

The id
that occ
District.
carbonac
below the

The gr
on the w
or "shells
frequentl
below the

Below
This rock
toward t
the striki
sand pun

The to
to establ
Traverse
drilling i
is shown
between
constant

The mc
time hav
a gray to
shows a c
the top a
erse lime
ture.

Since r
stones in
between
thin decic
strata in
termining
only pres
dolomitic
drilling t
ness limit

The fir
Lane and
tion was
Lake, an
These res
Since the
evidently
drilling p

Dry ho
tions and
southwes
are that
Points of

amount of closure can not be determined. Production in the Traverse has been limited so far within the 970 foot contour, but just recently a well which was dry in the Traverse obtained a large gas flow at 2045 feet. This gas is probably coming from the upper Monroe and demonstrates the possibility of shifting structure at depth below an unconformity to extend the immediate productive area. A progress structure map drawn on the red horizon of the Coldwater is shown in Fig. 15, and one drawn on the top of the Traverse is shown in Figure 16.

Deeper drilling is forecasted by the results of the A. & O. Becker No. 1 Well of the Dixie Oil Company which found the gas about 300 feet below the present pay horizon. Since the finding of a true sandstone in the top of the Niagaran near Walhalla, Mason County, considerable possibilities offer themselves in this formation. The top of the Niagaran or Guelph should be expected between 2900 and 3000 feet, although accurate depths to this formation will depend on the thickness of Salina of which no data is available. The salt beds of the Salina entirely disappear between Ludington and Manistee. If these figures prove to be nearly correct, then the Trenton should be found between 3800 and 3900 feet, which is well within the reach of the drill.

EGELSTON TOWNSHIP

The location for the first remote wildcat well in Muskegon County was made in Section 24, Egelston Township, and will be known as the Cochran-Langeschulte No. 1. Drilling is being carried on by A. S. Cochran of Cleveland, Ohio, and a standard rig is being used. Other parties associated in the venture are Kuntz-Hulse, Inc., Lakewood, Ohio; Arthur F. Shaw, Gerald J. Wagner, and Robert Johnson of Grand Rapids, Michigan, and H. J. Langeschulte of Barrington, Ill.

MANISTEE COUNTY.

Since the drilling of the unsuccessful well by the Manistee Oil and Gas Company in 1923, citizens have not lost sight of the possibilities of the region. Several years ago a group of leases were taken and plans were laid to put down a test on the Basserab farm in Section 9, Stronach Township. The rig was built and is still standing but the well was never drilled. In the summer of 1927, an organization was effected for the future development of an area which was under lease in the vicinity of Stronach. The acreage had been obtained upon the basis of an indicated rise in the rocks between the old Canfield-Wheeler and Stronach wells, which were put down for salt in the early days. Among those interested in the project are H. S. Gray of Saginaw, Chas. A. Phelps of Grand Rapids, Calvin A. Palmer of Detroit, and Gus Kitzinger and Oscar L. Larson of Manistee. Tentative arrangements were made for the raising of \$40,000 in order to commence operations and R. S. Anderson was put in charge.

FILER TOWNSHIP

Ruggles and Rademaker began some drilling near their salt plant during the summer of 1927. Well No. 25 was put down to a depth of over 2000 feet into salt bearing rock. Harry F. Freezner was driller on the job. Well No. 24 was reamed down in preparation for a deep test, which was commenced in February, 1928. According to last reports, drilling was still in progress at over 4600 feet. This is the greatest depth ever penetrated by any well in Michigan.

MANISTEE TOWNSHIP

The well drilled by the Manistee Oil & Gas Company across the river from East Lake Village and northeast of Manistee Lake in Section 6 was allowed to stand until 1925 when the decision was made to drill it deeper. Oscar Davis who is now associated with the Johnson Oil Refining Company, carried on the drilling to a total depth of about 1920 feet. Oil was first encountered at 1905 feet. Although the hole contained about 1700 feet of water, the well showed something over a barrel of oil before it was finally abandoned. The equipment was purchased by the Logan Oil Company for their project in Mason County and the rig was moved off the location.

MASON COUNTY.

Borings for salt at Ludington had shown numerous shows of oil and in the fall of 1927 when the number 7 well of the Morton Salt Co. was opened, considerable quantities of petroleum escaped between the casing. These indications and stories of an opinion formed years ago on the possibilities of the region by Dr. Southley, a geologist from Chicago, who had given it an examination, prompted some local people to lease several thousand acres and commence a well.

LOGAN TOWNSHIP

The Logan Oil Company was organized by A. L. Pratt of Ludington for the drilling of a deep test near the Carrs settlement in Logan township, Mason County. A trust was formed of the parties interested, which included Arthur Adamy and V. W. Montgomery of Reed City, F. J. Campbell of Walhalla, and A. L. Pratt. Clarence Welch of Hart and W. C. Taggart of Big Rapids became involved later in the project and were accordingly appointed as additional trustees. A Standard Rig was purchased at Manistee and drilling was commenced on October 13th, 1927.

The location was on the W. K. Young Bros. ranch along side the Pere Marquette River in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 9, 60 feet north of the road and 260 feet east of the road. John Love was the first driller on the well to depth of 1970 feet. The first rock was encountered at 280 feet in the Lower Marshall formation, and water was present from 370 to 440 feet.

The top of the Traverse formation was found at 1840 feet, and salt water was tapped from 1880 to 1910 feet. Oil and gas occurred from 1950 to 1971 feet, but because of the hole full of water, accurate determinations could not be made of the quantity of this finding. A test of the oil showed the gravity to be about 37.5° Be. and the quality was good. The decision was made to case off the water and go on with operations. Ray Drum of Lancaster, Ohio, who had previously been tool-dresser on the job, was made driller and continued so to the completion of the well. More water was obtained at 2035, 2185 and 2292 feet and gas was present at 2285 feet. The first salt occurred at 2736 feet and the top of the Guelph formation was penetrated at 3245 feet. Gas was tapped in a white sandstone and white porous dolomite at 3256 feet. The flow was gauged at about 143,000 cubic feet several days after the well was drilled in. Oil was found from 3260 to 3262 feet and although the quantity

was small, the quality was exceptionally high grade, testing about 53° Be. After continuing the drilling to 3301 feet, the well was shot with 100 quarts of nitroglycerin. The gas flow increased to over 1,000,000 cubic feet per day and about one barrel of oil was bailed from the hole.

At the present time the rig has been moved to a new location about 1500 feet northeast of the first well which has been tubed for production of the gas. This fuel is to be used for steaming the boilers during the drilling of the new hole.

NEWAYGO COUNTY.

Only one attempt at deep drilling has been made recently in Newaygo County, but since the Muskegon Field was opened, leasing operations have been very active. O. E. Atwood and associates of Fremont, Michigan, leased a large block of land in the southern part of the county, and negotiations are now under way for the drilling of a test well. Numerous other operators are interested in the development of this territory and several tests will probably be put down in the near future.

BARTON TOWNSHIP

The Ichenberg family with some people from Reed City, Michigan, started to put down a well on their Grass Lake Ranch in the northeast corner of Newaygo County. The location was in the SW $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 7 and about 300 feet back from the road. Harold G. Smith contracted for the well and S. J. Sanford of Reed City was in charge of the drilling. The outfit was not suitable for such a deep test and in the winter of 1927 operations were closed down at 370 feet without having reached bed rock. Plans are now under way to move in a Standard Rig and continue further drilling in order that the territory may be thoroughly tested.

OCEANA COUNTY.

Because Oceana County immediately adjoins Muskegon County on the north several companies and private parties have leased large blocks of land in this vicinity. The Muskegon Oil Corporation, the Pure Oil Company, and the Johnson Oil Refining Company have all obtained large blocks of acreage in various parts of the county. Edward DuVall of Blue Island, Illinois, is about to commence drilling in Golden Township, T. 15 N., R. 19 W. The location is to be in the northeast corner of the SE $\frac{1}{4}$ of the NE $\frac{1}{4}$ of Section 36, and southwest of Silver Lake.

OTTAWA COUNTY.

The discovery of oil in Muskegon County caused considerable leasing activity in the county to the south. The Ottawa Development Company was formed at Holland and the North Ottawa Oil Company was organized at Spring Lake for testing out the possibilities. Other syndicates, local parties, and major companies also entered the area with expectations of development.

HOLLAND TOWNSHIP

The second well is being commenced near Waverly by the Ottawa Development Company, and drilling has now reached a depth of about 300 feet. C. L. Bullock is also the contractor on this well.

OLIVE TOWNSHIP

The Ottawa Development Company which was organized at Holland with J. C. Ridenour as president, drilled in the spring of 1928 on the Fred E. Stone farm in the SE¹/₄ of the NW¹/₄ of Section 3, 200 feet from the south line and 200 feet from the west line. C. L. Bullock contracted for the drilling which was carried on with a portable outfit.

The top of the Traverse formation was found at 1581 feet and water occurred at 1780 feet. Drilling proceeded to a total depth of 1900 feet where the well was plugged and abandoned with no significant shows of oil or gas.

OIL AND GAS DEVELOPMENT

MUSKEGON COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. |
|-----------|------|-----------|--------------|-----------------------------------|-----------------------------|-------|--------|-----------|--------|----------------------|
| S.E./N.E. | 28 | 10N.-16W. | Muskegon.... | Eastgate Ave. and G. R. Road..... | Muskegon Oil Corp..... | 635 | 250 | ..... | ..... | 1,710 (Pay-1,658) |
| N.W./N.W. | 9 | 10N.-16W. | Muskegon.... | Chas. Reeths..... | Muskegon Oil Corp..... | 629 | 233 | ..... | 1,180 | 1,570 (Pay-1,662) |
| N.W./N.W. | 9 | 10N.-16W. | Muskegon.... | Fred Figge..... | Muskegon Oil Corp..... | 627 | ..... | ..... | 1,192 | 1,572 |
| S.W./N.W. | 3 | 10N.-16W. | Muskegon.... | Grace Cihak..... | Johnson Oil Ref. Co..... | 647 | 267 | ..... | 1,312 | 1,687 (Pay 1,731) |
| N.E.-S.W. | 4 | 10N.-16W. | Muskegon.... | A. Becker..... | Citizens' Pet. Co..... | 634 | ..... | ..... | 1,223 | 1,615 (Pay Gas) |
| S.E./N.W. | 9 | 10N.-16W. | Muskegon.... | M. Figge..... | Maire-Caswell..... | 586 | 199 | ..... | 1,140 | 1,535 |
| N.E./S.W. | 3 | 10N.-16W. | Muskegon.... | Chas. W. Smith..... | Bowers-O'Keefe..... | 643 | 245 | ..... | 1,315 | 1,695 (Pay 1,678) |
| N.E./N.W. | 17 | 10N.-16W. | Muskegon.... | Torrent Estate..... | Bankers Trust Co..... | 584 | 230 | ..... | 1,024 | 1,595 |
| S.E./S.E. | 5 | 10N.-16W. | Muskegon.... | Harley Smith..... | Johnson Oil Refin. Co..... | 634 | ..... | ..... | 1,198 | 1,588 |
| S.W./S.E. | 7 | 10N.-16W. | Muskegon.... | Jno. C. Marquart..... | R. H. Hill, et al..... | 585 | 213 | ..... | 1,165 | 1,572 |
| S.E./S.E. | 6 | 10N.-16W. | Muskegon.... | Chas. Giles..... | Bulldog Oil & Gas Co..... | 599 | 213 | ..... | 1,180 | 1,539 |
| S.E./N.W. | 5 | 10N.-16W. | Muskegon.... | Jas. Dow..... | Lakeshore Pet. Co..... | 633 | ..... | ..... | 1,202 | 1,596 |
| S.E./N.W. | 8 | 10N.-16W. | Muskegon.... | Jno. B. Nichols..... | Joliet Morris Dev. Co..... | 632 | 251 | ..... | 1,185 | 1,574 |
| S.W./N.W. | 9 | 10N.-16W. | Muskegon.... | Chas. Reeths..... | Dixie Oil Co..... | 582 | 215 | ..... | ..... | 1,520 |
| S.E./S.E. | 5 | 10N.-16W. | Muskegon.... | F. Figge..... | A. S. Cochran, et al..... | 589 | ..... | ..... | 1,155 | 1,526 |
| N.E./N.E. | 8 | 10N.-16W. | Muskegon.... | A. R. Taggart..... | Muskegon Oil Corp..... | 635 | 242 | ..... | 1,200 | 1,590 |
| N.W./N.W. | 8 | 10N.-16W. | Muskegon.... | H. C. Heinz..... | Wolverine Min. Dev. Co..... | 633 | ..... | ..... | ..... | 1,596 |
| N.E./N.W. | 9 | 10N.-16W. | Muskegon.... | Geo. H. Shoup..... | Muskegon Dev. Co..... | 591 | 226 | ..... | ..... | 1,540 |
| S.W./S.E. | 8 | 10N.-16W. | Muskegon.... | H. Hartman..... | Muskegon Oil Corp..... | 585 | 188 | ..... | ..... | 1,535 |
| N.E./N.E. | 8 | 10N.-16W. | Muskegon.... | Albert Heinz..... | Muskegon Oil Corp..... | 632 | 240 | ..... | ..... | 1,564 |
| N.W./N.E. | 8 | 10N.-16W. | Muskegon.... | Fred Figge B-1..... | Dixie Oil Co..... | 632 | ..... | ..... | ..... | 1,666 (Pay 1,666) |
| S.W./S.E. | 8 | 10N.-16W. | Muskegon.... | Geo. Workman..... | Glenn Porter—Trustee..... | ..... | 249 | ..... | ..... | 1,580 |
| S.W./N.E. | 8 | 10N.-16W. | Muskegon.... | Garrett Kooi..... | Joliet Morris Dev. Co..... | 632 | ..... | ..... | ..... | ..... |
| S.E./S.W. | 4 | 10N.-16W. | Muskegon.... | A. & O. Becker..... | Dixie Oil Co..... | 635 | ..... | ..... | ..... | ..... |
| S.W./S.W. | 4 | 10N.-16W. | Muskegon.... | Peck & Anderson..... | Wa-Je-sel Oil Co..... | 635 | ..... | ..... | ..... | ..... |
| S.W./N.E. | 24 | 10N.-15W. | Egelston.... | H. J. Langeschulte..... | Kundtz-Hulse..... | 660 | 350 | ..... | 1,210 | 1,880 |

MASON COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. |
|-----------|------|-----------|------------|------------------|------------------------|-------|--------|-----------|--------|-----------|
| S.E./S.W. | 9 | 17N.-15W. | Logan..... | W. K. Young..... | Logan Oil Company..... | 665 | 280 | ..... | ..... | 1,840 |

NEWAYGO COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. |
|-----------|------|-----------|-------------|----------------|-----------------------|-------|--------|-----------|--------|-----------|
| S.W./N.W. | 7 | 16N.-11W. | Barton..... | Ichenberg..... | Ichenberg, et al..... | 1,020 | | | | |

OCEANA COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. |
|-----------|------|-----------|-------------|----------------------|-----------------|-------|--------|-----------|--------|-----------|
| S.E./N.E. | 36 | 15N.-19W. | Golden..... | Carrie E. Mears..... | Ed. Duvall..... | 595 | | | | |

OTTAWA COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. |
|-------------------------|---------|----------------------|----------------------------|---------------------------------------|--|------------|-----------|-----------|--------|-----------|
| S.E./N.W. Lot 2/S.E. | 3 21 | 6N.-15W. 5N.-15W. | Olive..... Holland..... | Fred E. Stone..... H. Vreling..... | Ottawa Dev. Co..... Ottawa Dev. Co..... | 615 605 | 280 37 | | | 1,581 |

TYPICAL WELL RECORDS
FROM
WESTERN MICHIGAN

MUSKEGON (MUSKEGON COUNTY)

CITIZENS PETROLEUM CO.—A. & O. BECKER, No. 1

Location. N. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Sec. 4 T. 10 N.—R. 16 W., Muskegon Township on A. & O. Becker property located 330 feet north of south line and 330 feet west of east line.

Elevation: 634 feet above sea level.

Drilled in 1928 by the Gray Drilling Co., Milwaukee, Wis. Record compiled from driller's log and samples by R. B. Newcombe.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Drift..... | 253 | 253 |
| Mississippian: | | |
| Lower Marshall Formation: | | |
| From casing record..... | 100 | 353 |
| Coldwater Formation: | | |
| Blue shale (no record)..... | 267 | 620 |
| Gray sandy and shaly limestone..... | 20 | 640 |
| Hard blue-gray shale (sandy and pyritiferous)..... | 20 | 660 |
| Blue-gray shale (fairly hard)..... | 85 | 745 |
| Blue-gray shale (softer and breaks into large chips)..... | 75 | 830 |
| Blue-gray shale (chips large just above red limestone)..... | 52 | 882 |
| Light red to pink limestone (some greenish streaks)..... | 28 | 910 |
| Greenish-blue shale (soft)..... | 30 | 940 |
| Gray micaceous sandy shale..... | 10 | 950 |
| Bedford Formation (probably Berea in part): | | |
| Gray to greenish-gray shale..... | 20 | 970 |
| Hard gray shale (somewhat micaceous)..... | 10 | 980 |
| Gray shale (soft to hard)..... | 40 | 1,020 |
| Darker gray to greenish gray shale..... | 50 | 1,070 |
| Blue-gray shale..... | 40 | 1,110 |
| Gray to greenish gray shale..... | 90 | 1,200 |
| Greenish gray shale (soft and hard)..... | 20 | 1,220 |
| Gray micaceous sandy shale with iron stain (Berea shell reported 1,223-1,224)..... | 10 | 1,230 |
| Hard gray to greenish-gray shale..... | 70 | 1,300 |
| Soft gray shale..... | 10 | 1,310 |
| Gray to grayish-green shale (hard)..... | 150 | 1,460 |
| Gray to brownish-gray shale with some pyrite (Antrim?)..... | 30 | 1,490 |
| Devonian: | | |
| Antrim Formation: | | |
| Black to brownish black bituminous shale with pyrite..... | 135 | 1,625 |
| Black to dark gray shale with some streaks of limestone and pyrite (probably partly Traverse)..... | 15 | 1,640 |
| Traverse and Dundee Formations (undivided): | | |
| Gray limestone with pyrite and fossiliferous calcareous shale..... | 25 | 1,665 |
| Gray calcareous fossiliferous shale (breaks up coarser)..... | 15 | 1,680 |
| Gray to buff limestone with crystalline pyrite..... | 22 | 1,702 |
| Light to dark buff limestone that drills fine..... | 29 | 1,731 |
| Light buff limestone (somewhat crystalline and with pyrite) show of oil 1731-1734..... | 9 | 1,740 |
| Darker buff limestone (some white and crystalline)..... | 10 | 1,750 |
| Limestone..... | 15 | 1,765 |
| Gray and white limestone ("salt and pepper")..... | 10 | 1,775 |
| Brown limestone..... | 25 | 1,800 |
| Black limestone..... | 15 | 1,815 |
| Gray speckled limestone..... | 85 | 1,900 |
| Brown limestone..... | 10 | 1,910 |
| Limestone (show of oil)..... | 5 | 1,915 |
| Dark gray to buff fossiliferous limestone..... | 15 | 1,930 |
| Dark buff limestone (granular and porous) should oil from 1,925-1,935..... | 10 | 1,940 |
| Dark gray to variegated buff limestone..... | 5 | 1,945 |
| Dark buff granular limestone (drills fine)..... | 5 | 1,950 |
| Dark gray to buff limestone (bituminous and porous)..... | 20 | 1,970 |
| Buff to white limestone (water reported 1950-1975)..... | 5 | 1,975 |
| Brownish buff bituminous limestone..... | 5 | 1,980 |
| Buff limestone (drills fine)..... | 10 | 1,990 |
| Brownish-buff limestone with some white specks (Monroe?)..... | 10 | 2,000 |
| Brownish-buff limestone (iron stained and drills very fine)..... | 5 | 2,005 |
| Buff limestone..... | 5 | 2,010 |
| Brownish crystalline limestone iron stained and dolomitic..... | 10 | 2,020 |
| Brown dolomite (drills very fine)..... | 5 | 2,025 |
| Dark gray limestone..... | 5 | 2,030 |
| Very fine grained buff dolomite (water sand reported from 1,975 to 2,038)..... | 8 | 2,038 |

Casing Record:
10 inches—253 feet and 7 inches.
8 $\frac{1}{4}$ inches—353 feet and 6 inches.

MUSKEGON (MUSKEGON COUNTY)

DIXIE OIL CO.—C. REETHS, No. 1.

Location: S. W. $\frac{1}{4}$ of N. W. $\frac{1}{4}$ of Sec. 9,—T. 10 N.—R. 16 W on the C. Reeths farm, located 330' from north line of Dixie lease and 250' from east property line.
Elevation: 581.8 feet above sea level
Drilled for the Dixie Oil Co. by Hagan & Hagan, Contractors and completed on April 7, 1928. Record compiled from samples and driller's log by R. B. Newcombe.

| | Thickness feet | Depth feet |
|---|-------------------|---------------|
| No record..... | 215 | 215 |
| Mississippian: | | |
| Lower Marshall Formation: | | |
| Sandstone..... | | |
| No record..... | 5 | 220 |
| Gas at..... | 60 | 280 |
| Coldwater Formation: | | 280 |
| Blue-gray shale..... | | |
| Gray sandy limestone (gas at 535 feet)..... | 240 | 520 |
| Blue-gray shale (several bailers of oil at 635 feet)..... | 50 | 570 |
| Red limestone..... | 220 | 790 |
| Shale..... | 25 | 815 |
| | 25 | 840 |
| Devonian: | | |
| Bedford Formation: | | |
| Greenish-gray shale..... | 130 | 970 |
| Flaggy greenish-gray shale..... | 50 | 1,020 |
| Greenish-gray shale..... | 150 | 1,170 |
| Gray shaly limestone..... | 5 | 1,175 |
| Greenish-gray shale..... | 255 | 1,330 |
| Antrim Formation: | | |
| Greenish-gray to brownish-gray shale..... | 15 | 1,345 |
| Brown shale with pyrite..... | 175 | 1,520 |
| Gray shale (calcareous)..... | 25 | 1,545 |
| Traverse Formation: | | |
| Gray to buff fossiliferous and shaly limestone..... | 32 | 1,577 |
| Gray to buff variegated fossiliferous limestone (breaks in chips and called top of Traverse by drillers)..... | | |
| Buff limestone (drills fine)..... | 5 | 1,582 |
| Gray limestone..... | 1 | 1,583 |
| Lighter buff limestone..... | 3 | 1,586 |
| Light to dark buff crystalline limestone (iron stained)..... | 6 | 1,592 |
| Gray limestone (gas at 1,597)..... | 9 | 1,601 |
| Grayish-buff limestone (drills finer) (big gas at 1,605)..... | 5 | 1,605 |
| Porous limestone (fragments thrown out of well)..... | 5 | 1,610 |
| Light brown oily limestone..... | 2 | 1,612 |
| Oil..... | | at 1,613 |
| Limestone..... | 9 | 1,622 |
| Porous limestone (buff and fine grained at 1,632)..... | 16 | 1,638 |

Production:—4,500,000 cubic feet of gas and about 30 barrels of oil first 24 hours.
Casing Record:— $6\frac{1}{4}$ inch at 1577 feet.

WEST OLIVE (OTTAWA COUNTY)

OTTAWA DEVELOPMENT COMPANY—FRED STONE, No. 1

Location: S. E. $\frac{1}{4}$ of N. W. $\frac{1}{4}$ of Sec. 3, T. 6 N., R. 15 W., Olive Township, on the Fred E. Stone farm located 200 feet from the south line and 200 feet from the west line.
Elevation: Approximately 615 feet above sea level.
Drilled in 1928 by C. L. Bullock for the Ottawa Development Company. Record from samples by R. B. Newcombe.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| No record..... | 195 | 195 |
| Yellow sand..... | 10 | 205 |
| Gray clayey gravel..... | 13 | 218 |
| Gravel..... | 7 | 225 |
| Boulder clay..... | 21 | 246 |
| Sand and fine gravel..... | 17 | 263 |
| Yellow sand..... | 17 | 280 |
| Mississippian: | | |
| Lower Marshall Formation: | | |
| Gray micaceous sandy shale..... | 12 | 292 |
| Coldwater Formation: | | |
| Gray to buff variegated shale, calcareous shale, and limestone (fossiliferous, especially crinoid stems and pyrite). Breaks into large rounded fragments and shows greenish color toward bottom..... | 256 | 548 |
| Light gray sandy shale..... | 80 | 628 |
| Gray calcareous shale..... | 38 | 666 |
| Soft gray shale..... | 19 | 685 |
| Gray calcareous shale..... | 29 | 714 |
| Soft gray fissile shale (some calcareous zones)..... | 118 | 832 |
| Pink to greenish limestone..... | 25 | 857 |
| Gray shale (pyrite and some black streaks (Sunbury)..... | 40 | 897 |
| Bedford Formation (probably Berea in part): | | |
| Gray to greenish gray shale with some pyrite..... | 406 | 1,303 |
| Greenish to dark gray shale (drills into large chips)..... | 52 | 1,355 |
| Devonian: | | |
| Antrim Formation: | | |
| Dark gray shale with some green (drills coarse)..... | 48 | 1,403 |
| Brown pyritiferous shale with some green shale..... | 35 | 1,438 |
| Brown shale (with pyrite)..... | 113 | 1,551 |
| Brown to gray shale with pyrite (calcareous)..... | 22 | 1,573 |
| Blue-gray calcareous shale..... | 8 | 1,581 |
| Traverse and Dundee Formations (Undivided): | | |
| Blue-gray limestone with pyrite and fossils..... | 48 | 1,629 |
| Dark gray limestone and abundant pyrite..... | 9 | 1,638 |
| White and buff limestone..... | 7 | 1,645 |
| Buff limestone (pyrite)..... | 24 | 1,669 |
| Darker buff limestone..... | 7 | 1,676 |
| Light buff limestone..... | 27 | 1,703 |
| Vari-colored gray to buff limestone..... | 18 | 1,721 |
| Blue-gray limestone..... | 7 | 1,728 |
| Dark gray to buff limestone (shale break 1735-1740)..... | 27 | 1,755 |
| Light buff limestone (drills very fine) (water 1,780 pay 1,785)..... | 36 | 1,791 |
| Buff limestone..... | 21 | 1,812 |
| Buff to white limestone..... | 24 | 1,836 |
| Light buff to dark gray limestone that drills fine (with pyrite)..... | 64 | 1,900 |

Casing Record:
14 inches—196 feet.
10 inches—285 feet.
 $8\frac{1}{4}$ inches—857 feet.

NORTHERN LOWER MICHIGAN

The northern part of the Lower Peninsula is a province characterized by thin drift and exposures along the lake shores, thick drift inland, and regional dips with a prominent south component. In passing around the lake shore the formations beneath the drift form belts more or less concentric, and the dip in going across the State from Alcona to Benzie County is successively southwest, south, and southeast. Where the Berea and Antrim formations occur immediately below the unconsolidated material, shallow showings of gas are commonly found around springs and in water wells. The deep tests put down for oil and gas have been largely confined in those counties marginal to the lake where the difficulties of thick surface material are not so great. Activities started around the north part of Saginaw Bay and extended northward. Although private parties entered largely into these "wildcat" operations the lumber companies were instrumental in several of the tests for the purpose of developing their cut-over lands.

ALCONA COUNTY.

HAYNES TOWNSHIP

Charles Lasky of Detroit organized the Alcona Prospecting Company in order to drill a well near Harrisville, Alcona County. The location was made in the northeast corner of the SE $\frac{1}{4}$ of Section 22, on the John Campbell farm, about 175 feet west of the road. Surface deposits occurred to a depth of 316 feet where the black Antrim shale was first encountered. The top of the Traverse was penetrated at 625 feet and the Dundee was first struck at 1335 feet. Oil was present in the Dundee at 1400 feet, and after drilling to 1710 feet the well was shot with 40 quarts of nitroglycerin. The hole filled with water on top of which floated about 20 feet of oil. Plugging and abandonment followed in the fall of 1927.

ALPENA COUNTY.

ALPENA TOWNSHIP

Wm. Bradley of Saginaw and several associates of Alpena commenced to drill in November, 1927, on the Fred N. Potter property west of the city. The well was located in the SE $\frac{1}{4}$ of the SE $\frac{1}{4}$ of Section 20, 200 feet from the north line and 100 feet from the east line. Drilling progressed to a depth of 125 feet where operations were shut down for the winter.

ARENAC COUNTY

CLAYTON TOWNSHIP

V. M. Voorhees of Saginaw and W. J. Sovereign of Bay City drilled in the SE $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 33 on the P. J. Gilbert estate. This location was about 5 miles northeast of Sterling, 300 feet north of the road and 450 feet west of the center line of Section 33. The well was spudded in on September 15, 1927, and the Berea was reached at a depth of 1640 feet with no significant shows of oil and gas. Water was tapped in the Berea formation at 1693 feet. The top of the Traverse formation occurred at 2114 feet and at 2119 feet brine came in with sufficient pressure to flow over the top of the casing. An analysis of this brine showed the following constituents:

| Chemical Analysis | Parts Per Million |
|--------------------------------------|-------------------|
| Sodium | 81,650 |
| Potassium | 16,700 |
| Lithium | 7 |
| Solids, total | 324,940 |
| Solids, dissolved | 318,253 |
| Solids, suspended | None |
| SiO ₂ (Silica) | None |
| Fe | 5.0 |
| Ca | 20,050 |
| Mg | 5,960 |
| Cl | 193,500 |
| So ₄ | 37. |
| HCO ₃ (Bicarbonate) | 14. |
| Co ₃ (Carbonate) | None |
| Iodine p. p. b. | 204 |
| Bromine | 180 |

Drilling was carried on to 2122 feet, where the well was plugged and abandoned on Dec. 3, 1927.

CHARLEVOIX COUNTY.

Attention has been frequently directed to the oil and gas possibilities of Charlevoix County because of suggestions of a fold from outcrop observations along the south shore of Little Traverse Bay. The structure indicated is small and the evidence for its presence is indefinite because the tracing of beds along the bay is based only upon lithologic characteristics of the limestones. Coral reef formation in the Traverse limestone often gives rise to sharp dip pseudo-structures which are local and do not carry down into the deeper rocks. One deep test was drilled during 1927 for the purpose of proving up this structure, and shallow wells are now being put down through the Antrim shale to more exactly determine its trend.

EVANGELINE TOWNSHIP

L. L. Linton and F. D. Barton acquired leases on a block of land in the vicinity of Boyne City and made arrangements with J. B. Reed for the drilling of a well. The concern was known as the Northwestern Michigan Development Company and the well was located in the SE $\frac{1}{4}$ of the NW $\frac{1}{4}$ of Section 16, 330 feet north of the center of the section and 200 feet west of the center of the section. The top of the Traverse occurred at 127 feet and a copious flow of water was tapped at a depth of 200 feet. The Dundee was found at 810 feet and drilling continued to 820 feet with no significant showings. Operations during the winter were suspended and the well was temporarily abandoned.

CRAWFORD COUNTY.

The Grayling Development Company was organized in July, 1926, for drilling and prospecting for oil and gas in Crawford and Roscommon Counties. This concern which was intimately connected with the Hanson Lumbering Company of Grayling had as its officers; Henry A. Bauman, Grayling, president; George L. Burrows, Saginaw, vice president; John Bruun, Grayling, secretary, and Marius Hanson, Grayling, treasurer. The original capitalization was \$50,000 and plans were laid to carry on an active drilling campaign in the north central part of the State on lands owned or acquired through leasehold by the company.

FREDERIC TOWNSHIP

The first well drilled by the Grayling Development Company was commenced near the town of Frederic on May 14, 1927. B. C. Calkins of Saginaw was contractor and a Standard Wood Rig was used. The location which was situated on a high hill, was in the northeast corner of the NW¼ of Section 34. After experiencing considerable difficulty, rock was first struck at a depth of 592 feet. Water was found in the Upper Marshall formation at 625 feet and some oil and water in the Lower Marshall formation at 722 feet. An equivalent horizon to the Berea was reached at a depth of 1598 feet, and the Traverse was present at 2287 feet. Some gas which burned up 2 feet high for about ½ minute was encountered at 2398 feet. The Dundee was penetrated at 2951 feet and drilling was continued to a total depth of 2973 feet. Plugging and abandonment was finished on May 31st, 1928.

IOSCO COUNTY.

TAWAS TOWNSHIP

The Iosco Oil Company was formed for the purpose of prospecting or drilling a test well in the vicinity of East Tawas, Iosco County. Originators of the Company included Charles Coryell and Chas. A. Coryell of Bay City and Henry K. McHarg, Jr., Herman N. Butler, and Lloyd G. McKay of East Tawas. The contract for drilling the well was given to George Talbot of Saginaw who commenced operations in February, 1927.

The location was on the Emery Brothers property in Block No. 72, Oakes Street, SW¼ of the SW¼ of Section 21, 300 feet from the west line fence and 200 feet north of the road. The Marshall was penetrated immediately below the surface deposits and the Berea occurred at 1523 feet. A very strong brine which rose to the surface was found in the Berea at 1578 feet. The top of the Traverse formation was encountered at 2095 feet and the Dundee formation at 3000 feet. Water in the Dundee was tapped at 3010 feet and the well was plugged and abandoned.

ROSCOMMON COUNTY.

The second test of the Grayling Development Company was made southeast of Grayling in the northeast corner of Roscommon County. Locations for this well and the first hole near Frederic were both made by Mr. Reber who had gained so much fame and prestige in the Saginaw field. Results were in no way encouraging for oil and gas production, but a very complete record was kept.

HIGGINS TOWNSHIP

George Talbot, contractor, commenced drilling the Grayling Development Company well No. 2 on August 27, 1927. The location was on State land in the NW¼ of the SW¼ of Section 2 about ½ mile south of the highway. The Marshall was found at 530 feet and the probable Berea horizon at 1737 feet. Water was present in the Antrim shale at 2146 feet. The top of the Traverse occurred at 2336 feet and the top of the Dundee at 3070 feet. A strong flow of brine was tapped in the top of the Dundee formation. The first salt was penetrated at 3575 feet and drilling was continued to a total depth of 3730 feet. Plugging and abandonment was completed on May 31st, 1928.

ALCONA COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelph. | Trenton. |
|-----------|------|--------|-----------|---------------|----------------------|-------|--------|-----------|--------|-------|-------|-------|-------|-------|---------|----------|
| N.E./N.E. | 22 | 27N-9E | Haynes | Jno. Campbell | Alcona Prospect. Co. | 740 | 316 | | | 625 | 1,835 | 1,550 | | | | |

ALPENA COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelph. | Trenton. |
|-----------|------|--------|-----------|-----------------|---------------------------|-------|--------|-----------|--------|-------|------|------|-------|-------|---------|----------|
| S.E./S.E. | 20 | 31N-3E | Alpena | Fred. N. Potter | Wm. Bradley Oil & Gas Co. | | 22 | | | | | | | | | |

ARENAC COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelph. | Trenton. |
|-----------|------|--------|-----------|---------------|---------------------|-------|--------|-----------|--------|-------|------|------|-------|-------|---------|----------|
| E./S.W | 33 | 20N-4E | Clayton | P. J. Gilbert | Voorhes & Sovereign | 761 | 161 | 330 | 1,640 | 2,114 | | | | | | |

CHARLEVOIX COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelph. | Trenton. |
|-----------|------|--------|------------|----------------|----------------------|-------|--------|-----------|--------|-------|------|------|-------|-------|---------|----------|
| S.E./N.W. | 16 | 33N-6W | Evangeline | J. M. Stutzman | N. W. Mich. Dev. Co. | 640 | 107 | | | 127 | 810 | | | | | |

CRAWFORD COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Mar-shall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelp. | Trenton. |
|-----------|------|--------|-----------|------------------------|-----------------------|-------|--------|----------------|------------------|-------|-------|------|-------|-------|--------|----------|
| S.W. ¼ | 34 | 28N-4W | Frederick | Hanson Lumbering Co... | Graying Devel. Co.... | 1,330 | 592 | 625 not top | Horizon 1,598 | 2,225 | 2,951 | | | | | |

IOSCO COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Mar-shall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelp. | Trenton. |
|-----------|------|--------|-----------|-----------------|-------------------|-------|--------|------------|--------|-------|-------|------|-------|-------|--------|----------|
| S.W./S.W. | 21 | 22N-8E | Tawas | Emery Bros..... | Iosco Oil Co..... | 592 | 55 | | 1,523 | 2,095 | 3,000 | | | | | |

ROSCOMMON COUNTY.

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Mar-shall. | Berea. | Trav. | Dun. | Mon. | Sylv. | Salt. | Guelp. | Trenton. |
|-----------|------|--------|-----------|-----------------|----------------------|-------|--------|------------|--------|-------|-------|-------|-------|-------|--------|----------|
| N.W./S.W. | 2 | 24N-2W | Higgins | State Land..... | Graying Dev. Co..... | 1,158 | 450 | 530 | 1,737 | 2,336 | 3,070 | 3,300 | | | | |

TYPICAL WELL RECORDS
FROM
NORTHERN LOWER MICHIGAN

STERLING (ARENAC COUNTY).

VOORHEES & SOVEREIGN—P. GILBERT NO. 1.

Location: S. E. $\frac{1}{4}$ of the S. W. $\frac{1}{4}$ of Section 33, T. 20 N., R. 4 E., on the P. Gilbert estate, 300 feet north road and 450 feet west of center line of Sec. 33.
 Elevation: 761 (Approximate with aneroid).
 Drilled in 1927 by V. M. Voorhees, Contractor, of Saginaw, for W. J. Sovereign of Bay City. Record compiled from driller's log by R. B. Newcombe.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Sand and gravel | 161 | 161 |
| Mississippian: | | |
| Michigan Formation: | | |
| Blue mud | 89 | 250 |
| White mud | 50 | 300 |
| Gray lime | 26 | 326 |
| Blue mud | 4 | 330 |
| Napoleon (Upper Marshall) Formation: | | |
| Sandstone | 115 | 455 |
| Lower Marshall Formation: | | |
| Hard gray shale | 45 | 500 |
| Red shale | 30 | 530 |
| Blue mud | 18 | 548 |
| Red shale | 3 | 551 |
| Hard Gray shale | 114 | 665 |
| Sandy shell | 25 | 690 |
| Coldwater Formation: | | |
| Soft shale | 50 | 740 |
| Hard shale (Blue mud from 815-978) | 680 | 1,420 |
| Red rock | 6 | 1,426 |
| Hard blue shale | 184 | 1,610 |
| Sunbury Formation: | | |
| Shale | 30 | 1,640 |
| Berea Formation: | | |
| Sandstone (water at 1,693) | 78 | 1,718 |
| Devonian: | | |
| Bedford Formation: | | |
| Hard blue shale | 62 | 1,780 |
| Antrim Formation: | | |
| Brown shale | 334 | 2,114 |
| Traverse Formation: | | |
| Limestone (heavy flow of brine at 2,119) | 8 | 2,122 |

Casing Record: 10 in.—161 ft.
 8 $\frac{1}{4}$ in.—740 ft.
 6 5-8 in.—1,747 ft.

MINERAL RESOURCES OF MICHIGAN

HARRISVILLE (ALCONA COUNTY).

ALCONA PROSPECTING CO., —JOHN CAMPBELL NO. 1.

Location: About five miles northwest of Harrisville in Haynes township. In the N. E. corner of the S. E. $\frac{1}{4}$ of section 22, T. 27 N., R. 9 E., on the John Campbell property, 175 feet west of road.
Elevation: 740 feet above sea level (approx.)
Well drilled in 1927.

| | Thickness feet | Depth feet |
|---|-------------------|---------------|
| Pleistocene: | | |
| Surface deposits (Found rotten log at 280 feet) | 316 | 316 |
| Devonian: | | |
| Antrim Formation: | | |
| Black shale | 284 | 600 |
| Blue calcareous shale | 25 | 625 |
| Traverse Formation: | | |
| Gray limestone | 78 | 703 |
| Brown limestone | 2 | 705 |
| Gray limestone | 4 | 709 |
| Brownish cherty limestone | 14 | 723 |
| Dark gray limestone | 22 | 745 |
| Light gray limestone | 20 | 765 |
| Gray limestone | 136 | 901 |
| Brownish gray limestone (some chert) | 89 | 990 |
| Gray limestone | 68 | 1,058 |
| Brownish limestone (gypsum) | 37 | 1,095 |
| Gray limestone | 210 | 1,305 |
| Bell Formation: | | |
| Blue shale | 30 | 1,335 |
| Dundee Formation: | | |
| Gray limestone | 65 | 1,400 |
| Dark brown limestone (show of oil reported) | 5 | 1,405 |
| Gray to light buff limestone | 125 | 1,530 |
| Light gray pure limestone | 10 | 1,540 |
| Light buff limestone | 10 | 1,550 |
| Gray to buff limestone | 5 | 1,555 |
| Light buff limestone; full of black specks | 15 | 1,570 |
| Buff limestone | 25 | 1,595 |
| Gray to buff limestone | 58 | 1,653 |
| No record | 47 | 1,700 |
| Upper Monroe Formation: | | |
| Limestone and dolomite | 10 | 1,710 |
| After shot with 40 qts. hole filled with water and 20 ft. of oil. | | |

Casing Record: 10 in.—350 ft.
8 $\frac{1}{2}$ in.—650 ft.
6 5-8 in.—1,445 ft.

OIL AND GAS DEVELOPMENT

EAST TAWAS (IOSCO COUNTY).

IOSCO OIL COMPANY WELL NO. 1.

Provisional Record.

Location: Block No. 72 Oakes St. East Tawas, Emery Bros. Addition. SW/SW Sec. 21, T. 22 N. R. 7 E., 300 feet from West line fence, 200 feet north of road.

Elevation: 592+.

Drilled in 1927. Record compiled from samples and log furnished by Henry W. Berger.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Surface deposits | 55 | 55 |
| Mississippian: | | |
| Upper Marshall (Napoleon) Formation: | | |
| White sandstone | 65 | 120 |
| Lower Marshall Formation: | | |
| Red shaly sandstone | 15 | 135 |
| Gray shale (soft) | 32 | 167 |
| Red shaly sandstone | 33 | 200 |
| Red shaly sandstone (small quartz pebbles) | 74 | 274 |
| Gray shale (soft) | 26 | 300 |
| Red shaly sandstone | 56 | 356 |
| Gray shale (soft) | 60 | 416 |
| Red shale | 10 | 426 |
| Gray shale | 29 | 455 |
| Red rock (no sample) | 13 | 468 |
| Gray shale (no sample) | 32 | 500 |
| Red shale | 7 | 507 |
| Coldwater Formation: | | |
| Gray shale (some reddish tinge) (one sample) | 71 | 578 |
| Gray shale | 102 | 680 |
| Sandstone (strong brine) | 205 | 885 |
| Gray shale | 355 | 1,240 |
| Light gray sandy shale | 75 | 1,315 |
| Red and blue shales | 71 | 1,386 |
| Dark gray shale (some light gray sandy shale) | 24 | 1,410 |
| Dark gray shale | 40 | 1,450 |
| Red shale | 10 | 1,460 |
| Dark gray shale | 20 | 1,480 |
| Sunbury Formation: | | |
| Black shale | 43 | 1,523 |
| Berea Formation: | | |
| Gray sandstone (fine grained) | 118 | 1,641 |
| Very strong brine rises to surface. | | |
| Devonian: | | |
| Bedford Formation: | | |
| Light gray shale | 19 | 1,660 |
| Gray shale | 68 | 1,728 |
| Antrim Formation: | | |
| Black shale | 367 | 2,095 |
| "From 1926-1940, blackish shale, containing sand and carbonates of lime, and super-saturated with oil. Some gas also." | | |
| Traverse Formation: | | |
| Buff dolomitic limestone | 10 | 2,105 |
| Gray to buff limestone | 5 | 2,110 |
| Gray shaly limestone | 95 | 2,205 |
| Blue shaly limestone | 20 | 2,225 |
| Light buff limestone | 10 | 2,235 |
| Gray limestone | 25 | 2,260 |
| Dark gray limestone | 115 | 2,375 |
| Gray limestone | 17 | 2,392 |
| Black shaly limestone | 3 | 2,395 |
| Gray limestone | 65 | 2,460 |
| Dark gray limestone | 60 | 2,520 |
| Gray limestone | 37 | 2,557 |
| Light gray limestone | 15 | 2,572 |
| Gray limestone | 258 | 2,830 |
| Bell Formation: | | |
| Blue shale with some light gray limestone (one sample) | 100 | 2,930 |
| No record | 70 | 3,000 |
| Dundee Formation: | | at 3,000 |

Total depth—3,010.
Water in Berea at 1,578.
Water in Dundee at 3,010.
Casing Record: 8 $\frac{1}{2}$ inch—900 ft.
6 5-8 inch—1,660 ft.

MINERAL RESOURCES OF MICHIGAN

BOYNE CITY (CHARLEVOIX COUNTY).

NORTHWESTERN MICHIGAN DEVELOPMENT CO.

J. M. STUTZMAN WELL NO. 1.

Location: S. E. $\frac{1}{4}$ of N. W. $\frac{1}{4}$ of Sec. 16, T. 33 N., R. 6 W., Evangeline Twp., Charlevoix Co. 330 ft. north of center of section and 200 feet west of center of section.
Elevation: 640 feet above sea level.
Drilled in 1927 by J. B. Reed for Barton, et al. (Northwestern Michigan Development Company). Record compiled from samples by R. B. Newcombe.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Drift..... | 107 | 107 |
| Devonian: | | |
| Antrim Formation: | | |
| Black shale..... | | |
| No record to..... | | 141 |
| Traverse Formation: | | |
| Brown limestone..... | 5 | 146 |
| Brown limestone, Sample No. 4..... | | |
| Dark brown oily limestone, Sample No. 5..... | | |
| Gray to buff fossiliferous limestone, samples No. 6, 7, 8..... | | |
| Very light gray limestone, Samples 9, 10..... | | |
| Buff limestone, Samples 11, 12, 13..... | | |
| Brown oily limestone, Sample 15..... | | |
| Soft gray blue shale, Samples 16, 17, 18, 19..... | | |
| Blue to buff limestone, Samples 20, 21..... | | |
| Light gray limestone, Samples 22, 23, 24, 25..... | | |
| Light buff limestone, Samples 26, 27, 28..... | | |
| Blue gray shale, Sample 29..... | | |
| Buff limestone, Sample 30..... | | |
| Blue gray shale, Samples 31, 32..... | | |
| Gray to buff limestone to 395..... | | |
| No record..... | | 450 |
| Dark buff limestone..... | 55 | 460 |
| Buff limestone..... | 10 | 490 |
| Dark buff limestone..... | 30 | 505 |
| Brown limestone..... | 15 | 510 |
| Light gray limestone..... | 5 | 520 |
| Buff limestone..... | 10 | 530 |
| Dark gray limestone..... | 10 | 540 |
| Buff limestone..... | 10 | 550 |
| Dark gray limestone (fossiliferous)..... | 80 | 630 |
| Gray shaly limestone..... | 10 | 640 |
| Buff limestone..... | 5 | 645 |
| No record (possibly Bell shale)..... | 165 | 810 |
| Dundee Formation (?): | | |
| Gray to buff limestone..... | 40 | 850 |
| Dark buff limestone..... | 15 | 865 |
| Large flow of water at 200 ft. | | |
| Dundee reported by driller at 550 ft. | | |

FREDERIC (CRAWFORD COUNTY).

GRAYLING DEVELOPMENT COMPANY WELL NO. 1.

Location: N. E. corner of N. W. $\frac{1}{4}$ of S. W. $\frac{1}{4}$ section 34, T. 28 N., R. 4 W., Frederic Township, Crawford County, on land owned by the Hanson Lumbering Company.
Elevation: 1,330 feet above sea level (approximately).
Drilled in 1927 by B. C. Calkins for the Grayling Development Company. Record by R. B. Newcombe. From partial log from driller and samples,

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Yellowish sand (grains frosted and somewhat faceted). Water at 171 ft..... | 255 | 255 |
| Blue gray clay..... | 45 | 300 |
| Gravel and yellow sand..... | 3 | 303 |
| Gray clay..... | 4 | 307 |
| Yellow sand..... | 83 | 390 |
| Gravel..... | 47 | 437 |
| Sand and gravel..... | 55 | 492 |
| Mud..... | 25 | 517 |
| Yellow sand and boulders..... | 25 | 542 |
| Gravel..... | 20 | 562 |
| Red clay..... | 30 | 592 |
| Mississippian: | | |
| Upper Marshall (Napoleon) Formation: | | |
| Greenish gray sandstone (angular grains, some brown and green)..... | 33 | 625 |
| No record..... | 7 | 632 |
| Fine grained greenish gray sandstone..... | 30 | 662 |
| Lower Marshall Formation: | | |
| Red and gray shale..... | 15 | 677 |
| Light red shale..... | 45 | 722 |
| Red and dark gray shale (sandy and calcareous)..... | 15 | 737 |
| Gray shale..... | 3 | 740 |
| Pink sandy shale..... | 10 | 750 |
| Gray micaceous shale..... | 60 | 810 |
| Pink micaceous sandy shale..... | 10 | 820 |
| Coldwater Formation: | | |
| Light blue gray shale..... | 255 | 1,075 |
| Iron stained gray shale..... | 5 | 1,080 |
| Blue gray shale..... | 430 | 1,510 |
| Red shale..... | 5 | 1,515 |
| Light blue gray shale..... | 23 | 1,538 |
| Hard gray calcareous shale..... | 4 | 1,542 |
| Sunbury (?) Formation: (This may be Bedford, but it is equivalent in position to Sunbury). | | |
| Brown shale..... | 14 | 1,556 |
| Black and gray black shale..... | 42 | 1,598 |
| Bedford Formation: | | |
| Brown shale..... | 75 | 1,673 |
| Greenish gray shale..... | 59 | 1,732 |
| Soft blue gray shale..... | 153 | 1,885 |
| Hard and soft blue gray shale..... | 120 | 2,005 |
| Devonian: | | |
| Antrim Formation: | | |
| Brown shale..... | 12 | 2,017 |
| Brownish gray shale..... | 13 | 2,030 |
| Brown shale..... | 37 | 2,067 |
| Dark brown shale (fossils?)..... | 43 | 2,110 |
| Brownish gray shale..... | 22 | 2,132 |
| Brown shale..... | 33 | 2,165 |
| Dark brown shale..... | 10 | 2,175 |
| Brown shale..... | 50 | 2,225 |
| Traverse (?) Formation: | | |
| Light gray shale..... | 22 | 2,247 |
| Dark brownish gray shale and desiccated salt..... | 18 | 2,265 |
| Gray shale with desiccated salt..... | 22 | 2,287 |
| Light gray shale (highly calcareous)..... | 67 | 2,354 |
| Gray shale and crystalline limestone..... | 6 | 2,360 |
| Brown calcareous shale with disseminated salt..... | 10 | 2,370 |
| Calcareous gray shale..... | 28 | 2,398 |
| Brownish gray calcareous shale with disseminated salt..... | 17 | 2,415 |
| Gray limestone..... | 20 | 2,435 |
| Brownish gray calcareous shale..... | 10 | 2,445 |
| Buff limestone (drills fine)..... | 10 | 2,455 |
| Brownish calcareous shale..... | 13 | 2,468 |
| Light gray limestone and calcareous shale (drills fine)..... | 22 | 2,490 |
| Blue shale..... | 2 | 2,492 |
| Gray limestone (shaly)..... | 146 | 2,638 |
| Darker gray limestone and calcareous shale..... | 62 | 2,700 |
| Dark gray limestone and shale..... | 20 | 2,720 |
| Light gray shale..... | 2 | 2,722 |
| Gray shale (calcareous)..... | 23 | 2,745 |
| Dark brownish calcareous shale..... | 10 | 2,755 |

GRAYLING DEVELOPMENT COMPANY WELL No. 1—Continued

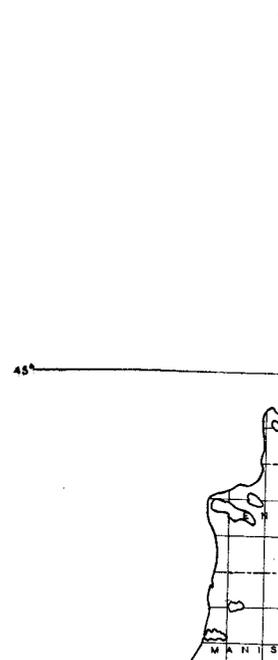
| | Thickness feet | Depth feet |
|---|-------------------|---------------|
| Traverse (?) Formation:—Continued | | |
| Light gray to buff gray calcareous shale and limestone which drills fine..... | 30 | 2,785 |
| Black shale..... | 20 | 2,805 |
| Gray shaly limestone..... | 25 | 2,830 |
| Gray to dark gray shaly limestone..... | 30 | 2,860 |
| Brown bituminous limestone..... | 15 | 2,875 |
| Bell Formation: | | |
| Blue to greenish blue calcareous shale (chips flaky)..... | 76 | 2,951 |
| Dundee Formation: | | |
| No record..... | 16 | 2,967 |
| Ferruginous brown limestone (individual grains buff)..... | 6 | 2,973 |

ROSCOMMON (ROSCOMMON COUNTY).

GRAYLING DEVELOPMENT COMPANY WELL NO. 2.

Location: N. W. $\frac{1}{4}$ of S. W. $\frac{1}{4}$ of Section 2, T. 24 N., R. 2 W., Higgins township, on State land.
Elevation: 1,158 feet above sea level (approximate).
Drilling commenced in August 27, 1927. Talbert, Contractor. Record compiled by R. B. Newcombe from driller's log, samples, and data furnished by John Bruun.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Loose sand and gravel..... | 350 | 350 |
| Mississippian: | | |
| Michigan Formation: | | |
| Gray calcareous sandstone (grains vari-colored)..... | 15 | 365 |
| Gray calcareous shale and fossiliferous limestone (Bayport?)..... | 15 | 380 |
| Blue gray shale and gypsum (selenite)..... | 32 | 412 |
| Blue gray shale and sandstone..... | 118 | 530 |
| Upper Marshall (Napoleon) Formation: | | |
| Sandstone (gray shale sample at 575 ft.)..... | 120 | 650 |
| Lower Marshall formation (Possibly Coldwater in lower part): | | |
| Gray and pink sandy shale with pyrite..... | 250 | 900 |
| Gray and buff fine grained sandstone..... | 60 | 960 |
| Coldwater Formation: | | |
| Blue, gray, and some red shale (hard)..... | 580 | 1,540 |
| Dark gray to black shale (possibly Sunbury in lower part)..... | 50 | 1,590 |
| Devonian: | | |
| Bedford Formation: | | |
| Greenish gray to gray shale..... | 410 | 2,000 |
| Antrim Formation: | | |
| Hard black shale..... | 125 | 2,125 |
| Hard brown shale, some gray and calcareous (water at 2,146)..... | 40 | 2,165 |
| Brown shale..... | 61 | 2,226 |
| Traverse Formation: | | |
| Blue gray shale and buff limestone..... | 64 | 2,290 |
| Brown shale..... | 46 | 2,336 |
| Buff limestone with some pyritiferous blue-gray shale..... | 44 | 2,380 |
| Hard gray limestone..... | 20 | 2,400 |
| Gray to light buff limestone with pyrite (some hard gray shale)..... | 80 | 2,480 |
| Limestone and shelly limestone..... | 12 | 2,492 |
| Buff limestone and hard gray shale (sample grayish buff)..... | 83 | 2,575 |
| Gray to brownish buff limestone..... | 235 | 2,810 |
| Hard dark calcareous shale and gray limestone..... | 37 | 2,847 |
| Dark limestone that drills fine like sand..... | 30 | 2,877 |
| Hard gray shale..... | 64 | 2,941 |
| Buff limestone that drills fine..... | 31 | 2,971 |
| Brown limestone..... | 23 | 2,994 |
| Bell Formation: | | |
| Hard gray shale..... | 75 | 3,070 |
| Dundee Formation: | | |
| Brown limestone (flow of brine)..... | 95 | 3,165 |
| Gray to buff limestone..... | 135 | 3,300 |
| Upper Monroe (Detroit River) Formation: | | |
| Gray to white flaky dolomite. Salt with dolomite at top..... | 150 | 3,450 |
| Sand (probably dolomite that drills up fine) Sylvania?..... | 125 | 3,575 |
| Salt..... | 10 | 3,585 |
| Brown oily dolomite..... | 45 | 3,630 |
| Discolored brownish salt..... | 25 | 3,655 |
| Clear white salt..... | 28 | 3,683 |
| Impure gray salt..... | 11 | 3,694 |
| Buff colored salt..... | 14 | 3,708 |
| Total depth..... | | 3,730 |



and completed on July 1st by the Gray well Drilling Company of Milwaukee, Wisconsin. A. R. Sarver was driller and a complete set of

WILDCAT WELLS DRILLED IN THE SOUTHERN PENINSULA OF MICHIGAN

1924 1925 1926 1927

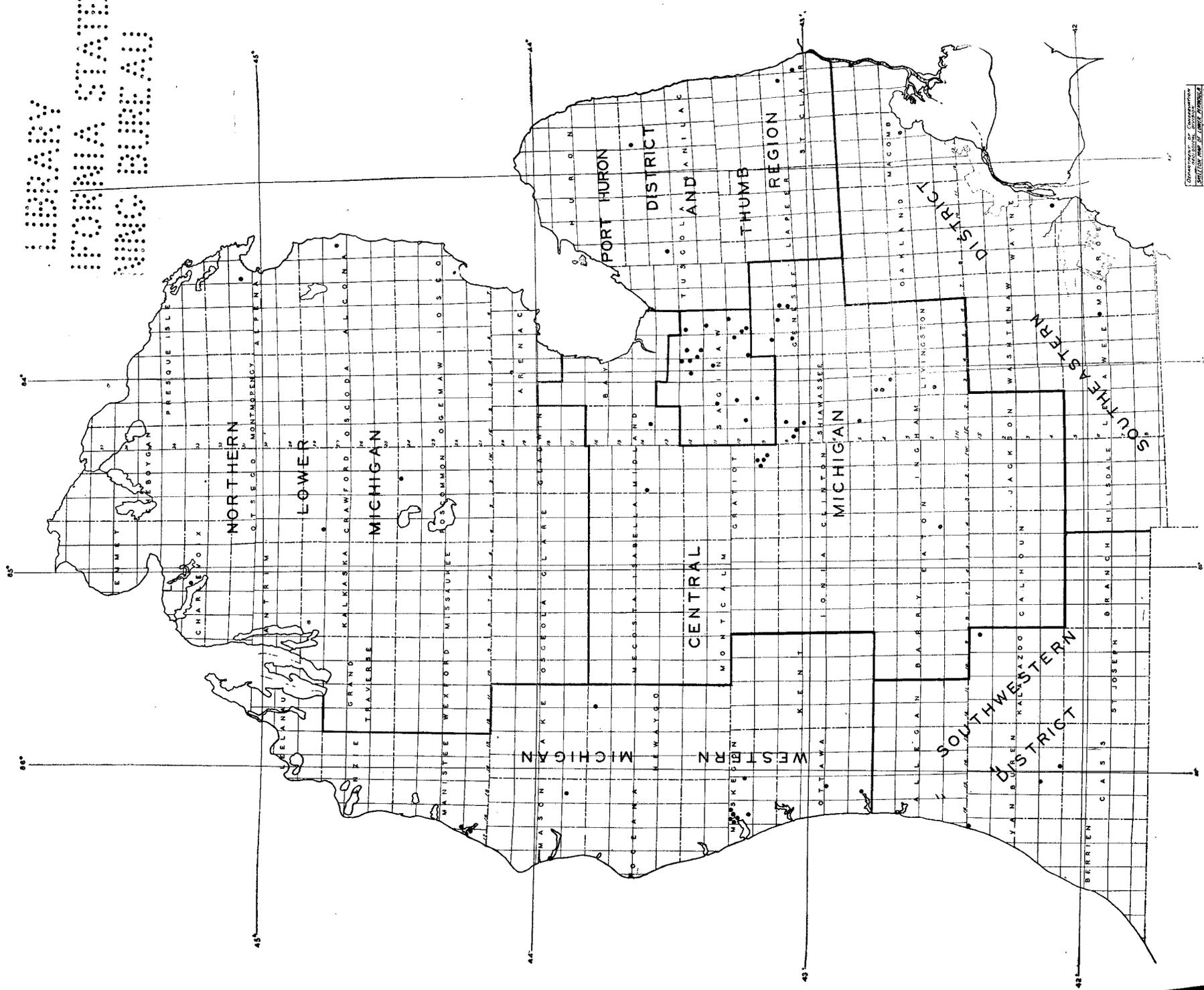


FIGURE 17.
Location of Wildcat Wells Drilled in the Southern Peninsula of Michigan
1924, 1925, 1926, 1927.

University of Connecticut
GEOLOGICAL MAP OF MICHIGAN
VF-3083

NORTHERN PENINSULA

Over half of the Northern Peninsula is condemned for oil and gas because of being underlain by Pre-Cambrian or a very thin veneer of Paleozoic rocks. The remaining southeastern part of the peninsula includes rocks beneath the drift which range upward from Cambrian to Silurian age. The northern and western part of this territory is not highly prospective because of the lack of source rocks.

The Trenton is the principal productive formation to be sought after in the southeastern part of the Upper Peninsula. In places an asphaltic oil or tar residue is found in cracks, fissures, and vug-like cavities. These occurrences have been observed in the vicinity of Rapid and Whitefish rivers and several deep wells have witnessed the oily and bituminous character at depth. The Guelph (Niagaran) also exists under cover in the southernmost tip of the peninsula, but the maximum depth will not greatly exceed 500 feet.

Southern Schoolcraft and Mackinac Counties have been tested to considerable depths without favorable results. A well drilled in 1924 near Seul Choix Point, Delta County, was located on a structure worked out from surface exposures. The top of the Trenton (Black River) was found at 1005 feet and fresh water was tapped at 1225 feet. The Trenton in the southern part of Mackinac County will probably be encountered at from 1000 to 1800 feet. These depths are sufficient for accumulation of commercial pools on structure but the appearance of fresh water as in the Seul Choix Point Well is not altogether promising.

The Paleozoic strata of the Upper Peninsula dip to south and southeast and form the northern marginal tip of the Michigan Basin. The rocks outcrop in arcuate belts extending east and west and the limestones form pronounced escarpments. Artesian water conditions are usually present along the lake shore due to the dip from the outcrop in that direction. This regional dip varies from 40 to about 65 feet to the mile and carries on over into the Southern Peninsula.

DELTA COUNTY

As far as known Delta County is entirely underlain by Paleozoic sediments. Numerous wells drilled for water have shown the thickness of these beds to total anywhere from 480 to 850 feet. Ridges of Pre-Cambrian extend into the county from the west and cause considerable variance in the Paleozoic from place to place. The dip of the rocks varies from southeast to east and going eastward across the county the Trenton, Cincinnati, Medina-Rochester, Niagaran, and Salina occur in successive belts. The maximum depth to the Trenton is probably about 800 feet.

WELLS TOWNSHIP

The Escanaba Drilling Company was organized in the spring of 1927 for the purpose of drilling a well in search of oil and gas. The officers were B. P. Pattison, president; M. Gunter, vice president, and H. H. Speck, secretary and treasurer, and the location was made by Mr. Pattison with an instrument. Drilling was commenced on April 10th and completed on July 1st by the Gray Well Drilling Company of Milwaukee, Wisconsin. A. R. Sarver was driller and a complete set of

Traverse
Light
Black
Gray s
Gray t
Brown
Bell Form
Blue to
Dundee F
No reco
Ferrugin

Location:
Elevation:
Drilling con
from driller's l

Pleistocene:
Loose sand

Mississippian:
Michigan Form
Gray calcare
Gray calcare
Blue gray sh
Blue gray sh
Upper Marshall
Sandstone (gr
Lower Marshall
Gray and pial
Gray and buff
Coldwater Form
Blue, gray, and
Dark gray to b

Devonian:
Bedford Formatic
Greenish gray t
Antrim Formation
Hard black shal
Hard brown sha
Brown shale...
Traverse Formatio
Blue gray shale t
Brown shale....
Buff limestone wi
Hard gray limest
Gray to light buff
Limestone and sh
Buff limestone and
Gray to brownish
Hard dark calcare
Dark limestone th
Hard gray shale...
Buff limestone th
Brown limestone...
Bell Formation:
Hard gray shale...
Dundee Formation:
Brown limestone (fl
Gray to buff limest
Upper Monroe (Detro
Gray to white flaky
Sand (probably dolo
Salt.....
Brown oily dolomite
Discolored brownish
Clear white salt....
Impure gray salt....
Buff colored salt....
Total depth.....

samples was saved. The location was on property of the I. Stephenson Company, trustees, in the southwest corner of the NW¹/₄ of the SW¹/₄ of Section 18, 250 feet from the west line and 250 feet from the south line. Rock was encountered at 70 feet and about 260 feet of Trenton was present. The Pre-Cambrian Schists and slates were penetrated at 807 feet and the total depth of the well reached 860 feet. Records from the samples were made by both the Michigan and Wisconsin Surveys.

NORTHERN PENINSULA
DELTA COUNTY

| Location. | Sec. | T.-R. | Township. | Farm. | Company. | Elev. | Drift. | Marshall. | Berea. | Traverse. | Dundee. |
|-----------|------|-----------|------------|----------------------|---------------------------|-------|--------|-----------|--------|-----------|---------|
| N.W./S.W. | 18 | 39N.-22W. | Wells..... | I. Stephenson Co.... | Escanaba Drilling Co..... | 620 | 70 | ..... | ..... | ..... | ..... |

*(Started in Trenton).

WELLS COUNTY (DELTA COUNTY)

I. STEPHENSON WELL NO. 1.

Location: On property of I. Stephenson Co., Trustees, in S. W. $\frac{1}{4}$ of N. W. $\frac{1}{4}$ of section 18, T. 39 N., R. 22 W., Wells township, 250 feet from west line and 250 feet from south line.
Elevation: About 620 feet above sea level.
Drilled in 1927 by Escanaba Drilling Company. Record by W. Osgood from samples and data furnished by Escanaba Drilling Company.

| | Thickness feet | Depth feet |
|--|-------------------|---------------|
| Pleistocene: | | |
| Reddish yellow sand..... | 16 | 16 |
| Light gray sand..... | 6 | 22 |
| Coarse gray sand with some gravel..... | 8 | 30 |
| Fine gray sand (water from 16-52 feet)..... | 22 | 52 |
| Light brown to red clay..... | 13 | 65 |
| Light brown to red clay with boulders..... | 5 | 70 |
| Ordovician: | | |
| Trenton Formation: | | |
| Gray limestone (sand from above in samples)..... | 6 | 76 |
| Buff bituminous limestone (water)..... (Sand from above)..... | 3 | 79 |
| Gray sand and gray limestone..... (Sand possibly from above)..... | 3 | 82 |
| Gray to buff limestone (some sand)..... | 3 | 85 |
| Buff limestone (some contamination from surface)..... | 38 | 123 |
| Gray limestone..... | 79 | 202 |
| Buff limestone..... | 15 | 217 |
| Buff and dark gray limestone..... | 27 | 244 |
| Buff dolomite..... | 66 | 310 |
| Gray to buff dolomite..... | 20 | 330 |
| Beekmantown Formation: | | |
| Gray sandy dolomite..... | 15 | 345 |
| Sand and dolomite..... | 5 | 350 |
| Gray dolomite..... | 5 | 355 |
| Upper Cambrian—Ozarkian: | | |
| Jordan (Madison) Sandstone Formation (?): | | |
| Gray to white sand (some dolomite toward bottom)..... | 70 | 425 |
| St. Lawrence (Mendota) Formation (?): | | |
| Gray to light buff sandy dolomite..... | 20 | 445 |
| Gray dolomite..... | 15 | 460 |
| White to light gray sand..... | 10 | 470 |
| Sandy dolomite..... | 15 | 485 |
| Light buff dolomite..... | 30 | 515 |
| Light gray sandy dolomite..... | 5 | 520 |
| Light buff dolomite (somewhat sandy)..... | 15 | 535 |
| Brown dolomite..... | 5 | 540 |
| Dark gray dolomite..... | 5 | 545 |
| Dark gray and brown dolomite..... | 5 | 550 |
| Light buff to buff dolomite..... | 20 | 570 |
| Reddish to brownish dolomite..... | 35 | 605 |
| Gray dolomite..... | 25 | 630 |
| Pre-Cambrian—Keweenawian: | | |
| Lake Superior (Potsdam) Sandstone: | | |
| Gray sand..... | 5 | 635 |
| Iron stained sand..... | 45 | 680 |
| No record..... | 5 | 685 |
| Fine white sand..... | 5 | 690 |
| Gray sand..... | 15 | 705 |
| Iron stained sand..... | 45 | 750 |
| White to light gray sand..... | 35 | 785 |
| Iron stained sand..... | 10 | 795 |
| Pre-Cambrian: | | |
| Red and green shale (Upper samples contaminated by sand from above)..... | 65 | 860 |

10 inch drive pipe set at 70 feet.
8 inch casing set at 93.5 feet.

LEGISLATION CONCERNING OIL AND GAS

With the development of the first significant oil field in the State at Saginaw an urgent need arose for legislation dealing with drilling for oil and gas. Various factors arose to stimulate legislative action and guide the passage of a bill. The salt operators of the Saginaw Valley were anxious to protect the brines used from fresh water and petroliferous contamination. The oil and gas men wished to prevent migration of fluids from one stratum to another on account of the flooding possibilities on productive pay horizons. The coal mining companies were afraid of gas danger from improper casing and water incursions into their galleries. Finally, the State wished a protective measure to minimize careless exploitation of private domain, to control usurping of public rights, and to gain closer contact with oil and gas development from a geological standpoint.

In response to these needs Act No. 65 was drafted and passed during the Legislative Session of 1927. The law provided for creating a Supervisor of Wells, required the filing of a written application for a permit to drill, and made proper plugging under supervision compulsory. The act which became in effect on Sept. 6, 1927, is included below in complete detail:

OIL AND GAS WELLS. (Act No. 65, Public Acts of 1927)

An act to create the office of supervisor of wells; to prescribe his powers and duties; to provide regulations for the sinking, drilling, deepening, abandonment and plugging of oil and gas wells or test holes; to provide regulation for payment of fees, issuance of permits and payment of money received under the provisions of this act; and to prescribe penalties for the violation of this act:

The People of the State of Michigan enact:

Section 1. The *Director of Conservation* shall act as *Supervisor of Wells*. He shall designate such suitable assistants in the Department of Conservation as shall be required to carry out the provisions of this act.

Section 2. It shall be the *duty of the Supervisor of Wells to supervise the sinking, drilling, and deepening of oil and gas wells or test holes* so far as such sinking, drilling, and deepening may result in or do damage to the petroleum industry; it shall also be his duty to supervise the abandonment and plugging of abandoned oil and gas wells or test holes and to see that such work is done in accordance with the methods prescribed in this act.

Section 3. *No person shall begin the sinking or drilling of any oil or gas well or test hole until he shall first have filed with the Supervisor of Wells a written application setting forth the exact location of the proposed well, and giving the section, township and range thereof in unplatted land, and the lot, block, recorded plat and municipally thereof in platted land. Such application shall also set forth the intended depth of the well; the name and address of the owner or owners of the fee; the name and address of the lessee or lessees, if any, of the fee; the name and address of the person who is to sink or drill the well; the purpose for which the well is to be sunk or drilled; and the intent and plan and method of casing the well and performing the work. Such application shall be signed by the owner of such proposed well, forwarded to the Supervisor of Wells and when received by him shall be filed as a permanent record in the Department of Conservation. Upon the payment of a permit fee of ten dollars by such applicant, the Supervisor of Wells shall issue to any responsible person making proper application therefor, a permit to sink or drill such well or test hole in accordance with the terms of such application, which permit when obtained by the applicant shall be exhibited in a conspicuous place at all times at the location of the well.*

Section 4. The Supervisor of Wells shall thereupon pay such permit fee to the State Treasurer together with a report giving the name of the applicant, the date and number of the permit issued and the location of the proposed well. The State Treasurer shall place all permit fees so paid to him in the general fund.

Section 5. Every person who shall sink or drill or cause to be sunk or drilled, such well or test hole penetrating bed rock (except test holes for iron or copper in iron or copper bearing districts) shall case and seal off each oil, gas, brine or water stratum or formation to prevent migration to other strata. This casing and sealing off shall be effected by the use of suitable steel or wrought iron pipe and shall be kept in constant repair to prevent migration to other strata. Whenever requested by the Supervisor of Wells or his duly authorized representative, the owner or operator of any such well or test hole shall forthwith furnish an accurate record or log of such well or test hole to the date thereof, and in addition thereto shall furnish forthwith adequate samples of the core, cuttings, charrings removed therefrom and liquids contained therein. In the event that any strings of casing are permanently removed during the drilling or operation of such well or test hole, then a mud laden fluid shall be used and properly placed in such well or test hole to prevent migration in such a manner as hereinafter provided to be used in case such well or test hole is plugged.

In case the owner or operator of any such well or test hole shall desire to deepen such well or test hole, written permission therefor shall first be obtained from the Supervisor of Wells, which permit shall be issued without fee, providing the permit fee has already been paid under the provision of this act. If such permit fee has not been so paid then an application shall be made for such deepening by the owner of such well or test hole and all proceedings shall be followed and payment made as for applications to sink or drill a well or test hole in the first instance under this act.

Section 6. Every person before abandoning such well or test hole for any reason shall first notify in writing the Supervisor of Wells, adjoining lessee or lessees, if any, and the adjoining fee owner or owners, of his intention so to do. The Supervisor of Wells or his duly authorized representative shall thereupon supervise the work of abandoning such well or test hole and the same shall be plugged by the owner or operator thereof, forthwith under the supervision of the Supervisor of Wells or his duly authorized representative. In order to effectually confine all oil, gas or water to its own stratum such well or test hole owner shall before removing any casing securely fill the well or test hole with properly prepared mud laden fluid weighing eleven pounds per gallon to the bottom of the casing to be removed, and after removal shall place an iron ball of proper diameter on the offset so exposed. This procedure shall be repeated for each string of casing removed, and upon removal of the last string, the hole shall be filled to the surface with mud laden fluid: Provided, however, that such hole may be filled to a fresh water level and not to the surface with such mud laden fluid in case the same is desired to be used as a fresh water well: And provided further, That the procedure herein described for the plugging of such wells or test holes may be departed from and some equally effective procedure may be followed when written permission therefor is first obtained from the Supervisor of Wells, who shall be satisfied that such substitute method will adequately prevent migration.

Section 7. Every well or test hole penetrating oil, gas, or water bearing strata which has been abandoned since January first, nineteen hundred twenty-five, and which has not been plugged in accordance with the provisions of this act, shall be forthwith plugged by the owner or operator thereof in the presence of and under the supervision of the Supervisor of Wells or his duly authorized representative in accordance with the provisions of this act. In case such well or test hole shall not have been properly plugged within thirty days after this act shall have become effective, the Supervisor of Wells shall thereupon ascertain the name and address of the owner or operator thereof and shall proceed to give personal notice or notice by registered mail of such fact to such owner or operator thereof, after which time such owner or operator shall forthwith take all steps necessary to comply with the provisions of this act and shall thereafter be liable to the penalties herein provided. Hereafter such well or test hole shall be deemed to have been abandoned for the purposes of this act when the same shall have been left with intent on the part of the owner or operator thereof not to renew operations thereat, or, when and after the Supervisor of Wells shall find that such well or test hole is in fact not being operated or worked and shall give thirty days' written notice thereof to such owner or operator, which notice shall have been served personally or by registered mail sent to the last known mail address of such owner or operator of such well or test hole.

Section 8. When any owner or operator of any oil or gas well or test hole which has not been properly cased, plugged or repaired cannot be found, the Supervisor of

Wells, after having attempted to give thirty days' written notice thereof as provided in section seven of this act to the owner or operator of such well or test hole, shall thereupon serve like notice in like manner upon the owner or owners of the fee of the land upon which such well or test hole is located (or should there be no known fee owner, then such notice shall be served in like manner upon the person or persons having charge of or being in control of the said land upon which such well or test hole is located), and may enter upon the property and case, plug or repair the well or test hole and the cost of such casing, plugging or repairing shall thereupon be determined by the Supervisor of Wells and shall become a lien against the property of the owner of such well or test hole located thereat, or if such owner of the well or test hole cannot be found, or if the property of the owner of such well or test hole located thereat shall not be sufficient to satisfy the expense so determined by the Supervisor of Wells, then the same shall become a lien against the land upon which such well or test hole was sunk or drilled, and the Supervisor of Wells may take all steps necessary to enforce such lien.

Section 9. The provisions of this act shall not apply to fresh water wells or test holes not exceeding four inches in diameter; nor to coal test holes not exceeding three inches in diameter; nor to fresh water wells sunk for municipal purposes of any diameter or depth; nor to test holes for iron or copper in iron or copper bearing districts.

Section 10. Any person hereafter failing or neglecting to comply with or follow any of the provisions of this act shall be deemed guilty of a misdemeanor and shall, upon conviction thereof, be liable to pay a fine of not more than one hundred dollars nor less than fifty dollars, or to imprisonment for not more than ninety days in the county jail, or to both such fine and imprisonment in the discretion of the court. Where the offense is continuing such as the failure to properly plug an abandoned well or test hole, each day such failure to comply with or follow any of the provisions of this act continues, may be considered a separate offense, and shall be punishable as such.

Section 11. The provisions of this act are declared to be severable, and if any section or part of section be held invalid for any reason, it is hereby declared to be the legislative intent that the remaining provisions of this act would have been enacted without such section or part held to be invalid having been included therein.

CONSERVATION POLICIES

Discovery of commercial pools of oil and gas in Michigan also led to the problem of the disposition of State owned lands. The major companies in their leasing campaigns and development projects constantly ran into the proposition of obtaining leasehold rights on Tax Homestead Lands. The mineral rights were reserved on all tracts which had been sold by the State to private individuals since 1909. In consequence, oil and gas rights could only be secured through the Department of Conservation and its Lands Division. Tentative plans and policies were drawn up during May, 1928, for the disposal of leaseholds to these properties.

The Conservation Commission decided that anyone desiring to lease State homestead lands should first be required to submit a letter of application. In this letter is to be included the purpose for which the land is wanted, the plan of development, and a list of the lands desired. Upon receiving the letter of application the Commission will pass on it favorably or unfavorably, first considering the land owners rights and second the priority in which the application is received. If a lease is to be granted then before it can become binding the lessee must (1) deposit the first quarter's rental at 50 cents per acre in advance (2) and file a bond in amount to be determined by the Department of Conservation.

The following recommendations were made to the Conservation Commission on May 7th, 1928, and the policies adopted were based on these recommendations. The tentative lease form which is now in use was recommended at that time.

RECOMMENDATIONS AS TO FORM OF OIL AND GAS LEASES AND POLICIES

1. That the attached lease can be adopted as fair and equitable to both Lessor and Lessee; changes can be made later as experience indicates.
2. That the owner of the surface rights shall be given written notice of intent of the State to lease the oil and gas or mineral rights as mentioned above, and that the owner shall have preference rights of application for a lease provided he can meet the conditions of bond and other requirements imposed by the Department of Conservation.
3. That applicants shall pay a rental fee of fifty cents per acre per year for the oil and gas leases granted to cover in part office costs and also expenses of special investigation of records and of formal notification of owners of surface rights of the intention of the State to lease the oil and gas rights.
4. That applicants other than owners of the surface rights for leases on the oil and gas rights shall be considered in the order that the written applications are received by the Department of Conservation, but any applicant who shall be unable to meet the general conditions and requirements imposed by the Department of Conservation in connection with the leasing of oil and or gas or mineral rights owned by the State shall lose his rights of priority of application.
5. That the amount and distribution of acreage leased shall bear a definite relation to the amount and location of development proposed to be done by the applicant before a lease shall be issued.
6. That before a lease shall be issued the applicant must file a satisfactory surety bond in amount and sufficiency to be determined by the Lessor, that said applicant will carry out in good faith the terms and conditions of said lease.
7. That no leases shall be granted on tracts of land less than five acres except under special conditions, and no lease shall be granted to any applicant until said applicant can show adequate financial responsibility and business and operating experience adequate to reasonably insure intelligent and efficient development and operation of the properties.

These recommendations are by no means final and as future needs arise changes will follow as decided upon by the Commission. It is entirely possible that arrangements will be made to dispose of State lands by public auction.

The lease form adopted includes a tenure of five years and a rental rate of fifty cents (\$.50) per acre in advance in lieu of operations. Royalty consideration to the State as lessor is $\frac{1}{8}$ of the oil and $\frac{1}{8}$ of the gas. All payments of royalties are to be made monthly and rentals are to be paid quarterly. Lessee is given the right of complete or partial surrender at any time. Operations are to be carried on strictly in compliance with Act No. 65 of the Public Acts of 1927 and offset wells are required on adjoining tracts regardless of ownership or leasehold. Such offsets shall be no less distance than 200 feet back from the property lines except by permission of the lessor and shall be commenced within thirty days after notification.

The State reserves the right to examine the books of the Lessee insofar as they may relate to products from respective premises leased by the

State. The right of free access for examination and inspection is also reserved. Accurate records of all operations are required to be kept by the Lessee and no equipment shall be removed from the premises if any royalties, damages or other payments are due the Lessor. Accurate logs and samples of cuttings, oil, gas, water and brine are to be saved for the State and delivered in good condition.

The Lessee is given the right to use, free of cost, oil, gas and water necessary for the operation of the property. The Lessee must bury pipe lines below plow depth on request, keep at least 200 feet from private buildings and 300 feet from public buildings, and pay all damages caused by its operations.

The Lessee must agree to drill all wells in good faith to a depth where there is a reasonable expectation of finding oil and gas, and the Lessor shall have the right to determine whether or not any boring is an adequate test.

No assignment shall be made except after written approval is given by the Lessor. If the estate of either party be assigned, the covenants shall extend to their heirs, executors, administrators, successors or assigns, but no change in ownership shall be binding on the Lessee until a written transfer or assignment is furnished.

The Lessee expressly agrees not to sell stock or security involving lands included in the lease without the approval of the Commission of Conservation and the Michigan Securities Commission.

Upon the failure of any of the Covenants by the Lessee, the lease shall be null and void at the option of the Lessor. To exercise such option the Lessor shall give written notice thereof and file a copy of the same with the register of deeds in the office of original filing or recording.

In the execution of a state lease it shall be approved by the Department of Conservation and signed by its Director.

CURRENT PRODUCTION

Despite the discovery of oil at several places in Michigan prior to 1925, the quantity of output had never reached sufficient figures for the keeping of accurate statistics. With the development of the Saginaw Oil Field, sufficient data became available from refinery runs and tank car clearings to give some idea concerning the total production of the State.

During 1925 the total output for the year amounted to 4,000 barrels valued at \$10,000. This production came from a total of three wells, but average daily production per well was not compiled. The average price per barrel for that year was \$2.50.

In 1926 production was available from 90 wells and totaled 94,000 barrels valued at \$253,000. The average daily production per well was 9.3 barrels, for which an average price of \$2.69 per barrel was received. This average daily output per well was somewhat greater than that for the United States which was reported as 7.4 barrels.

Although U. S. Bureau of Mines figures are not yet available for 1927, the production of the Saginaw field amounted to 433,328 barrels. The Muskegon field added to this would bring the total output up to over 434,000 barrels, which came from 310 wells. An average production thus derived would be 14 barrels per day per well. The price paid for crude declined in 1927 to an average of about \$2.00 per barrel.

The number of well completions, the quantity of initial production, and the number of dry holes showed a constant increase through the years of 1925, 1926, 1927. In 1925 there were 3 completions with no dry holes and 30 barrels initial production. Completions increased to a total of 105 in 1926 with 16 dry holes and initial production of 1884 barrels. During 1927, completions more than doubled from the preceding year with a total of 266 of which 45 were dry. Two large flush production wells in 1927 increased initial output to 4667 barrels.

Since 1925 Saginaw County has continually held the lead in completions, initial production, and dry holes. St. Clair County was second in completions and production during 1926, with 5 wells completed showing an initial production of 15 barrels. In 1927 second place in number of completions was shared by Gratiot County and Shiawassee County with 6 wells in each. Second place in initial production went to Muskegon County where one well came in with a flow of 330 barrels. Gratiot County was third with 30 barrels and Shiawassee County was fourth with 9 barrels. Dry holes for 1927 amounted to 24 in Saginaw County, 5 in Shiawassee County, and 4 in Gratiot County.

Early in 1928 a field of larger flush production developed in Muskegon County and both the initial and daily output far eclipsed any previous figures. The gas pressure was so great that several wells flowed initially over 300 barrels daily. Largest daily production reported for the entire field totalled 2,000 barrels, but this was not sustained for any length of time.

CRUDE PETROLEUM PRODUCED IN MICHIGAN IN 1925, 1926, 1927.

| Month. | Production—Thousands of Barrels (42 Gal.) | | |
|---------------------------------|---|-----------|-------------|
| | 1925 | 1926 | 1927 |
| January..... | | | 30 |
| February..... | | 2 | 27 |
| March..... | | 1 | 37 |
| April..... | | 2 | 41 |
| May..... | | 3 | 39 |
| June..... | | 3 | 41 |
| July..... | | 4 | 36 |
| August..... | | 7 | 39 |
| September..... | | 8 | 41 |
| October..... | | 15 | 36 |
| November..... | | 20 | 34 |
| December..... | | 26 | 33 |
| TOTAL..... | 4 | 94 | *434 |
| Average per well per total..... | | 9.3 | *14.0 |
| Value..... | \$10,000 | \$253,000 | *\$868,000 |
| Average value per bbl..... | \$2.50 | \$2.67 | \$2.00 |

* Approximate.

*COMPLETIONS FOR 1925, 1926, AND 1927.

| Month. | Completions. | | Initial Production. | | Dry. | | Gas. | |
|-------------------|--------------|------------|---------------------|--------------|-----------|-----------|----------|----------|
| | 1925. | 1926. | 1925. | 1926. | 1925. | 1926. | 1925. | 1926. |
| January..... | | 23 | 357 | 30 | | | 0 | 0 |
| February..... | | 22 | 350 | 30 | | | 0 | 0 |
| March..... | | 24 | 860 | 65 | | | 0 | 0 |
| April..... | | 19 | 353 | 47 | | | 0 | 0 |
| May..... | | 25 | 434 | 30 | | | 0 | 0 |
| June..... | | 25 | 506 | 45 | 1 | | 0 | 2 |
| July..... | | 26 | 407 | 95 | 1 | | 0 | 0 |
| August..... | | 23 | 375 | 157 | 3 | | 0 | 0 |
| September..... | | 24 | 272 | 158 | 1 | | 0 | 0 |
| October..... | | 39 | 17 | 431 | 3 | | 0 | 0 |
| November..... | | 5 | 80 | 443 | 2 | | 0 | 0 |
| December..... | | 11 | 398 | 353 | 5 | | 0 | 1 |
| TOTAL..... | 3 | 266 | 4,667 | 1,884 | 16 | 45 | 0 | 3 |

SUMMARY BY COUNTIES.

| County. | Completions. | | | Initial Production. | | | Dry. | | | Gas. | | |
|-----------------|--------------|-------|-------|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| | 1925. | 1926. | 1927. | 1925. | 1926. | 1927. | 1925. | 1926. | 1927. | 1925. | 1926. | 1927. |
| | Alcona..... | | | 1 | | | 0 | | | 1 |  |  | 0 |
| Arenac..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Bay..... | | | 2 | | | 0 | | | 2 | | | 0 |
| Genesee..... | | | 0 | | | 30 | | | 4 | | | 0 |
| Gratiot..... | | | 1 | | | 0 | | | 1 | | | 1 |
| Iosco..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Jackson..... | | | 2 | | | 0 | | | 2 | | | 0 |
| Livingston..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Macomb..... | | | 1 | | | 3 | | | 2 | | | 0 |
| Mason..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Midland..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Monroe..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Muskegon..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Newaygo..... | | | 1 | | | 330 | | | 1 | | | 0 |
| Saginaw..... | | | 95 | | | 1,869 | | | 10 | | | 0 |
| St. Clair..... | 3 | | 238 | 30 | | 4,290 | | | 24 | | | 0 |
| Shiawassee..... | | | 1 | | | 0 | | | 1 | | | 0 |
| Van Buren..... | | | 6 | | | 15 | | | 1 | | | 1 |
| Wayne..... | | | 2 | | | 9 | | | 5 | | | 0 |
| Wayne..... | | | 1 | | | 0 | | | 1 | | | 0 |
| TOTAL..... | 3 | 105 | 266 | 30 | 1,884 | 4,667 | 0 | 16 | 45 | 0 | 0 | 3 |

*Data compiled from the Oil and Gas Journal with some revision.

NATURAL GAS

Previous to 1927 natural gas in Michigan was obtained entirely from small producers. Although many wells were supplying local demands, the amount was so variable and the volume and pressure was so low that its production never constituted an important industry. The Saginaw Oil Field tapped a new supply which did not prove of any significance from a commercial angle except for fuel at drilling wells. The small quantity and the intimate association with the oil kept it from general household use in the city.

The gas from shallow wells is produced largely in Manistee, Alcona, and Montmorency Counties and in the southeastern part of the State in Macomb, Oakland and St. Clair Counties. This flow is obtained both from bed rock and from the drift. The drift gas is doubtless due to leakage from underlying bituminous and petroliferous Devonian formations as it is most abundant in belts overlying these rocks. Gas given off by springs and shallow wells has occasioned unsuccessful exploration, since these wells are along the exposures of oil and gas bearing formation, therefore, they are along the line or leakage and not in the zone of accumulation. In most cases the wells yield gas sufficient for a few families only, some lasting a score or more of years, but the greater number "play out" in a few weeks or days. Farmers of Oakland and Macomb Counties report that the 15 or 20 gas wells which are in use for heating and lighting purposes are rapidly declining in pressure and volume of gas.

The artesian wells around Portage Lake, Manistee County, yield some gas. The most notable yield was from a well driven in 1913 in the drift west of Onekama. In June, 1918, surface gas was struck in a well in Mikado Township, Alcona County. The mineral wells of Mt. Clemens also yield gas which is nearly sufficient for heating the boilers used for pumping. A very limited supply of gas is obtained from small drift wells in Benzie, Monroe, Washtenaw, and Wayne Counties.

Many of the oil wells of the Port Huron oil field yielded gas. The May and Gillette wells west of Port Huron are reported to yield from 20,000 to 40,000 feet of gas per day, when allowed to flow freely, with a gas pressure said to vary from 125 to 250 pounds per square inch. Other wells in Port Huron yield gas sufficient for domestic and small industrial purposes.

In 1920 a gas well was reported from Clawson, Oakland County. In drilling a well for water a gas pocket was reached. The flow of gas blew out the tools, ignited and burned down the nearby farmhouse before being capped.

Numerous showings of gas have been found in Livingston County in the vicinity of Fowlerville and Howell. In 1924 one well northeast of Howell in Section 10, Howell Township, struck gas at 46 feet and another about 80 rods to the north encountered a flow at 76 feet. These gas shows were originally thought to come from the Saginaw formation but recent drilling in the general vicinity seems to contradict this early correlation. The gas very likely occurs in the Sunbury Shale which overlies the Berea formation. Water is usually found immediately beneath the gas.

In the early summer of 1927 the first real gas well of any size was found near Ashley, Gratiot County. The Sun Oil Company in drilling a

test well southeast of the village encountered a flow of gas at 490 feet. When gauged the flow measured 1,750,000 cubic feet and the pressure was 217 pounds. The well was closed in and has not been used for any purpose except fuel in drilling an offset location to the southwest.

Sufficient gas was struck in a well drilled by W. E. Ellis south of Frankenmuth, Saginaw County, to cause a fire which burned down the rig. After the fire was extinguished and the pay streak at 2139 was shot with nitroglycerine the flow gauged 175,000 cubic feet. Drilling was continued deeper and the well was never operated for gas production.

The Diamond Crystal Salt Company at St. Clair drilled in a gas well near their plant. The gas was piped for use under the boilers at the salt works and created sufficient saving in fuel cost to prompt drilling a second well. Pressure and open flow were remarkably large for Michigan wells and considerable excitement was caused by the discovery which occurred in December, 1927. Three other wells are now being drilled in the vicinity of St. Clair.

The Muskegon Oil Field developed the largest amount of gas found anywhere in Michigan. The discovery well on the Charles Reeths farm tapped between 500,000 and 1,000,000 cubic feet at depths from 1640 to 1658 feet. Nearly all of the producing wells in the field show considerable gas, and two of these are now shut in because the gas far exceeds the oil. The Lima Oil Corporation's M. Figge No. 1 Well is the largest with over six million cubic feet of gas under a pressure of about 600 pounds per square inch. The second largest is the Dixie Oil Company, C. Reeths No. 1 which came in with an initial flow of between 4 million and 5 million cubic feet. The gas zone exists in the Traverse formation between depths of 1600 and 1640 feet but the greatest flow comes from about 1611 feet. Negotiations are now under way for distribution of this gas through the Muskegon Light and Traction Company.

The most recent gas discovery in the Muskegon territory is in a deeper pay streak at 2045 feet. The Dixie Oil Company encountered this gas in their A. Becker No. 1 Well on the north edge of the field. Difficulties were experienced in setting a packer to shut off water above the gas, but estimates consider the flow to be over 4,000,000 cubic feet. Further drilling is projected to this pay which is probably in the Monroe formation.

Near Walhalla in Mason County the Logan Oil Company found gas in their W. K. Young No. 1 Well at 3257 feet. The flow which was coming from the Guelph formation gauged 143,000 cubic feet and after being shot with 100 quarts, increased to over a million cubic feet. This gas is now being used to drill a second well.

Prior to the recent development the greatest total production of natural gas in any year was 2,422,000 cubic feet in 1914. The value reached its peak in 1915 when \$1,510 was paid for 2,060 cubic feet. Both production and value dwindled until in 1925 the Bureau of Mines figures showed an output of 400 cubic feet valued at \$200. The year previous reported 600 cubic feet valued at \$300, but in 1926 the output was still 400 cubic feet valued at \$200. These figures for 1926 are probably somewhat divergent from the true totals, because although no gas wells were reported from Saginaw drilling, several of them furnished appreciable quantities of gas.

Extremely large increases in Michigan's natural gas production will be seen for 1927 and 1928.

PRODUCTION OF NATURAL GAS IN MICHIGAN—1911-1926.

| Year. | No. of Producers. | Domestic. | | Industrial. | | Other. | | Total. | |
|-----------|-------------------|---------------|--------|---------------|--------|---------------|--------|-----------------|---------|
| | | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. | Quantity. | Total. |
| 1911..... | 22 | M cu. ft. 930 | \$930 | M cu. ft. 900 | \$450 | M cu. ft. 800 | \$400 | M cu. ft. 1,730 | \$1,330 |
| 1912..... | 17 | ..... | 1,020 | ..... | ..... | ..... | ..... | 900 | 1,470 |
| 1913..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 1,805 | 1,405 |
| 1914..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 2,442 | 1,442 |
| 1915..... | 16 | 960 | 960 | 1,100 | 550 | 1,100 | 550 | 2,060 | 1,510 |
| 1916..... | 12 | 598 | 598 | 700 | 350 | 700 | 350 | 1,298 | 948 |
| 1917..... | 10 | 613 | 613 | 571 | 400 | 571 | 400 | 1,184 | 1,043 |
| 1918..... | 14 | 745* | 745 | 428 | 300 | 428 | 300 | 1,173 | 1,045 |
| 1919..... | 15 | 773 | 586 | 325 | 325 | 325 | 325 | 1,098 | 911 |
| 1920..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 500* | 500* |
| 1921..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 400 | 300 |
| 1922..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 350 | 350 |
| 1923..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 700 | 320 |
| 1924..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 600 | 300 |
| 1925..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 400 | 200 |
| 1926..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | 400 | 200 |

*Estimated.

INDEX

| | Page |
|---|------|
| A | |
| Acknowledgments | 146 |
| Alcona County, Haynes Township | 266 |
| Alcona Prospecting Company, Jno. Campbell, well No. 1, tabulation of | 269 |
| Alcona Prospecting Company, Jno. Campbell, well No. 1 | 266 |
| Alpena County, Alpena Township | 266 |
| Alpena County, Wm. Bradley Oil and Gas Company, Fred N. Potter well, tabulation of | 269 |
| Analysis of Monroe Formation brine from Huber Bros. well | 217 |
| Anderson, Peter, well, drilled by the Sun Oil Company | 220 |
| Anticlinal theory of accumulation | 166 |
| Anticlines indicated in the state of Michigan | 164 |
| Antrim shale, description of | 154 |
| Antrim Township, Shiawassee County | 223 |
| Arenac County, Clayton Township | 266 |
| Arenac County, Voorhees and Sovereign, P. J. Gilbert well No. 1, tabulation of | 269 |
| Arctic Dairy Products Lake Odessa well, record of | 230 |
| Ashley gas well drilled by the Sun Oil Company | 219 |
| Atkins, D. D., well, drilled by the R. V. Dillard Company | 188 |
| Average cost of wells of Saginaw Prospecting Company | 167 |
| B | |
| Bacon, S., well, drilled by the Universal Oil Company | 218 |
| Bailey, O. K., well, drilled by E. J. Miller | 194 |
| Barton Township, Newaygo County | 257 |
| Bass Island Series, description of | 152 |
| Bayport Formation, description of | 156 |
| Becker, A. & O., well No. 1, drilled by the Citizens Petroleum Co. | 247 |
| Beds encountered at Muskegon, discussion of | 253 |
| Beekmantown (Hermansville limestone), description of | 150 |
| Berea sandstone, description of | 154 |
| Birch Run Township, Saginaw County | 185 |
| Bliss Petroleum Company well No. 1, Saginaw, record of | 183 |
| Blumfield Township, Saginaw County | 186 |
| Boldebuck, well, drilled by the Bliss Petroleum Company | 194 |
| Bostwick, F., well, drilled by the Saginaw Homebuilders and others | 237 |
| Boyne City well (Northwestern Michigan Development Company—J. M. Stutzman No. 1), record of | 276 |
| Bradley and others, Fred N. Potter well No. 1 | 266 |
| Bradley, J. M., well drilled by Norris and Montgomery | 221 |
| Brant and Hallick well at Ashley | 219 |
| Brant Township, Saginaw County | 193 |
| Bruner well, drilled by the Universal Oil Company | 218 |
| Buena Vista Township, Saginaw County | 187 |
| C | |
| Cambrian rocks | 150 |
| Capacity and type of Standard Oil Company of Indiana, refinery at Zilwaukee, Mich. | 175 |
| Caro Oil Company, organization | 199 |
| Carrollton Township, Bacon Petroleum Company well | 194 |
| Cedar, Samuel, well, S. M. Bacon and others | 188 |
| Central Michigan | 215 |
| Chapman Bros. well, drilled by E. M. Treat Oil and Gas Co. | 224 |
| Chapman, Frank, water well records of | 220 |
| Characteristics of the Berea sandstone in the Saginaw Oil Field | 177 |
| Characteristics of southeastern Michigan | 203 |
| Charlevoix County, general discussion | 267 |
| Charlevoix County, Northwestern Michigan Development Company, J. M. Stutzman well No. 1, tabulation of | 269 |
| Chemical analysis of brine from P. J. Gilbert well No. 1, Arenac County | 267 |
| Chesaning Township, Ino County | 193 |
| Cihak, Grace B., well, drilled by the Johnson Oil Refining Co. | 247 |
| Cincinnati series, description of | 151 |
| Citizens' Petroleum Company, A. & O., Becker well No. 1, record of | 263 |
| Coldwater shale, description of | 155 |
| Comparison of Napoleon and Berea structure at Saginaw | 179 |
| Comparison of well sections across the Saginaw Oil Field | 179 |
| Comparison of well sections | 159 |
| Completions for 1925, 1926 and 1927 | 289 |
| Completion summary by counties for 1925, 1926 and 1927 | 290 |
| Composite production decline curves of Saginaw Prospecting Company wells extended to show future production | 178 |
| Conservation policies | 285 |
| Consolidated Coal Company well, drilled by the Sun Oil Company | 186 |
| Contemplated tankage facilities for the Muskegon Field | 253 |
| Conway Township, Livingston County | 221 |
| Correlation of well sections across southern Michigan | 161 |
| Correlation of well sections across central Michigan | 160 |
| Coulon, Otto, well No. 1, drilled by the St. Clair Oil and Gas Corporation | 204 |
| Courtney, Mike, well No. 1, Wolohan Petroleum Company | 185 |
| Courtney, Mike, well No. 1, Saval Development Company | 185 |
| Craven, J., well, drilled by McLaughlin and associates | 193 |

| | Page |
|--|------|
| Crawford County, Grayling Development Company, Hanson Lumbering Company No. 1, tabulation of | 270 |
| Crawford County, general discussion | 267 |
| Crudes obtained from the Saginaw Field | 171 |
| Crude oil analysis of Berea crude made by the Pure Oil Company | 173 |
| Crude petroleum produced in Michigan in 1925, 1926 and 1927, tabulation by months | 288 |
| Current production, 1925, 1926 and 1927 | 287 |
| Curtin well (Phelon St.) drilled by the Star Petroleum Company | 187 |
| Curtis, Daniel D., well, drilled by Welch and Voorhees | 223 |
| D | |
| Darry, A. M., well drilled by V. M. Voorhees and others | 219 |
| Decatur Township, Van Buren County | 237 |
| Decline and future productivity of Muskegon wells | 253 |
| Decline of production of wells in the Saginaw Oil Field | 175 |
| Decline of Saginaw Prospecting Company wells | 175 |
| Decline of Saval Development Company wells | 255 |
| Deeper drilling forecasted at Muskegon | 177 |
| Deepest well in the Saginaw Oil Field | 203 |
| Deerfield, The, Anticline | 182 |
| Deindorfer, M., well, Saginaw, record of | 279 |
| Delta County, general discussion | 281 |
| Delta County, tabulation of I. Stephenson well | 150 |
| Description of formations, general discussion | 153 |
| Detroit River Series, description of | 152 |
| Devonian rocks | 205 |
| Diamond Crystal Salt Company wells No. 12 and No. 13 | 254 |
| Difficulties of correlation in the Muskegon area | 166 |
| Discovery well in the Saginaw Field | 171 |
| Distillation and acid treatment of Saginaw crude | 264 |
| Dixie Oil Company, C. Reeths well No. 1, record of | 249 |
| Dow, James, well No. 1, drilled by the Lakeshore Petroleum Company | 153 |
| Dundee Limestone, description of | 179 |
| Dundee Limestone, at Saginaw, depths and pay zones | 174 |
| "Dundee" oil from Saginaw Field | 257 |
| Duvall, Edward, well, Oceana County | 257 |
| E | |
| Early discoveries in Michigan: | |
| Port Huron | 147 |
| Allegan | 148 |
| Saginaw | 148 |
| Deerfield | 274 |
| East Tawas well (Iosco Oil Company—Emery Bros No. 1), record of | 217 |
| Eaton County | 225 |
| Eaton County, well record tabulation | 239 |
| Edgemere Beach Hotel well, South Haven | 255 |
| Egelston Township, Muskegon County | 219 |
| Elba Township, Gratiot County | 214 |
| Ellis, W. E., Trenton well, record of | 268 |
| Emery Bros., well No. 1, of the Iosco Oil Company | 279 |
| Escanaba Drilling Company, organization of | 282 |
| Escanaba Drilling Company, I. Stephenson well No. 1, record of | 267 |
| Evangeline Township, Charlevoix County | 185 |
| Explorations resulting from the Saginaw development | 150 |
| Exposures and outcropping areas | 181 |
| Extent and closure of the Saginaw structure | 181 |
| F | |
| Fairfield Township, Shiawassee County | 223 |
| Fier, Anton, well, drilled by the Vermont Petroleum Development Co. | 238 |
| Figge, Fred, well No. 1, drilled by the Muskegon Oil Corporation | 249 |
| Figge, Fred, well No. 1, drilled by the Dixie Oil Company | 247 |
| Figge, Margaret Figge, well No. 1, drilled by the Lima Oil Corp. | 255 |
| Filer Township, Manistee County | 221 |
| Finlan, Jno. well, drilled by Norris and Smith | 218 |
| Flushing Township, Genesee County | 157 |
| Formations containing oil and gas | 177 |
| Formations included in the geological section at Saginaw | 159 |
| Formations offering best possibilities as a source of production | 188 |
| Frankenmuth Township, Saginaw County | 268 |
| Frederic Township, Crawford County | 277 |
| Frederic well (Grayling Development Company No. 1), record of | 175 |
| Future life of Saginaw Oil Field as computed by the Beal Family Curve Method | 204 |
| G | |
| Gaertner wells No. 1 and No. 2, Deerfield Oil Producing Company | 199 |
| Gaines, J. C., drilling projects in 1924 | 223 |
| Gallagher and Scullen well drilled by the Sun Oil Company | 192 |
| Gardner Petroleum Company Schwannecke well, record of | 253 |
| Gas in the Muskegon Field | 171 |
| Gas in the Saginaw Oil Field | 291 |
| Gas well at Ashley, Gratiot County | 292 |
| Gas at Frankenmuth | 292 |
| Gas well at St. Clair | 292 |
| Gas from the Muskegon Oil Field | 292 |
| Gasoline yields from Saginaw crudes | 171 |

| | Page |
|--|------|
| Genesee County | 217 |
| Genesee County, well record tabulation | 225 |
| Genesee Development Company, organization of | 217 |
| Genesee Township, Genesee County | 218 |
| Geological conditions in the Muskegon Oil Field | 253 |
| Geological conditions in the Saginaw Oil Field | 177 |
| Geological conditions in the Upper Peninsula | 279 |
| Geologists, names of contributing | 146 |
| Gilbert, P. J., well No. 1, drilled by Voorhees and Sovereign | 266 |
| Giles, Chas., well No. 1, drilled by the Bulldog Oil & Gas Company | 251 |
| Gratiot County, general discussion of developments | 219 |
| Gratiot County, well record tabulation | 225 |
| Grayling Development Company, organization of | 267 |
| Gravities of crudes from the Saginaw Field | 171 |
| Greatest depth ever penetrated in Michigan | 255 |
| Gusher on F. Steltzride farm from the "Saginaw" sand | 179 |

H

| | |
|--|-----|
| Hamilton Township, Van Buren County | 238 |
| Hanson Lumbering Company well No. 1, drilled by the Grayling Development Company | 268 |
| Haphazard nature of wildcat operations | 145 |
| Harrisville well (Alcona Prospecting Company—Jno. Campbell No. 1) record of | 274 |
| Harris, Wm., well, drilled by J. R. Keenan and others | 193 |
| Hartman, Herman, well No. 1, drilled by the Muskegon Development Co. | 249 |
| Hazekamp, Bert, well No. 1, drilled by the Muskegon Oil Corporation | 244 |
| Heinz, Albert, well No. 1, drilled by the Muskegon Oil Corp. | 250 |
| Heinz, H. C., well No. 1, drilled by the Muskegon Oil Corp. | 250 |
| Hemmeler well, drilled by the Saginaw Prospecting Company | 194 |
| Higgins Township, Roscommon County | 268 |
| Hill, Leigh, well, drilled by J. C. Gaines and others | 200 |
| History of Michigan Oil Development | 147 |
| Hlavacek, Chas., well, drilled by the Saginaw Prospecting Co. | 222 |
| Holihan, Thos., well, drilled by the P. D. Snavely Company | 193 |
| Holland Township, Ottawa County, well in | 257 |
| Horrie, Chas. B., wells No. 1 and No. 2 of the Horrie Oil Company | 220 |
| Howell-Owosso Anticline | 215 |
| Huber Bros. well No. 1, drilled by Wittmer Oil and Gas Properties Co. | 217 |

I

| | |
|--|-----|
| Ichenberg well on the Grass Lake ranch, Newaygo County | 257 |
| Iosco County, Tawas Township | 268 |
| Iosco County, Iosco Oil Company, Emery Bros. No. 1, tabulation of | 270 |
| Iosco Township, Livingston County | 221 |
| Intervals between the Upper Marshall and Berea Formations showing compressional effects in the Saginaw structure | 179 |
| Investment and return from the Saginaw Oil Field | 181 |
| Ireland, Frank M., well of the Wayco Producing Company | 220 |

J

| | |
|--|-----|
| Janis Hotel well, record of | 243 |
| Janis Hotel well, South Haven | 238 |
| Judd, Geo., well, S. M. Bacon and others | 188 |
| Jurica, Joe, well, drilled by Norris and Smith | 224 |

K

| | |
|--|-----|
| Kalamazoo County, Ross Township | 237 |
| Kalamazoo County, well record tabulation | 240 |
| Kiel, H., well, drilled by J. C. Gaines and others | 200 |
| Kobs, Ed., well, drilled by W. E. Ellis | 186 |
| Kundinger well, the Wanigas Oil Company | 187 |

L

| | |
|--|-----|
| Lake Superior sandstone, description of | 150 |
| Langeschulte well drilled by Cochran and others | 255 |
| Large well of Western Drilling & Oil Company | 179 |
| Legislation concerning oil and gas | 283 |
| Limits of the Saginaw pool and possibilities of extension | 181 |
| Livingston County, general discussion | 220 |
| Livingston County, well record tabulation | 226 |
| Loackridge, Ephriam, well, drilled by Voorhees and Sovereign | 193 |
| Logan Township, Mason County | 256 |
| Logan Oil Company, organization of | 256 |

M

| | |
|--|-----|
| Macomb County | 203 |
| Macomb County, well record tabulation | 206 |
| Major companies holding acreage in the vicinity of the Muskegon Oil Field | 251 |
| Major companies operating in Michigan | 146 |
| Major structure of the state | 162 |
| Manistee County, general discussion | 255 |
| Manistee Oil and Gas Company well, deepening of | 256 |
| Manistee Township, Manistee County | 256 |
| Map showing orientation of sections across southern and central Michigan with location of wells involved | 160 |
| Marketing of Muskegon oil | 252 |

| | Page |
|--|------|
| Marquart, John Co., well No. 1, drilled by R. L. Hill and others | 248 |
| Marshall Formation, description of | 155 |
| Marshall, Mrs., well, drilled by V. M. Voorhees and others | 194 |
| Mason County, general discussion | 256 |
| Mathews, Roy, well drilled by J. W. Fordney and others | 223 |
| Medina, Clinton interval, description of | 151 |
| Menter, S. S., well of the Sun Oil Co. | 220 |
| McGinnis, H. C., well drilled by the Sun Oil Co. | 223 |
| McGinnis, Mrs. M., well, drilled by the Genesee Development Co. | 219 |
| McGrew, Station well, Genesee County | 218 |
| McLaughlin and Associates, J. Craven well, record of | 197 |
| Michigan Petroleum Company, O. J. Richardson No. 2, record of | 208 |
| Michigan Petroleum Company, organization | 199 |
| Michigan Petroleum Company, Chris Rogner well, record of | 191 |
| Michigan Series, description of | 155 |
| Midland County, general discussion of | 221 |
| Midland County, well record tabulation | 226 |
| Miller, E. J., O. K. Bailey, well, record of | 198 |
| Minden City, development in vicinity of | 199 |
| Minor structures in the State | 164 |
| Mississippian rocks | 154 |
| Monroe County | 204 |
| "Monroe Formation," division of | 152 |
| Monthly production of the Saginaw Field during 1927 | 175 |
| Montrose Township, Genesee County | 218 |
| Morning well, drilled by Chas. Murrin | 194 |
| Mt. Morris Township, Genesee County | 219 |
| Muhleman, R., well drilled by Willard Johnson and associates | 186 |
| Muskegon County, general discussion | 244 |
| Muskegon Oil Corporation, organization of | 244 |
| Muskegon Oil Corporation, operating subsidiaries, tabulation of | 246 |
| Muskegon Township, history of development | 244 |

N

| | |
|--|-----|
| Napoleon sandstone, description of | 155 |
| Natural gas | 291 |
| Nature of central Michigan geological province | 215 |
| Nature of structure at Muskegon | 254 |
| Newaygo County, general discussion | 257 |
| New discovery of gas in Muskegon at 2045 feet | 255 |
| Niaganan Series (Guelph and Lockport), description of | 152 |
| Nichols, Jno. B., well No. 1, drilled by the Joliet-Morris Development Co. | 249 |
| Norris and Smith, Jno. Finlan, well No. 1, record of | 233 |
| North and west of the city of Saginaw, discussion of drilling | 194 |
| North Ottawa Oil Company, organization of | 257 |
| Northern lower Michigan, general discussion | 266 |
| Northern Peninsula, general discussion | 279 |

O

| | |
|---|-----|
| Obee, Frank, well No. 1 | 200 |
| Oceana County, general discussion | 257 |
| Oil and gas wells, Act No. 65, Public Acts of 1927 | 283 |
| Oil producing horizons at Saginaw | 177 |
| Olive Township, Ottawa County | 258 |
| Ordovician rocks | 150 |
| Other areas of early development interest: | |
| Monroe County | 149 |
| Hillsdale County | 149 |
| Lenawee County | 149 |
| Thumb region | 149 |
| Western Michigan | 149 |
| Ottawa County, general discussion | 257 |
| Ottawa Development Company, organization of | 257 |
| Ottawa Development Company, Fred Stone, well No. 1, record of | 265 |
| Outline a real geological map of the Southern Peninsula of Michigan | 163 |
| Owosso Township, Shiawassee County | 223 |

P

| | |
|---|-----|
| Parma Formation, description of | 156 |
| Pay strata in the Upper Traverse at Muskegon | 254 |
| Pennsylvanian rocks | 156 |
| Pioneer operators in the Muskegon Oil Field | 245 |
| Pleistocene, description of | 157 |
| Points in favor of shallow testing | 146 |
| Port Huron district and Thumb region | 199 |
| Position of Michigan in petroleum industry | 145 |
| Possibility for extension of the Muskegon Field | 251 |
| Possibilities of central Michigan | 216 |
| Possibilities of southeastern Michigan | 203 |
| Price range obtained for crudes from the Saginaw Field | 174 |
| Principal operators in central Michigan | 216 |
| Principal productive formations in the Upper Peninsula | 279 |
| Production decline curves for Saval Development Company wells | 177 |
| Production decline curves for several Saginaw prospecting company wells | 176 |
| Production from the Muskegon Oil Field, discussion of | 252 |
| Production of natural gas in Michigan, 1911 to 1926, tabulation of | 293 |

| | Page |
|--|------|
| Producing properties in the Saginaw Oil Field | 167 |
| Production of the Saginaw Oil Field | 171 |
| Progress structure maps of Muskegon Anticline drawn on the Coldwater red horizon and the top of the Traverse | 255 |
| Properties and price-range of Muskegon oil | 252 |
| Prospecting, need for shallow testing for structure | 145 |
| R | |
| Rating of major producers at Muskegon | 253 |
| Raymer, L. E., well, drilled by Norris and Smith | 221 |
| Recent activities in the southeastern district | 203 |
| Recommendations as to form of oil and gas leases and policies | 286 |
| Reeths, Chas., well No. 1 drilled by the Muskegon Oil Corp., discovery well in the Muskegon Field | 245 |
| Reeths, Chas., well No. 1, drilled by the Dixie Oil Company | 248 |
| Refineries using crude products from the Saginaw Field | 174 |
| Refinery at Zilwaukee, Mich., constructed by the Standard Oil Company of Indiana | 174 |
| Regional structure of southeastern Michigan | 236 |
| Relative size of operators in the Saginaw Oil Field | 167 |
| Reorganization of the Muskegon Oil Corporation | 245 |
| Results of the Saginaw Oil Field | 181 |
| Richardson, O. J., wells No. 1 and No. 2, drilled by the Sanilac-St. Clair Prospecting Company | 200 |
| Robb, Ross, well drilled by Norris and Smith, J. L. Hoover and others | 221 |
| Robinaut, well drilled by the Sun Oil Co. | 219 |
| Rochester shale, description of | 152 |
| Roe, F., well No. 1 | 204 |
| Rogner, Chris., well, the Michigan Petroleum Company | 188 |
| Root, Laura, well No. 1, drilled by the Pure Oil Company | 222 |
| Roscommon County, general discussion | 268 |
| Roscommon County, Grayling Development Company, State land well No. 1, tabulation of | 270 |
| Roscommon well (Grayling Development Company No. 2), record of | 278 |
| Rosette, Mary, well No. 1 drilled by the St. Clair Oil and Gas Corporation | 203 |
| Ruff, Theodore, well, St. Clair Oil and Gas Corporation | 205 |
| Ruggles and Rademaker, wells No. 24 and No. 25 | 255 |
| Rush Township, Shiawassee County | 224 |
| Rust, E. G., well drilled by the Saginaw Prospecting Company | 187 |
| S | |
| Saginaw County, wells north of the City of Saginaw, tabulation of | 195 |
| Saginaw County, wells southeast of the City, tabulation of | 189 |
| Saginaw County, wells southwest of the City of Saginaw, tabulation of | 195 |
| "Saginaw" crude | 174 |
| Saginaw Formation, description of | 156 |
| Saginaw Homebuilders, F. Bostwick well, record of | 241 |
| Saginaw Oil Field, history of discovery | 166 |
| Saginaw Prospecting Company, Chas. Hlavacek well, record of | 233 |
| Saginaw Prospecting Company, organization of | 166 |
| "Saginaw" sand a misleading term | 177 |
| Saginaw Township, Saginaw County | 194 |
| Salient features illustrated by well sections across the state | 162 |
| Salina Formation, description of | 152 |
| Sanilac County | 200 |
| Sanilac County, well tabulation | 202 |
| Sanilac-St. Clair Prospecting Company, O. J. Richardson No. 1, record of | 207 |
| Sauve, Pat, well B. & B. Petroleum Company | 186 |
| Saval Development Company, M. Courtney well, record of | 190 |
| Schwannecke well, Gardner Petroleum Co. | 187 |
| Scope of the Muskegon Oil Field | 245 |
| Scope of Saginaw Oil Field | 167 |
| Shallow gas wells | 149 |
| Shallow natural gas wells in Michigan | 291 |
| Shallow test hole drilling in the "thumb" | 199 |
| Shiawassee County, general discussion of | 222 |
| Shiawassee County, well record tabulation | 226 |
| Shooting of Saginaw Field wells | 177 |
| Shoup, Geo. H., well No. 1, drilled by the Wolverine Mineral Development Co. | 248 |
| Silurian rocks | 151 |
| Size of wells producing in the Saginaw Oil Field | 170 |
| Smith, Chas. W., well No. 1, drilled by Bowers and O'Keefe | 248 |
| Smith, Harley, well No. 1, drilled by the Johnson Oil Refining Company | 248 |
| Smith, W. J., well, J & S. Corporation | 186 |
| Southeastern district | 203 |
| Southeast of city of Saginaw developments | 185 |
| South Haven Township, Van Buren County | 238 |
| Southwest of city of Saginaw, discussion of wells | 193 |
| Southwestern Michigan, general discussion | 236 |
| South Mt. Pleasant, W. F. Braun well, record of | 231 |
| Spaulding Township, Saginaw County | 193 |
| State homestead lands, leasing of | 285 |
| State Land well No. 1, drilled by the Grayling Development Co., Roscommon Co. | 268 |
| St. Charles Township, Saginaw County | 193 |
| St. Clair County | 200 |
| St. Clair County, tabulation of wells | 205 |
| St. Clair County, well record tabulation | 202 |
| St. Clair Oil and Gas Corporation, Otto Coulon No. 1, record of | 206 |
| Stephenson, I., well, drilled by the Escanaba Drilling Company | 213 |
| Sterling well (Voorhees and Sovereign—P. Gilbert No. 1) record of | 280 |

| | Page |
|--|------|
| Stone, Fred E., well No. 1, drilled by the Ottawa Development Company, Ottawa County | 258 |
| St. Peter's sandstone, description of | 151 |
| Stratigraphy | 150 |
| Structure at Muskegon, early ideas of | 254 |
| Structure at Saginaw | 179 |
| Structural conditions in central Michigan | 215 |
| Structural contour map of the Saginaw Anticline | 180 |
| Structure, general discussion | 162 |
| Structure in southeastern Michigan | 203 |
| Stutzman, J. M., well No. 1, drilled by the northwestern Michigan Development Company | 267 |
| Summary of completions in the Muskegon Oil Field up to May 18, 1928 | 251 |
| Summary of the Saginaw development | 181 |
| Sun Oil Co., Anderson well No. 1, record of | 229 |
| Sun Oil Co., H. C. McGinnis well, record of | 235 |
| Sun Oil Co., No. 1 Weiss well, record of | 184 |
| Swan Creek Township, Saginaw County | 194 |
| Sylvania sandstone, description of | 153 |
| T | |
| Taggart, A. R., well No. 1, drilled by A. S. Cochran and others | 250 |
| Taylor, David, well, drilled by the Caro Oil Company | 200 |
| Taymouth Township, Saginaw County | 188 |
| Theory of origin and accumulation of oil | 165 |
| Theory of Robinson pertaining to Michigan structures | 199 |
| "Thumb" region, future possibilities in oil production | 250 |
| Torrent, Jno., well No. 1, drilled by the Bankers Trust Co. | 250 |
| Torrent, Jno., well No. 1, drilled by the Muskegon Oil Corporation | 251 |
| Total production of natural gas prior to recent development | 254 |
| Traverse Formation, characteristics of top beds at Muskegon | 153 |
| Traverse Formation, description of | 185 |
| Trend of developments in Saginaw County | 151 |
| Trenton limestone, description of | 205 |
| Trenton well drilled by W. E. Ellis | 200 |
| Tuscola County | 202 |
| Tuscola County, well tabulation | 210 |
| Tuscola Oil Company, David Taylor No. 1, record of | 238 |
| Tuttle location, on Fred Steele farm, Hamilton Township, Van Buren County | 227 |
| Typical well records from central Michigan | 271 |
| Typical well records from northern Lower Michigan | 182 |
| Typical well records from the Saginaw Oil Field | 207 |
| Typical well records from southeastern Michigan including Port Huron district and the Thumb region | 241 |
| Typical well records from southwestern Michigan | 190 |
| Typical well records from Saginaw County, southeast of the City of Saginaw | 196 |
| Typical well records from Saginaw County, southwest of the City of Saginaw | 261 |
| Typical well records from western Michigan | 179 |
| U | |
| Uncertainty of Saginaw "sand" production | 179 |
| Undulations in upper surface of the Berea at Saginaw | 217 |
| Universal Oil Company, organization of | 228 |
| Universal Oil Company, Bruner well No. 1, record of | 237 |
| V | |
| Van Buren County, general discussion | 240 |
| Van Buren County, well record tabulation | 177 |
| Variance in depth to the Berea at Saginaw | 196 |
| Voorhees and Sovereign, E. Loackridge well, record of | 237 |
| Vought, A. D., wells No. 1 and No. 2, drilled by the West Oil and Gas Co. | 223 |
| W | |
| Wade, Pat, well, drilled by Voorhees and Sovereign | 292 |
| Walhalla gas well, Mason County | 253 |
| Water and oil, productive zones in the rocks at Muskegon | 177 |
| Water producing horizons at Saginaw | 218 |
| Waterworks, well, Flushing, Michigan | 205 |
| Wayne County | 206 |
| Wayne County, well record tabulation | 259 |
| Well in Mason County, tabulation of | 260 |
| Well in Newaygo County, tabulation of | 260 |
| Well in Oceana County, tabulation of | 259 |
| Wells in Muskegon County, tabulation of | 252 |
| Wells in Muskegon Oil Field (to May 15, 1928) tabulated list of | 260 |
| Wells in Ottawa County, tabulation of | 179 |
| Wells operating from the Dundee at Saginaw | 216 |
| Wells penetrating the Berea Formation in East Central Michigan, list of | 236 |
| Wells penetrating the red Coldwater horizon in southwestern Michigan, list of | 236 |
| Wert Oil and Gas Company, organization of | 242 |
| Wert Oil and Gas Company, A. D. Vought, well No. 1, record of | 244 |
| Western Michigan, general discussion | 145 |
| Wildcat drilling activity | 278 |
| Wildcat wells drilled in Southern Peninsula of Michigan, 1924, 1925, 1926 and 1927, map of | 227 |
| Wittmer Co., Huber well No. 1, record of | 185 |
| Wolohan Petroleum Company, organization of | 156 |
| Woodville Formation, description of | 256 |
| Y | |
| Young, W. K. Bros., well No. 1, drilled by the Logan Oil Company | 256 |

SUMMARY
PRODUCTION AND VALUE OF MINERAL PRODUCTS IN
MICHIGAN 1922—1926

During the period of five years from 1922 to 1926 inclusive, Michigan made striking gains in production and value of sand-lime brick, Portland cement, gypsum, limestone, petroleum, pottery products, sand and gravel. Shipments of iron ore were larger in 1925 and 1926 than any year since 1920, but prices were lower and the value failed to approach the peak of 1920 and 1923 when higher prices prevailed. The production of copper has increased steadily since 1921.

Michigan ranks tenth among the states of the Union in the value of mineral products. Michigan holds first rank in the production and value of bromide, calcium chloride, natural magnesium chloride and magnesium sulphate, salt and sand-lime brick. Michigan ranks second in production and value of iron ore, metallic magnesium, and in quantity of graphite produced. Third in quantity of gypsum, stone, sand and gravel, grindstones and manganiferous ore, and fourth in production and value of copper.

SUMMARY TABLE OF THE PRODUCTION AND VALUE OF MINERAL PRODUCTS IN MICHIGAN, 1922-1926.

| Mineral Products. | 1922. | | 1923. | | 1924. | | 1925. | | 1926. | |
|---|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|-------------|---------------|
| | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. | Quantity. | Value. |
| Brick and tile products, number of brick. | 748,608,890 | \$3,915,318 | 183,350,663 | \$3,723,018 | 261,614,000 | \$6,976,606 | 260,280,000 | \$4,339,478 | 275,294,000 | \$4,227,731 |
| Brick, sand-lime, number of brick. | 46,558 | 567,647 | 64,650,000 | 777,993 | 89,239,000 | 1,062,495 | 97,828,000 | 1,175,776 | 108,434,000 | 1,341,284 |
| Bromine, pounds. | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) |
| Calcium chloride, tons. | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) |
| Cement, Portland-bis. made, value cement shipped | 6,249,805 | 11,145,573 | 7,619,762 | 14,038,322 | 9,259,781 | 16,403,761 | 10,936,181 | 17,511,908 | 12,037,400 | 19,620,962 |
| Clay, tons. | 1,653 | 4,852 | 3,617 | 11,903 | 9,332 | 3,602,000 | 3,953 | 7,405 | 4,287 | 9,340 |
| Coal, tons. | 929,390 | 4,693,000 | 1,172,075 | 5,545,000 | 831,020 | 3,602,000 | 808,233 | 3,391,000 | 686,707 | 2,829,000 |
| Coke, tons; value sales. | 1,142,059 | 9,229,083 | 1,648,773 | 14,389,742 | 1,770,547 | 11,914,098 | 1,751,118 | 11,708,519 | 1,826,638 | 12,713,083 |
| Copper, lbs. | 121,866,726 | \$16,387,208 | 137,952,586 | \$20,062,984 | 145,333,227 | 19,038,652 | 156,157,388 | 22,082,363 | 175,441,565 | 24,883,754 |
| Glass sand. | ..... | (c) | ..... | (c) | ..... | (c) | ..... | (c) | ..... | (c) |
| Graphite. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Gypsum, tons. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Gypsum, tons mined; value gypsum products sold. | 471,355 | 2,843,117 | 1,253 | 38,212 | ..... | ..... | ..... | ..... | ..... | ..... |
| Iron ore, shipments long tons; value f. o. b. mine. | 12,433,729 | 43,760,509 | 586,987 | 3,252,993 | 577,526 | 5,940,822 | 649,053 | 5,447,294 | 613,403 | 5,021,465 |
| Iron, pig, long tons made; value pig iron shipped. | 595,647 | (b)14,791,041 | 13,962,769 | 54,256,527 | 11,248,641 | 35,605,002 | 15,234,093 | 40,926,315 | 16,699,984 | 43,932,982 |
| Lime, tons made. | 56,635 | 484,845 | 717,279 | (b)15,327,808 | 650,333 | (b)15,255,000 | 831,435 | (b)18,452,346 | 688,282 | (b)13,180,113 |
| Limestone. | ..... | 4,533,998 | 59,629 | 612,369 | 73,096 | 5,782,072 | 35,036 | 909,952 | 107,671 | 995,123 |
| Mineral paints. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Mineral and spring waters, gallons sold. | 1,229,802 | 150,237 | 1,478,135 | 164,968 | 9,901,910 | 5,848,649 | 11,460,000 | 6,327,634 | 10,788,740 | 6,411,828 |
| Natural gas, M. cu. ft. | 700 | 350 | 700 | 320 | ..... | ..... | ..... | ..... | ..... | ..... |
| Petroleum, bbls. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Pottery. | ..... | 1,337,000 | ..... | 2,810,619 | ..... | 3,334,818 | 4,000 | 10,000 | 400 | 200 |
| Potash (Pure K ₂ O) tons produced; value potas isoid | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Precious stones. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Quartz. | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) | ..... | (f) |
| Salt, bbls. | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) |
| Sand and gravel, tons. | 14,322,057 | 8,693,604 | 15,195,800 | 8,684,148 | 13,703,307 | 7,864,888 | 15,518,571 | 7,710,331 | 16,145,174 | 7,594,418 |
| Sandstone. | 5,962,916 | 3,222,043 | 9,601,562 | 5,096,071 | 11,381,084 | 5,973,757 | 10,878,375 | 5,684,474 | 14,398,338 | 7,265,101 |
| Silver, fine oz. Troy. | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) | ..... | (a) |
| Stone, crushed. | 361,912 | 361,912 | 253,705 | 208,038 | 153,201 | 102,951 | 139,499 | 96,812 | 107,094 | 66,827 |
| Tranrock. | ..... | (g) | ..... | (g) | ..... | (g) | ..... | (g) | ..... | (g) |
| Miscellaneous. | 94,560 | 376,778 | 109,810 | 420,524 | 103,860 | 231,302 | 110,400 | 323,991 | 96,990 | 303,601 |
| ..... | ..... | 627,860 | 200,590 | 200,590 | ..... | 1,705,306 | ..... | 2,347,794 | ..... | 2,178,892 |
| Total. | ..... | \$112,325,034 | ..... | \$140,758,121 | ..... | \$126,307,285 | ..... | \$133,972,829 | ..... | \$142,816,799 |

† Figures from State Tax Commission.
 ‡ Estimated at \$.135 per pound, the average price.
 †† Estimated at 14.9545 cents per pound, the average price.
 a. Included under miscellaneous.
 b. Excluded from total; covered by iron ore.
 c. Included under sand and gravel.
 d. Copper sales.
 e. Estimated.
 f. No production.
 g. Included in limestone.
 h. No canvass.

APPENDIX
 DIRECTORY OF THE PRODUCERS OF NON-METALLIC
 MINERALS IN MICHIGAN, 1926

APPENDIX

BRICK AND TILE MANUFACTURERS, 1926.

| | Office. | Works. |
|---|---|--------------------|
| <i>Allegan County</i> | | |
| Allegan Brick Works (Fish & Fish) | Allegan | Allegan. |
| States Clay Products Co. | Holland | Hamilton. |
| <i>Berrien County</i> | | |
| Theona Brick Co. | St. Joseph | St. Joseph. |
| <i>Eaton County</i> | | |
| Grand Ledge Clay Product Co. | Grand Ledge | Grand Ledge. |
| American Vitrified Products Co. | Akron, Ohio | Grand Ledge. |
| Briggs Company | Lansing | Grand Ledge. |
| <i>Genesee County</i> | | |
| L. J. and C. E. School | Clio | Clio. |
| Flint Faience Tile Co. | Flint, Industrial Ave. | Flint. |
| <i>Gratiot County</i> | | |
| Ashley Tile Company | Ashley | Ashley. |
| North Star Tile Co. | North Star | North Star. |
| Riverside Brick & Tile Yard | Sumner | Sumner. |
| St. Louis Clay Products Co. | St. Louis | St. Louis. |
| <i>Ingham County</i> | | |
| The Briggs Co. | Lansing | Lansing. |
| Williamston Clay Products Co. | Williamston | Williamston. |
| Michigan Clay Products Corp. | Williamston, Box 37 | Williamston. |
| <i>Ionia County</i> | | |
| Michigan Porcelain Tile Works, | Ionia | Ionia. |
| <i>Jackson County</i> | | |
| American Vitrified Products Co. | Akron Ohio, (15 Broad St.) | Jackson. |
| <i>Lenawee County</i> | | |
| Albert A. Comfort | Tecumseh | Tecumseh. |
| Fairbank Bros. | Morenci | Morenci. |
| <i>Macomb County</i> | | |
| The Trombley Brick Co. | Detroit, (11803 Gratiot Ave.) | Warren. |
| <i>Midland County</i> | | |
| R. W. D. Fish | Coleman, R. D. No. 4 | Coleman. |
| <i>Sanilac County</i> | | |
| Croswell Brick Co. | Croswell | Croswell. |
| <i>Shiawassee County</i> | | |
| New Corunna Brick Co. | Corunna | Corunna. |
| <i>Van Buren County</i> | | |
| A. C. Olney | Hartford | Hartford. |
| <i>Wayne County</i> | | |
| Jacob Daniel Brick Co. | Detroit, 2213 Atkinson Ave. | Springwells. |
| John S. Haggerty | Detroit, 1815 Dime Bk. Bldg. | Detroit (Fordson). |
| Pewabic Pottery & Tile Co. | Detroit, 10125 Jefferson Ave. | Detroit. |
| Buute Bros. Tile Co. | Flat Rock | Flat Rock. |
| Clippert Brick Co. | Detroit, Wyoming and Southern | (Fordson). |
| Wm. Clippert Brick Co. | Detroit, Western Ave. and South- ern | Detroit (Fordson) |
| Porath Brothers | Detroit, 305 Transportation Bldg. | Detroit (Fordson) |
| Walker & Frank | Detroit, 8810 Dix Ave. | Detroit. |
| Mercier-Bryan-Larkins Co. | Detroit, Michigan Ave. and Miller Road | Detroit (Fordson) |
| Arthur G. Egle Mfg. Co. | Detroit, 6543 Sylvester St. | Detroit. |
| Standard Fuel Engineering Co. | Detroit, 667 Post Ave. S. | Detroit. |
| J. H. Mercier Brick Co. | 3895 Roulo St. | Detroit (Fordson) |

SAND LIME BRICK PRODUCERS, 1926.

| | Office. | Works. |
|---|---|---------------|
| <i>Genesee County</i> Flint Sandstone Brick Co. | Flint | Flint. |
| <i>Huron County</i> Sebawaing Sandstone Brick Co. | Sebawaing | Sebawaing. |
| <i>Jackson County</i> Jackson Brick Company | Jackson | Jackson. |
| <i>Kent County</i> Grande Brick Co. | Grand Rapids, 1456 Sunnyside Ave. | Grand Rapids. |
| <i>Menominee County</i> Menominee Brick Co. | Menominee | Menominee. |
| <i>Oakland County</i> Rochester Brick & Sand Co. | Detroit, 400 Penobscot Bldg. | Rochester. |
| <i>Saginaw County</i> Saginaw Brick Co. | Saginaw, 321 N. Hamilton St. | Saginaw. |
| <i>Wayne County</i> Michigan Pressed Brick Company | Detroit, Cor. Lawton Ave. at M. C. Railroad | Detroit. |
| Sand Lime Products | Detroit, Foot of Jean St. | Detroit. |
| Walker and Frank Brick Co. | Detroit, 8810 Dix Ave. | Detroit. |

CEMENT PRODUCERS, 1926.

| Operator. | Office. | Works. |
|----------------------------------|--------------------------------|-----------------------|
| Consolidated Cement Corporation | Cement City | Cement City. |
| Huron Portland Cement Company | 1325 Ford Building, Detroit | Alpena. |
| Alpha Portland Cement Co. | 140 S. Dearborn St., Chicago | Bellevue. |
| Wolverine Portland Cement Co. | Coldwater | Coldwater & Quincy. |
| Aetna Portland Cement Co. | 1518 Buhl Bldg., Detroit | Fenton & Bay City. |
| Newaygo Portland Cement Co. | Grand Rapids | Newaygo. |
| Peerless Portland Cement Co. | 8941 W. Jefferson, Detroit | Union City & Detroit. |
| Wyandotte Portland Cement Co. | 1325 Ford Bldg., Detroit | Wyandotte. |
| New Egyptian Portland Cement Co. | 1144 Free Press Bldg., Detroit | Fenton & Port Huron |
| Petoskey Portland Cement Co. | Petoskey | Petoskey. |
| Michigan State Cement Industry | Chelsea | Chelsea. |
| Ford Motor Company | Detroit | Fordson. |

COAL MINES IN OPERATION, 1926.

| Name of Mine. | County. | Address. |
|---|---------|-----------|
| Robert Gage Coal Co. Beaver No. 7 | Bay | Bay City. |
| Wolverine Coal Mining Co. No. 2 | Bay | Saginaw. |
| What Cheer Coal Mining Co. No. 1 | Bay | Bay City. |
| Robert Gage Coal Co. No. 8 | Saginaw | Bay City. |
| Consolidated Coal Co. { Shiawassee Uncle Henry No. 2 Midland | Saginaw | Saginaw. |
| | Saginaw | Saginaw. |
| | Midland | Saginaw. |

CLAY MINERS, 1926.

| Operator | Office. | Pit. |
|---|--|----------------------------------|
| <i>Onionugon County</i> Emmond Estate Robinson Clay Product Co. | Rockland. Akron, Ohio, 1010 E. Market St. | Rockland. Rockland. |
| <i>Wayne County</i> Arthur G. Egle Mfg. Co. Pewabic Pottery Clippert Brick Co. | Detroit, 6543 Sylvester St. Detroit, 10125 E. Jefferson Ave. Detroit, Wyoming and Southern Aves. | Detroit. Detroit. Fordson. |

COKE PRODUCERS, 1926.

| Operator. | No. of Ovens. | Office. | Location of Plant. |
|--|------------------|---------------------------------------|--|
| <i>Calhoun County</i> Battle Creek Gas Co. | 11 | Battle Creek | Battle Creek. |
| <i>Saginaw County</i> Consumers Power Co. | 19 | Zilwaukee | Zilwaukee. |
| <i>Wayne County</i> Ford Motor Co. Michigan Alkali Co. Semet-Solvay Co. | 120 54 216 | Detroit Detroit Syracuse, N. Y. | River Rouge. Wyandotte. Detroit. |

GRAPHITE PRODUCERS, 1926.

| Operator. | Office. | Quarry. |
|--|-----------------------|---------|
| <i>Baraga County</i> Detroit Graphite Co. | Detroit, 550 12th St. | L'Anse. |

GRINDSTONE AND SCYTHESTONE PRODUCERS, 1926.

| Operator. | Office. | Quarry. |
|--|-----------------|----------------------------------|
| <i>Huron County</i> Cleveland Stone Co. | Cleveland, Ohio | Grindstone City and Port Austin. |

PRODUCERS OF GYPSUM PRODUCTS, 1926.

| Operator. | Office. | Name of Plant. | Location of mine. |
|----------------------------------|-------------------------------------|----------------|-------------------|
| United States Gypsum Co. | Chicago, Ill. | Alabaster | Alabaster. |
| United States Gypsum Co. | Chicago, Ill. | Midland | Grand Rapids. |
| Alabastine (Michigan Gypsum Co.) | Grand Rapids | | Grand Rapids. |
| Grand Rapids Plaster Co. | Grand Rapids, 427 Mich. Trust Bldg. | Grandville | Grandville. |
| Beaver Products Co. | Grand Rapids | | Grand Rapids. |
| Certainfeed Products Co. | Grand Rapids | | Grand Rapids. |

LIMESTONE AND LIME PRODUCERS, 1926.

| Operator. | Office. | Quarry. |
|--|--|---|
| <i>Alpena County</i> Michigan Alkali Co. Kelly Island Lime and Transport Co. | Wyandotte Cleveland | Alpena. Rockport. |
| <i>Cheboygan</i> Campbell Stone Co. (also lime) | Indian River | Afton. |
| <i>Delta County</i> Bichler Bros. | Gladstone | Pine Ridge. |
| <i>Dickinson County</i> Metronite Co., The Crystallite Reduction Co. | Milwaukee, Wis. Iron Mountain | Felch. Randville. |
| <i>Emmet County</i> Antrim Lime Co. (also lime) Northern Lime Co. (also lime) Petoskey Portland Cement. | 904 Mich. Trust Bldg., Grand Rapids Petoskey Petoskey | Petoskey. Petoskey. Petoskey. |
| <i>Huron County</i> Wallace Stone Co. | Bayport | 3 mile E. of Bayport. |
| <i>Mackinac County</i> Ozark Stone Quarry Fiborn Limestone Co. | Ozark Sault Ste. Marie, Ont., Canada | Ozark. Fiborn Quarry. |
| <i>Menominee County</i> Limestone Products Co. (lime) | Menominee | |
| <i>Monroe County</i> The France Stone Co. Morris, Sam W. | 1800 Second National Bank Bldg., Toledo, Ohio Monroe | Monroe. Monroe. |
| <i>Presque Isle County</i> Michigan Limestone & Chemical Co. | 55 Liberty St., New York or Rogers City, Mich. | Calcite. |
| <i>Schoolcraft County</i> Manistique Lime & Stone Co. | Manistique | Blaney, Manistique, and Marblehead. |
| <i>Wayne County</i> Solvay Process Co. Dunbar & Sullivan Dredging Co. | Syracuse, N. Y. Detroit or River Rouge | Trenton and Sibley. Mouth of Detroit River. |

OIL AND GAS PRODUCERS IN 1926.

| Operator. | Address. | County of Operation. |
|--------------------------------|----------------------------|----------------------|
| Atlas Oil Company | Saginaw | Saginaw. |
| Bacon Petroleum Company | Saginaw | Saginaw. |
| Barker Oil & Gas Company | Saginaw | Saginaw. |
| Bergerhorn, W. D. | Saginaw | Saginaw. |
| Bliss Petroleum Co. | Flint, Citizens Bank Bldg. | Saginaw. |
| Bourdow, Wm. et al. | Saginaw | Saginaw. |
| Bradley, Wm. & Son | 814 Emerson St., Saginaw | Saginaw. |
| Brant, Chas. P. | Indianapolis, Ind. | Saginaw. |
| Cooper, Jas. & Newberry, Jno. | Saginaw | Saginaw. |
| Crescent Oil Company (Bourdow) | Saginaw | Saginaw. |
| Cross Petroleum Company | Saginaw | Saginaw. |
| Deerfield Oil Producing Co. | Deerfield | Monroe. |
| Dietrich, S. R. et al. | Saginaw | Monroe. |
| Fordney Petroleum Company | Saginaw | Saginaw. |
| Gilgias, Thos. J. | Saginaw | Saginaw. |
| Great Lakes Oil Company | Saginaw | Saginaw. |
| G. & W. Oil Company | Saginaw | Saginaw. |
| Hoeggler, Mathew | Saginaw | Saginaw. |
| J. & S Development Company | Saginaw | Saginaw. |
| K. & M. Oil Company | 5535 Second Blvd., Detroit | Saginaw. |
| Kipp Oil Company | Saginaw | Saginaw. |
| Lee, Myron E. | Saginaw | Saginaw. |

OIL AND GAS PRODUCERS IN 1926—Concluded

| Operator. | Address. | County of Operation. |
|-----------------------------------|----------------|----------------------|
| Local Petroleum Co. | Saginaw | Saginaw. |
| Michigan Oil & Gas. Company | Saginaw | Saginaw. |
| Michigan Petroleum Company | Brown City | St. Clair. |
| Mills, Ralph E. | Saginaw | Saginaw. |
| Ohio Fuel Gas Company | Columbus, Ohio | Saginaw. |
| Ohio Oil Company | Findlay, Ohio | Saginaw. |
| Saginaw Prospecting Company | Saginaw | Saginaw. |
| Saval Development Company | Saginaw | Saginaw. |
| Schaiberger Bros., H. W. & W. H. | Saginaw | Saginaw. |
| Schwinck, Jno. | Saginaw | Saginaw. |
| Schwinck, Samuel | Saginaw | Saginaw. |
| Shaltry, J. H., et al. | Saginaw | Saginaw. |
| Star Oil Company | Saginaw | Saginaw. |
| Sun Oil Company | Toledo, Ohio | Saginaw. |
| Superior Oil Company | Saginaw | Saginaw. |
| Sutherland, Wm., Trustee | Saginaw | Saginaw. |
| Valley Oil & Gas Company | Saginaw | Saginaw. |
| Voorhees & McNally (Pine Oil Co.) | Saginaw | Saginaw. |
| Wanigas Oil Company | Saginaw | Saginaw. |
| Wayco Oil Producing Company | Saginaw | Saginaw. |
| Wells-Schmidt Oil Company | Saginaw | Saginaw. |
| Western Drilling & Oil Company | Saginaw | Saginaw. |
| Willex Oil Company | Saginaw | Saginaw. |

PIG IRON PRODUCERS, 1926.

| Operator. | Office. | Name of Furnace. | Location of Furnace. |
|------------------------------|-----------------|------------------|----------------------|
| Michigan Iron & Chemical Co. | East Jordan | East Jordan | East Jordan. |
| Mitchell-Diggins Iron Co. | Cadillac | Cadillac | Cadillac. |
| Cleveland Cliffs Iron Co. | Cleveland, Ohio | Pioneer No. 2 | Near Marquette. |
| Antrim Iron Co. | Antrim | Antrim | Mancelona. |
| Antrim Iron Co. of America | Detroit | Newberry | Newberry. |
| Charcoal Co. | Dearborn | Henry & Benson | Fordson. |
| Delta Chemical & Iron Co. | Escanaba | Delta | Wells. |
| Ford Motor Co. | Detroit | A & B | Detroit. |
| Hanna Furnace Co. | Detroit | | |

POTTERY PRODUCERS, 1926.

| Operator. | Office. | Works. |
|--|---|----------------------|
| <i>Ionia County</i> Ionia Pottery Co. | Ionia | Ionia. |
| <i>Kalamazoo County</i> Kalamazoo Sanitary Mfg. Co. | Factory and Alcot Streets, Kalamazoo | Kalamazoo. |
| <i>Macomb County</i> Mt. Clemens Pottery Co. | Mt. Clemens, Rose & Church Sts. | Mt. Clemens. |
| <i>Monroe County</i> F. W. Ritter Sons | South Rockwood | South Rockwood. |
| <i>Wayne County</i> Becker Bros. Flower Pot Co. Champion Porcelain Co. | Detroit, 4645 51st St. Detroit, 8525 Butler Ave. | Detroit. Detroit. |

SALT PRODUCERS, 1926.

| Operator. | Office. | Works. |
|--|---|--|
| <i>Bay County</i> Halverson Lumber & Salt Co. | Bay City, 205 Salzburg Ave. | W. Bay City. |
| <i>Manistee County</i> Louis Sands Salt & Lumber Co. Ruggles & Rademacher | Manistee. Manistee. | Manistee. Manistee. |
| <i>Mason County</i> Morton Salt Co. | Ludington. | Ludington. |
| <i>Midland County</i> The Dow Chemical Co. (also bromine). (calcium chloride and magnesium) | Midland. | Midland. |
| <i>Saginaw County</i> Mershon, Eddy, Parker & Co. Saginaw Salt Products Co. Estate of Edward Germain. | Saginaw. Saginaw, W. S. Saginaw, W. S., Holland Ave. near Genesee Street. | Saginaw. Saginaw. Saginaw. Saginaw. |
| National Plate Glass Co. Strable Lumber & Salt Co. Saginaw Chemical Co (calcium chloride) | Saginaw. Saginaw. Saginaw. | Saginaw. Saginaw. Saginaw. |
| <i>St. Clair County</i> Michigan Salt Works. Morton Salt Co. Diamond Crystal Salt Co. | Marine City. Chicago, Ill., 717 Railway Exch. St. Clair. | Marine City. Port Huron. St. Clair. |
| <i>Wayne County</i> Solvay Process Co. (brine) Detroit Rock Salt Co. Mulkey Salt Co. Worcester Salt Co. Michigan Alkali Co. (brine) Pennsylvania Salt Mfg. Co. | Detroit. Scranton, Pa. Detroit, 610 Equity Bldg. New York City, 166 Duane Street. Wyandotte. Philadelphia, Pa., 115 Chestnut St. | Delray. Detroit. Oakwood. Ecorse. Wyandotte. Wyandotte. |

SANDSTONE PRODUCERS, 1926.

| Operator. | Office. | Quarry. |
|---|------------------|-------------|
| <i>Huron County</i> Cleveland Stone Co. | Cleveland, Ohio. | Grindstone. |
| <i>Marquette County</i> City of Marquette. | Marquette. | Marquette. |

SAND AND GRAVEL PRODUCERS, 1926.

| Operator. | Address. | Pit. |
|--|--|--|
| <i>Barry County</i> Hastings Gravel and Construction Co. Chas. Woolston Penock Poultry Farm. | Hastings. Hastings. Nashville. | Hastings. Hastings. Nashville. |
| <i>Bay County</i> A. J. Schabel, Jr. | Munger. | Munger. |
| <i>Berrien County</i> Ireland & Lester Garden City Sand Co. (molding sand) Broderick Bros. Kerlikowske Bros. (molding sand) E. F. Case & Son. | Benton Harbor. Chicago. Benton Harbor. St. Joseph. Watervliet. | Benton Harbor. Coloma (near) Riverside. Riverside. Watervliet. |
| <i>Branch County</i> Albert Hoskins D. H. Rogers J. F. Werner. | Bronson, R. D. No. 4. Bronson. | Bronson. Matteson. |

SAND AND GRAVEL PRODUCERS, 1926 (Continued)

| Operator. | Address. | Pit. |
|---|---|--|
| <i>Calhoun County</i> A. C. Behling Floyd Van Sickle Willard A. Young Brownlee Park Gravel and Mat. Co. | Albion. Albion. Albion, R. D. No. 6. Battle Creek, R. D. No. 1, Box 83. | Albion. Albion. Albion. Brownlee Park, Battle creek. Marshall. |
| Michigan Railway Co. | Jackson. | Marshall. |
| <i>Cass County</i> Fred Crandall. | Cassopolis. | Cassopolis. |
| <i>Chippewa County</i> F. H. Taylor. | Pickford. | Pickford. |
| <i>Clinton County</i> Essex Gravel Co. | St. Johns. | St. Johns. |
| <i>Crawford County</i> Federal Sand & Gravel Co. | Saginaw, 302½ Federal Ave. | Roscommon (nr) |
| <i>Delta County</i> Delta County Highway Comm. Bichler Bros. | Escanaba. Gladstone, R. D. No. 1. | Escanaba. Escanaba. |
| <i>Dickinson County</i> Anton Meinh. Champion Gravel Co. | Marquette. | Loretto. |
| <i>Eaton County</i> Ezra Goode. | Ionia. | Charlotte. |
| <i>Genesee County</i> Morehouse Bros. Flint Sandstone Brick Co. Flint Washed Sand & Gravel Co. Ford Goodrich. Alfred Reid Bayer-Brice Gravel Co. Genesee Gravel Co. Otisville Gravel Co. | Fenton. Flint. Flint, 316 S. Saginaw Street. Flint, 3222 S. Saginaw Street. Flint. Flint, 701 Genesee Co. Sav. Bk. Bldg. Detroit, 1409 Ford Bldg. Saginaw. | Fenton. Flint. Grand Blanc. Goodrich. Rogersville. Earlistead. Otisville. |
| <i>Gogebic County</i> Chicago & N. W. R. R. Co. | Chicago, Ill., 226 W. Jackson St. | Blenners. |
| <i>Gratiot County</i> James Dexter Elmon J. Evey A. E. Tomlin Wm. L. Wiles | Shepherd. Sumner. Sumner. Sumner, R. D. No. 2. | Summerton. Sumner. Sumner. Sumner. |
| <i>Hillsdale County</i> Chas. Coler New York Central R. R. Co. Jonesville Gravel Corporation Greenville Gravel Corporation | Camden. Cleveland, Ohio. Fort Wayne, Ind. Greenville, Ohio. | Camden. Jonesville. Hillsdale Jonesville. Somerset Center. |
| <i>Houghton County</i> Copper Range R. R. Co. (engine sand) | Houghton. | Dollar Bay. |
| <i>Huron County</i> Port Crescent Sand & Fuel Co. (core sand) Pere Marquette R. R. Co. | Detroit, 208 First Natl. Bk. Bldg. Detroit. | Port Austin. |
| <i>Ingham County</i> Central Michigan Gravel Co. Lansing Sand & Gravel Co. Leonard Gravel Co. River Forest Development Co. West & Ormsby Hugh Campbell & Son. Chas. Couch Michigan Railway Co. Antonio Glenco & Son. | Lansing. Lansing, 308 Cap. Nat. Bk. Bldg. Lansing, 311 E. Mt. Hope Ave. Lansing. Lansing, 1005 Mahlon Street. Bay City, 1516 6th St. Mason. Jackson. Mason. | Lansing. Lansing. Lansing. Lansing. Bath. Mason. Mason, Haslett. Mason. |

SAND AND GRAVEL PRODUCERS 1926, (Continued)

| Operator. | Address. | Pit. |
|--------------------------------------|-------------------------------------|--|
| <i>Ionia County</i> | | |
| J. I. Hazelitt | Ionia, R. D. | Ronald Tp. |
| E. J. Elvert | Muir | Muir. |
| Glick's Gravel Co. | Grand Rapids, 953 S. Ionia St. | Saranac. |
| S. L. McIntyre | Lowell, R. D. No. 3. | Saranac. |
| G. P. Scharl | Grand Rapids, Box 133. | Saranac. |
| <i>Jackson County</i> | | |
| Alfred Cooper | Horton | Horton. |
| Wm. Blake | Jackson, R. D. No. 6. | Jackson. |
| <i>Kalamazoo County</i> | | |
| Michigan Railway Co. | Jackson | Augusta. |
| County Road Commission | Kalamazoo | Kalamazoo. |
| Greenville Gravel Corporation | Greenville, Ohio | Kalamazoo. |
| John Rysenga | Kalamazoo, 434 Drexel Place | Kalamazoo. |
| <i>Kent County</i> | | |
| Belmont Sand and Gravel Co. | Grand Rapids, 606 Commercial Bldg. | Belmont. |
| Kent County Road Comm. | Grand Rapids | Ada, Kent City, Sparta, Rockford, Grand Rapids |
| Richard J. Slater | Ada, R. D. No. 1 | Cascade. |
| Battjes Fuel Co. | Grand Rapids, 36 Pearl St. | Grand Rapids. |
| Grand Rapids Gravel Co. | Grand Rapids, 327 Mich. Trust Bldg. | Grand Rapids. |
| Michigan Railway Co. | Jackson | Grand Rapids. |
| Valley City Stone & Gravel Co. | Grand Rapids, 135 E. Fulton St. | Grand Rapids. |
| Miendertsma & Langland | Coopersville, R. D. No. 1. | Grand Rapids. |
| <i>Lapeer County</i> | | |
| Willis Van Alstine | Goodrich | Goodrich. |
| Lapeer County Road Comm. | Lapeer | Lapeer. |
| M. Caley | Metamora | Metamora. |
| <i>Lenawee County</i> | | |
| Acme Concrete Products & Gravel Co. | Cement City | Cement City. |
| Geo. Evans | Morenci | Morenci. |
| R. B. Gillispie Estate | Tecumseh | Clinton Tp. |
| Detroit, Toledo & Ironton R. R. | Dearborn | Tecumseh. |
| Lenawee Sand & Gravel Co. | Tecumseh | Tecumseh. |
| Puritan Sand & Gravel Co. | Tecumseh | Tecumseh. |
| Tecumseh Gravel Co. | Tecumseh | Tecumseh. |
| <i>Livingston County</i> | | |
| Greenville Gravel Corporation | Greenville, Ohio | Brighton. |
| Ohio & Michigan Sand & Gravel Co. | Toledo, Ohio, 1021 Nicholas Bldg. | Chilson. |
| <i>Mackinac County</i> | | |
| Hill and Belknap | East Tawas | St. Ignace. |
| Duluth, South Shore & Atlantic R. R. | Marquette | |
| <i>Macomb County</i> | | |
| Cadillac Builders Supply Co. | Detroit, 26 Campau Bldg. | Detroit. |
| Peters Bros. | Mt. Clemens | Mt. Clemens. |
| Lakeside Ice & Coal Co. | Mt. Clemens | Mt. Clemens. |
| Mt. Clemens Sand & Supply Co. | Mt. Clemens, 111 Rose Street. | Mt. Clemens. |
| Ray Sand & Gravel Co. | Detroit, 2508 Book Bldg. | Utica. |
| <i>Manistee County</i> | | |
| Hubbell Sand Co. (core sand) | Manistee | Manistee. |
| Geo. Szymanski | Manistee, R. D. No. 2 | Manistee. |
| M. A. Farr & Co. | Chicago, 140 S. Dearborn St. | Onkama. |
| <i>Marquette County</i> | | |
| Champion Gravel Co. | Marquette | Champion. |
| <i>Mason County</i> | | |
| Marion N. Fitch | Manistee | Ludington. |
| Hubbell Sand Co. (core sand) | Tallman | Walhalla. |
| C. C. Dodge & Son | | |
| <i>Mecosta County</i> | | |
| Midland Gravel Co. | Midland | Millbrook. |
| <i>Menominee County</i> | | |
| County Road Commission | Menominee | Various places. |
| W. A. Blackman | Daggett | Carney, Nadeau |

SAND AND GRAVEL PRODUCERS 1926, (Concluded)

| Operator. | Address. | Pit. |
|--|--------------------------------------|---------------------|
| <i>Montcalm County</i> | | |
| Benhagel Construction Co. | Ionia | Greenville. |
| Belknap Cement Products Co. | Greenville | Pierson. |
| Alexander Kenney | Pierson | Pierson. |
| Frank H. Stoerk | Pierson | Pierson. |
| <i>Muskegon County</i> | | |
| County Highway Commission | Muskegon | Casnovia. |
| <i>Oakland County</i> | | |
| Warner R. Thompson & Co. (molding sand) | Detroit, 604 Kerr Bldg. | Goodison. |
| Standard Gravel Co. | Pontiac | New Hudson. |
| Detroit-Oxford Gravel & Stone Co. | Oxford | Oxford. |
| Fuller-Becker Sand & Gravel Co. | Oxford | Oxford. |
| P. Koenig Coal Co. | Detroit, 1480 Gratiot Ave. | Oxford. |
| Ward Sand & Gravel Co. | Oxford | Oxford. |
| Boice Bros. | Pontiac, 974 Orchard Lake Ave. | Pontiac. |
| M. D. Ward | Pontiac, Box 184. | Pontiac. |
| Michigan Pressed Brick Co. | Detroit, 4500 Lawton Ave. | Goodison. |
| Rochester Sand & Brick Co. | Detroit, 400 Penobscot Bldg. | Rochester. |
| Ray Sand & Gravel Co. | Detroit, 2508 Book Bldg. | Oxford, New Hudson. |
| <i>Oceana County</i> | | |
| Newfield Township | Hesperia | Hesperia. |
| <i>Osceola County</i> | | |
| Crescent Gravel Co. | Reed City | Hersey. |
| Hersey Gravel Co. | Hersey | Hersey. |
| Pere Marquette R. R. | Detroit | Hersey. |
| <i>Ottawa County</i> | | |
| D. J. Sharporn | Hudsonville | Allendale. |
| Walliga Bros. | Coopersville | Coopersville. |
| Jno. Holtrop | Ferrysburg | Ferrysburg. |
| Tom Johnson Gravel Co. | Grand Haven | Grand Haven. |
| Construction Materials Co. | Chicago, Ill., 133 W. Washington St. | Eastmanville. |
| I. Van Welden & Co. | Grand Haven, 609 Fulton St. | Grand Haven. |
| <i>Presque Isle County</i> | | |
| Alpena Gravel Co. | East Tawas | Millersburg(near) |
| <i>Saginaw County</i> | | |
| Valley Sand Co. | Bay City, 209 S. Chilson St. | Saginaw River. |
| Barry Sand Co., Ltd. (molding sand) | Saginaw | Saginaw. |
| <i>St. Clair County</i> | | |
| Superior Sand & Gravel Co. | Detroit, 926 Dime Bk. Bldg. | Marine City. |
| Ontario Gravel Freighting Co. | Windsor, Ont., 228 Sandwich St. | Algonac. |
| McLouth Estate | Marine City | St. Clair River. |
| Lake Gravel Co. | Marysville | St. Clair River. |
| Michigan Molding Sand Co. (molding sand) | Port Huron, 1928 7th Street | Marine City. |
| Thompson Tug Co. | Port Huron | Port Huron. |
| Service Gravel Co. | Marysville | Marysville. |
| F. D. Gleason Coal Co. | Detroit, 28 Campau Bldg. | St. Clair River. |
| <i>Shiawassee County</i> | | |
| Bert Martenis | Owosso, R. D. No. 1, Box 120. | Byron. |
| John Graham | Byron | Byron. |
| John Frischke | Owosso | Owosso. |
| Fred Hayes | Owosso | Lennon. |
| J. C. Stewart Co. | Flint, 1605 S. Saginaw St. | Owosso, Oxford. |
| <i>Tuscola County</i> | | |
| Tom Hile | Caro, R. D. No. 2. | Caro. |
| Cass City Sand & Gravel Co. | Cass City | Cass City. |
| Great Lakes Foundry Sand Co. | Detroit, 1326 Penobscot Bldg. | Juniata. |
| Benson Whittaker | Kingston, R. D. No. 2. | Kingston. |
| Burt Core Sand Co. (core sand) | Detroit, 642 Beaubien St. | Vassar. |
| <i>Washtenaw County</i> | | |
| Cadillac Sand & Gravel Co. | Toledo, Ohio, 1021 Nicholas Bldg. | Ann Arbor. |
| Fred Fiegel | Ann Arbor, R. D. No. 3. | Ann Arbor. |
| D. A. Killins & Sons | Ann Arbor | Ann Arbor. |
| William Schiller | Ann Arbor, R. D. No. 3. | Ann Arbor. |
| County Road Commission | Ann Arbor | Ann Arbor. |
| Finkbeiner Bros. | Saline | Saline. |
| Geo H. Campbell | Ypsilanti, W. Cross St. | Ypsilanti. |
| <i>Wayne County</i> | | |
| Cameron Steamship Co. | Detroit, Ft. of Chene St. | Detroit River |
| Michigan Silica Co. (glass sand) | Rockwood | Rockwood. |

MINERAL RESOURCES OF MICHIGAN

TRAP ROCK (BASALT) PRODUCERS, 1926.

| Operators. | Office. | Quarry. |
|--|---|---|
| <i>Gogebic County</i> McKenna Bros. Wakefield Crushed Stone Co. | Wakefield | Wakefield. |
| <i>Iron County.</i> Iron County Road Commissioners..... | Crystal Falls..... | N. W. of N. E. Sec. 7, 43-32. |
| <i>Marquette County</i> City of Negaunee..... Olivine Co. City of Ishpeming..... Advance Industrial Supply Co. | Negaunee..... Marquette..... Ishpeming..... Chicago, Ill. | Negaunee..... Marquette..... Ishpeming..... Marquette. |

INDEX

Part I and Part II

INDEX—PART I AND PART II

| | Page |
|---|------|
| Adams Point, limestone on | 72 |
| Afton, analysis of limestone near | 73 |
| limestone near | 72 |
| Agates | 138 |
| Alabaster, gypsum at | 103 |
| Alger County, gravel deposits | 76 |
| Alma, mineral waters produced at | 135 |
| Alpena, cement plant at | 99 |
| coral reefs near | 138 |
| limestone near | 72 |
| Alpena County, gravel in | 75 |
| lake clays | 65 |
| limestone deposits in | 72 |
| limestone resources of | 73 |
| shale in | 67 |
| Amethyst | 138 |
| Analyses, iron ores by ranges and grades | 22 |
| Anhydrite | 104 |
| Antrim County, shales in | 67 |
| Antrim shale, suitability for brick and tile products | 67 |
| Description of | 154 |
| Appendix | 303 |
| Arcadian Consolidated Mining Company, company report | 58 |
| Arenac County, gypsum beds in | 103 |
| Arenac County, limestone in | 73 |
| Arvon, slate near | 83 |
| Asbestos | 139 |
| Ashley, drain tile manufactured at | 109 |
| B | |
| Baraga County, graphite in | 82 |
| lake clays | 65 |
| slate deposits | 83 |
| Basalt, directory of producers 1926 | 314 |
| Bay City, shale at | 66 |
| Bay County, production of coal in | 123 |
| Bayport, limestone near | 72 |
| Bayport Formation, description of | 156 |
| Bedford shale use in cement manufacture | 67 |
| Bell shale, suitability of for brick and tile products | 67 |
| Benton Harbor, mineral waters produced at | 135 |
| peat produced at | 87 |
| Berea sandstone, description of | 154 |
| Berrien County, core sand produced in | 80 |
| peat produced in | 87 |
| Bessemer, mica near | 139 |
| Blaine, nature of Salina Formation near | 89 |
| Blaney, limestone near | 72 |
| Brick and tile products | 109 |
| directory of producers 1926 | 305 |
| production and value | 110 |
| trend of industry | 110 |
| Brines, formations producing | 63 |
| products of | 61 |
| resources of | 63 |
| Bromine | 61 |
| Bronson, shale near | 67 |
| Buhrstones | 85 |
| C | |
| Calcium chloride | 62 |
| Calhoun County, gravel in | 75 |
| sandstone in | 84 |
| Calumet and Hecla Consolidated Copper Co., company report | 34 |
| Cambrian sandstone | 84 |
| Capac, peat produced at | 87 |
| Celestite | 83 |
| Cement, directory of producers 1926 | 306 |
| history of industry | 98 |
| production and value in Michigan | 100 |
| production and value in U. S. | 99 |
| raw materials | 98 |
| Charlevoix, limestone at | 72 |
| Charlevoix County, limestone deposits | 72 |
| shale in | 67 |
| Chippewa County, lake clays in | 65 |
| limestone in | 73 |
| Chlorastrolite | 139 |
| Cheboygan County, gravel in | 75 |
| lake clays in | 65 |
| limestone deposits in | 72 |
| limestone resources of | 73 |
| shale in | 67 |
| Clay | 63 |
| composition and properties of | 64 |
| directory of producers 1926 | 307 |

| | Page |
|--|------|
| manner of formation | 64 |
| sold by producers | 66 |
| types of | 64 |
| Coal | 113 |
| areal extent of coal bearing rocks | 115 |
| analysis of | 119 |
| directory of producers 1926 | 306 |
| economic features | 121 |
| historical account | 119 |
| local features of beds | 118 |
| mining methods | 121 |
| production and value | 123 |
| properties of | 119 |
| pyrites in | 139 |
| relation of beds | 117 |
| structure of coal basin | 117 |
| table showing production and value | 124 |
| undeveloped areas | 122 |
| Coal basin—elevations in | 115 |
| percent underlain with coal | 117 |
| percent workable coal | 117 |
| Coal bearing rocks, geology of | 115 |
| Coal fields in Michigan | 120 |
| Coal measures, correlation of strata | 116 |
| description of members of | 116 |
| fire clays of | 64 |
| outcrops of | 116 |
| sandstone quarries in | 84 |
| thickness of | 115 |
| Coal measure shales, brick manufactured from | 109 |
| Coal reserves | 122 |
| Coal seams, correlation of | 117 |
| Coke, directory of producers 1926 | 307 |
| Coldwater, shale near | 67 |
| Coldwater shale, suitability for brick and tile products | 67 |
| Copper | 27 |
| content per ton of rock | 29 |
| prices per pound | 29 |
| Copper mines, details of company reports | 34 |
| Copper production, by mines | 30 |
| general statement | 29 |
| Copper Range Company, company report | 38 |
| Coral reef formations | 138 |
| Corunna, face brick manufactured at | 109 |
| shale at | 66 |
| Costs of mining, average for state | 20 |
| copper | 33 |
| Dickinson County | 16 |
| Gogebic County | 15 |
| Iron County | 17 |
| Marquette Range | 18 |
| siliceous open pit mines | 19 |
| Crystal Falls, trap rock near | 81 |
| Crystal Falls iron bearing district, marble present in | 85 |
| D | |
| Dearborn, lake clay deposits at | 109 |
| Dear Lake, quartzite at | 139 |
| Detroit, lake clay deposits | 109 |
| mineral water production | 136 |
| Diamonds | 139 |
| Dickinson County, limestone deposits | 72 |
| marble quarries | 85 |
| production and shipment from iron mines | 11 |
| Directory of producers of non-metallic minerals 1926 | 303 |
| Dow Chemical Company | 61 |
| Dowagiac, diamond found near | 139 |
| Dundee, limestone near | 73 |
| Dundee Formation, mineral water produced from | 135 |
| E | |
| Eaton County, drain tile and sewer pipe manufacture | 109 |
| sandstone in | 84 |
| Eagle Mills, grindstone quarries at | 85 |
| East Jordan, shale near | 67 |
| El Cajon Beach, limestone at | 72 |
| Ellsworth, shale near | 67 |
| Emery Junction, gypsum beds near | 103 |
| Emmet County, fuller's earth in | 64 |
| limestone deposits in | 72 |
| shale in | 67 |
| F | |
| Faults, in coal seams | 117 |
| Feldspar | 80 |
| analysis of near Republic | 81 |

| | Page |
|--|------|
| Feldspar dikes, kaolin in | 64 |
| Felch, magnesian limestone near | 72 |
| Fiborn, limestone at | 64 |
| Fire clay | 109 |
| Flat Rock, drain tile manufactured at | 66 |
| Flushing, shale at | 80 |
| Fondry sands | 64 |
| Fullers earth | 64 |
| G | |
| Gems and precious stones | 139 |
| Gibraltar, celestite near | 83 |
| Glass sand | 131 |
| Gogebic County, feldspar dikes in | 80 |
| lake clays in | 65 |
| production and shipment from iron mines | 11 |
| trap rock in | 81 |
| Gold | 137 |
| Graphitic and mineral paints | 82 |
| directory of producers, 1926 | 307 |
| Grand Island, gravel on | 76 |
| Grand Lake, depth of salt beds at | 92 |
| Grand Ledge, drain tile and sewer pipe manufactured at | 109 |
| face brick manufactured at | 109 |
| sandstone quarries near | 84 |
| shale at | 66 |
| Grand Rapids, gypsum at | 103 |
| Grand River, gravel deposits of | 76 |
| Grandville, gypsum at | 103 |
| Granite | 138 |
| Graiot County, drain tile manufactured in | 109 |
| gravel deposits in | 76 |
| Grindstone City, sandstone quarries at | 84 |
| Grindstone and other abrasives | 84 |
| directory of producers 1926 | 307 |
| Gypsum | 103 |
| directory of producers 1926 | 307 |
| production and values | 104 |
| uses | 106 |
| H | |
| Hancock, Maryland, glass sand from | 34 |
| Harmon City, gypsum beds near | 103 |
| Heisterman's Island, limestone on | 73 |
| Hendricks, limestone at | 72 |
| Hillsdale County, sandstone in | 84 |
| Houghton County, lake clays in | 65 |
| Humus | 87 |
| Huron Bay district, slate quarries in | 83 |
| Huron County, core sand in | 80 |
| limestone deposits in | 72 |
| sandstone in | 84 |
| Huron Portland Cement Co | 67 |
| I | |
| Ida, celestite and strontianite near | 83 |
| Ingham County, manufacture of face brick in | 109 |
| Iodine | 63 |
| Ionia, sandstone quarries near | 84 |
| Ionia County, gravel deposits in | 76 |
| sandstone in | 84 |
| Iosco County, gypsum in | 103 |
| Iron County, production and shipment from iron mines | 12 |
| trap rock in | 81 |
| Iron industry | 7 |
| Iron mines, Dickinson County | 11 |
| production and shipment by counties | 11 |
| summary by counties | 13 |
| Iron ore, mined in U. S. by districts and varieties | 21 |
| reserves | 25 |
| reserves and assessed valuation by counties | 14 |
| shipment of from 1880 to 1926 | 9 |
| shipped from mines in U. S. by states | 21 |
| Ishpeming, asbestos near | 139 |
| gold near | 137 |
| peat near | 87 |
| quartz mined near | 87 |
| quartzite near | 139 |
| trap rock near | 81 |
| Isle Royale, chlorastrolite on | 139 |
| Isle Royale Copper Company, company report | 43 |
| J | |
| Jackson, sewer pipe manufactured at | 109 |
| shale at | 66 |
| Jackson County, gravel deposits in | 75 |
| sandstone in | 84 |
| Jacobsville, sandstone at | 84 |

| | Page |
|---|--------|
| K | |
| Kalamazoo County, gravel deposits in | 75 |
| Kaolin | 64 |
| Keweenaw County, gravel deposits in | 76 |
| Kent County, gravel deposits in | 76 |
| gypsum in | 103 |
| Kona dolomite | 85 |
| L | |
| Lake Michigamme, peridotite dike rocks near | 87 |
| Lake Superior sandstone, analyses and tests of | 84 |
| description of | 150 |
| undesirability in gravel | 75 |
| L'Anse, graphite near | 82 |
| Lime | 69 |
| production and value of | 70 |
| Lime burning, history of the industry | 69 |
| Limestone | 70 |
| character and occurrence of | 71 |
| history of the industry | 70 |
| production and value of | 74 |
| uses of | 73 |
| Limestone and lime, directory of producers 1926 | 308 |
| Limestone resources | 73 |
| Ludington, core sand at | 80 |
| M | |
| Mackinac County, lake clays in | 65 |
| limestone deposits in | 72 |
| Mackinaw City, limestone near | 72 |
| Magnesium | 62 |
| Magnesium chloride | 63 |
| Magnesium sulphate | 63 |
| Manistee, core sand at | 80 |
| Manistique, limestone near | 72 |
| Maple River, gravel deposits of | 76 |
| Marble | 85 |
| Marblehead, limestone at | 72 |
| Marl | 85 |
| counties having deposits | 86 |
| production and uses | 87 |
| Marquette, granite near | 139 |
| sandstone quarries at | 84 |
| serpentine near | 87 |
| trap rock near | 81 |
| Marquette County, feldspar dikes in | 64, 80 |
| quartz in | 87 |
| Marquette iron bearing district, marble present in | 85 |
| Marquette Range, production and shipments from iron mines | 13 |
| Marshall Formation, brines and salt from | 61, 95 |
| description of | 155 |
| effect on quality of gravel | 75 |
| mineral waters from | 135 |
| sandstone quarries in | 84 |
| Mason County, core sand in | 80 |
| Maybee, celestite near | 83 |
| Mayflower—Old Colony Copper Company, company report | 57 |
| Menominee iron bearing district, marble present in | 85 |
| mica in | 139 |
| Midland, production of bromine at | 61 |
| production of magnesium at | 62 |
| Minnesota, iron ore shipped | 14 |
| Mine operation, general statistics | 20 |
| Mineral waters, chief horizons | 135 |
| therapeutic value | 134 |
| production and value of | 136 |
| Miscellaneous minerals | 139 |
| Mohawk Mining Company, company report | 47 |
| Monroe, celestite and strontianite near | 83 |
| limestone near | 72 |
| Monroe County, glass sand in | 131 |
| lime burning in | 69 |
| limestone deposits in | 70, 72 |
| Monroe Formation, celestite and strontianite in | 83 |
| Morenci, drain tile manufactured at | 109 |
| Mount Clemens, mineral waters produced at | 135 |
| N | |
| Negaunee, trap rock near | 81 |
| Newaygo Portland Cement Company | 67 |
| New York, slip clay produced in | 64 |
| Northern Peninsula, lake clays of | 65 |
| Norwood, limestone at | 72 |
| Novaculite | 85 |

O

| | Page |
|---|--------|
| Oakwood, salt shaft at..... | 89, 94 |
| Oil and gas, directory of producers 1926..... | 308 |
| Omer, limestone near..... | 73 |
| Onaway, depth to salt beds at..... | 92 |
| Ontonagon county, feldspar dikes in..... | 80 |
| lake clays in..... | 60 |
| slip clay in..... | 64 |
| Ottawa County, gravel deposits in..... | 76 |
| sandstone in..... | 84 |
| Ottawa, Illinois, glass sand from..... | 134 |
| Ozark, limestone at..... | 72 |

P

| | |
|--|---------|
| Parma, sandstone quarries at..... | 84 |
| Parma sandstone, description of..... | 16, 156 |
| Peat..... | 87 |
| Petoskey, coral reefs near..... | 139 |
| limestone near..... | 72 |
| Petoskey agates..... | 139 |
| Petoskey Portland Cement Co..... | 99 |
| shale quarry..... | 67 |
| Pig iron, directory of producers 1926..... | 309 |
| Plaster Creek, discovery of gypsum along..... | 103 |
| Pt. aux Chenes, gypsum beds at..... | 104 |
| Potash..... | 63 |
| Pottery, directory of producers 1926..... | 309 |
| Pottery and porcelain ware..... | 67 |
| Porphyry coppers, competition with Michigan mines..... | 29 |
| Portage Entry, sandstone quarries at..... | 84 |
| Port Crescent, core sand at..... | 80 |
| Presque Isle, serpentine at..... | 87 |
| Presque Isle County, lake clays in..... | 65 |
| limestone deposits in..... | 72 |
| shale in..... | 67 |
| Pyrites..... | 139 |

Q

| | |
|--|-----|
| Quartz..... | 87 |
| Quartzite..... | 139 |
| Quincy Mining Company, company report..... | 52 |
| Quincy, shale near..... | 67 |

R

| | |
|--|--------|
| Randville dolomite..... | 73, 85 |
| Randville, marble quarries at..... | 85 |
| Republic, analysis of feldspar dikes near..... | 81 |
| asbestos near..... | 139 |
| mica near..... | 139 |
| Richmondville, shale at..... | 66 |
| Formation, bromine from..... | 65 |
| Rockland, slip clay near..... | 64 |
| Rockwood, celestite near..... | 83 |
| glass sand near..... | 131 |
| Rockport, limestone near..... | 72 |
| Rogers, analysis of limestone near..... | 73 |
| limestone near..... | 72 |
| Rope's gold mine..... | 87 |

S

| | |
|---|----------|
| Saginaw County, coal production in..... | 123 |
| Saginaw Formation, description of..... | 116, 156 |
| brick manufactured from..... | 109 |
| Saint Clair County, peat produced in..... | 87 |
| production and value of salt from..... | 95 |
| Saint Ignace, gypsum beds near..... | 104 |
| Saint Louis, mineral waters produced at..... | 135 |
| Salina Formation, description of..... | 152 |
| extent of..... | 92 |
| outcrops recorded and wells penetrating..... | 89 |
| Salt, areas favorable for exploration..... | 92 |
| directory of producers 1926..... | 310 |
| growth of industry in Wayne County..... | 94 |
| history of industry..... | 94 |
| production and value of in Michigan and U. S..... | 96 |
| Salt and brine bearing formations..... | 89 |
| Sand and Gravel..... | 74 |
| directory of producers 1926..... | 310 |
| growth of the industry..... | 76 |
| production and value of..... | 78 |
| quality and composition of..... | 75 |
| rank of counties..... | 76 |
| specifications for roads..... | 76 |
| unfavorable areas for..... | 75 |

| | Page |
|---|----------|
| Sand Lime Brick..... | 125 |
| directory of producers 1926..... | 306 |
| manufacture and raw materials..... | 126 |
| production and value of in Michigan and U. S..... | 129 |
| Sandstone..... | 84 |
| directory of producers..... | 310 |
| Schoolcraft County, limestone in..... | 72 |
| Seneca Copper Mining Company, company report..... | 55 |
| Serpentine and verde antique..... | 87 |
| Seul Choix Point, limestone on..... | 73 |
| Shale..... | 66 |
| resources of..... | 67 |
| Sibley, limestone near..... | 72 |
| Slate..... | 83 |
| Slip clay..... | 64 |
| Southern Peninsula, lake clays of..... | 65 |
| South Haven, proposed mineral water wells..... | 136 |
| Springwells, lake clay deposits at..... | 109 |
| Steiner, glass sand near..... | 131 |
| Strontianite..... | 83 |
| Sylvania sandstone..... | 131 |
| analysis of..... | 132 |
| celestite in..... | 83 |
| Summary..... | 301 |
| Summary table of production and value, 1922-1926..... | 302 |
| U | |
| Talc..... | 139 |
| Thomsonite..... | 139 |
| Trap rock..... | 81 |
| Traverse limestone, coral reefs in..... | 139 |
| description of..... | 153 |
| Turner, gypsum beds near..... | 103 |
| Tuscola County, core sand in..... | 80 |
| Twining, gypsum beds near..... | 102 |
| Twin Lakes, limestone near..... | 73 |
| V | |
| Union City, cement plant at..... | 98 |
| shale near..... | 67 |
| W | |
| Vassar, core sand at..... | 80 |
| W | |
| Wayne County, celestite in..... | 83 |
| drain tile manufactured in..... | 109 |
| glass sand in..... | 131 |
| limestone deposits in..... | 72 |
| Wakefield, trap rock near..... | 81 |
| Wexford County, fuller's earth in..... | 64 |
| Williamston, face brick manufactured at..... | 109 |
| shale at..... | 66 |
| Wisconsin, iron ore shipped..... | 14 |
| Woodville sandstone, description of..... | 116, 156 |