mass than in the center; this may be due to localized leaching of iron accompanying the post-magmatic deuteric alteration indicated by extensive epidotization and secondary feldspar, or may be a result of late hydrothermal metamorphism.

The rock is an adamellite, corroborating work of earlier writers; laboratory and field observations by this and other writers support an igneous origin.

SUBJECT INDEX

UNIVERSITY INDEX

ALABAMA, UNIVERSITY OF

1950	Drennen, Charles	MS
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