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PAMPHLET

GEOLOGIC AND MINERAL RESOURCE POTENTIAL OF THE CHAMBERS FERRY  
ROADLESS AREA, SABINE COUNTY, TEXAS

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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 discusses the results of a mineral survey of the Chambers Ferry Roadless Area, Sabine National Forest, Sabine County, Tex.

MINERAL RESOURCE POTENTIAL  
SUMMARY STATEMENT

Geologic and geochemical investigations have been conducted to evaluate the mineral resource potential of the Chambers Ferry Roadless Area, Sabine County, Tex. The roadless area lies within the western Gulf of Mexico Coastal Plain on the southern margin of the Sabine uplift and is underlain by lower Eocene semiconsolidated clastic sediments. Thirty-four percent of the mineral rights to land within the roadless area are privately owned.

The area has moderate to high potential for oil and gas resources on the basis of the regional setting and nearby producing fields. Near-surface lignite is present in the area, but the lignite seams are thin and laterally discontinuous and the ash content is high. These conclusions are based on surface and shallow subsurface geologic examination, radiometric surveys, and geochemical and mineralogic study of subsurface auger samples.

INTRODUCTION

There has been no mining or quarrying activity within the roadless area. There are no producing oil or gas wells although one dry hole has been drilled in the area and three additional dry holes have been drilled within 1.5 mi of the area boundaries. The geologic mapping, shallow drilling, geochemical sampling, and radiometric surveys of this study were conducted in April 1981 and January to March 1982.

Area description

The Chambers Ferry Roadless Area comprises 4,661 acres in the Sabine National Forest in Sabine County, Tex., adjacent to the Texas-Louisiana State line (fig. 1).

The roadless area is in the Gulf of Mexico Coastal Plain and is characterized by low hills separated by numerous small drainages. The elevation ranges from 160 to 285 ft. Drainage consists of steep-gradient intermittent streams and gullies tributary to Martinez Bayou on the northeast, Patroon Bayou on the southwest, and the Sabine River on the east (now

Toledo Bend Reservoir). The climate is humid subtropical with an annual precipitation of about 52 in. and a mean annual temperature of about 66°F. The area supports the vegetation of the pine woods belt of the forested Coastal Plain.

Access to the periphery of the area is provided by Texas Route 87, U.S. Forest Service road 121-1, and by boat on Toledo Bend Reservoir. Interior access is provided by U.S. Forest Service roads 121-1, 121-2, 121-A, and 131-1 and by abandoned logging roads.

U.S. Forest Service records indicate that 34 percent of the mineral rights of the Chambers Ferry Roadless Area are privately held. Permits for seismic exploration surveys in and around the area are issued routinely.

Previous mineral resource investigations

The roadless area has been included in several reports of regional scope on mineral and energy resources. Sabine County is included in the survey of the rock and mineral resources of east Texas by Fisher (1965). Under the National Uranium Resource Evaluation (NURE) program, aerial gamma-ray and

magnetic surveys were made of the Alexandria 1° x 2° quadrangle, which includes the Chambers Ferry Roadless Area (U.S. Department of Energy, 1980). The ball clay and bentonite resources of the central and western Gulf Coastal Plain were assessed by Hosterman (written commun., 1982). Lignite resources in the national forests of Texas have been evaluated in a special report by Garner and others (1978); lignite resources in Texas, as a whole, have been evaluated by Kaiser and others (1980). Information on oil and gas production, reserves, and potential can be found in Cram (1971), Peppard-Souders and Associates (1981 and 1982), International Oil Scouts Association (1977), American Petroleum Institute, American Gas Association, and Canadian Petroleum Association (1980), University of Texas at Austin, Bureau of Economic Geology (1981), and The Railroad Commission of Texas (1981).

#### Present investigation

Geologic and geochemical investigations have been conducted to evaluate the mineral resource potential of the study area. The U.S. Bureau of Mines investigation included a radiometric survey and analysis of surface sediment samples for uranium. The U.S. Geological Survey conducted geologic and geochemical surveys of the region, which included drilling and collecting samples from six auger holes (ranging from 57 to 102 ft deep) for stratigraphic and geochemical analyses.

The oil and gas resource potential of the area was evaluated by Gordon L. Dolton of the U.S. Geological Survey, using readily available data only.

#### GEOLOGY

The roadless area is in the north-central part of the greater western Gulf basin, which is filled with a thick sequence of off-lapping sedimentary prisms of Cenozoic clastic rocks. This sequence rests upon Cretaceous and Jurassic sandstones and carbonates and the Jurassic Louann Salt. The area was mapped previously at a scale of 1:250,000 as part of the Palestine 1° x 2° quadrangle of the Geologic Atlas of Texas (Barnes, 1968).

The rock units present in the Chambers Ferry area are semiconsolidated to consolidated, fine-grained clastic sediments of the lower Eocene Wilcox Group and Quaternary alluvium. In this region the Wilcox Group is predominantly a mudstone facies informally named the Pendleton Lagoon-Bay system (fig. 2). Fisher and McGowen (1967, p. 117) described the Pendleton system as consisting "chiefly of laminated to locally bioturbated muds with local lenses and beds of very fine to fine-grained, sparingly glauconitic, massive to crossbedded sands and fine-grained, broken, massive to crossbedded, lignitic sands \* \* \* clay-ironstone concretions are common. Lignites are locally common, though they are relatively impure, thin, and discontinuous." This description corresponds well to the lithologies encountered in the auger holes and in natural exposures of the Wilcox Group in bluffs bordering Toledo Bend Reservoir.

Rocks of the middle Eocene Claiborne Group crop out on a relatively high ridge less than 1.5 mi southwest of the study area. The approximate contact

of the Claiborne with the Wilcox Group was taken from the geologic map of the Palestine 1° x 2° quadrangle (Barnes, 1968).

Pleistocene(?) and Holocene alluvium is present in the flood plain of Patroon Bayou. The alluvium is thin and was not investigated in this study.

#### STRUCTURE

The Chambers Ferry area is on the south-southwest margin of the Sabine uplift (fig. 2) and, thus, the rocks dip gently to the southwest. Because of the absence of distinctive stratigraphic marker horizons, more precise determination of the strike and dip of the units is not possible. Exposures in the bluffs along Toledo Bend Reservoir indicate that the rocks probably are largely undeformed.

#### ASSESSMENT OF MINERAL RESOURCE POTENTIAL

##### Oil and gas

The Chambers Ferry Roadless Area has moderate to high oil and gas resource potential (fig. 3). Exploration drilling has been done in the vicinity. Most exploratory wells were shallow, on the order of 1,500-3,000 ft, and penetrated portions of the Eocene sequence; however, there are several deep wells in the general area, which test rocks as old as Cretaceous. A 9,500-ft test well was drilled near the southeastern edge of the area (Santa Fe Energy, #1 Chamber). The nearest production is about 2-3 mi to the north and northwest of the roadless area at Bridges and Patroon fields in Shelby County, Tex. These fields, discovered in 1950 and 1948 respectively, have produced only small amounts of high-gravity oil to date (slightly more than 50,000 barrels) from the Lower Cretaceous Fredericksburg Group. Gas production has been established at Huxley field about 15 mi north of the roadless area, where production is from the Lower Cretaceous Paluxy, Rodessa, and Pettet Formations. Oil has been produced about 10 mi east of the Chambers Ferry Roadless Area in Sabine Parish, La., at Zwolle, Pendleton-Many, and Converse fields, in addition to production at small fields such as Blue Lake (now beneath Toledo Bend Reservoir). The significant production zones at these fields in Louisiana are Upper and Lower Cretaceous reservoirs, and producing depths are generally 1,500-3,000 ft. By the end of 1976, Pendleton-Many, the largest field, had produced about 20 million barrels of oil and Zwolle had produced more than 16 million barrels.

##### Near-surface lignite

The resource potential for near-surface lignite in the Chambers Ferry area is high, but the seams are thin and laterally discontinuous and the ash content is high. Seven lignite seams, ranging from 2 to 11 ft thick and averaging 4 ft in thickness, were penetrated in the auger holes. In table 1, proximate and ultimate analyses of four lignite samples from the area are compared with an average analysis of lignites from the Wilcox Group on the Sabine uplift, chiefly to the northwest of the roadless area (Kaiser and others, 1980). The analyses shown in table 1 indicate that the lignite in the roadless area has a high ash content and

Table 1.--Proximate and ultimate analyses of lignite samples from the Wilcox Group in the roadless area (south flank, Sabine uplift) and averaged analyses of 113 samples of Wilcox Group lignite from the Sabine uplift, chiefly northwest of the roadless area [Proximate and ultimate analyses, forms of sulfur, and equilibrium moisture in percent. Analyses of Wilcox Group samples from Kaiser and others (1980)]

		1 61(26-27) <sup>3</sup>	2 <sup>1</sup> 63(23-25)	3 63(54-57)	4 64(50-52)	Arithmetic mean	Sabine uplift <sup>2</sup>
As-received basis							
Proximate	Moisture	19	8	35	41	32	33
	Ash	58	45	40	22	40	15
	Volatile matter	15	26	13	18	15	27
	Fixed carbon	8	21	11	19	13	25
Ultimate	Hydrogen	3.4	3.4	5.2	6.5	5.0	3.1
	Carbon	15	32	16	27	19	39
	Nitrogen	0.3	0.7	0.3	0.6	0.4	0.7
	Sulfur	1.6	3.4	1.1	2.0	1.6	1.1
	Oxygen	22	15	37	42	34	8
	Ash	58	45	40	22	40	15
BTU/lb		2335	5637	2713	4555	3201	6441
Forms of sulfur	Sulfate sulfur	0.43	0.07	0.26	0.09	0.26	0.03
	Pyritic sulfur	0.76	2.73	0.57	1.39	0.91	0.26
	Organic sulfur	0.38	0.61	0.24	0.47	0.36	0.65
Dry basis							
Proximate	Ash	72	49	62	37	55	22
	Volatile matter	18	28	21	31	25	41
	Fixed carbon	10	22	17	32	20	37
Ultimate	Hydrogen	1.6	2.8	2.0	3.3	2.4	4.6
	Carbon	18	35	25	45	31	59
	Nitrogen	0.4	0.8	0.5	1.0	0.7	1.0
	Sulfur	1.9	3.7	1.7	3.3	2.7	1.7
	Oxygen	6	9	8	10	8	12
	Ash	72	49	62	37	55	22
BTU/lb		2904	6113	4181	7708	5227	9764
Forms of sulfur	Sulfate sulfur	0.53	0.08	0.40	0.15	0.29	0.05
	Pyritic sulfur	0.93	2.97	0.88	2.34	1.78	0.39
	Organic sulfur	0.48	0.64	0.37	0.81	0.58	0.98
Ash fusion temperatures <sup>4</sup>	Initial deformation	2400	2200	2240	2210	2263	2108
	Softening	2590	2310	2430	2370	2425	2168
	Fluid	2680	2420	2560	2540	2550	2393
Equilibrium moisture		17	16	25	28	23	

<sup>1</sup>Sample was dried out and was omitted for calculations of arithmetic means of analyses in as-received basis.

<sup>2</sup>Average of 113 samples (Kaiser and others, 1980).

<sup>3</sup>Auger hole number with depth interval of lignite sample in parentheses. See figure 1 for location of auger holes.

<sup>4</sup>Fusion temperatures in reducing atmosphere, °F.

a higher sulfur content than the lignites to the northwest. The high ash content may be caused in part by sediment mixing inherent in the augering method of drilling; however, Fisher and McGowen (1967) noted that lignite of the Pendleton Lagoon-Bay facies of the Wilcox Group is relatively impure.

#### Deep-basin lignite

Deep-basin lignite (defined as lignite occurring at depths of 200-2,000 ft) is probably not present beneath the roadless area. The projected depth of lignite seams exposed to the north is greater than 2,000 ft beneath the roadless area (Kaiser and others, 1980).

#### Clay

All clay encountered in the auger holes was silty. X-ray diffraction patterns of three crushed, nonoriented, bulk samples of silty clay indicate similar mineralogic composition for the three samples. The samples contain 30-50 percent quartz, feldspar, and muscovite (mainly silt size). The principal clay minerals are kaolinite and smectite, present in subequal amounts. The presence of illite could not be determined because of masking by muscovite. The color of the dry crushed, silty clay is medium light olive gray (5Y 5/1) and medium yellowish brown (10YR 5/2). Analyses by Fisher (1965) of similar silty clays from the Wilcox Group in Sabine County and in Shelby County indicated that the only industrial or construction use for clay of this type is as lightweight aggregate. Although there is an abundant resource of silty clay in the roadless area, it has limited use because of distance from industrial centers and the abundance of similar material in the region surrounding the roadless area.

#### Sand

Lenticular bodies of clean to slightly muddy, fine-grained sand averaging 20 ft thick, are common in the Wilcox Group in the Chambers Ferry Roadless Area. The sand is dominantly quartzose and includes as much as 15 percent impurities; mostly feldspar, muscovite, and opaque grains. The utility of the sand resource for construction or other purposes is minimized by the distance from the area to urban and industrial centers and by the proximity of high-quality specialty sand in the Carrizo Formation (basal Claiborne Group) to the south and southwest (Fisher, 1965).

#### Uranium

Formations that contain economic uranium deposits in east and south Texas are not present in the Chambers Ferry Roadless Area. In addition, National Uranium Resource Evaluation (NURE) studies (U.S. Department of Energy, 1980) indicated no anomalous radioactivity in the roadless area. Although no uranium deposits are known in the immediate vicinity of the roadless area, a 1-mi-long zone of anomalous radiation count was detected 3 mi south of the roadless area. One sample obtained from the residuum

in that zone assayed 0.0046 percent uranium. None of the subsurface samples obtained by augering had anomalous radiation counts.

#### Trace-element abundance

Eighteen auger samples of silty clay from the Wilcox Group were analyzed spectrographically for 31 minor and trace elements. Table 2 shows the amounts of 14 trace elements present in Wilcox Group clay in comparison to the amounts of these elements present in chiefly fine-grained rocks of the Pierre Shale (Schultz and others, 1980). This comparison 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.

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Table 2.--Average trace element determinations for 18 samples of silty clay  
from the Wilcox Group and 202 samples of the Pierre Shale

[Six-step D.C.-arc semiquantitative spectrographic analyses made in U.S.  
Geological Survey laboratories. Analyst, Betty Adrian. Determinations for  
Pierre Shale from Schultz and others (1980)]

Trace elements	Wilcox Group		Pierre Shale	
	Arithmetic mean (ppm)	Standard deviation (ppm)	Arithmetic mean (ppm)	Standard deviation (ppm)
Mn	508	232	720	275
B	150	17	99	49
Ba	683	110	650	300
Co	22	6	12	6
Cr	133	30	75	34
Cu	31	13	34	23
La	51	5	39	25
Ni	49	22	36	27
Pb	47	10	22	8
Sc	15	2	16	5
Sr	197	48	204	204
V	128	31	156	97
Y	34	9	28	12
Zr	178	55	190	62

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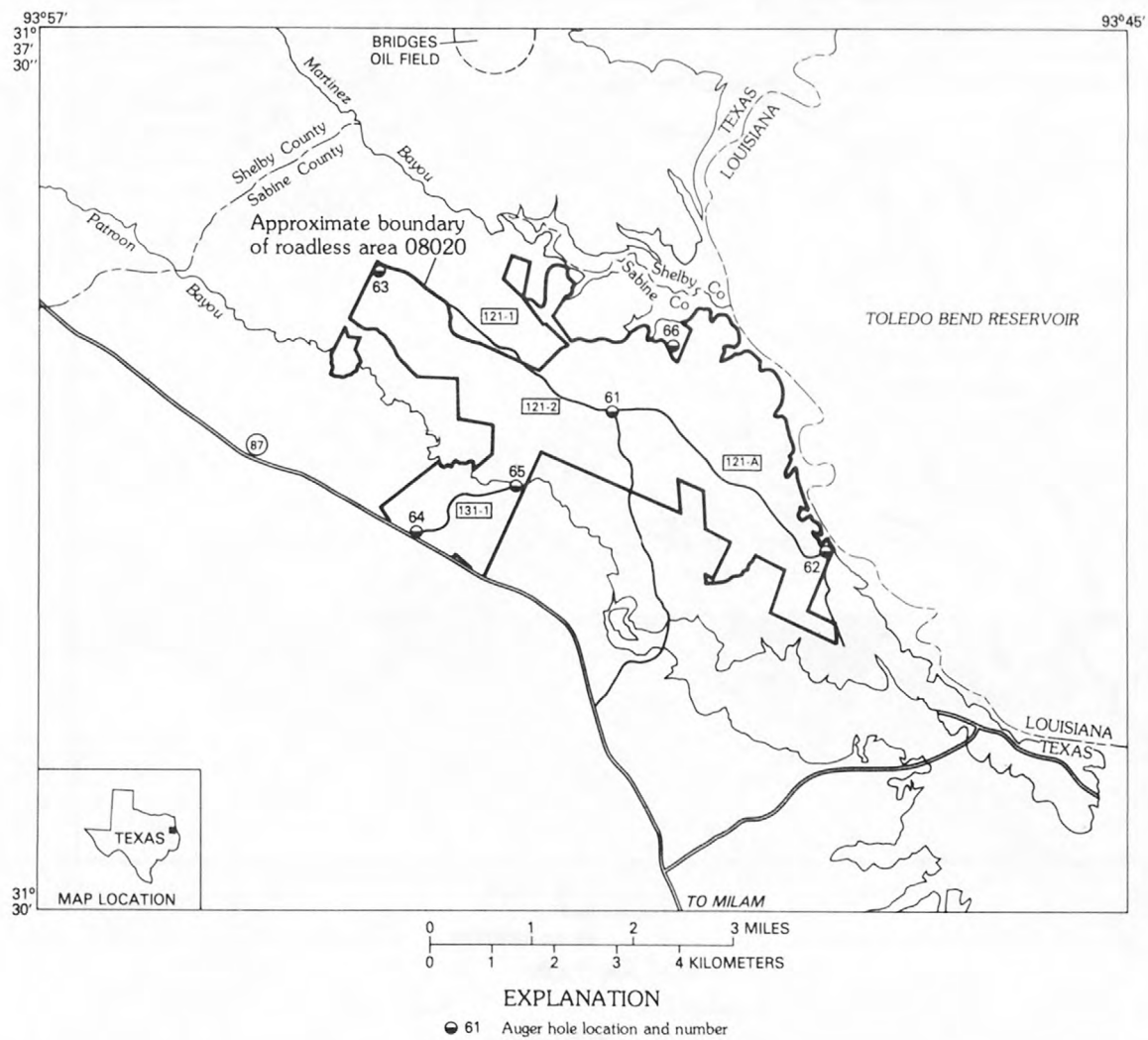


Figure 1.—Index map showing location of the Chambers Ferry Roadless Area (U.S. Forest Service area 08020), Sabine County, Texas.

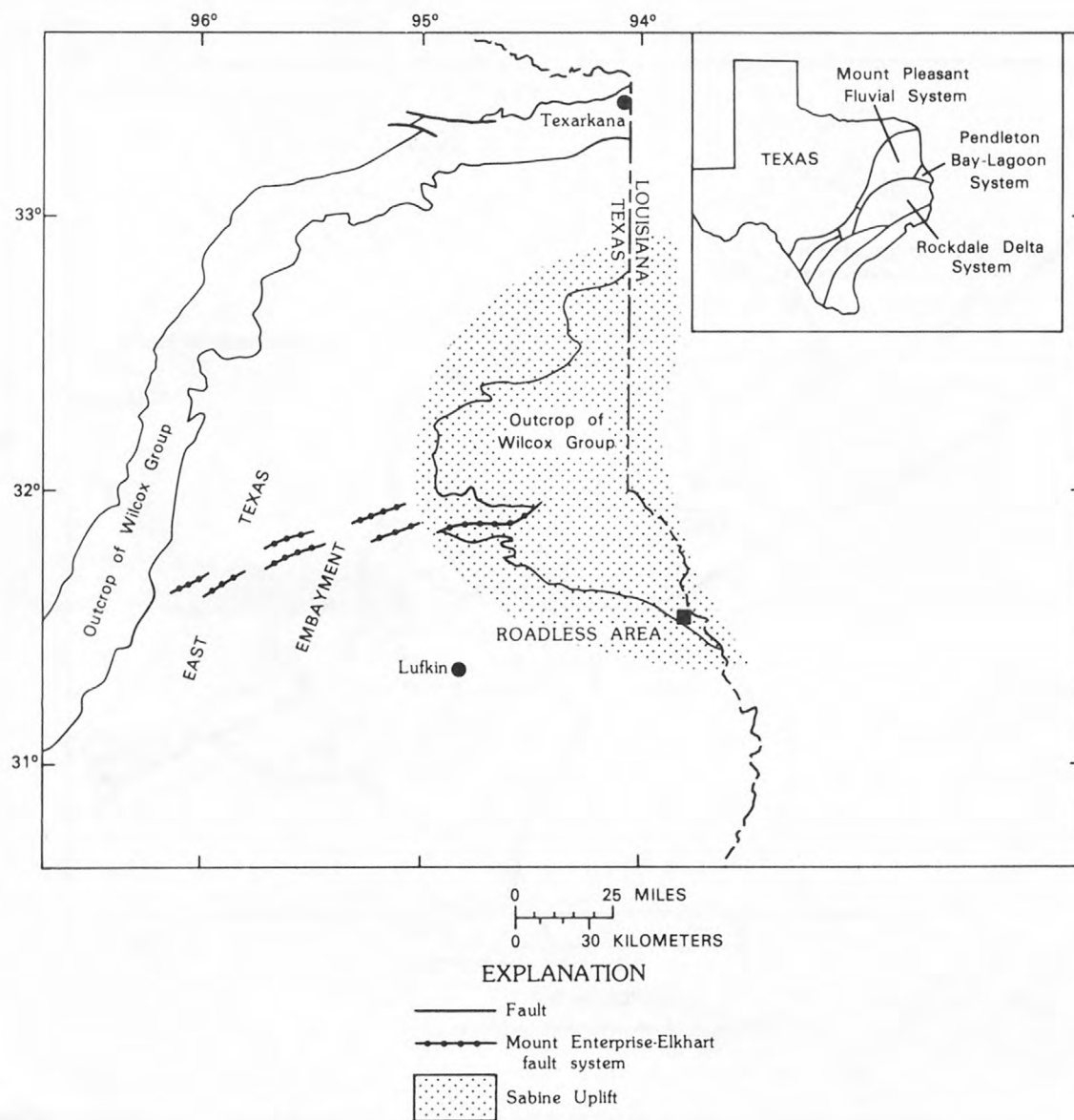
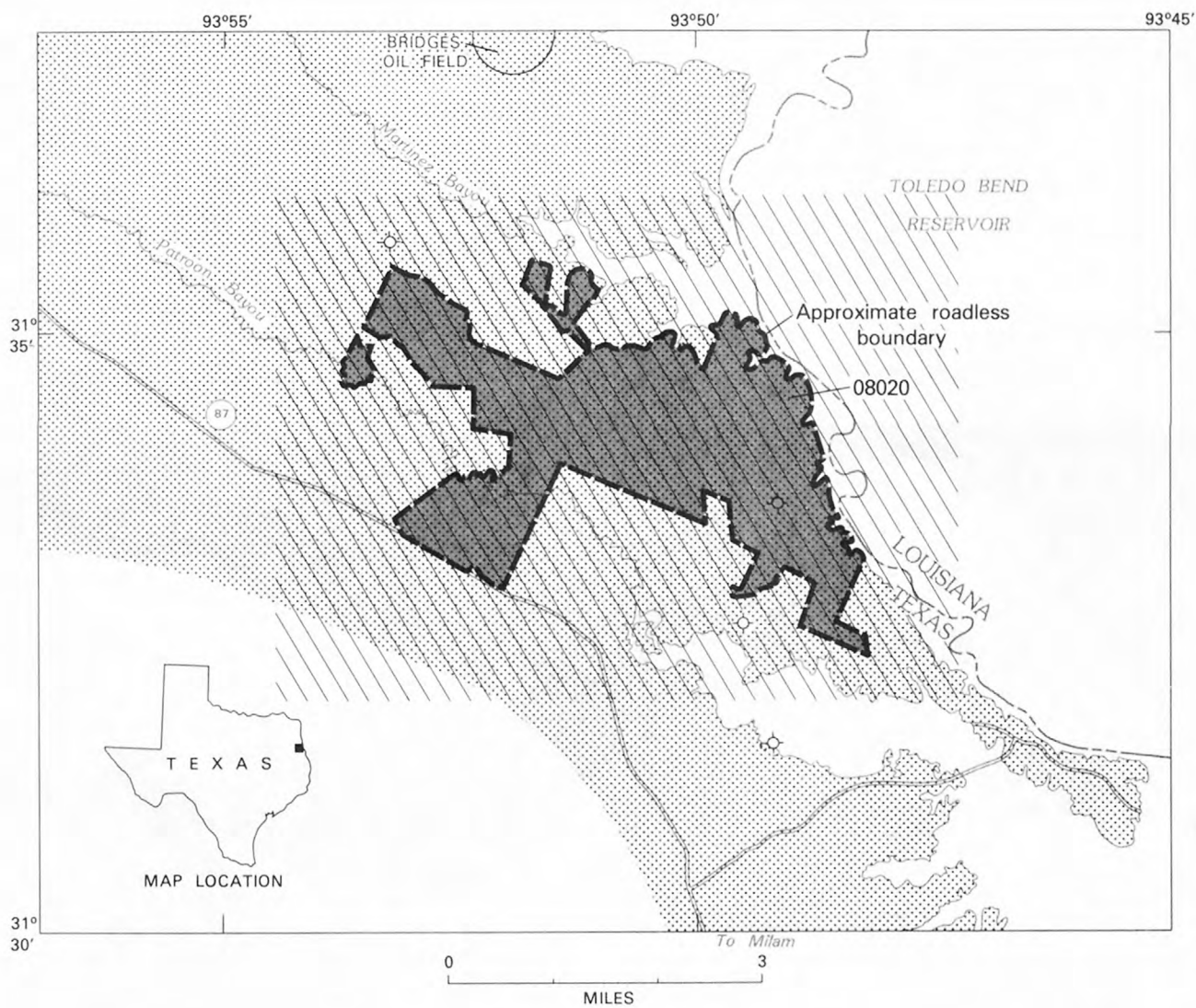


Figure 2.—Major structural elements of the Gulf Coastal Plain in East Texas, and depositional systems of the Wilcox Group in and adjacent to the Chambers Ferry Roadless Area (modified from Fisher and McGowen, 1967). Extension of the Sabine uplift into Louisiana not shown.





### EXPLANATION



Geologic terrane with moderate to high potential for oil and gas and high potential for lignite



Wilcox Group, undivided (Eocene)



Oil and gas test well (dry hole)

Figure 3.—Map showing mineral resource potential of the Chambers Ferry Roadless Area, Texas.

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