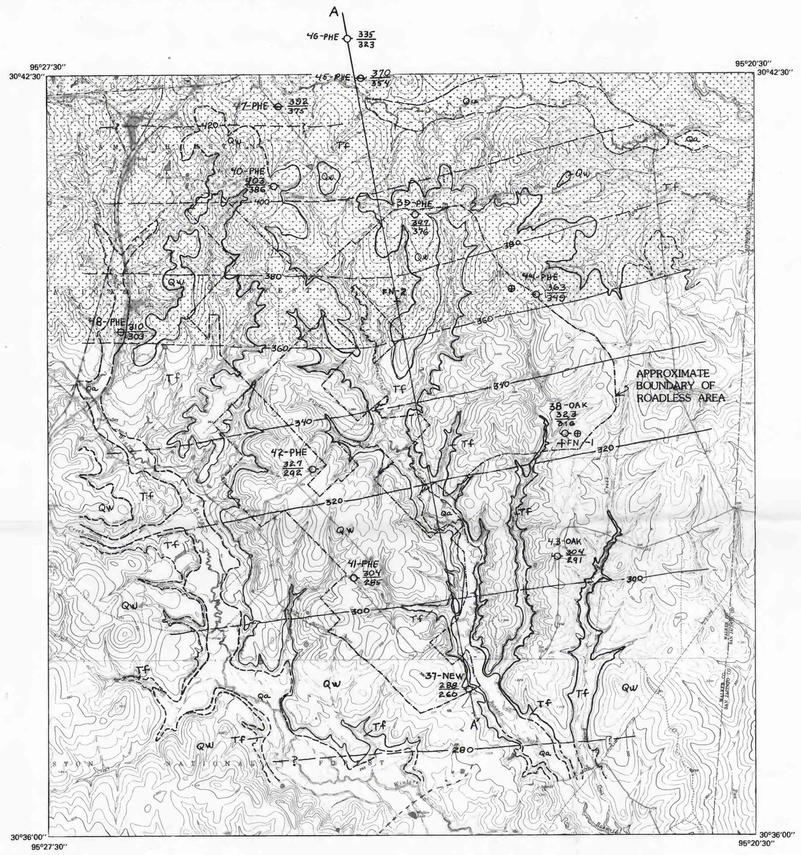
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1549
PAMPHLET ACCOMPANIES MAP



Base from U.S. Geological Survey 1:24,000
Phelps, 1960; Oakhurst, 1961; Maynard, 1960;
New Waverly, 1960

Geology mapped by B. B. Houser, 1982;
assisted by F. N. Houser

SCALE 1:50 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 10 FEET

CORRELATION OF MAP UNITS

Qa	Holocene	QUATERNARY
UNCONFORMITY		
Qw	Pleistocene	QUATERNARY
UNCONFORMITY		
Tf	Miocene	TERTIARY

DESCRIPTION OF MAP UNITS

Qa — ALLUVIUM (HOLOCENE AND PLEISTOCENE?)--Fine- to medium-grained quartz sand and sandy clay with local lenses of quartz-pebble gravel. Floodplain and channel deposits of larger streams. Thickness 0-10 ft

Qw — WILLIS SAND (PLEISTOCENE)--Chiefly fine- to medium-grained, clean to muddy quartz sand and lesser amounts of clayey sand, stiff sandy clay, and clay laminae. Basal lenses of quartz-pebble gravel are common. Thickness 0-80 ft

Tf — FLEMING FORMATION (MIOCENE)--Yellowish-gray (5 Y 7/2), stiff, calcareous clay containing calcareous nodules as much as 8 in. across. Minor constituents are clayey fine-grained sand and sandy clay. Maximum thickness beneath the roadless area is approximately 500 ft

——— CONTACT--Dashed where inferred

—300— STRUCTURE CONTOUR--Drawn on Fleming-Willis contact. Dashed where Willis is absent; queried where inferred. Contour interval is 20 ft

41-PHE 307/285 — AUGER HOLE LOCATION AND NUMBER
Elevation of the Fleming-Willis contact and bottom of the hole given in feet

Willis Sand not present. Elevation of the top of the Fleming Formation and bottom of the hole given in feet

48-PHE 310/303

⊕ OIL OR GAS TEST WELL--Approximately located

FN-1 + SAMPLE FOR URANIUM ANALYSIS

RESOURCE POTENTIAL OF THE AREA FOR OIL AND GAS--Entire area has moderate to high potential. Pattern indicates area which may have high potential on the basis of geologic structure

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must 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 Four Notch Roadless Area (08133) in the Sam Houston National Forest, Walker County, Tex. The Four Notch 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 Four Notch Roadless Area is within the western Gulf of Mexico Coastal Plain and is underlain by Miocene and Pleistocene semiconsolidated clastic sedimentary rocks.

The area has moderate to high potential for oil and gas, as indicated by the regional geologic setting and the presence of nearby producing fields, although five dry holes have been drilled in the area and on private land enclosed by the area. Results of surface and shallow subsurface geologic studies, a radiometric survey, and geochemical and mineralogic studies of subsurface auger samples indicate that the roadless area has high potential for sand for construction and clay. Abundant clay and sand resources are presently available, however, much closer to population and industrial centers than those in the roadless area. There has been no mining or quarrying in the area.

INTRODUCTION

The Four Notch Roadless Area (fig. 1) comprises 5,605 acres in the Sam Houston National Forest, Walker County, Tex., about 70 mi north of Houston. The roadless area is in the Gulf of Mexico Coastal Plain. It is characterized by low, rounded hills and has a total relief of about 170 ft and median elevation of about 350 ft. The region is drained by a dendritic network of southeast-flowing intermittent streams tributary to the East Fork of the San Jacinto River. The humid subtropical climate has an annual precipitation of about 45 in. and a mean annual temperature of about 67°F. The region supports the vegetation of the pine woods belt of the forested Coastal Plain.

Access to the periphery of the roadless area (fig. 2) is provided by named county roads (Three Notch Road and Four Notch Road) and by U.S. Forest Service road 200. Interior access is provided by U.S. Forest Service roads 213 and 223, by a loop of the Lone Star foot trail, and by abandoned logging roads. Access to privately owned tracts of land, both entirely and partly enclosed by the roadless area, is by unnumbered dirt roads that cross the roadless area.

GEOLOGY

The roadless area is in the north-central part of the greater western Gulf basin, which is filled with a thick sequence of fluvial, deltaic, and marine Cenozoic clastic rocks. This sequence overlies Cretaceous and Jurassic sandstones and carbonates and the Jurassic Louann Salt.

The Four Notch Area is underlain by upper Cenozoic semiconsolidated sediments and Quaternary alluvium. The oldest unit in the roadless area is the Miocene Fleming Formation. The Pleistocene Willis Sand unconformably overlies the Fleming Formation. The contact between the Fleming and Willis is an erosional unconformity of low relief. It is marked by a 3- to 5-foot-thick oxidized zone consisting of red- and yellow-mottled clay at the top of the Fleming and local quartz-pebble gravel lenses less than 3 ft thick at the base of the Willis. Pleistocene(?) and Holocene alluvium is present in the flood plains and channels of the larger streams in and around the roadless area.

Within the roadless area, the sediments are undeformed. The strike of the unconformable surface separating the Fleming Formation and Willis Sand is about N. 80° E. This surface slopes gently to the southeast at about 15 ft/mi in the southern part of the area and 30 ft/mi in the northern part of the area.

Data from an auger hole drilled 1.75 mi north of the roadless area (46-PHE) indicate about 100 ft of stratigraphic offset in the contact of the Fleming with the Willis, down on the north. Four interpretations of this offset are shown in figure 3.

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

Oil and Gas

The Four Notch Roadless Area has moderate to high potential for the discovery of oil and gas. In the western Gulf basin, which includes the roadless area and vicinity, oil and gas are produced from Jurassic through Pleistocene rocks. In the Tertiary part of this sequence, production tends to be localized by age in concentric, arcuate belts around the Gulf of Mexico, becoming progressively younger toward the center. One of these trends, the Jackson-Yegua (Eocene) trend, extends partly into the region of the Four Notch Roadless Area. Another, the deep Tuscaloosa trend (Cretaceous), also projects into the region south of the roadless area.

Sedimentary rocks of Eocene and Miocene age are exposed at the surface in the vicinity of the roadless area and regionally dip gently southward. In the subsurface, Tertiary rocks of Paleocene through Eocene age overlie Cretaceous rocks. Within the sequence, Eocene sandstone reservoirs of the Wilcox, Claiborne, and Jackson Groups and a variety of Cretaceous reservoirs account for significant oil and gas production. One of the largest salt-dome fields in Texas, the giant Conroe field, is only 20 mi south of the Four Notch Roadless Area and has accounted for more than 600 million barrels of oil from Eocene and Oligocene rocks. Oil and gas production is associated with this and several other large salt domes in adjoining areas near the north margin of the Gulf Coast salt basin. In addition, production is associated with growth faults and folds that are locally related in part to elements of the Angelina-Caldwell flexure.

Production in the immediate vicinity of the roadless area is not large. It derives from reservoirs of Cretaceous and of Eocene age associated with faults and other structural elements. There is a history of exploration drilling in and around the roadless area, some of it quite deep (greater than 15,000 ft), but no significant production has been established in the immediate area. Closest production to the roadless area is to the west at the Morian-Sam Houston field (fig. 2), which has yielded approximately 150,000 barrels of oil from the Eocene Yegua Formation. This field appears to be associated with a major fault trend. Other small fields, farther both to the north and to the south, are producing principally from Eocene and (or) Cretaceous rocks.

Four alternative interpretations of the stratigraphic offset of the Fleming-Willis contact north of the roadless area are shown in figure 3. The potential for oil and gas in the northern part of the roadless area is higher if the stratigraphic offset revealed there in the auger holes is caused by folding or faulting, rather than by pre-Willis erosion. It is not known if the trend of the offset is in any way related to the location of the Morian-Sam Houston field.

Clay

The calcareous clay of the Fleming Formation consists of major smectite, minor to zero kaolinite, and trace to zero illite. Although the clay is abundant and fairly free of sand, it apparently has no exceptional properties that are of value to industry.

Sand

The Willis Sand contains thick beds of relatively clean, moderately well sorted, fine- to medium-grained sand that could be used in construction or for industrial purposes. There are no nearby markets, however, and similar sand is relatively abundant throughout the Texas Gulf Coastal Plain.

Uranium

A surface radiometric survey of the roadless area indicated anomalous radiation counts in two small areas. Samples collected from these two small areas contain only 9 ppm (sample FN-1) and 26 ppm (sample FN-2) of uranium. None of the subsurface auger samples show anomalous radiation counts. The National Uranium Resource Evaluation (NURE) survey (U.S. Department of Energy, 1980, p. 20) did not reveal any uranium deposits in the Beaumont 1° X 2° quadrangle.

Lignite

Lignite is mined at the surface from Eocene rocks about 25 mi north of the roadless area. Lignite occurs in the same Eocene formations beneath the roadless area, but it is too deep for surface mining. Garner and others (1978, p. 36) reported that the shallowest lignite deposits in the Sam Houston National Forest are deeper than 1,500 ft and range from 2 to 5 ft thick.

Trace-Element Abundance

Nineteen auger samples of clay from the Fleming Formation and Willis Sand were analyzed spectrographically for 31 minor and trace elements. A comparison of these samples with chiefly fine-grained rocks of the Pierre Shale (Schultz and others, 1980) indicates that the trace-element composition of the clay in the roadless area is within the normal range for nonmineralized clay sediment, both marine and nonmarine.

SELECTED REFERENCES

American Petroleum Institute, American Gas Association, and Canadian Petroleum Association, 1980, Reserves of crude oil, natural gas liquids, and natural gas in the United States and Canada as of December 31, 1979: New York, American Petroleum Institute, v. 34, 253 p.

Barnes, V. E., 1968, Geologic atlas of Texas, Beaumont 1° X 2° quadrangle: University of Texas at Austin, Bureau of Economic Geology, scale 1:250,000.

Cram, I. H., ed., 1971, Future petroleum provinces of the United States--their geology and potential: American Association of Petroleum Geologists Memoir 15, v. 2, p. 805-984.

Dickinson, K. A., 1976, Uranium potential of the Texas Coastal Plain: Geological Society of America Abstracts with Programs, v. 8, no. 1, p. 18.

Fisher, W. L., Chelf, C. R., Shelby, C. A., Garner, L. E., Owen, D. E., and Schofield, D. A., 1965, Rock and mineral resources of East Texas: University of Texas at Austin, Bureau of Economic Geology Report of Investigatons No. 54, 439 p.

Garner, L. E., Pass, D. A., and West, E. S., 1978, Evaluation of lignite resources in the National Forests of Texas: Unpublished data on file at U.S. Forest Service office, Lufkin, Tex. [report prepared by University of Texas at Austin, Bureau of Economic Geology, contract no. 38-3145], 82 p.

International Oil Scouts Association, 1977, International oil and gas development yearbook 1977 (Review of 1976): International Oil Scouts Association, Austin, Tex., v. 47, pt. 2, 352 p.

Kaiser, W. R., Ayers, W. B., Jr., and LaBrie, L. W., 1980, Lignite resources in Texas: University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 104, 52 p.

Peppard-Souders and Associates, 1981, Executive reference map no. 302 for East Texas: Dallas, Tex., Geomap, scale 1:187,500.

_____1982, Executive reference map no. 312 for northeast Texas Gulf Coast: Dallas, Tex., Geomap, scale 1:187,500.

Railroad Commission of Texas, 1981, Annual report of the Oil and Gas Division: Austin, Tex., 700 p.

St. Clair, A. E., Evans, T. J., and Garner, L. E., compilers, 1976, Energy resources of Texas (reprinted 1981): Austin, Tex., University of Texas, Bureau of Economic Geology, scale 1:1,000,000.

Schultz, L. G., Tourtelot, H. A., Gill, J. R., and Boerngen, J. G., 1980, Composition and properties of the Pierre Shale and equivalent rocks, northern Great Plains region: U.S. Geological Survey Professional Paper 1064-B, 114 p.

Solis Iriarte, R. F., 1981, Upper Tertiary and Quaternary depositional systems, central Coastal Plain, Texas--regional geology of the coastal aquifer and potential liquid-waste repositories: University of Texas at Austin, Bureau of Economic Geology Report of Investigatons No. 108, 89 p.

U.S. Department of Energy, 1980, Hydrogeochemical and stream sediment basic data for Beaumont NTMS quadrangle, Texas: National Uranium Resource Evaluation Project GJBX-67 (80), 131 p.

Winslow, A. G., 1950, Geology and ground-water resources of Walker County, Texas: Texas Board of Water Engineers Bulletin 5003, 48 p.

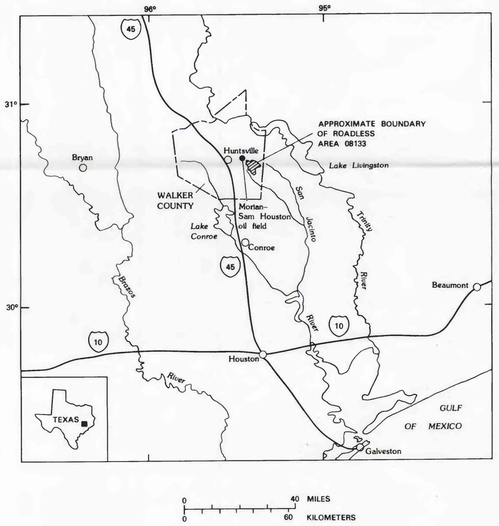


Figure 1.--Index map showing location of the Four Notch Roadless Area, Walker County, Tex.

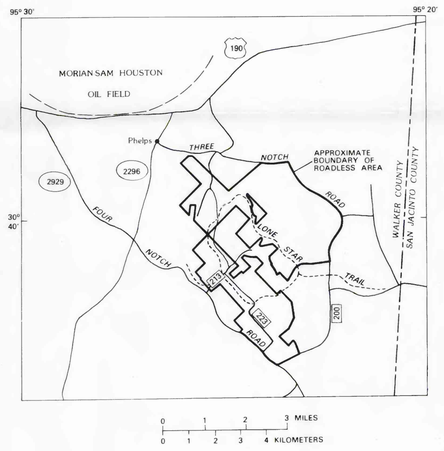


Figure 2.--Map showing access to the Four Notch Roadless Area and location of the Morian-Sam Houston oil field.

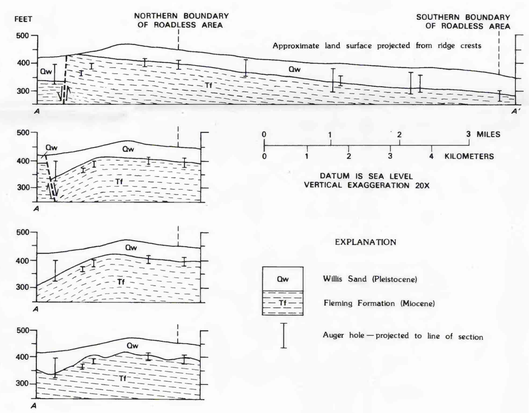


Figure 3.--Cross sections showing (A) the Fleming-Willis contact in the Four Notch Roadless Area, and (A, B, C, D) four interpretations of the stratigraphic offset of this contact north of the area.

MINERAL RESOURCE POTENTIAL MAP OF THE FOUR NOTCH ROADLESS AREA, SAM HOUSTON NATIONAL FOREST, WALKER COUNTY, TEXAS

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1983

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1983

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