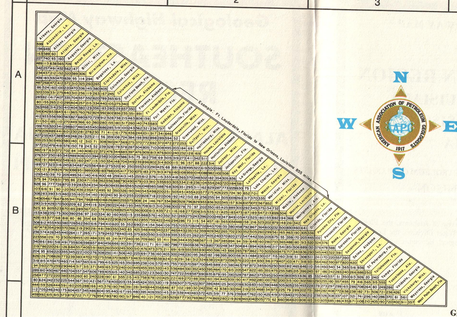
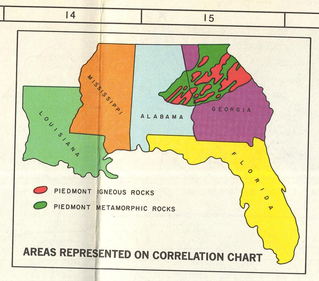
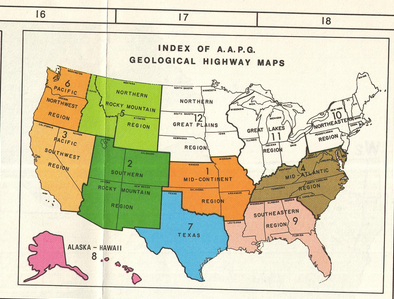
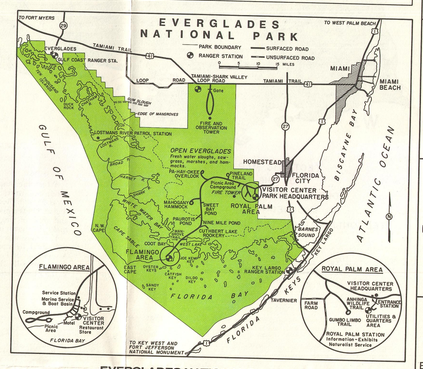




AREAS REPRESENTED ON CORRELATION CHART





EVERGLADES NATIONAL PARK

"Everglades National Park preserves a unique American landscape. Here the temperate zone meets the sub-tropics, blending the wildlife and vegetation of both. Here an horizon-reaching prairie is in reality a river in whose shallow flow the sawgrass wets its feet. Vast space of water, land and sky is a first impression; further acquaintance brings the canvas into intimate focus—the water teeming with fish and amphibians, the land shaded by unfamiliar trees, the sky a freeway for exotic birds. Different is the word for the Everglades." From William B. Robertson, Jr.'s *Everglades—the Park Story.*

This amazing ecosystem of the Everglades is delicately attuned to its regional geology and climatology. The Everglades are underlain by at least 3 miles of mainly carbonate rocks that accumulated at or near sea level during the last 150 million years, and this sequence, in turn, rests on more ancient rocks probably dominated by volcanic flows and intrusions mixed with desert-type redbeds and evaporite deposits. In the park, however, only the uppermost layers of this vast rock pile are visible.

These surficial deposits are of Quaternary age and are related to the rise and fall of sea level during the Pleistocene Ice Age. The third interglacial sea (Sangamon), about 75,000 to 100,000 years ago, deposited the limestone beds that now occur near the surface. The Key Largo Limestone, an old coral reef, forms much of the Upper Florida Keys. The Miami Oolite makes up the east coast ridge of the mainland, then dips west to provide a floor for the southern Everglades and Florida Bays, and emerges again to form the islands from Big Pine Key to beyond Key West. A shallow and almost impervious veneer of marl, peat, clay, and soil formed on top of these limestones as a result of late Pleistocene and recent sea-level oscillations.

Although the Everglades area appears exceedingly flat, the land along both coasts is slightly more elevated and partially encloses an interior saucerlike basin now occupied by the Park. This saucer is tilted almost imperceptibly toward the south and west with a wide break in the rim at the southwest side along the Gulf of Mexico. Rainfall amounting to about 60 inches a year causes periodic flooding and overflow along the low south shore of Lake Okeechobee; the water then flows seaward over relatively impervious surface layers. Thus the Everglades represent essentially a very broad and shallow marshy river whose waters drift slowly southward to the sea.

Curiously, sites that differ in elevation by no more than a few inches in such a flat plain as this may present strikingly different plant and animal communities. Five such types may be distinguished—hammocks, bayheads, pineland, mangrove swamps, and sawgrass. The latter comprises much of the park and features many ponds and sloughs crowded with small fish, snails, and crayfish that provide food for alligators, birds, and mammals. The adjoining mangrove-swamp forests with tangled arching aquatic roots are among the most spectacular in the world. The higher rocky areas exhibit "hammocks" that consist of broad-leaf subtropical forests with ferns and epiphytic orchids. However, the pinelands grow on the rockiest soil in the park. Elsewhere, hundreds of tree islands—the "bayheads"—dot the marshy expanses of the Everglades, and trees may be cypress, willow, magnolia, holly, or bay. The peat soil of these bayheads burns readily when dry, leading to many glade fires.

Visitors to the Everglades should admire but not disturb the delicate balance of nature in this natural wonderland.

(The source of much of the above material is William B. Robertson, Jr.'s *Everglades—the Park Story.*)

THE SOUTHEAST STORY—FROM ROCKS TO ROCKETS

For those who delight in geological puzzles, the southeastern corner of America can provide endless pleasure. Its outward simplicity is deceptive. It is hinged by Florida, which is covered by soft surficial young sediments, and which protrudes like a downward-pointed thumb into the subtropical Atlantic and Gulf of Mexico. North and west of Florida along the Coastal Plain, the Cenozoic and late Mesozoic deposits, which are tilted gently seaward, sweep broadly and discordantly around a corner of hard, deformed ancient metamorphic and igneous rocks of Precambrian to Paleozoic age in the Georgia and Alabama Piedmont.

To the north and west, the Appalachian highlands are ribbed by convoluted folds of Paleozoic sedimentary rocks; in northern Alabama is a triangular patch of gently southward-tilted Carboniferous strata resembling those of the continental interior. This is known as the Black Warrior basin. Still farther west, throughout Mississippi and Louisiana, lies the great Mississippi embayment with its terminal birdfoot delta below New Orleans. Exceedingly varied strata extending from billion-year-old gneisses of the Georgia Piedmont to recent deposits of southern Florida and the Mississippi Delta partly explain why the Southeast is such a fantastically rich mineral storehouse and such a delight to geologists, rockhounds, and interested tourists.

According to the recent concepts of many geoscientists, this southeast corner is the arena where three continents—North and South America and Africa—met and then drifted apart. This is also the area where the buried extensions of the great Appalachian and Ouachita mountain systems trend respectively southeast and southwest toward a collision course about 2 miles below the coastal plain of southeastern Mississippi. The nature of this juncture is still not fully known.

Throughout the Coastal Plain, deep oil and gas wells have gradually revealed a long complex Permian to Early Cretaceous history not represented at all in the regional surface rocks. Below these lie still older Paleozoic "chapters" which are barely deciphered yet differ in many details from the better-known Paleozoic history of the Appalachian area.

Volcanoes in Florida and coral reefs in northern Alabama seem improbable, but early Paleozoic history suggests such events for that time. In the uplands of the Appalachian Mountains and the Piedmont Plateau, vast thicknesses of Paleozoic and late Precambrian strata suggest rapidly subsiding oceanic trench-type accumulations.

The Florida Strait and its relation to the Florida Peninsula to the north and the Bahama Platform to the southeast is not clear. Is it a depressed fault block, a scour channel carved by the Gulf Stream, a combination of these two, or something quite different? Future drilling and seismic exploration may provide the answers.

Throughout Louisiana and southern Mississippi many tall, tapering cylinders of salt and anhydrite rise 2 to 5 miles above a floor of pre-Cretaceous salt-bearing formations to intrude and fracture vast thicknesses of overlying Cretaceous and Tertiary sedimentary rocks. These intrusions have set up many potential traps for migrating oil and gas. Although we know much about their considerable complexity from the thousands of wells drilled about them, their mode of emplacement and evolution in time is still controversial.

A quite different sedimentary structure is also found in the southwest part of the geological highway map. This is the Mississippi Delta, one of the greatest deltaic systems on earth. Its surface area extends about 100 miles southward to the very edge of the continental shelf and probably spills down the continental slope. The mouths of its shifting distributaries have probably formed over more than 200 miles of coastal waters from west to east, producing in cross section an overlapping series of great lenslike deltaic deposits. This delta is still growing outward from its present mouth because of the upstream channels and levy construction by man, but the river is constantly seeking to find a shorter outlet to the sea, especially through the old Atchafalaya Channel. Because this delta has been extensively penetrated by thousands of wells in the search for oil and gas, the third dimension has been added and has provided us with an ideal model for delta studies throughout the world. However, there are still many unsolved problems relating to delta formation and evolution.

Throughout the Gulf and Atlantic Coastal Plain, there exists almost a continuous series of low scarps and terraces involving late Tertiary and Quaternary deposits. Some of these terraces and their associated sediments have been assigned names that appear on the accompanying time-rock chart and are even correlated with glacial and interglacial low- and high-water stages. Some stratigraphers are contesting these concepts. Many of the associated deposits are older than they should be and also some of the scarps appear to be related either to faulting or to sedimentary structures other than strandline features. Arguments will probably persist for many years about terrace formations throughout our coastal areas.

These and many other puzzling geological features probably interrelate to the even greater puzzles of mobile oceanic and continental plates, seafloor spreading, subduction of oceanic crustal and mantle rocks below continental crustal rocks, and generation of granitic and ultramafic batholithic bodies. Most proponents of plate tectonics concede that the southeastern United States and the adjoining Bahama Platform probably represent the poorest fit between the reassembled continent plates composing the conjectured ancient giant continent of Pangaea.

These geological complexities, however, have served the economy of the southeastern region well. This area is currently undergoing a great industrial expansion owing largely to its great and varied mineral wealth. The tremendous oil and gas reserves of Louisiana are now being supplemented by recent major oil discoveries in Mississippi, southern Alabama, and Florida. The coal reserves of the Black Warrior basin in northern Alabama, together with the low cost of the Silurian ferruginous oolitic beds and the limestones of the nearby Paleozoic fold belt of the southern Appalachian Mountains, have been exploited for many years in the manufacture of Birmingham steel.

Nearby Arkansas and the island of Jamaica, a short water-haul across the Gulf of Mexico, are suppliers of high-grade bauxite—the ore of aluminum—which is processed by the use of the abundant electrical energy in the southeast derived from the burning of oil, gas, and coal and from the hydroelectric facilities such as the TVA enterprises of Alabama and Tennessee.

The phosphate reserves of Florida and Georgia are among the largest in the world and are as important to agriculture as to industry. Sulfur and salt are found in important supplies in hundreds of salt domes throughout Louisiana and Mississippi. The list goes on and on, especially in those items essential to the space-age industries.

Even common sand and gravel find many uses. Perhaps the most spectacular use of all, although indirect, is that of the tremendously large compound and spit of Holocene age in eastern Florida—Cape Canaveral—which serves as the rocket platform for the Kennedy Space Center. From here the Apollo rockets went to the moon to return with the rocks peculiar to that celestial body.

Perhaps in your travels along the highways of Dixie, you may find evidence in its rocks to resolve some of these multitudinous problems that have fascinated several generations of geoscientists. In this endeavor we recommend that this map be used in conjunction with the many fine state and county maps on sale at the several state geological survey offices.

Use of the color and symbol codes

The main map on this page shows in a generalized fashion the age and outcrop pattern of the surface rocks over which you drive, build, look, and live. This has been done by using various colors and symbols to identify rocks of different ages and classes.

The time-rock chart shows the probable age of the rock group with a particular color—generally those used by the United States Geological Survey—and a particular letter symbol. For example, certain blue areas with a capital "M" are Mississippian rocks formed 305 to 330 million years ago. Locally a smaller letter preceding the capital letter further divides the rock systems—"u" to indicate the upper (younger) subdivision, "m" to indicate the middle part, and "l" to indicate the lower (older) part. A special case is the Tertiary Period whose particular epochs are denoted by small letters following "T"—"Tp" for Paleocene, "To" for Oligocene, "Tm" for Miocene, and "Tp" for Pliocene. Those map units that include both Pliocene and Miocene rocks are shown by the combining symbol "Tpm." Throughout the large extent of the broad Coastal Plain a further refinement is introduced for finer subdivisions, such as "Tej" and "Tec" for formations of the Eocene Jackson and Claiborne Groups, or "Tmu," "Tmm," and "Tml," respectively, for upper, middle, and lower Miocene beds. These devices are also used for other rock systems.

Other letter symbols are added for special classes of rocks—"m" for metamorphic or altered rocks, "v" for volcanic or extrusive rocks, "g" for intrusive granitic rocks, "gb" for intrusive gabbroic rocks, and "d" for diabasic rocks. A broader time grouping of rocks is necessary in places. This involves the use of the symbols "Pzg" for granitic rocks of the Paleozoic Era and "pCm" for Precambrian metamorphic rocks.

A still broader grouping of rocks is used for extensive terranes of metamorphic and igneous rocks of uncertain age in the Piedmont area of Alabama and Georgia. For example, "m-s" is used for a dominantly mica schist sequence of uncertain age, "p" for a phyllite sequence, etc., as noted on the time-rock chart under the heading "Metamorphic Rocks." Where the metamorphic rocks have been dated, a designation such as "Dm" for Devonian metamorphics will be used.

Also in the columns of time and rock units, graphic representation of rock types is shown. These patterns are explained in a separate legend. Limestone is shown by a brickwork pattern, sandstone by dots, shale by dashes, conglomerates by circles, etc.

PRINCIPAL SOURCES OF MAP INFORMATION

Geology adapted from: the Geologic Map of the United States (USGS, 1974); the Tectonic Map of the United States (USGS-AAPG, 1962); the Tectonic Map of Gulf Coast Region, USA (AAPG and GCAGS, 1972); the Geologic Map of Alabama (Geological Survey of Alabama, 1971); various published county geological maps (Geological Survey of Alabama); Geologic Map of Florida (Florida Board of Conservation, Division of Geology, 1964); various bulletins and reports of investigation (Florida Geological Survey); manuscript Geologic Map of Georgia (Georgia Division of Mines, Mining and Geology, The Geologic Survey, 1975); generalized Geological Map of Louisiana (Louisiana Geological Survey, 1959); manuscript geological map of Louisiana by Rufus LeBlanc; Geologic Map of Mississippi (Mississippi Geological Survey, 1969); and supplemented by various maps of the southeastern region appearing in *The Quaternary of the United States* (Princeton University Press, 1965); the *Post-Miocene Stratigraphy Central and Southern Atlantic Coastal Plain* (Utah State University Press, 1974); and the bulletins, circulars, maps (CQ, I, OC, POC, POM series), and professional papers of the U.S. Geological Survey.

Geologic maps and publications of Louisiana, Mississippi, Alabama, Florida, and Georgia are available at nominal cost from the following: Lists of publications and maps are sent free on request.

Geological Survey of Alabama, P.O. Drawer O, University, Alabama 35486

Florida Bureau of Geology, 903 West Tennessee St., Tallahassee, Florida 32304

Georgia Earth and Water Division, Department of Natural Resources, 19 Hunter Street, S.W., Atlanta, Georgia 30334

Louisiana Geological Survey, Box G, University Station, Baton Rouge, Louisiana 70803

Mississippi Geological, Economic, and Topographical Survey, P.O. Box 4915, Jackson, Mississippi 39216

Topographic maps, geologic maps, and other publications of the U.S. Geological Survey on the southeastern states are available from the U.S. Geological Survey—

Branch of Distribution, 1200 South Eads Street, Arlington, VA 22202

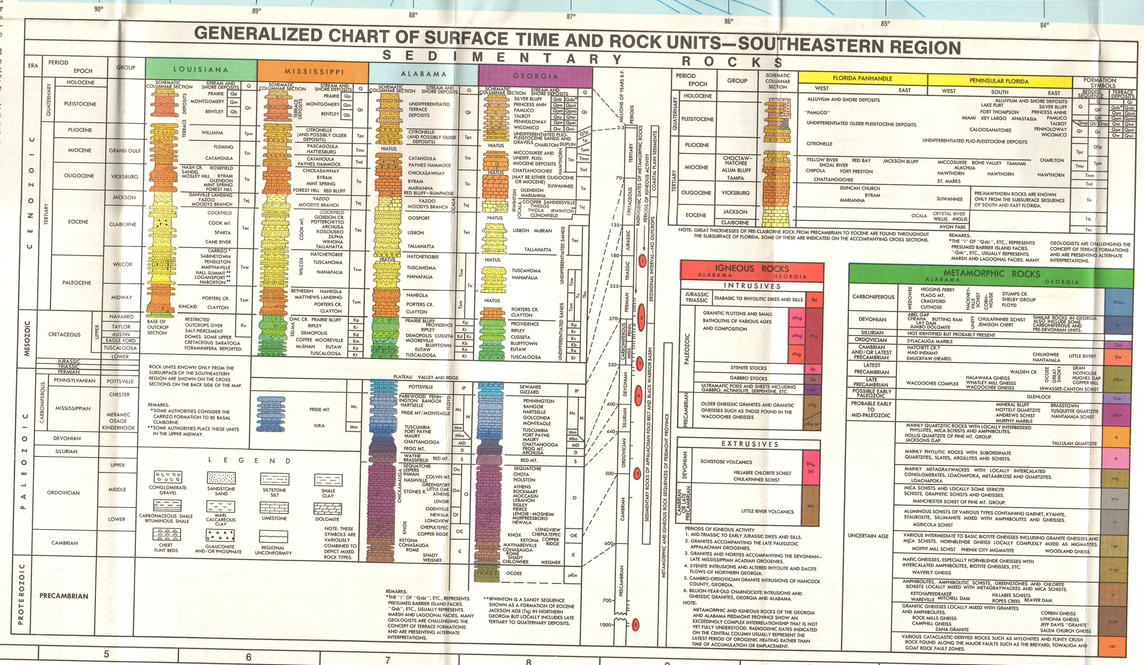
Room 1028 General Services Building, 19th and F Streets, N.W., Washington, DC 20244.

Maps and publications of the southeastern states are available for sale over the counter only at Room 1C, 402 Geological Survey National Center, 12201 Sunrise Valley Drive, Reston, VA 22092.

Topographic maps of the U.S. Geological Survey are also available at many dealers at prices usually slightly more than Survey prices. Dealers are sometimes listed in telephone directories or on the topographic indexes for the various states. These indexes are provided free on request from most Survey offices.

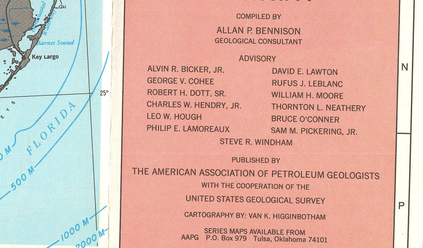
GENERALIZED CHART OF SURFACE TIME AND ROCK UNITS—SOUTHEASTERN REGION

SEDIMENTARY ROCKS



IGNEOUS ROCKS

METAMORPHIC ROCKS



MAP NO. 9
UNITED STATES GEOLOGICAL HIGHWAY MAP SERIES
Geological Highway Map
OF THE
SOUTHEASTERN REGION
ALABAMA GEORGIA
FLORIDA LOUISIANA
MISSISSIPPI

COMPILED BY
ALLAN P. BENNISON
GEOLOGICAL CONSULTANT

ADVISORY
ALVIN R. BICKER, JR.
GEORGE V. COHEE
ROBERT H. DOTT, SR.
CHARLES W. HENDRY, JR.
LEO W. HOUGH
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