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MINERAL RESOURCE SURVEY OF TEXAS
Circular No. 2

A mineral resource survey of Texas has been started by the Works Progress Administration, The Bureau of Economic Geology of The University of Texas acting as sponsor. The purpose of the survey is to assemble information and make it available to the public. The counties in which the mineral resource survey is being made were listed in Circular No. 1, issued on February 27, 1936. Since that circular was issued, the survey has been started in the following counties: Cherokee, Clay, El Paso, Fayette, Grimes, and Young. The following report is based on work in Bexar County.

REPORT ON A MINERAL RESOURCE SURVEY OF BEXAR COUNTY, TEXAS—W.P.A. PROJECT 3527
by Richard A. Jones, geologist

Large outcrops of greensand, formerly considered of Navarro or Upper Cretaceous age but now believed to be of Midway or lower Eocene age, occur in the bluffs and hills on the southwest side of Leon Creek, about 6 miles southwest of the central part of San Antonio. The greensand occurs on the northwest and southwest flanks of the Gas Ridge anticline, a large southwestward-plunging anticlinal nose. It crops out for about 7 miles along Leon Creek, being absent only on the axis of the anticline where it has been eroded away.

The greensand is not really quartz sand but is composed of small rounded particles of the green-colored mineral glauconite, a mineral containing potassium. Certain horizons also contain small pebbles of potash. Small shark teeth are quite abundant.

The following is a description of various samples of the greensand from outcrops on Leon Creek, examined by the writer with hand lens.

Whole specimens.—Some light green, some dark green in color; numerous small grains of glauconite, light and dark green. As a general thing, the greensand is soft and friable. Contains some small brownish shark teeth.

Crushed material.—The material is seen to consist almost entirely of crowded masses of small oval globules of glauconite, often glistening beautifully with a dark green lustre. The green glauconite grains are imbedded and cemented in a matrix of gray and white material apparently calcareous. No true silica or quartz sand grains seen, unless it were some yellow and orange-colored grains of about the same size as the glauconite grains. Some grayish dull-looking phosphate pebbles, small, but relatively large in comparison with the glauconite grains. The pebbles are sometimes rounded, sometimes angular with dulled edges.

The occurrence of the greensand from north to south along Leon Creek will be noted in the following paragraphs.

The most northerly occurrence of the greensand observed by the writer was in bluffs immediately north of the Castroville highway crossing Leon Creek. There are good outcrops here.

About 1 mile south of the Castroville highway crossing over Leon Creek there are high bluffs of greensand on the west side of Leon Creek, immediately west of Kelly Field. During the present examination of the mineral resources of Bexar County, the writer was unable to make excavations in this area. The bluffs are part of the Kelly Field Government airplane bombing reservations. On the flat land above the bluffs, and possibly also along the bluffs, are old bombs, "duds," which did not explode when dropped. However, they might explode if accidentally struck with a pick or shovel, and it is not safe to work a crew of men along that part of Leon Creek.

Both of the above-described areas of greensand are on the northwest flank of the Gas Ridge anticline.

From one-half to a mile above the Laredo or Frio City crossing of Leon Creek, high bluffs may be found on the west side of the stream. Exposed here are bluish shale, weathering yellow; brown, yellow, clayey, fine-grained and yellow claystones; and small white oval sandstone concretions. The dip is 2° to 4°N. 70°W. No greensand was observed in this section, which is near the axis of the Gas Ridge anticline, although slightly down the northwestern flank. The axis of the anticline crosses Leon Creek approximately at the Laredo or Frio highway crossing of the creek. There are outcrops of shale along the highway in the slope on the west side of the creek.

For over a mile north of the Quintana or Van Ormy highway crossing of Leon Creek, there are high bluffs, broken by steep ravines on the west side of the creek. In the present survey of the mineral resources of Bexar County, men were employed in cutting into the sides of the ravines and bluffs at favorable localities to expose the greensand and in digging pits on the gentle slopes to determine its presence or absence. By this means, good sections of the greensand were exposed, sections measured, and samples taken at many localities and at different levels in the greensand section. Following are sections measured.

Section A. On west side of Leon Creek about one-fourth mile above Van Ormy highway (Quintana road) crossing of Leon Creek.

	Thickness in feet
10. Steep gravelly slope to flat top of hill, capped with gravel, mostly chert, some limestone	40
9. Weathered outcrops of brownish-yellow clay on steep slope; in dug pits yellowish, brown, and yellowish-green clay	15
8. Covered, grassy, gravelly slope; dug pit reveals greensand	5
7. Covered grassy slope; dug pits expose soft greensand	5
6. Soft greensand; in places hardened into ledges	5
5. Brownish clay mixed with greensand	1½
4. Predominantly greensand, from soft to rather indurated, chiefly soft. From strata an inch or several inches to 3 feet or more in thickness. Interbedded with smaller amounts of brownish clay layers from a streak to 6 inches thick. Small phosphate pebbles and shark teeth present. Some small hard greensand nodules about the size of walnuts. Some cross-bedding. The strata show some undulation here, there being different dips both northwest and southeast, from 5° to 15°. However, the general dip of this area, which is on the southeast flank of the Gas Ridge anticline, is much gentler. The steep dips are probably due to cross-bedding, as, for example, one excellent outcrop of bright greensand which dips 20° south measured along a winding ravine which had been cleaned out by workmen. There is a small greensand quarry or commercial pit in this part of the section	22
3. Soft greensand; in places clayey; exposed by cutting	6
2. Soft greensand exposed by cutting	6
1. A few feet above water level of Leon Creek; brownish clay exposed in shallow dug pit. However, this is not believed to be the base of the greensand section but only one of the clayey layers interbedded with the greensand	1
Total thickness of section measured	106½
Total greensand section exposed in Section A	51

Section B. About 100 yards south-southeast of Section A, in bluffs on west side of Leon Creek.

7. Yellowish-brown and greenish-brown clay with thin hematite and yellow claystone; sometimes aggregated into small concretions, to top of slope	17
6. Same as below but more clayey toward top and has thin layers of red hematite	25
5. Greensand as below; some cross-bedding; up to 15° dip to the south	11
4. Soft to somewhat indurated greensand in layers from 1 inch to over 1 foot thick; interbedded with thin strata (streak to several inches) of brownish clayey material, usually containing glauconite; section chiefly greensand; small commercial pit here; dip from gentle to 5° south and southeast	11
3. Soft greensand exposed in trenches	5½
2. Soft greensand revealed in trenches on gentle slope	5½
1. Dug pit on bank of Leon Creek; soft greensand	3
Total thickness of section measured	78
Total greensand section exposed in Section B	61

Section C. About one-fourth mile upstream from Sections A and B, in bluffs and hills on west side of Leon Creek.

7. Steep slope to top of hill which is capped by gravel and caliche; presumably clay under gravel	23
6. Yellow, brown, and gray clay on steep slope in pits and trenches; small hematite nodules	11
5. Greensand in cuts and trenches; some yellow clay	11
4. Good exposures of greensand, as described in previous sections, in cuts and trenches dug at old commercial pit; harder ledges near top, outcropping on hillside	39
3. Chiefly soft greensand, some brownish clay, exposed in trench	17
2. Soft greensand and yellowish-brown clayey material, usually glauconite, in cuts and steep banks	17
1. Weathered greensand in gullies just above Leon Creek; also greensand in dug pit	5½
Total thickness of section measured	123½
Total greensand section exposed in Section C	89

Besides these measured sections, excavations were made at other localities, the greensand observed, and samples taken. It would be possible to spend a very considerable time in this immediate vicinity making a complete detailed study of the greensand. However, the writer was unable to make a detailed study of the greensand in view of the time limits of the mineral survey which compelled the party to move on to other localities.

The above sections are all on the southeast flank of the Gas Ridge anticline, the general dip being to the southeast. In this area from 50 to 90 feet of greensand are exposed, the bluffs and hills west of Leon Creek being practically entirely composed of the greensand except for the capping clay, gravel, and caliche. It is believed that the greensand is not much thicker than 90 feet, although the party did not have time to make excavations farther up Leon Creek where the base of the greensand might be revealed.

About 1 mile south of the general locality where the above sections were taken, there are outcrops of greensand in low bluffs at the water level of Leon Creek, on the east side of the creek, a short distance upstream from the Somerset highway crossing Leon Creek. For a considerable distance, from 10 to 20 feet of greensand capped by terrace gravels are exposed. Soft shaly sections alternate with hard ledges from 6 inches to 3 feet in thickness. At the water level, the greensand, where wet, is almost black in color. Some is a bright, light green in color; there are shark teeth in places; and the soft sections sometimes weather greenish brown. There is distinct cross-bedding occasionally. However, the general dip is estimated to be 10° to the southeast. On the terrace above Leon Creek there is an old shaft, said to be about 30 feet deep, for mining greensand. This is the most southerly appearance of the greensand on Leon Creek. Near the Somerset highway crossing of Leon Creek there is a large fault, determined by well records, with downthrow on the southeast side, which abruptly carried the greensand far below the surface.

These outcrops of greensand along Leon Creek are the only large deposits of greensand that the writer has observed in Bexar County. The greensand has been encountered by the drill in numerous wells drilled for oil, gas, and artesian water in southern Bexar County, but a detailed subsurface study of Bexar County, with its thousands of wells, is beyond the scope of the present report. In eastern Bexar County on the Grayton road, south of Randolph Airport, the writer has observed yellow clay and clayey sand with considerable glauconite—an impure greensand, and nearby are outcrops of weathered greensand in creek banks. At a farmhouse here there are numerous *Exogyra costata* said to come from a cistern 14 feet deep. This locality is near the Navarro-Midway contact and may roughly be the same horizon as the large greensand outcrops along Leon Creek many miles to the west.

The following analysis of greensand is taken from The University of Texas Bulletin, page 69 (Phillips, W. B., Mineral Resources of Texas, 1914):

	Percent
Silica	35.18
Alumina	5.30
Lime	16.00
Oxide of iron	17.35
Magnesia	Trace
Soda	1.39
Potash	1.69
Carbonic acid	8.00
Loss on ignition	10.10
Phosphoric acid	3.30
	98.21

This deposit contains rounded phosphatic pebbles, from one-eighth inch to one-fourth inch in diameter, of the following composition:

	Percent
Silica	7.50
Alumina	31.03
Oxide of iron	4.58
Lime	18.08
Carbonic acid	4.60
Phosphoric acid	18.19
Loss on ignition	12.60
	98.34

The larger pebbles are not abundant. For the most part the pebbles are very small, less than one-twentieth of an inch in diameter.

An examination of 10 feet of this phosphatic greensand, foot by foot, gave the following results, from above downward:

Foot	Phosphoric acid (percent)
First	3.09
Second	2.38
Third	3.22
Fourth	3.07
Fifth	4.00
Sixth	2.73
Seventh	4.32
Eighth	2.60
Ninth	3.70
Tenth	3.97
Average	*3.30*