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MINERAL RESOURCE POTENTIAL OF THE CLEAR LAKE ROADLESS AREA, LEON COUNTY, FLORIDA

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STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral survey of the Clear Lake Roadless Area in the Apalachicola National Forest, Leon County, Florida. The Clear Lake Roadless Area was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

The only mineral material that has been produced within the Clear Lake Roadless Area is clayey sand used as fill for highway construction and for stabilizing Forest Service roads. Fuller's earth, common clay, and sand and gravel presently are produced in Leon County and in nearby counties, and limestone and peat have been produced in the past. However, no commercial deposits of these commodities exist in the Clear Lake Roadless Area. The Apalachicola National Forest has been explored for phosphate and the region reconnoitered for heavy minerals, but no valuable deposits of either have been found.

The potential for finding valuable mineral deposits or oil and gas in the Clear Lake Roadless Area is low. However, the area and nearby lands have not been thoroughly tested for oil and gas, and the possibilities for discovery cannot be ruled out.

INTRODUCTION

The Clear Lake Roadless Area is in the Apalachicola National Forest, Leon County, which is in the Big Bend region of the Florida panhandle (fig.1). The area is about 10 mi southwest of the Tallahassee business district. Clear Lake, for which the area is named, is the designation used on U.S. Forest Service maps for the small body of water otherwise called Dog Pond on the U.S. Geological Survey (USGS) topographic map (fig. 2). The roadless area contains 6,485 acres and is bounded by Florida Highway 267 on the southwest and by Forest Service unimproved roads 367, 383, and 305 on the west and north and 307 on the southeast. The topography is gently undulating; altitudes range from a maximum of 117 ft at a benchmark along the western boundary road to a low of 75 ft in the southwestern part of the area. The water level is at 88 ft in the collapsed sinkhole forming the Clear Lake basin. A few small swamps are scattered throughout the area, but permanently wet areas are not as extensive as indicated by the swamp symbols on the map. The drier areas are covered by pine-palmetto flatwoods, and the small swamps support tangles of shrubs, small trees, and other plants of the titi-vegetation type (Clewell, 1971).

Previous Investigations

The most thorough published work on the geology of the Clear Lake area was by Hendry and Sproul (1966) who investigated all of Leon County. Hendry, senior author, and J. W. Sweeney, coauthor, of the present report, wrote chapters in U.S. Bureau of Mines Minerals Yearbooks for several years that include information on mineral activities in the Big Bend region. Applegate, Pontigo, and Rooke (1978) summarized the oil and gas potential of the region. Cameron and Mory (1977) briefly discussed the peat, limestone, and other mineral resources of the Big Bend region, and several Florida State University M.S. theses, cited by Schmidt and Clark (1980), were concerned with heavy minerals. Patterson (1974) discussed fuller's earth and other industrial minerals in a large area north of Clear Lake. Cathcart (1968) outlined the distribution of phosphate in Florida, and Scott and others (1980) included some information on deposits in the Big Bend region in their report covering the sand and gravel resources of the State.

Present Investigation

The work on the present mineral evaluation of the Clear Lake Roadless Area began with a review of published and unpublished information on the Apalachicola National Forest by Sweeney, Patterson, and Crandall. Patterson reconnoitered the region and searched the reports and records of the Florida Bureau of Geology in the spring of 1980. Crandall, assisted by Frederick W. Miller, geologist, U.S. Bureau of Mines (USBM), conducted field investigations in the roadless area and visited active and inactive pits and quarries in the immediate vicinity in February 1981. During this work swampy areas were probed to make certain no significant deposits of peat were present. Cathy Neeley of the USGS performed particle-size and heavy-mineral determinations on sand samples.

Information on dry holes given in this report is based primarily on published reports and records on file in the Florida Bureau of Geology. The term "dry hole" is used

[1]Florida Bureau of Geology
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[3]U.S. Bureau of Mines

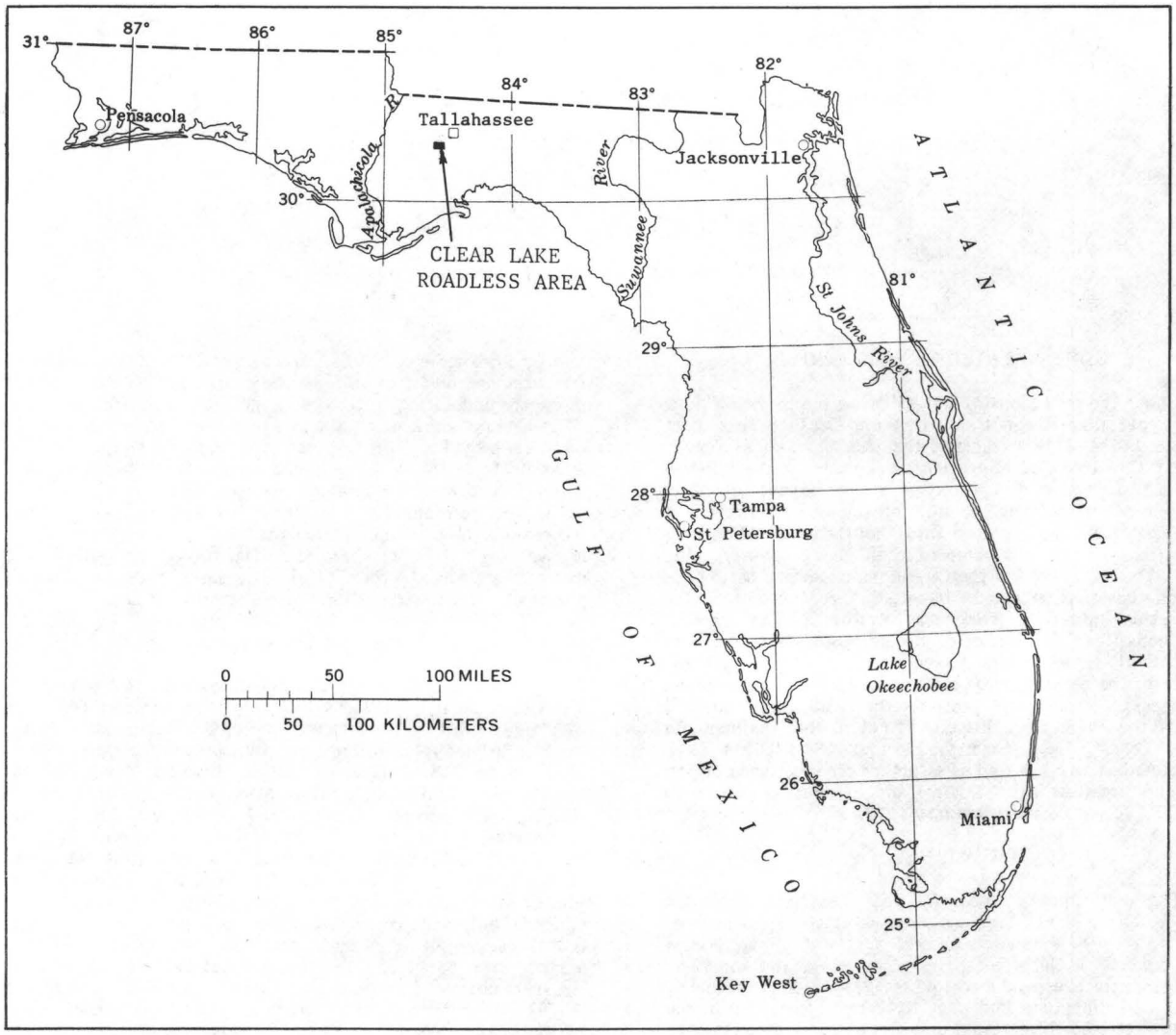

Figure 1.--Location of the Clear Lake Roadless Area, Leon County, Fla.

according to the definition meaning no significant amounts of oil or gas were found.

No geochemical survey was necessary during the work leading to this report because: 1) stream-sediment and soil sampling would have yielded no information of value in appraising the nonmetallic mineral potential of the area, and 2) the metallic and other heavy minerals occurring in strata near the surface are not in sufficient concentrations to form valuable mineral deposits.

Acknowledgments

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SURFACE- AND MINERAL-RIGHTS OWNERSHIP

The Federal Government owns all surface and mineral rights in the Clear Lake Roadless Area, which were acquired under the authority of the Weeks Act in the early 1930s by the U.S. Department of Agriculture, Forest Service.

In the 1950s a permit was issued to the State Highway Department to open a borrow pit and remove fill for construction of State Highway 267. The permit was terminated when highway construction was completed. In the 1960s phosphate-prospecting permits were issued for the entire Apalachicola National Forest; however, there were no subsequent applications for phosphate leases. Although the entire Clear Lake Roadless Area has been under simultaneous oil and gas leases in the past, there were no active oil and gas leases or applications for leases in the area as of October 1981.

GEOLOGY

Surficial deposits

The Clear Lake Roadless Area is entirely blanketed by unconsolidated sediments of Pleistocene and Holocene age that average about 35 ft in thickness (cross section, fig. 2). The principal sediment is Pleistocene sand that was called the Wicomico Formation by Hendry and Sproul (1966, p. 93). Holocene sediments consist mainly of a veneer of organic-rich silt, clay, and muck in the basin of Clear Lake and in some of the small swampy areas. The "A"-horizon soil covering the higher areas is rarely more than a foot thick. It consists of slightly clayey sand containing minor organic material and root remains.

Stratigraphy

Crystalline and Paleozoic rocks--A dry hole drilled offshore about 40 mi south of the Clear Lake Roadless Area intersected 10 ft of diabase at a depth of 10,460 ft, overlain by pinkish quartzitic sandstone and underlain by diabase fragments admixed with sandstone (Milton, 1972, p. 31). Two dry holes in Washington County, approximately 75 mi west of Clear Lake penetrated Cambrian quartzite and meta-arkose at depths of about 11,500 ft (Schmidt and Clark, 1980, p. 26). Crystalline rocks and probably Cambrian and possibly other Paleozoic sedimentary rocks are present at depth in the roadless area.

Triassic and Jurassic rocks--Triassic rocks were penetrated by a dry hole (fig. 4, hole 6, mineral resource potential map) in Leon County 13 mi east of the Clear Lake Roadless Area and by another dry hole in Wakulla County (fig. 4 hole 4, mineral resource potential map), 5 mi southwest of the area (Applegate, Pontigo, and Rooke, 1978). These rocks consist of micaceous and argillaceous sandstone, well-indurated shale, and a few dikes and sills of igneous rocks. The presence of Triassic rocks both east and southwest of Clear Lake suggests that beds of Triassic age occur at depth in the area.

Three formations of Jurassic age were identified in samples from the dry hole (hole 4) located 5 mi southwest of the Clear Lake area (Applegate, Pontigo, and Rooke, 1978, fig. 3). The lowermost formation is mainly salt, the middle formation consists of red and gray calcareous shale, sandstone, and carbonate rocks, and the upper formation is mainly varicolored mudstone and sandstone. It is not known whether or not any of the three formations are present at depth in the Clear Lake Roadless Area.

Cretaceous System--Both Lower and Upper Cretaceous sedimentary rocks have been recognized from cuttings of drill holes in Leon County (Hendry and Sproul, 1966, p. 49-50), and they probably are present at depth in the roadless area. The Lower Cretaceous rocks in the eastern part of the county are about 2,200 ft thick, and consist chiefly of reddish-brown shale containing interbedded sandy limestone and micaceous sandy shale. The Upper Cretaceous sequence is nearly 1,700 ft thick and is divided into three formations. The lower formation consists of poorly sorted fine to coarse micaceous sand interbedded with varicolored shale, and overlain by a deeper-water marine facies composed mainly of shale. The middle formation is chiefly sand and shale, and the upper formation is composed of interbedded gray marl, limestone, and gray to bluish-green calcareous shale.

Paleocene rocks--Sediments of Paleocene age have been identified in samples from two wells in Leon County. They have a total thickness of about 130 ft, and consist mainly of pale yellowish green, slightly calcareous, moderately soft clay containing microfossils. The lower part of the unit consists of sandy and silty, glauconitic, fine grained carbonate rock (calcilutite).

Eocene rocks--Lower, middle, and upper Eocene rocks are present in Leon County, and probably exist at depth in the Clear Lake Roadless Area. Undifferentiated lower Eocene rocks have been identified in Leon County on the basis of several species of foraminifera in samples from dry holes. Rocks containing these fossils consist principally of pale orange, soft, argillaceous, slightly dolomitic, glauconitic calcilutite containing some interstitial gypsum and abundant brown chert. The upper part of the lower Eocene sequence consists of soft, green, calcareous clay. Lower Eocene rocks were found to be 460 ft thick in one well and 535 ft thick in another. Three middle Eocene limestones, the Lake City, Tallahassee, and Avon Park, were described by Hendry and Sproul (1966, p. 52-53). The three formations differ somewhat in carbonate lithologies and in variations in content of chert, gypsum, and argillaceous materials. Total thickness of the three formations is about 1600 ft.

Upper Eocene rocks are represented by the Crystal River Formation of Puri (1957) that consists mainly of pale orange, microcoquina, porous, fragmental carbonate rock. Part of the formation consists of dense dolomite containing some molds and casts of fossils. Thicknesses of upper Eocene rocks in Leon County range from 200 to 400 ft.

Oligocene rocks--The Suwannee Limestone is the only formation of Oligocene age in Leon County. This unit consists of pale orange, partly recrystallized calcarenite having a finely crystalline matrix. It contains abundant microfossils, including several species of foraminifera. A milky chert zone commonly is present at the top of the formation. In most places, the thickness of the Suwannee Limestone is between 180 and 200 ft.

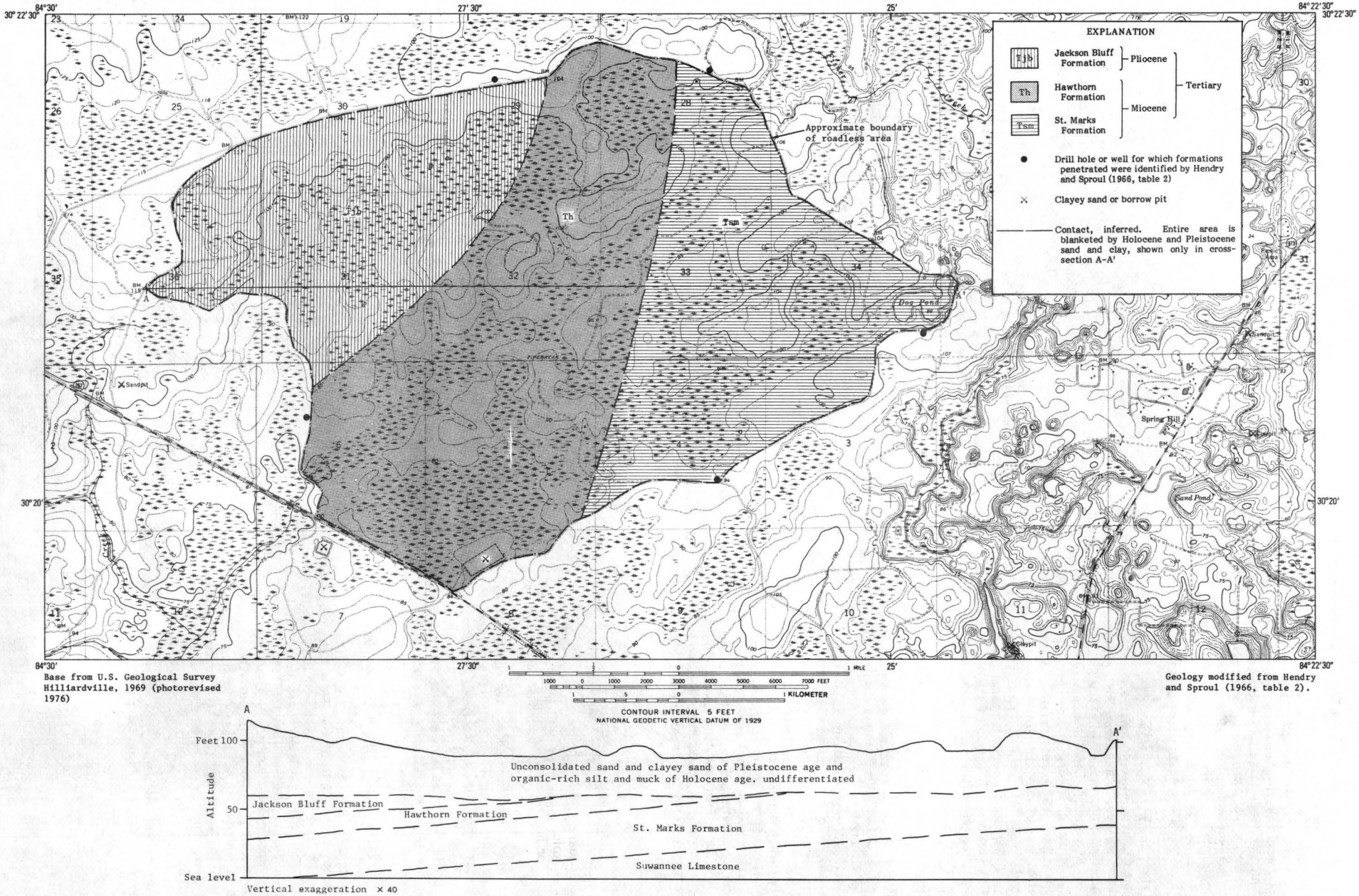

Figure 2.--Geologic map and cross section of the Clear Lake Roadless Area. Map does not show Pleistocene and Holocene sediments.

Miocene rocks--The rocks of Miocene age underlying the Clear Lake Roadless Area are assigned to the St. Marks and the Hawthorn Formations. The St. Marks unconformably overlies the Oligocene Suwannee Limestone, as indicated by the distinct lithologic and faunal differences and very irregular contact. The contact with the overlying Hawthorn Formation is also unconformable. The St. Marks Formation is predominantly fine- to medium-grained, silty and sandy limestone (calcilutite and calcarenite) that has undergone varying degrees of secondary dolomitization. In some places, the St. Marks is more than 200 ft thick; and a water-supply well at the site of the former Clear Lake campground penetrated 105 ft of this formation and failed to reach the base. The Hawthorn Formation in the vicinity of the roadless area is composed of fine- to medium grained quartz sand, sandy phosphatic limestone, silt, sand-sized phosphate pellets, and irregularly distributed attapulgite (palygorskite), kaolinite, and montmorillonite (smectite). In the Clear Lake Roadless Area the Hawthorn Formation is no more than 20 ft thick, and it has been removed by erosion in many places.

Pliocene rocks--All beds of Pliocene age in the roadless area are in the Jackson Bluff, Formation, which overlies the Hawthorn Formation. The Jackson Bluff consists of clayey sand and sandy clay containing abundant macrofossils. It is rarely more than 20 ft thick in Leon County, and where penetrated by a drill hole along the northern boundary road of the Clear Lake Roadless Area it is only 15 ft thick. The Jackson Bluff Formation was formerly assigned a Miocene age, but recent work has established that it is of Pliocene age (Schmidt and Clark, 1980, p. 54).

Structure

The sedimentary formations underlying the roadless area dip gently to the southwest toward the Apalachicola embayment (Pressler, 1947), which was formed by downwarping of crustal rocks. The central part of the embayment is filled with sediments of Triassic to Quaternary age having a thickness of more than 14,000 ft. No faults have been recognized in the roadless area. However, strata have been disturbed in many places by slumping into solution cavities.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Fuller's earth, sand and gravel, clayey sand, and common clay are produced in the Big Bend region, and limestone was quarried and peat dug in the past. The region also has been explored for phosphate and for oil and gas and reconnoitered for heavy minerals, but no commercial deposits have been found. The only mining activity within the boundaries of the Clear Lake Roadless Area was the removal of sand from a single borrow pit, which was used as fill in the construction of Florida Highway 267 and for stabilizing Forest Service roads.

Fuller's Earth and Other Clays

A large district leading the world in the production of palygorskite (attapulgite)-type fuller's earth straddles the boundary of Florida and Georgia north of the Clear Lake Roadless Area (fig.3). The closest active processing plants are at Quincy, Fla., 20 mi northwest of Clear Lake, and Hinson, Fla., 22 mi north of the roadless area. Fuller's earth mines closest to Clear Lake are in the vicinity of Midway, 11 mi north of the area, where the deposits are in the Hawthorn Formation. Mining near Midway ceased about five years ago, but production from pits located farther north has been increased.

Inasmuch as the Hawthorn Formation is present in the central part of the Clear Lake Roadless Area (fig. 2), some palygorskite may be present there. However, no deposits of sufficient size and purity to be mined at a profit are known to exist south of the vicinity of Midway (Patterson, 1974), and the potential for fuller's earth in the roadless area is low.

The only use of common clay in the Big Bend region is at the Apalachee Correctional Institution plant south of Chattahoochee, Fla. about 30 mi northwest of Clear Lake. This plant, which is operated by the State of Florida, uses clayey and silty alluvium from the floodplain of the Apalachicola River to make common construction brick. The alluvial materials in the vicinity of Clear Lake are small and scattered accumulations, and are of no value in making brick.

Heavy Minerals

Several reconnaissance studies of heavy minerals in sands in the Big Bend region have been made, but no valuable concentrations have been found. The studies include M.S. theses on heavy minerals in Leon and Wakulla Counties, cited by Schmidt and Clark (1980, p. 72). In the work leading to the present report, heavy-mineral determinations (table 1, mineral resource potential map) were made of three samples from pits near the Clear Lake Roadless Area and two samples from the Roberts Sand Co. pit 7 mi north of Clear Lake, at Norfleet. Heavy-mineral contents of samples from pits near Clear Lake range from 0.07 to 0.22 percent, which is far too low for profitable recovery. Heavy minerals identified include biotite, ilmenite, tourmaline, staurolite, rutile, zircon, kyanite, chlorite, garnet, and phosphate. The large variety of mineral species present, in addition to the insufficient concentrations of valuable minerals such as ilmenite, rutile, and zircon, further detracts from the heavy-mineral potential of the sand.

Limestone

Several inactive quarries, where limestone was obtained for stabilizing secondary roads, are scattered throughout the Big Bend region. The largest one is in sec. 4, T. 3 S., R. 1 W. east of Florida Highway 369 about 9 mi southeast of the Clear Lake Roadless Area. The workings of this quarry, which has not been operated for many years, extend over more than 40 acres. Another old quarry is located in sec. 12, T. 4 S., R. 2 W., 2.3 mi south of Crawfordville. The limestone at both quarries is in the St. Marks Formation. Marl, a soft impure calcareous rock, was also dug for road-surfacing material in the western part of Leon County about 9 mi west of the roadlesse area.

Large quantities of limestone are present below the surface in the roadless area, but they have no value. In the eastern part of the area, the St. Marks Formation, consisting mainly of limestone containing minor dolomite, underlies sand of the Pleistocene Wicomico Formation that is as much as 60 ft thick (fig. 2, cross section). In the western part of the area the St. Marks is even more deeply buried because both the Hawthorn and Jackson Bluff Formations as well as the Wicomico overlie it. Limestone also is present in the Suwannee Limestone and other formations below the St. Marks. Limestone in the Clear Lake Roadless Area has no value because of excessive overburden thicknesses and because the St. Marks Formation is under much thinner cover in extensive areas east and south of Clear Lake.

Peat

Peat has been produced on a minor scale in the Big Bend region, and small deposits occur in several swamps. The production closest to the roadless area in recent years has been near Carrabelle, about 35 mi to the southwest, where both bulk and packaged humus peat have been marketed (Cameron and Mory, 1977, p. 29). Minor use of local peat in Leon County and adjoining counties in the past was also reported by Davis (1946), but he noted no specific localities.

The swamps in the roadless area may contain a few thin pockets of peaty materials, but deposits sufficiently large to be attractive for mining are not present. This conclusion is supported in that the swamps are small, and favorable environments for peat accumulation extend over areas of no more than 300 ft in the longest dimension. The most favorable environment for peat is the bay-swamp type,

which supports vegetation characterized by sweetbay (Magnolia virginiana) and several less dominant species (Cameron and Mory, 1977, p. 29) adapted to living under waterlogged conditions.

Phosphate

Minor amounts of phosphate occur in the marine strata underlying the Apalachicola National Forest. The phosphate is generally most common in the Hawthorn Formation, but it is also found in older formations and in younger beds including sands that were reworked from Miocene marine beds in Pleistocene seas. Most of the identifiable phosphate occurs in very fine to medium sand-size pellets colored white, gray, tan, and black, but some is in the form of phosphatic fish and other fossil remains (Cathcart, 1968).

In the 1960s, phosphate-prospecting permits covering the entire Apalachicola National Forest were issued to two companies. A total of 124 holes were drilled, ranging from 40 to 150 ft in depth, and no minable deposits were found. One company did no analytical testing after examining core samples. The other company found that 37 of 52 holes penetrated phosphatic material worth sampling. The sample richest in P_2O_5 (5.45 percent) was from a 3-ft-thick interval (81-84-ft depth) penetrated by a single hole. Two other samples from thin, deep intervals each contained 4.16 percent P_2O_5. The remaining 49 samples contained less than 4 percent P_2O_5 and about half of them had less than 2 percent P_2O_5.

The current grade requirement by the Florida phosphate industry is for phosphate containing more than 28 percent P_2O_5 (J. B. Cathcart, written commun., 1981). Company data support the conclusion that it is very unlikely that economic phosphate deposits are present in the Apalachicola National Forest. It is even more unlikely that valuable deposits underlie the Clear Lake Roadless Area because samples from all nearby drill holes contained very little phosphate; four drill holes on the boundary roads contained so little phosphate that they were not analyzed.

Sand and Fill

The only mineral material produced within the boundaries of the Clear Lake Roadless Area was clayey sand used as fill in constructing the grade for Highway 267. The sand was dug from a rectangular borrow pit, now filled with water, near the south corner of the area. The sand in this pit is in the Pleistocene Wicomico Formation. Similar sand in this formation is dug occasionally from a borrow pit located 2 mi south of Clear Lake, from another 2 mi east of the lake and from a third pit one-half mile southwest of the western end of the roadless area (fig. 2). Grain-size distribution (table 1) was determined for samples from two of these pits and for samples from the Roberts Sand Co. pit at Norfleet. The Roberts Sand Co. is one of three firms producing sand from deposits in a marine terrace that has an east-west extent of more than 12 mi. These three companies produce sufficient sand to satisfy the requirements of the Tallahassee market area. A fourth company produces sand from three pits in the vicinity of Panacea, Fla., (Scott and others, 1980) 22 mi south of Clear Lake, for the markets along the Gulf coast.

The clayey sand in the Wicomico Formation in the Clear Lake Roadless Area has very little value. There are virtually unlimited supplies of the same type of sand in surrounding areas, and much better quality sand is located considerably closer to the major markets. The grain-size determinations of samples from the two pits 2 mi east and south respectively of Clear Lake (table 1) show the sand to be much finer grained and to contain a great deal more silt and clay than the extensive marine terrace deposits sampled in the Roberts Sand Co. pit at Norfleet. These marine deposits are notably closer to the Tallahassee area than are the deposits near Clear Lake.

ASSESSMENT OF OIL AND GAS POTENTIAL

According to the reports and records of the Florida Bureau of Geology, many exploratory holes have been drilled in search of oil and gas in the Big Bend region (fig. 4 and table 2). To date, only a few shows of oil have been found, and all of the holes have been dry. Of the selected holes shown in table 2, 30 were deeper than 5,000 ft and 15 were deeper than 10,000 ft. The deepest hole bottomed at 14,570 ft. Surprisingly, two of the shallow holes (table 2, holes 5 and 8) were reported to have good shows of oil (Hendry and Sproul, 1966, p. 105). These two holes are located less than 20 mi from the Clear Lake Roadless Area.

Although there are no reasons for optimism about the discovery of oil and gas in and near the roadless area, the possibilities cannot be completely ruled out. The principal reasons for the unfavorable outlook are the large number of dry holes in the Big Bend region, and the probable absence of the Jurassic Smackover Formation—which geologists think has the greatest potential for oil and gas in the region—under the Clear Lake Roadless Area. The Smackover Formation is thought to be the most likely host rock because it contains the oil and gas produced in the Jay field in the westernmost Florida panhandle and nearby fields in Alabama (Babcock, 1972). The Smackover has been found to be present in several wells southwest of Clear Lake and is thought to underlie about 2,000 mi^2 in the Big Bend region. However, the updip limit of this formation is shown by Applegate, Pontigo, and Rooke (1978, fig. 1) to be more than 15 mi west of the Clear Lake Roadless Area, in Liberty County. Reasons why some possibility remains for oil and gas discoveries near the roadless area include: 1) the shows of oil in dry holes east of the area, noted in the foregoing paragraph; and 2) uncertainty as to whether or not formations older than the Smackover may contain oil and gas.

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