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MINERAL RESOURCE SURVEY
Circular No. 34

The information contained in this circular was gathered by a unit of the WPA State-Wide Mineralogical Survey of Texas, a project sponsored by The University of Texas at Austin, Bureau of Economic Geology. The purpose of this survey is to assemble information concerning mineral products and to gather other geological data and make them available to the public. With this information in the hands of the public, it is reasonable to suppose that industries of value to the State may be developed. The following report is based on work done in Gonzales County by Work Project No. 17210, from December 10, 1940, to August 14, 1941.

PEAT BOGS IN GONZALES COUNTY
with Notes on Other Bogs*
Carl Chelf, Supervisor

INTRODUCTION

The production of peat as a general soil conditioner has recently become a potentially valuable small industry for Texas and surely a new one. The credit for realizing the possibilities and need of peat in Texas perhaps should go to Messrs. Joiner, B. P. Atkinson, and Sanquinet who began production of peat on a small scale near Lexington, Lee County, Texas, in 1940. Since the year of first production, Mr. Atkinson has discovered many hundreds of acres of peat heretofore unnoticed, and several bogs have been leased for commercial production.

Like other young industries which have made an attempt to begin operations in Texas on some newly discovered resource, peat is likely to meet with the common drawback: the prevalent belief of some landowners that the article is a "gold mine" when actually the chances for loss are even greater than in ordinary types of business. At the best, the peat industry in Texas will find it difficult to overcome certain production and marketing bottlenecks for a long time to come, and, therefore, every advantage should be afforded the producers to place before the public a graded product equal to the imported varieties.

For an extended treatise and bibliography on peat, *see* Bureau of Economic Geology Mineral Resource Circular No. 16, "Peat Deposits in Texas," by F. B. Plummer.

SCOPE OF INVESTIGATION

Three bogs with peat in commercial quantities were tested in Gonzales County, and two bogs, one of which could possibly be worked commercially, were investigated in adjoining Guadalupe County. One of the Gonzales County bogs, known as the Rutledge swamp, is included in the Gonzales Palmetto State Park. The principal bogs are located in the drainage of San Marcos River near the village of Ottine in the northern part of the county. All are in the same general area, and a description of the conditions surrounding the publicly owned Rutledge swamp will also serve for the bogs on the Henry Soefje land. The third bog, located on the George Hershop tract, is entirely above high flood level of San Marcos River and will be treated separately.

GEOLOGY OF THE AREA

Geologic exposures of the area belong to the upper Carrizo and lower Reklaw Formations of the Claiborne Group. In general, sediments of the lower Reklaw are more indurated than the underlying loosely consolidated sands and shales of the Carrizo. A prominent bluff near the entrance of the Palmetto Park is capped by a ferruginous sandstone of the Reklaw Formation which is resting on the loose sands of the Carrizo. Seeps and springs that furnish the permanent water supply in sufficient quantities to promote the abundant growth of marsh plants in the area come from these lower sands and form a well-marked line along the outer flood-plain margin. The flood plain developed along the San Marcos is 45 feet above the present river bed. Numerous remnants of former channels in the form of filled ox-bows, sloughs or "lakes," are still preserved on the flood-plain surface. The peat deposits lie partly upon the Carrizo slopes where the permanent springs find their outlet. The peat is siltly below the flood-plain surface and is somewhat sandy on the hill slopes.

SOEFJE BOGS

A marsh developed in a small tributary valley on the Soefje farm contains two areas of peat. The larger of these bogs is located on the south margin of the swamp and is primarily a slope deposit. The smaller bog is located on the northwest margin and lies almost entirely below the present flood-plain surface.

*Assistance in the preparation of these materials was furnished by the personnel of Work Projects Administration Official Project No. 665-66-3-233.

Due to its low elevation the smaller bog has been subjected to periodic flooding and consequent silting, whereas the larger or south deposit is situated partly on the lower slope of the Carrizo sand and is at a somewhat higher elevation. The upper portion of this south bog is above the flood level and is consequently free from silt.

Occasional lenses of sand appear in both deposits as a result of sheet wash from adjacent slopes. Outside of the present peat-forming areas along the west margin of the swamp are several interdigitated lenses of sand and peat. This condition is evidence of several periods of relatively widespread peat development, each state of which development having been arrested by successive encroachments of alluvial fans. During periods of excessive rainfall the small stream carries an unusually heavy load of sand which is deposited at the rapidly flattening gradient within the swamp.

The south peat deposit is a narrow strip about 2,000 feet in length and from 100 to 250 feet in width. The average thickness is 5 to 6 feet, but a maximum of 22 feet was reached in the west end of the south deposit. The two bogs cover an area of approximately 10 acres. For commercial purposes the west end of the south bog could best be mined because of its areal extent and depth. Tests show the peat to have an average thickness of about 10 feet in this portion of the deposit.

Ditches could easily aid in draining the upper 4 or 5 feet. Since drainage from a bog is slow even though there is an appreciable drop, the deeper parts might be more easily worked with the aid of a small capacity motor-driven pump. In any case, however, several feet of the upper material could be exploited without special emphasis upon drainage. The near-surface peat is undoubtedly the best.

The map of this bog (fig. 1) shows the approximate locations of bore holes where data were obtained for profiles. Samples for chemical test were also taken at points along section lines. Depths were found by the use of 8-foot lengths of 3/8-inch steel rod threaded for coupling. Such an instrument can be used to determine depths with accuracy, but it cannot be used to determine the quality or relative siltiness of material penetrated. On the other hand, interbedded sand which was found at many places in this bog was easily detected because of the increase in resistance on the rod. The sands were found to be elongated lenticular masses not easily defined without extensive drilling. Peat was found under as much as 4 feet of sand in the west end of the bog.

Analysis of peat from Soefje bogs. — Peat samples from numerous bore holes at various depths show great variety. The upper 6 or 7 feet are generally fibrous, grayish to dark reddish brown in color, contain localized areas of limonite replacement of Osmunda roots and Sphagnum and sedge rhizomes. The higher material is not only more fibrous but has less included sand and silt. The generic features of plants in the upper peat are evident. Samples from greater depths are altered progressively until black gelatinous to watery peat is reached. The lower portion of peat in the Soefje bog is below present flood-plain level and is consequently more silty than the upper portion. Very little plant tissue can be seen in unwashed samples of the lower peat. Sphagnum and sedges from the bulk of plant residue, but ferns and shrubby plants have also contributed.

Samples which were taken for chemical tests were obtained with a peat sampler designed by B. P. Atkinson. This instrument allowed the sample to be taken at any desired depth with a minimum of mixing. Specimens were ejected from the core barrel into chemically neutral jars and sealed without touching them with the hands. The following table gives results of chemical tests made on samples from this bog by Paul F. Tapp, chemist for the State-Wide Mineralogical Survey.

Analyses of samples from Soefje bog

Traverse	Hole	Position	Moisture	Ash	pH			Color
			%	%	2 days	6 days	14 days	of ash
A-B	1	...Spring water from swamp			3.7	6.6	3.7	
A-B	4	surface to 4"	9.0	2.8	5.8	5.2	4.6	White & yellow
A-B	4	upper	20.0	12.2	4.9	4.5	3.9	White
A-B	4	middle	23.2	12.7	4.4	4.4	4.1	White
A-B	4	lower	28.2	19.4	3.9	4.1	3.8	White
C-D	3	upper	24.0	13.7	5.2	5.0	4.7	White with brown & purple
C-D	3	lower	58.2	54.2	6.0	5.0	4.2	Gray-lavender
E-F	1	upper	20.5	13.5	3.1	3.2	3.4	Light brown
E-F	1	lower	15.6	10.1	6.1	5.5	4.7	White
G-H	1	upper	17.3	7.8	3.6	3.7	3.5	Brown
G-H	1	middle	36.3	24.1	4.6	4.7	4.4	Brown & white; SO_2 upon ignition
G-H	1	lower	23.0	10.5	6.1	6.3	6.0	White & brown

General appearance of Soefje bogs. — The active areas of peat formation are tangles of shrubs, ferns, sedges, Sphagnum, and many other plants typical of the bogs of East Texas. Plants grow in fairly well-defined zones as shown by the present distribution in profile G-H (fig. 4). The upland zone is the oak-hickory vegetation common to this belt of Texas. Zones B and C are dominated by yaupon, Spanish mulberry sassafras, Osmunda, Woodwardia, dewberry, Asclepias, Indian chocolate, Sphagnum, iris, orchids, sedges, and swamp myrtle. The line of demarcation between zones B and C is mainly on the presence of Sphagnum in the latter. Zones are transitional from one to another. Zone D carries an abundance of aquatic and semi-aquatic plants such as Typha, Pontederia, rattan, burreeds, Nymphaea, Radicula, Sagittaria, Alisma, Hydrocotyle, Piaropus, Sabal, and many others. The former distribution of the principal peat-forming plants such as Sphagnum, sedges, and ferns was greater than at present. This is determined by the distribution of peat of the above-named plants in areas that no longer support living examples. Several inter-related causes have brought about the present restriction of bog plants. For example, not only does the Soefje bog appear to have reached its maximum growth almost throughout the area, but the clearing of surrounding outcrops of timber and grazing by cattle has undoubtedly increased the amount of extraneous debris such as sand that is blown or washed on peat-forming areas to the detriment of the free growth of the principal plants.

A feature not uncommon to bogs elsewhere is the conspicuous doming of peat. The gently convex areas are from 12 to 15 feet across and rise about a foot above the surrounding area. At first glance these appear to be related to the underlying structure of the slope, but

convexity is due entirely to the growth of the Sphagnum-sedge-fern assemblage. Another feature typical of bogs is quaking. Large areas can be shaken by jumping up and down.

GEORGE HERSHOP BOG

The Hershop bog is located about 1 mile west of Ottine and about half a mile south of the Soefje bog. This peat area is situated farther inland from the river and flood plain than the Soefje and Rutledge bogs, and, consequently, peat development has never been hampered by periodic silting of the lower portions during deposition.

The peat is lying in a rounded basin near the head of a small valley. Cultivated sandy fields border it with the exception of a portion along the west and where ferruginous sandstone crops out (fig. 5). This end has a secondary growth of such forms as mesquite, potato-chip ash, and Opuntia. A small wet-weather stream empties into the bog from the northwest. This stream divides as it approaches the main peat dome, flows around the mass on north and south sides, and is confluent below on the east where it carries away excess water from the springs in the bog. This "moat" or marginal ditch is common to many of the raised bogs or other regions. The entire peat mass presents a raised appearance or slight convexity, becoming higher away from the field borders. The doming is conspicuous because of the small size of the bog. Profiles made from bore-hole data show that the convexity is due to growth of peat-forming plants and not to the structure of the basin. This was also true of the doming of the Soefje bog which has been described. Small domes such as those in the Soefje bog are developed in this marsh but not to such a large extent.

General appearance of the Hershop bog. — The visible peat area is somewhat smaller than the original bog. Sand and soil from the surrounding fields have washed over the margins of the bog and have appreciably reduced the peat-forming area. Bermuda grass is the most persistent vegetation covering the sand overlap, but it never grows in the active portion of the bog. The total area of recoverable peat having no overburden is approximately 450 by 450 feet, and the quality and composition compare favorably with peat from other regions. Depths at various points were determined by two lines of bore holes extending from the margins across the main dome. Profiles A-B and C-D (fig. 6) were made from data obtained. Profile A-B shows the results of the encroachment of sand carried by the stream entering the valley at the west end. Although the stream flows for only a short time out of each year, it has greatly hindered the peat development. From east to west the peat profile rises, and the included sand increases until sand alone is obtained in bore holes.

Stage of development. — The bog is near its end point of development since the peat is at near level with the surrounding sand outcrop. Other features support this. The peat is composed largely of Sphagnum, fern, and sedges, yet no Sphagnum is now living in the bog and only two genera of ferns, Woodwardia and Osmunda, are represented by a few existing specimens. Shrubs typical of other bogs are also rare. The extinction of Sphagnum and the near-extinction of ferns has come about in the past thirty years, and the bogs are not so moist the year around. In the past, livestock avoided attempts to cross the bog, but now they freely walk around the edges. Mr. Hershop says that the danger of sinking has gradually passed as the mass became firmer. The reasons for the changes mentioned are not altogether clear.

Analyses of peat from Hershop bog. — Bore holes were made over the entire area to observe the color, texture, and nature of the peat at various depths and a test pit near the east end of the dome was opened to a depth of 6 feet before it was abandoned because of excessive water. The upper peat to a depth of 6 feet or more is a dark reddish brown when wet and contains much partially altered but recognizable plant material. The principal material is Sphagnum and sedges. In sampling the deeper portions of the bog to depth of 12, 15, or more feet, the peat is found to be brownish black and finely divided with little of the original plant structure preserved. Portions of this bog, as in the case of all others investigated, could not be sampled thoroughly because of the "watery peat" strata present. Much of the black peat is of fine texture and is gelatinous. Dried specimens are "horny." Watery or unconsolidated layers make it impossible to recover a total depth or complete sample record. Several samples of lower-depth peat had Sphagnum rhizomes replaced with pyrite.

All samples from the Hershop bog were found to be strongly acidic (average 4.25), but none were so low in pH that they could not be used in growing certain acid-loving plants. The following table gives the results of tests made on samples from this bog.

Analyses of samples from George Hershop bog

Sample and position	Moisture %	Ash %	pH	Color of ash
No. 1, 3 ft., center of main dome	23.1	11.3	3.6	Gray & brown
No. 2, 6 ft., center of main dome	29.8	16.2	4.6	Dark brown; SO_2 on ignition
No. 3, 12 ft., center of main dome	21.7	11.8	4.7	Dark brown
No. 4, 12 ft. AB-6	32.6	17.6	4.1	Dark brown

RUTLEDGE SWAMP

The Rutledge swamp lies adjacent to the Soefje bog west of the village of Ottine. Little testing was done in it since it is now included in the Gonzales Palmetto State Park area, but peat is present in it lying in essentially the same position as that of the Soefje bog. In the area tested the peat was black and composed mainly of altered sedge and cat-tails. In the event that other bogs of this region are worked for commercial peat, the Rutledge swamp will act as a preserve for the unusual peat-forming flora of this area.

OTHER BOGS

Denman bog. — The Denman bog is located in the Carrizo 6 miles southwest of the town of Belmont in Guadalupe County. It is situated in a relatively flat valley of a small stream that empties into Guadalupe River. The area covered by this bog is roughly half an acre. Depth tests show that only a foot of peat is present, and this is so silty that samples were not taken for chemical tests. The peat in this bog is composed of sedge, cat-tail, bur grass, and other semi-aquatic plants. Typical peat-forming plants common to other described areas are not so prominent in the Denman bog.

Ted Berger bog. — The Ted Berger peat bog is also located in the Carrizo about 7½ miles southwest of Belmont in Guadalupe County. Numerous springs feed the bog the copious water supply necessary for the formation of peat. Approximately one acre of good

peat is available in this bog and the average depth is not more than 3 feet. As in the case of other bogs described, the Berger peat bog shows a good development of the small domes. Certain swamp shrubs cover the raised areas, and peat-forming material would be deposited beneath certain localized areas, namely, shrub areas; this might possibly explain the formation of small domes within peat area.

Analysis of peat from the Berger bog. — The following table gives the results of chemical tests made on samples from this bog:

Sample and position	Moisture %	Ash %	pH	Color of ash
No. 1, upper	23.8	9.7	6.5	Gray
No. 2, middle	28.6	15.9	6.3	Gray; SO_2 on ignition

GENERAL CONSIDERATIONS

Living Sphagnum is too scarce in Texas bogs to supply the needs of the local market with the dried product that is used for packing flowers and plant roots for shipment. However, the known quantity of fibrous Sphagnum peat is sufficient to supply the Texas market for many years. More than a thousand acres have been located in the past year. Since fuel is of no great concern because of the ready supply of almost every type, Texas peat will find its greatest use as a soil conditioner, either to increase its moisture-holding capacity or to control the alkalinity.

PLANT NOTES

Particular attention to the unusual flora of the Ottine region was brought about by the efforts of Edith Fly Hildebrand, a botanist of Gonzales. Many studies have since been made, particularly those of Dr. B. C. Tharp, Ellen Schulz Quillen, and E. R. Bozusch. The Gonzales and Guadalupe County bogs carry the westernmost known distribution of the typical bog flora of East Texas. The named areas are entirely isolated from the parent region to the east. The nearest known areas that have this flora are in Robertson and Milam counties.

The plants which are most conspicuously out of their normal distribution limits are the wax myrtle, members of the heath family, dwarf palmetto, from which the Palmetto Park gets its name, flowering herbs such as the orchid, iris, yellow-eyed grass, and arrowleaf, and Hibiscus. Marsh grasses and sedges are represented by many dozens of types. The variety of ferns is no less remarkable. These range in size from a fraction of an inch to the large cinnamon fern which attains 6 feet in height in the Soefje bog. Although Sphagnum has played an important role in the development of peat in these bogs, it is found only in the Soefje swamp at the present time.

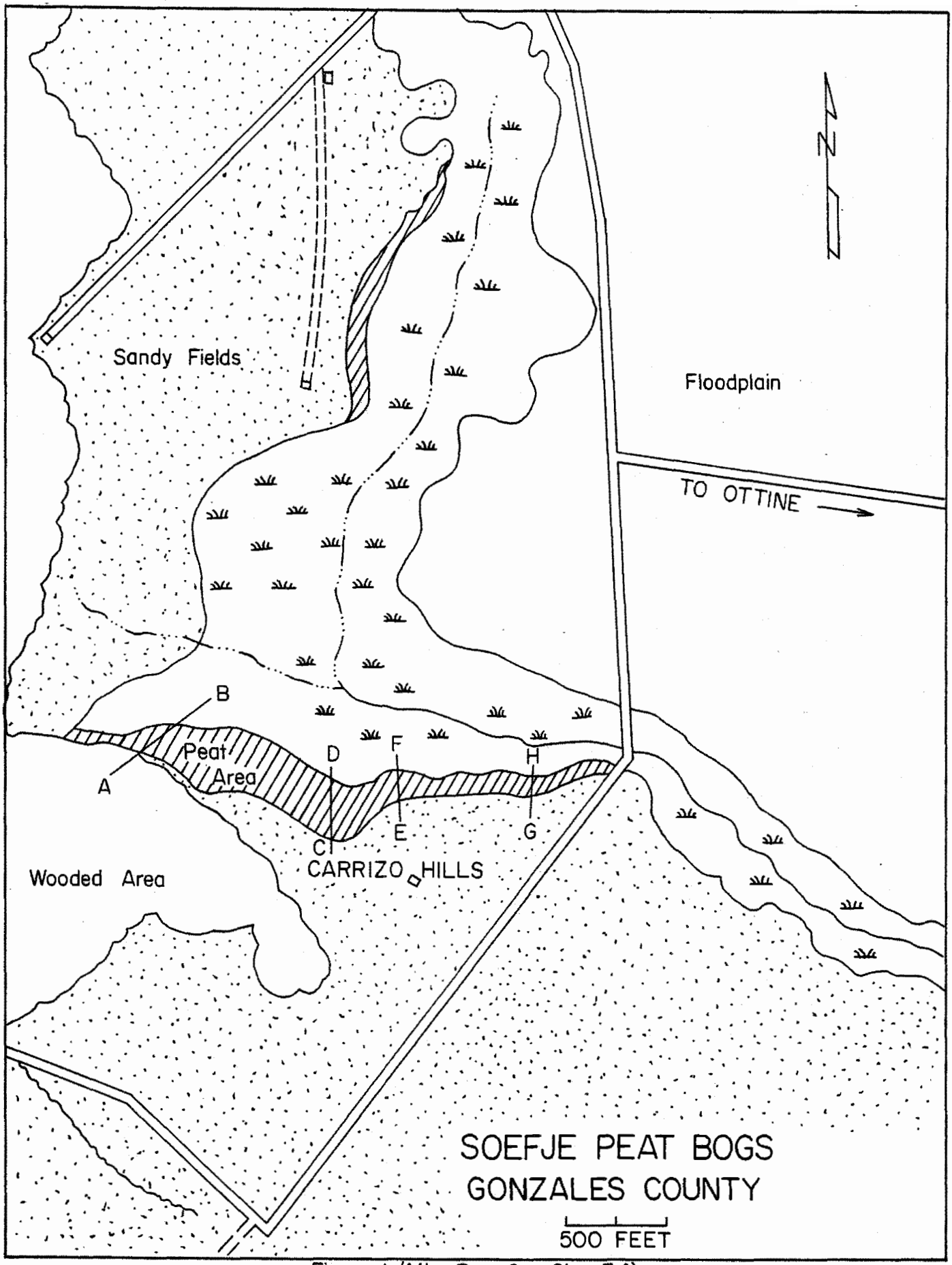
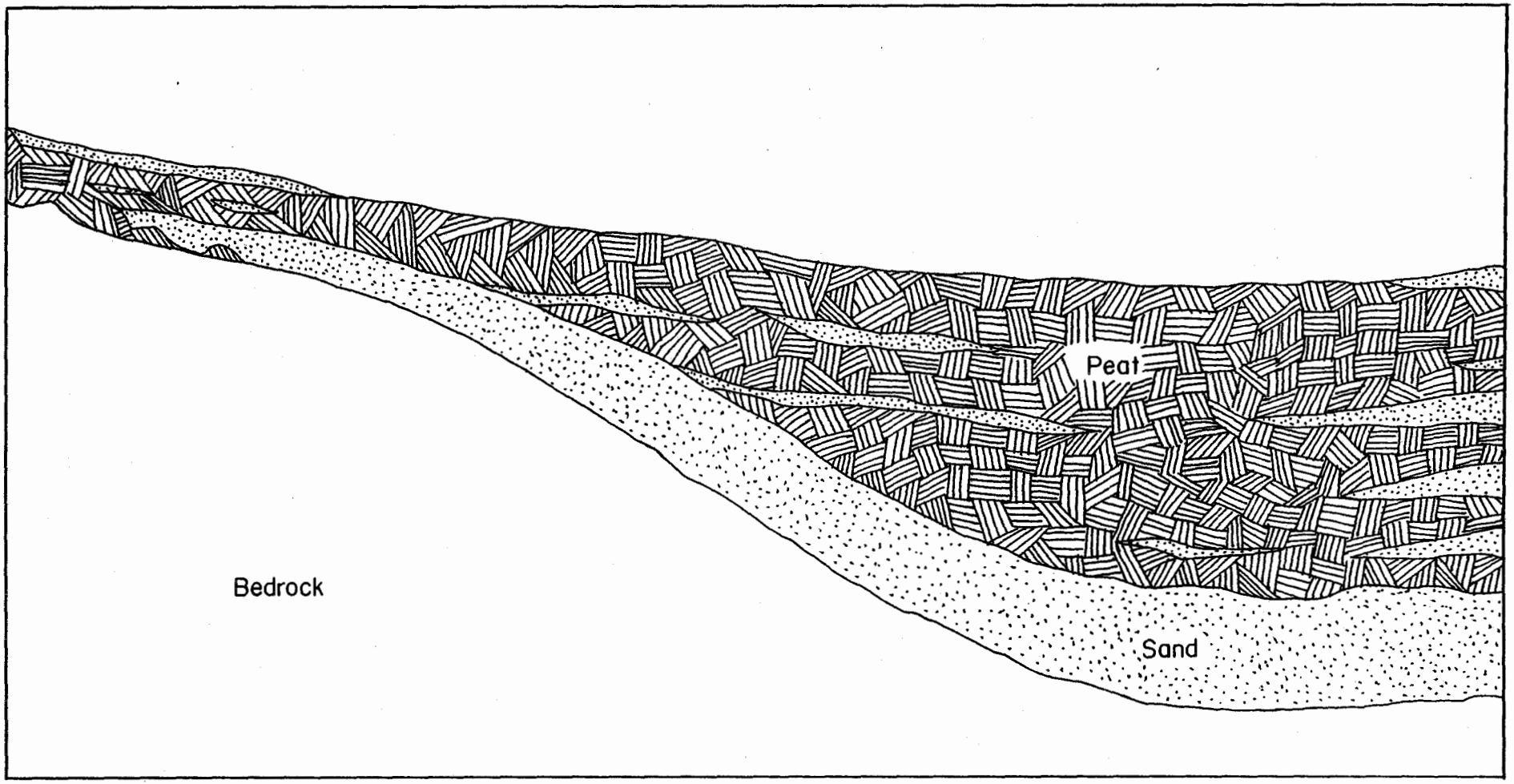


Figure 1.(Min. Res. Sur. Circ. 34).

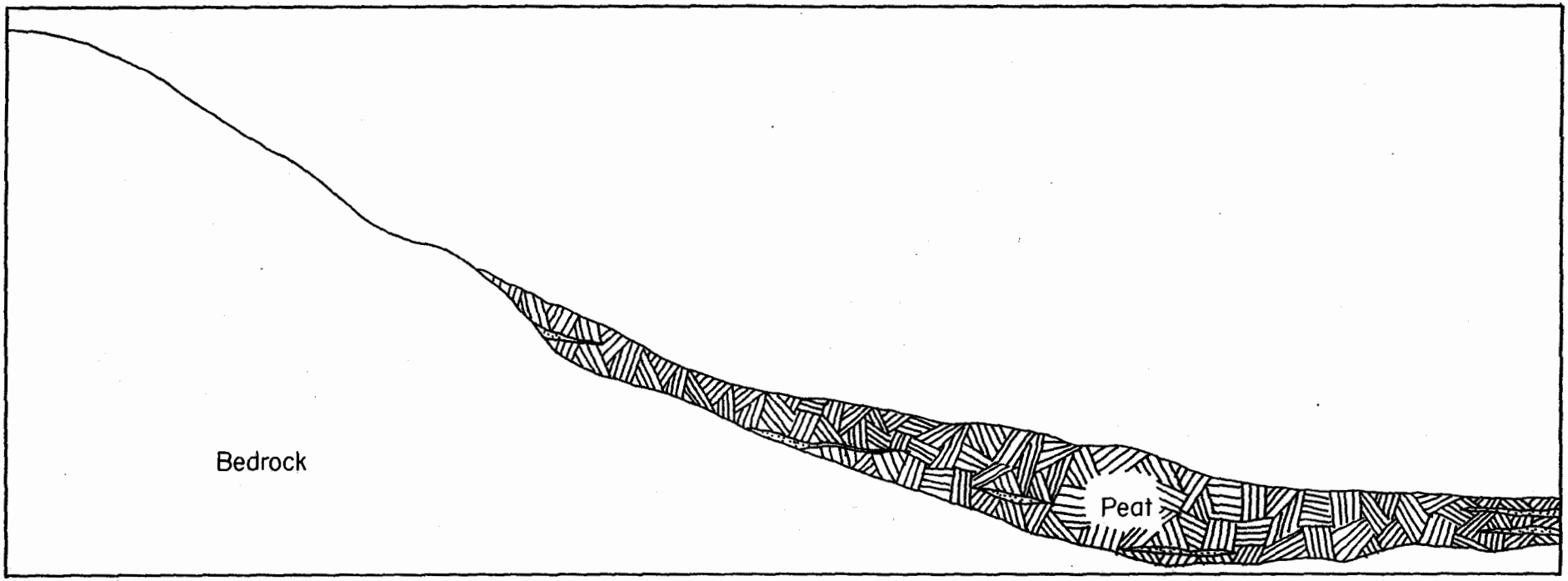


HENRY SOEFJE BOG
PARTIAL PROFILE: A-B

1"—10'

VERTICAL SCALE: 1"=10

Figure 2 (Min. Res. Sur. Circ. 34).

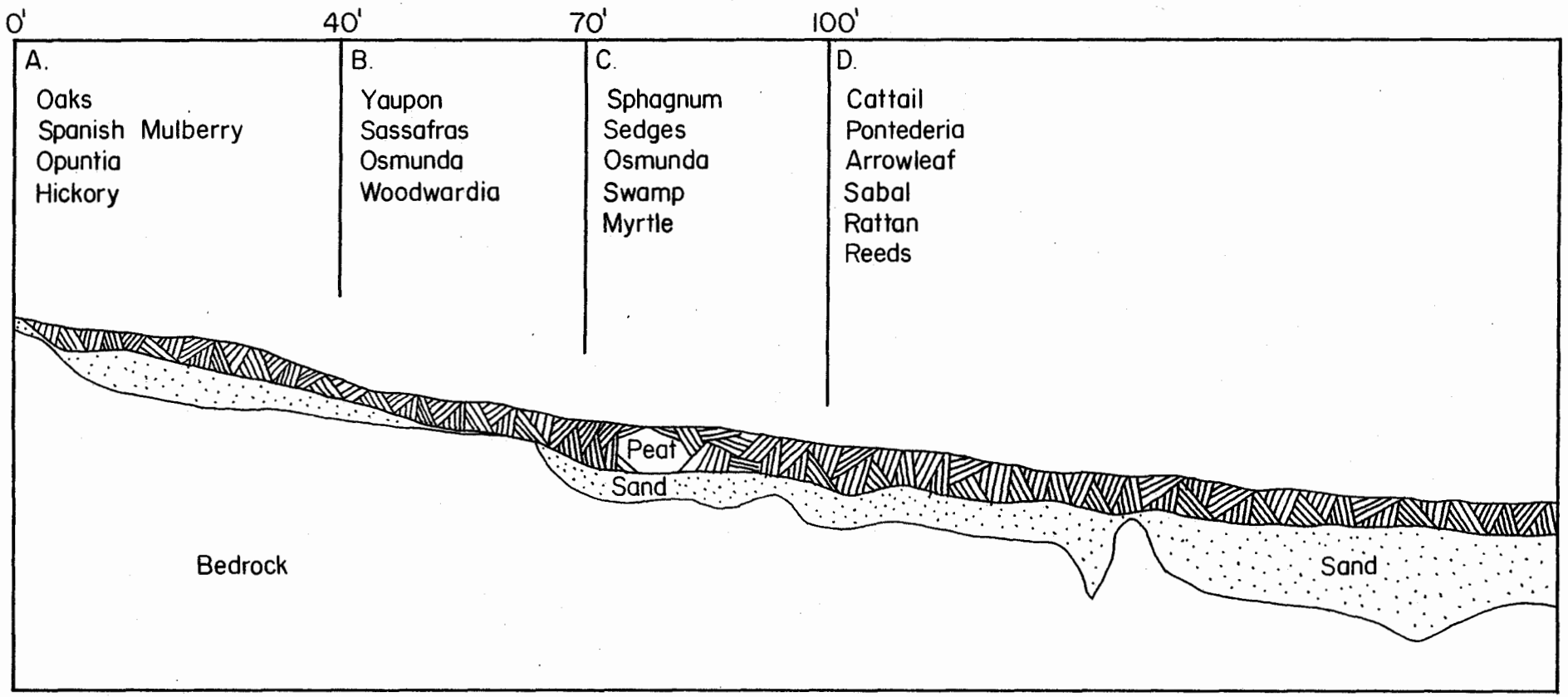


HENRY SOEFJE BOG
PROFILE E–F

1"= 40'

VERTICAL SCALE: 1"= 20'

Figure 3 (Min. Res. Sur. Circ. 34).



HENRY SOEFJE BOG
PROFILE G-H

VERTICAL SCALE: 1"=20'

Figure 4 (Min. Res. Sur. Circ. 34).

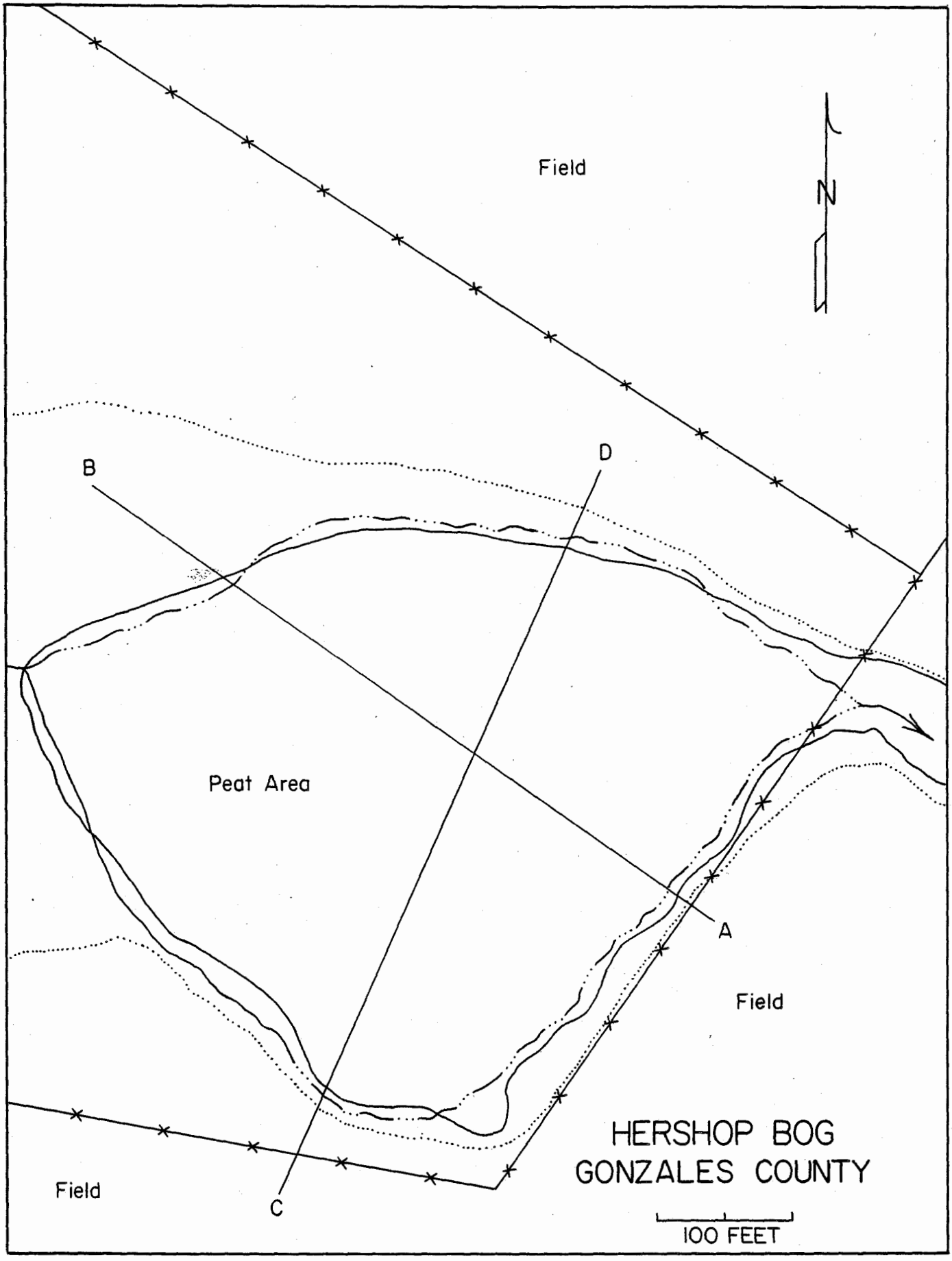
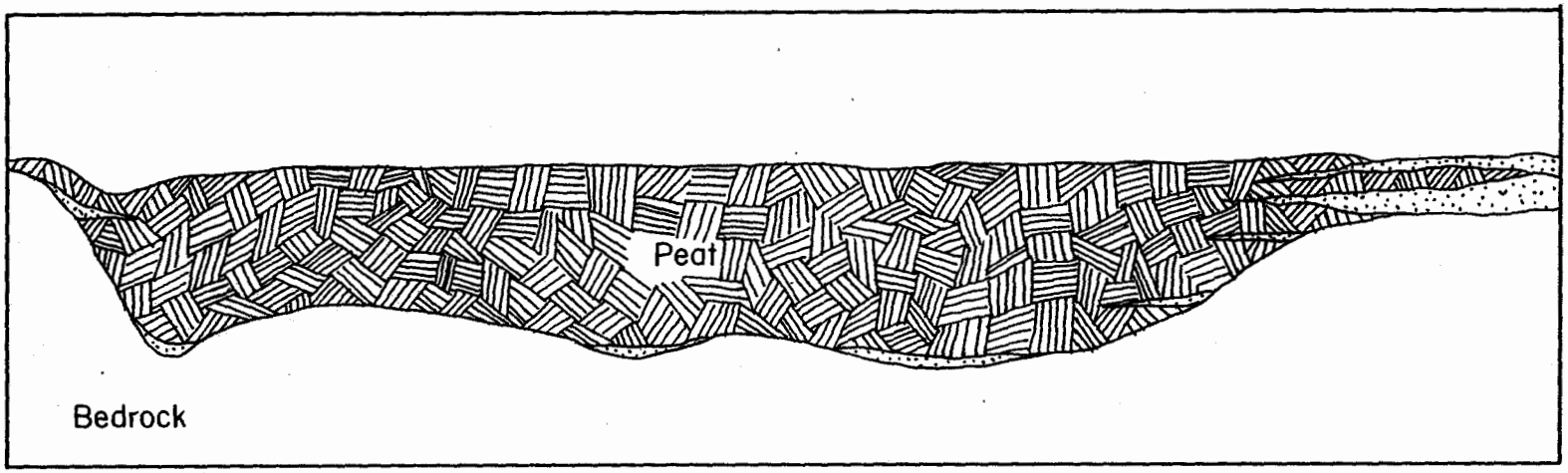


Figure 5 (Min. Res. Sur. Circ. 34).

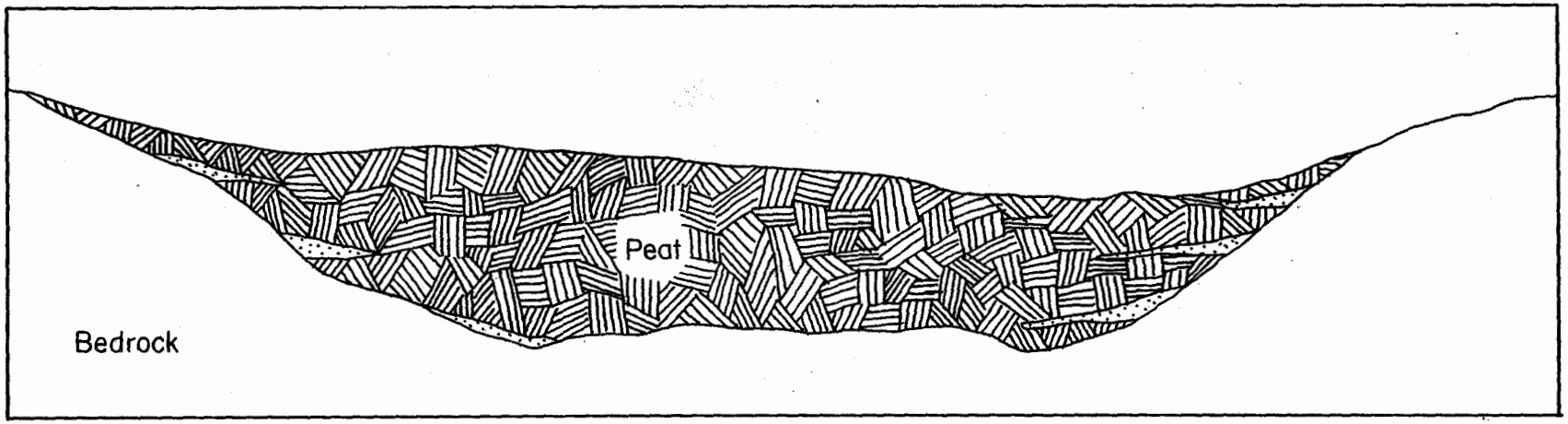


A-B

GEORGE HERSHOP BOG

100 FEET

VERTICAL SCALE: 1"=50'



C-D

50 FEET

VERTICAL SCALE: 1"=50'

Figure 6 (Min. Res. Sur. Circ. 34).