

University of Texas Bulletin

No. 2346: December 8, 1923

REPORT ON THE OIL AND GAS POSSIBILITIES OF THE UNIVERSITY BLOCK 46 IN CULBERSON COUNTY

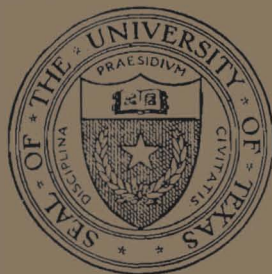
BY

J. W. BEEDE

Bureau of Economic Geology and Technology

Division of Economic Geology

J. A. Udden, Director of the Bureau and Head of the Division



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The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

Sam Houston.

Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

Mirabeau B. Lamar.

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REPORT ON THE OIL AND GAS POSSIBILITIES OF THE UNIVERSITY BLOCK 46 IN CULBERSON COUNTY¹

BY J. W. BEEDE

Block 46 of the University of Texas land is located in the northeastern part of Culberson county, 16 miles south of the New Mexico state line and 22 miles west of the east line of the county. The most convenient railway point from which to reach the land is Van Horn on the Southern Pacific Railroad, 39 miles south and 18 miles west of the property. The public road from Van Horn to Carlsbad, New Mexico, avoiding the gypsum country on the east, passes through the center of this block. The tract of land included in this block is eight miles long and six miles wide. It contains 48 sections, amounting to approximately 30720 acres.

GEOLOGY

All of the rocks in the region of University Block 46 are of Permian age. The formations represented are the Delaware Mountain, which lies at the surface in the west half of the block, and the Castile gypsum, which occupies a trifle less than the east half of the block. For the most part these formations dip to the east or a little north of east.

This block of land lies about 15 miles east of the Delaware Mountains or escarpment and all the rocks of this escarpment pass under the University block, as do those that outcrop between the block and the escarpment. Consequently no intelligent idea of the rocks to be encountered in drilling can be obtained without a careful study of the escarpment and the rocks outcropping between it and the University land. For that reason two sections were measured on the escarpment, one nearly opposite the north end and the other nearly opposite the south end of the block.

The one farther north was measured over the highest point on the Delaware escarpment north of Hogue Canyon.

¹Published February, 1924.

It lies nearly due east from the concrete tank on the east side of Salt Flat on the Six Bar, or Delaware Ranch. From there it swings northward to a high mountain with a sandstone top and then east down the ridge running just north of the D South wells to the point about north of the wells. Here it was offset to the point at the K.C. Last Chance wells. From this point it extends east along the ridge south of Chico Draw, to the flat west of the 7 L (Seven L) wells.

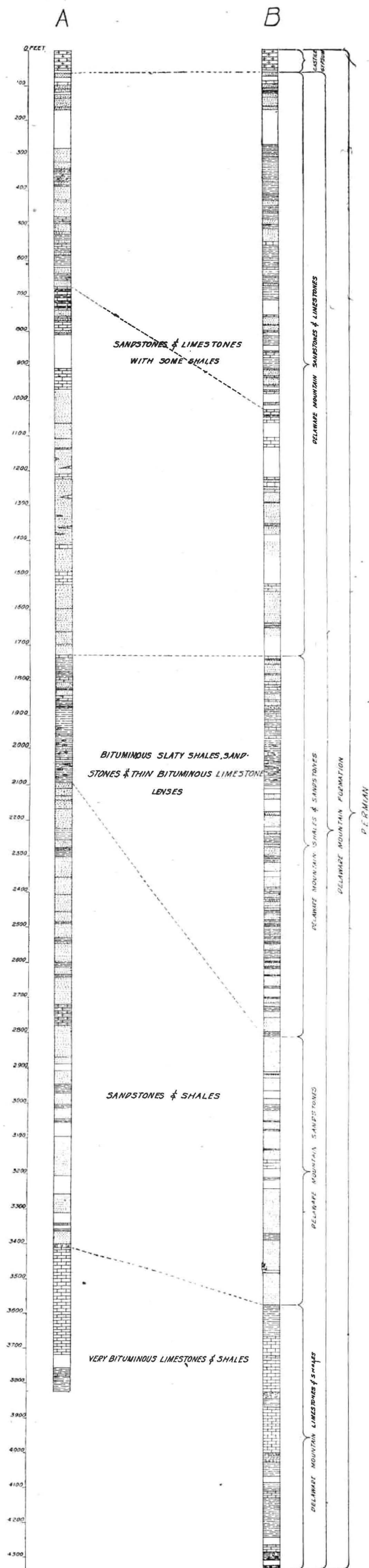
The south section was taken over the main scarp just north of Hogue Canyon and carried down Chico Draw and the divide south of it to the Last Chance Wells. Here it offset to the south of the old Terry Church and thence nearly east to Wildhorse Draw, thence southeast to the south line of the block and east to the gypsum beds on the scarp east of the Van Horn Road.

As nearly as possible the details of the succeeding beds were studied for the full distance. A comparison of the two sections shows some rather remarkable variations. The two sections are of sufficient importance to warrant including in this report. These sections follow:

NORTH DELAWARE MOUNTAIN SECTION

Between base of Escarpment east of Murchant concrete tank and Whitehorse Draw on the northern part of the University Block No. 46.

96. Sandstone, yellow, some shaly and brown with large concretions	40
95. Sandstone, light, some shale, two beds.....	20±
94. Shale, sandy, and limestone concretions and beds.....	35
93. Shale, 5 feet with massive sandstone on top.....	10
92. Sandstone, shaly	10
91. Sandstone, yellow	30
90. Limestone, 1 foot, followed by sandstone.....	50
89. Limestone, sandy, grading into sandy shale.....	10
88. Shales, sandy, dark buff.....	10
87. Sandstone, massive, light yellow, 20 feet to.....	25
86. Sandstone, rather massive, buff.....	10±
85. Shales, yellowish, sandy, probably weathering as sandstone under different exposure.....	15
84. Sandstone, shaly, "Base ball" concretions.....	7
83. Shale, dark brown, carrying nodular limestone with minute ammonoid fauna, 1 foot at the top.....	15



Geologic section; A, North Delaware Mountain section; B, South Delaware Mountain Section.

82. Limestone, dark concretionary	1
81. Shale, carbonaceous, dark brown, to yellow on weathering	10
80. Sandstone, yellow, shows tendency to spherical weathering	10
79. Shale, yellow, sandy, varying to brown.....	25
78. Shale, sandy with concretions a foot in diameter, which split up into horizontal slices on weathering.....	5
77. Limestone, thin plates and sandy shales to top of thin dark limestone which weathers into pieces resembling rounded loaves of bread.....	23
76. Sandstone, limestone, etc., mostly concealed.....	30
75. Limestone, drab, Fusulina, ammonoids, large sandy limestone concretions	15
74. Concealed, partially. Largely thin limestones with ammonoids at the top. Probably contains "iron fossil" horizon and has the <i>Waagenoceras</i> horizon at its base 30	30
73. Limestone, dark several layers, 4 to.....	5
72. Shales, sandy, and sandstone grading into limestone....	4
71. Limestones, thin dark, marly partings, sandy limestone at base	5
70. Sandstone, some of it shaly and some of it soft.....	18
69. Limestone, hard, darkly mottled, weathers shaly locally, makes line along outcrop. Two beds, thin shale parting	3
68. Sandstone	7
67. Limestone, or sandy limestone, weathers shaly, top of main ledge	2
66. Limestone, even-bedded, hard, mottled,, marly partings, weathers shaly in slope exposures. Ammonoids....	25
65. Sandstone, massive	5
64. Limestone, ammonoids, bright green shale in talus.....	5
63. Sandstone, thick and massive in part. Rest concealed. Precise thickness not determined on account of fault	100+
62. Limestone, nodular	3
61. Limestone, mostly. Some soft sandstones and marls....	13
60. Limestones, thin and marls.....	12
59. Limestone, massive, highly jointed, weathers to rusty color	3—
58. Marls with thin sheet or two of limestone.....	5
57. Limestone, rather firm, nodular, thin-bedded.....	5
56. Sandstone, with sparse limestone nodules.....	6
55. Limestone, somewhat conglomeratic, thin beds.....	5
54. Limestone, thin, lenticular, nodular, and marls.....	5
53. Sandstone, massive so far as exposed, some shale sheets	157

52. Sandstone, some limestones	100
51. Limestones, shaly to massive shale parting.....	15
50. Sandstone and concealed. Slope has a hard 8-inch limestone in it	100
49. Limestone, thin, slaty, slightly fossiliferous brown sand- stone, some nearly white sands.....	125
48. Sandstone	70
47. Limestone, marly partings, ammonoids, grades into sandstone farther west.....	38
46. Sandstone and shales, southward and eastward is 15 to 20 feet limestone lens which is not seen a little farther north. Total thickness	215
45. Shale 15 feet. Limestone, mottled, 8 inches; 50 feet of shales, 1 foot limestone at top.....	67
44. Limestones, fossiliferous, somewhat cherty, sponges, brachiopods, bryozoa, etc. 15 to.....	17
43. Sandstones, etc. limestone lens.....	50
42. Limestone, like those below, 18 inches, interval mostly shale. Some fossiliferous limestone in upper part	90
41. Shale, prevailing sandy, part of it calcareous, fissile, black, with small lenses of limestone.....	75
40. Limestone, first layer above the great sandstone succes- sion, 18 inches. Shales rusty to drab, brittle, black, bituminous, limestone lenses and shales.....	75
39. Sandstone, massive, uppermost bed of succession. Few fossils, shale partings, top composed largely of Fusulina	15
38. Sandstones, shale partings and some thin shale beds....	55
37. Sandstone, yellow, locally contains fusulinas, occasional coral or shell.....	55
36. Shale	25
35. Sandstone, locally containing Fusulina.....	25
34. Shale, black to sandy.....	25
33. Sandstone, massive, occasional Fusulina.....	50
32. Shale, sandy, blackish, and yellow sandstone, semi- quartzitic layer 75 feet below the top, mostly sandstone	260
31. Sandstone, massive, yellow, occasional Fusulina.....	20
30. Shales, drab	10
29. Sandstone, massive, some fusulinas.....	25
28. Sandstone, massive, barren, yellow.....	55
27. Shales, sandy	60
26. Sandstone, yellow, shale partings.....	80
25. Sandstone alternating with blue shale, some black cal- careous matter	20
24. Shale and sandy shale for the most part, partially con- cealed	20

23. Sandstone, massive, yellow	40
22. Shales, olive, sandy, followed by fine hard olive sandstone, weathering into semi-quartzite bed.....	25
21. Sandstone, massive, yellow.....	30
20. Shales, olive, sandy, or sandy marls weathering drab, three sandstone beds in the upper part.....	50
19. Concealed	40
18. Sandstone, soft yellow.....	55
17. Sandstone, soft, buff, thickest part of a lens. This sandstone weathers nearly to a quartzite at top, flesh-colored, brownish within, 125 to.....	60
16. Concealed	50
15. Sandstone, soft, buff, Fusulina in lower part.....	55
14. Concealed	30
13. Sandstone, soft, buff-gray.....	5
12. Concealed	12
11. Shales, sandy dark	6
10. Concealed, largely sandstone as seen farther north....	40±
9. Limestone conglomerate and breccia, cephalopods, brachiopods, fish teeth, etc.	7±
8. Limestone, black or brownish, thicker bedded than below, thin shale partings. Fossils.....	25
7. Limestone, laminated, black, bituminous, bedding crumpled locally, somewhat siliceous. Upper part weathers drab, lower part more buff, on some exposures	110
6. Concealed (bituminous shale?)	65
5. Limestone, black slaty, quite bituminous, concretions....	100
4. Talus to base of cliff.....	35
3. Shale, black, slaty bituminous, some fossils.....	15
2. Limestone, drab, composed of fragments of fossils including Fusulina	2—
1. Shales, black, slaty, bituminous, very hard and limestone sheets, fossiliferous, lens-shaped concretions	45

SOUTH DELAWARE MOUNTAIN SECTION

130. Gypsum, apparently formed by the replacement of limestone. Thickness varies with distance from the escarpment.	
129. Concealed, probably gypsum.....	10
128. Limestone, laminated, hard, blue to gray, very bituminous	5±
127. Concealed, 6 feet to.....	10
126. Sandstone, calcareous, lower part harder than the upper, weathers to buff-brown	11
125. Shales, soft sandy, dark buff, partially covered.....	15
124. Limestone, slabby, banded, rusty and dark blue, excellent horizon marker. 4 inches to.....	1

123. Sandstone, dark, shaly, and broken.....	15
122. Sandstone, rather massive, gray to yellow.....	7
121. Shale, brownish	10
120. Sandstone, gray	15
119. Sandstone, shaly, darker near its base, and sandstone, soft gray	43
118. Concealed	100
117. Sands and shales	240
116. Concealed, sandy material	40
115. Concealed, largely. Contains some sandstone, and some thin limestone and sandstone plates.....	130
114. Shale	40±
113. Concealed	40±
112. Limestone, gray to buffish, siliceous, <i>Fusulina</i> and other ground up fossils	4
111. Sandstone, with 18-inch calcareous sandstone at base	25±
110. Sandstone, with two beds of limestone.....	35
109. Shale, sandy, at base. Rest concealed.....	35
108. Concealed. Contains limestone bed with pelecypods....	20
107. Shale, brownish, sandy, brown sandstone at top.....	10
106. Concealed, lower part. Upper 20 feet limestone, some sandstone, small <i>Waagenoceras</i> and minute ammo- noid fauna	75
105. Limestone and sandstones with thin blue-gray limestone at the top	60
104. Limestone, thin, with thin sandstones and marls, nearly all talus covered much of the way. Minute ammo- noid fauna with some larger ones.....	60
103. Limestone, followed by thin marl bed (<i>Waagenoceras</i> bed) and long slope with "iron fossils" and lime- stone concretions resembling base balls.....	40
102. Concealed, largely, with some sandstone and limestone at the base	55
101. Limestone	25
100. Concealed, 90 to.....	100
99. Limestone, ammonoid, forms row of points.....	50±
98. Massive sandstone and concealed slope.....	145
97. Sandstone and concealed slope	155
96. Limestone, cephalopod, with other material interbedded	20
95. Sandstone, soft, with heavy indurated rusty bed at 65 feet	100
94. Sandstone, massive, very soft, with brown siliceous sandstone on top, much of section talus covered....	90
93. Sandstone slabs and limestone.....	25
92. Sandstones, platy, with shale and limestone beds in the lower part. Upper part largely sandstone slabs weathering to yellowish shade, more or less cherty casts of fossils	120

91. Limestone breccia, few fossils, blue-black in color, bituminous, a set of irregular concretionary masses 0 to	10
90. Shales. Some limestone beds and lenses to the base of the limestone ledge	165
89. Shaly and limy beds, some limestone locally, very bituminous	55
88. Slope containing slabby sandstone plates, shales, etc. Shales sandy, nearly black, carbonaceous, slaty, some limestone concretions	33
87. Concealed	35
86. Concealed, with hard thin black sandstone on top.....	7
85. Sandstone, massive, to top of heavy ledge. Fusulina at the top	35
84. Concealed	12
83. Sandstone, full of Fusulina	5
82. Sandstone, massive	10
81. Shale, hard, bituminous, sandy.....	15+
80. Sandstone, hard, blocky, Fusulina	2
79. Sandstone, soft	18
78. Shale, bituminous and thin sandstone	15
77. Sandstone, coarse, massive, somewhat calcareous, weathers reddish	20+
76. Concealed. Contains a light green sandstone.....	10
75. Sandstone, shaly, fine-grained, Fusulina.....	20+
74. Limestone, quite sandy, full of fusulinas.....	7
73. Shale, bituminous	2
72. Sandstone, somewhat bituminous	7
71. Shale, black, bituminous, fissile	3
70. Sandstone	12
69. Limestone, two beds, blue-gray, weathers buffish.....	2
68. Sandstone, thinner bedded at base.....	12
67. Shales, black, sandy near top, very carbonaceous.....	15
66. Sandstone, few long fusulinas, 20 to.....	25
65. Shale, sandy, dark, carbonaceous, 2 foot of sandstone, lens near the middle	13
64. Sandstone, soft	4
63. Shales, hard, dark.....	3—
62. Sandstone, soft, some fusulinas locally.....	7
61. Shale, dark	2+
60. Shale, dark, sandy and soft sandstone.....	15
59. Sandstone, massive	10
58. Shale and sandstone	5
57. Sandstone, massive	13
56. Shale, dark, two thin sandstone lenses in middle.....	10
55. Sandstone, massive, Fusulina	18
54. Shale, fissile, sandy, black to blue-black when wet.....	22
53. Sandstone, massive, two shale partings.....	18

52. Sandstones interstratified with thin shale beds.....	7
51. Sandstone, massive, 3 feet to	4
50. Shale, bituminous, and thin sandstone lenses.....	10
49. Sandstone, massive	22
48. Shales, drab to olive, sandy, somewhat carbonaceous....	8
47. Sandstone, massive irregularly bedded, local sheets of shale	35
46. Shale, like shale beds above it, local thin sandstone lenses, 4 feet to	6
45. Sandstone, massive, two distinct beds.....	30
44. Shale parting	2
43. Sandstone, calcareous, locally filled with fusulinas.....	15+
42. Shale, black, sandstone sheet in the middle.....	8
41. Sandstone, local shale partings, 6 to	15
40. Shale, bituminous, 3 to.....	15
39. Sandstone, with small and large concretions, the larger with light calcareous rims and sandy inside. Rip-ple marks and some shaly partings.....	20+
38. Sandstone, shaly, most of interval concealed.....	40
37. Shale, partly bituminous	15
36. Sandstone, rather massive	115
35. Concealed, thin quartzitic sandstone near top.....	20
34. Sandstone, 10 feet at base, rest concealed to top which is dark platy sandstone	40
33. Concealed, apparently shale	25
32. Sandstone	25
31. Shale, slaty, bituminous	15
30. Sandstone, with black slaty shale at 25 feet.....	65
29. Sandstone, massive, 1 foot reddish siliceous sandstone at the top	65
28. Sandstone	35
27. Sandstone, heavy, alternating with shales, 4-foot limestone with Fusulina 5 feet below top.....	30
26. Concealed, largely. Contains two sandstone beds 3 feet thick, some hard bituminous shale and much soft thin sandstone. Forms grassy slope.....	60
25. Sandstone, many soft streaks, probably some shale, in lower part. Fusulina in the upper part.....	140
24. Shales, locally brown, weathering yellow, followed by sandy shales and soft shaly sandstones.....	22
23. Sandstones, massive, yellow, rather thick beds, fairly coarse-grained	100
22. Concealed, apparently black shale	10
21. Sandstone, massive, base yellow	100
20. Shaly material, very bituminous, contains sandy beds, top of limestone-shale section	95
19. Limestone, slightly more resistant than beds above and below it	8

18. Limestone, more shaly than the one below it.....	60
17. Limestone, rather slaty, black, bituminous, weathers to lighter shale. Flattened fossils	110
16. Limestone, thin-bedded, beds contorted, bituminous, weathers with rusty edges	12
15. Limestone, black, bituminous, thin gnarly beds which appear to be folded but may be concretionary.....	25
14. Limestone, like the rest but more shaly and even-bedded	20
13. Limestone, thin-bedded, gnarled, folded and concretionary beds, blue-black, bituminous, weathers bluish-gray, usually forms talus slope.....	55
12. Limestone, hard, platy, dark blue, very bituminous, forms base of first lower black cliff.....	85
11. Sandstone, fine-grained, dirty brown, shaly, or very sandy shales, weathers dark yellow	25
10. Shales and concealed slope. Shales brownish, very bituminous, some concretions	45
9. Concealed	20
8. Shale, papery, black, very bituminous, flattened ammonoids, resembles base of north section.....	25
7. Limestone, massive, black, fine-grained, very bituminous, weathers light blue and slaty.....	20
6. Shale, papery, black, very bituminous, almost "oil soaked" concretions, large ammonoid, and small concretions	115
5. Concealed, probably shale	25
4. Limestone, composed of ground fossils and large Fusulina, and siliceous or cherty material, locally very bituminous, upper 5 feet more platy than the rest	13
3. Shales, papery, black, very bituminous, fossiliferous, large concretions and smaller concretions	27
2. Concealed	10
1. Limestone, fault breccia, nearly vertical. Talus slope from there to the flat below. Thickness.....	15±

It will be seen from the sections (Plate I), that, so far as our present discussion is concerned, the Delaware Mountain formation falls readily into four parts. First (beginning below); at the bottom black, bituminous, shales and limestone. Second; the thick, yellowish sandstones with rather distant shale partings. Third, the brownish, rather bituminous shales with limestones and some sandstones.

Fourth; very thick sandstones alternating with less thick limestones, and rather hard shales.

There is relatively little change in the thickness and appearance of the black shales and limestone, referred to by some geologists as "oil shale." However there is a very marked change in the thickness of the yellow sandstones which follow it, amounting to 550 feet, in a distance of not far from five or six miles. This appears to be due in part to the setting in or thickening up of shaly beds in the upper part of the section as one goes south. It may possibly be accounted for to some extent by faulting in the north section, though this is by no means all of it.

While the heavy sandstones are much thicker in the northern than in the southern section, the added thickness of the overlying shaly and limestone beds in the southern section more than counterbalance the reduction in thickness in the underlying sandstones which amounts to 720 feet. The thickness of the higher beds in the two sections varies but little.

Another point of interest is the fact that in some of the beds there is a tendency for the limestones to set in as one goes east. This is not so marked, perhaps as might be expected, yet there is evidence of it locally. Together with this is found a tendency for the shales to thicken in the same direction. This is particularly true in a south or east of south direction. Moreover these shales are sometimes fifty or more feet thick and bituminous, and frequently they are associated with large sandstone beds or lenses.

There are reasons for supposing that something of the same kind occurs in the yellow sandstone beds below as well. If this is actually the case it would reduce the large thickness of the basal bed of sandstone below the first shale of considerable thickness and increase the thickness of the shales over and in it until the sand might become a fair container for oil from the underlying very bituminous shales and limestones.

It will be seen from the sections that the top of these so-called "oil shales" should be reached on block 46 at a depth of about 3400 feet and the base at an uncertain depth,

four hundred or more feet, below that. The 3400 foot depth would be the best chance for oil unless there should be a good sandstone below the limestone and shales. This is not known to be the case in this latitude in the Delaware mountain region. The diamond drill at Guadalupe Point revealed no such sand.

The opportunity of possibly getting oil in the higher shales is not to be overlooked. It may be important.

STRUCTURE

The structure of this region is quite as remarkable as its stratigraphy. The Delaware escarpment is to a considerable extent a fault scarp, and is highly elevated. Nevertheless there is but very slight amount of folding to be noted. There are changes of dip which are easily noticeable locally, but on the whole the main structural features of the western part of the area are faults of relatively little displacement. They are usually nearly vertical and, near the escarpment, are parallel to it and open at the surface, the interior being filled apparently by crystallization of calcareous material infiltrated from the sides at shallow depths. They are probably closed a short distance below. One of these was seen in a ravine which formed a vertical wall that was from three to six feet thick and stood nearly fifteen feet high. Farther east the faults are closed and usually show drag. They become very inconspicuous as the University block is approached and are noticeable only on the scarp east of the Carlsbad road. Here they are very small and form lines along which replacement of limestone with gypsum has taken place. These faults, though quite small may be of importance in locating wells.

There are very few folds of any great consequence in this whole region. It is doubtful if there is an actual closure between the D. Ranch road and the Carlsbad road on the University block. However, terraces do occur as is the case shown on the map of the University block, in section 28. The significance of these terraces will be apparent

when it is stated that the dips vary from a hundred to four hundred feet to the mile. So far as determined the dips on that part of the University block which is not covered by gypsum deposits are shown on the map. No attempt was made to determine the structure in the gypsum area, since that is impossible.

From a structural standpoint there are possibilities of the accumulation of oil beneath University block 46. It deserves a thorough test.