STATE OF ILLINOIS

DEPARTMENT OF REGISTRATION AND EDUCATION

ORDOVICIAN GALENA GROUP (TRENTON) OF ILLINOIS — STRUCTURE AND OIL FIELDS

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ORDOVICIAN GALENA GROUP (TRENTON) OF ILLINOIS — STRUCTURE AND OIL FIELDS

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ABSTRACT

A structure map drawn on top of the Galena Group (Trenton) defines most of the major structural features of Illinois and reflects much of the structural movement that has occurred in the state since Cincinnatian (late Ordovician) time. The top of the Galena is more than 6500 feet below sea level in the deepest part of the Illinois Basin. It rises gently in all directions, and it reaches an elevation of about 1000 feet above sea level in northern Illinois.

Oil has been produced from the Galena in at least 22 fields in the southern half of Illinois. Information about each field is tabulated, but accurate production totals are not available because of some commingling of oil produced from the Galena with oil from shallower producing zones. Detailed structure maps of the larger fields show that the fields are associated with structural highs.

INTRODUCTION

The top of the Galena Group (Trenton)* is a widespread, easily recognized, mappable surface that is useful as a datum plane for estimating depths to the tops of underlying Cambrian and Ordovician formations. It also accurately reflects the structural movements that have taken place since the Galena was overlain by the Maquoketa Shale Group. The structure on top of the Galena has long been of interest to the petroleum industry because oil is produced from the upper 150 feet of the Galena. More recently, the gas-storage industry has used structure testing to the top of the Galena to locate closed structures in the deeper rocks (Buschbach and Bond, 1967). Most of the storage companies have made their structural information available to us, and it has been incorporated into our maps.

Oil produced from the Galena in Illinois accounts for less than one percent of the state's cumulative oil production. The oil fields are intimately associated with positive structures on top of the Galena and therefore they are described in this report. Individual structure maps have been prepared to show the details of the more heavily drilled areas where there is Galena (Trenton) production.

Acknowledgments

The authors express their appreciation to the many people who have contributed data or

*The term "Trenton" is not used formally as a rock-stratigraphic term in Illinois. It has, however, been used by the petroleum industry in this state for many years, and consequently we have included "Trenton" in parentheses following the accepted term, "Galena."

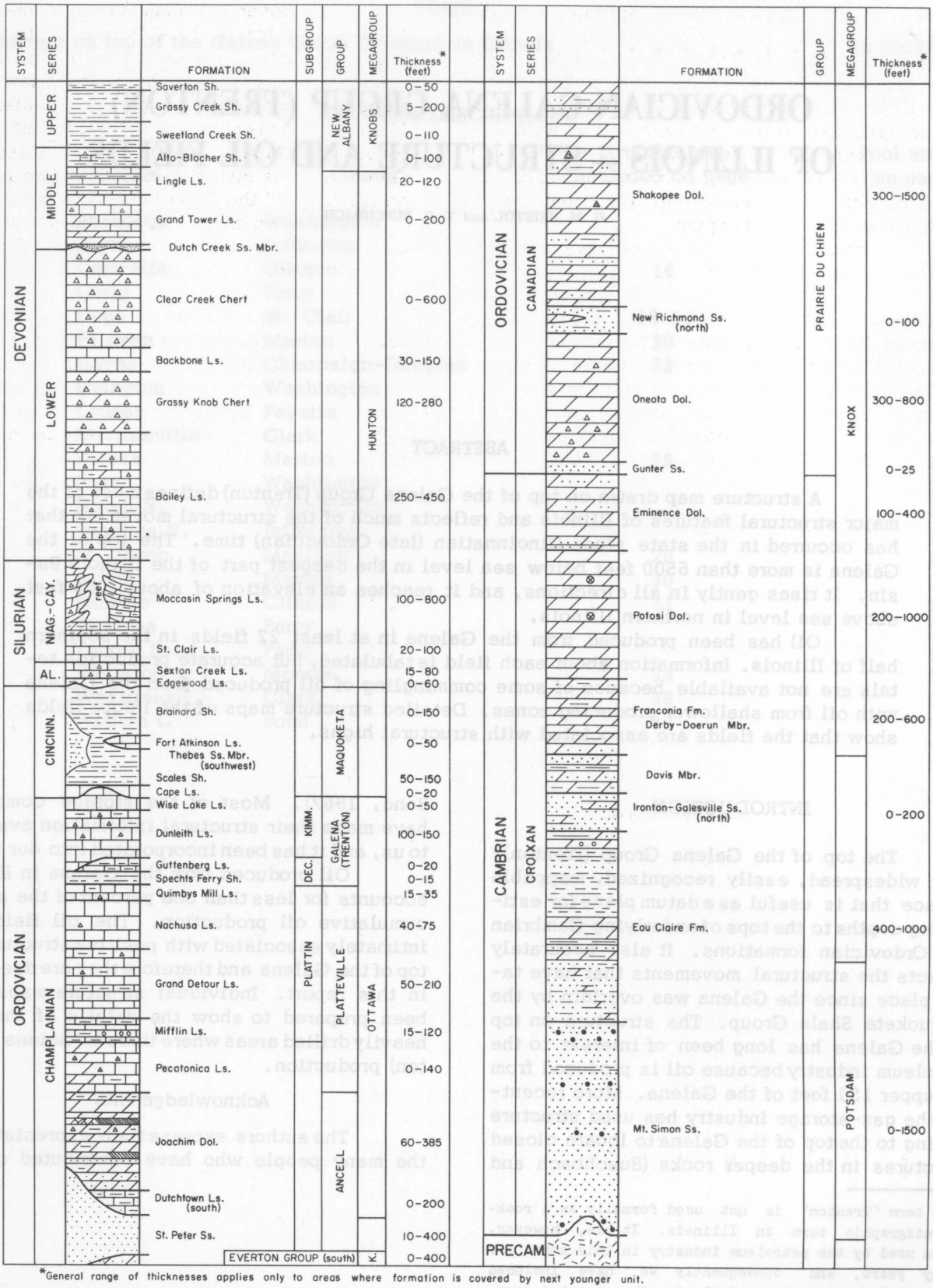

Fig. 1 - Generalized geologic column of lower Paleozoic strata in the Illinois Basin. Stratigraphy by T. C. Buschbach - modified from Willman et al., 1967. Abbreviations: Al. - Alexandrian; Cay. - Cayugan; Cincinn. - Cincinnatian; Dec. - Decorah; Kimm. - Kimmswick; K. - Knox; Niag. - Niagaran; Precam. - Precambrian.

ideas for this paper. W. F. Meents, Elwood Atherton, and H. B. Willman, all from the Illinois State Geological Survey, reviewed the structure map and offered helpful advice. Robert Magenheimer, Northern Illinois Gas Company, was especially cooperative in furnishing us with up-to-date maps and datum points. James Clark, Hydrocarbon Engineering Company, provided interpretations of existing data that contributed significantly to our mapping.

Structure maps have been prepared by many authors for portions of Illinois. These maps have been used as guides in the preparation of this report. The top of the Galena (Trenton) was mapped for the entire state by Meents and Horberg (1954). The Sangamon Arch area in west-central Illinois was mapped by Whiting and Stevenson (1965). Recent core testing and a seismic survey resulted in some new ideas about the structure on top of the Galena in northeastern Illinois (Buschbach and Heim, 1972).

STRATIGRAPHIC RELATIONS

The Galena Group in Illinois is chiefly a pure, buff-colored, medium-grained, fossiliferous limestone. It grades to dolomite, locally on the structural arches surrounding the Illinois Basin and regionally in the northern part of the state. The Galena is assigned to the Champlainian (middle Ordovician) Series (fig. 1). It overlies the fine-grained limestones of the Platteville Group and underlies the Maquoketa Shale Group of Cincinnatian age. The Maquoketa has been removed by erosion in north-central and northwestern Illinois and in discontinuous areas along the west side of the state (stippled areas, pl. 1). Structural mapping has not been extended into these stippled areas because the top of the Galena is not a reliable structural datum where the Maquoketa is absent.

Wherever the Maquoketa is present in Illinois, the top of the Galena and the base of the Maquoketa coincide. In a limited area in the southwest corner of the state, a few feet of Cape Limestone occurs beneath the shales of the Maquoketa and above the limestones of the Galena. The Cape is assigned to the Maquoketa Group, and the structure map therefore is drawn on the base of the Cape Limestone in this area.

The top of the Galena Group is usually easy to determine from inspection of drilling samples because of the marked lithologic contrast between the pure limestone or dolomite of the Galena and the overlying shale of the Maquoketa. Furthermore, most geophysical logs from Illinois clearly indicate the top of the Galena. The Galena has a marked increase in electrical resistivity and a marked decrease in sonic travel time and in gamma radiation from the overlying Maquoketa (table 1; figs. 2-6).

The contact between the Galena and the Maquoketa is sharp, and regionally it is unconformable. Southward thinning of the Galena is shown by DuBois (1945, fig. 5, p. 20); the thinning is largely a result of truncation of the upper units in the Galena (Templeton and Willman, 1963, p. 98). The top of the Galena, however, appears to be relatively flat, with no more than a few inches to a few feet of irregularities except for rare local caves or fissures. The thickness of the Galena Group is very predictable, an indication that there is little local relief at its top.

STRUCTURE

The top of the Galena is considered here to be the best available datum for predicting the tops of the underlying Cambrian and Ordovician formations and for reconstructing structural move-

TABLE 1 — NAMES, LOCATIONS, AND ELEVATIONS OF WELLS PLOTTED ON FIGURE 2
(Geophysical logs from these wells are illustrated in figures 3 to 6.)

Well	Driller	Farm	County	Sec.-T.-R.	Elevation
A	R. E. Davis	E. A. South No. 1	Henry	30-16N-1E	803
B	Northern Illinois Gas Co.	Feinhold No. 1	Livingston	33-28N-6E	730
C	Metropolitan Sanitary District	DH 71-91(67)	Cook	16-39N-14E	587
D	Central Illinois Public Service	Proctor No. SM-3	McDonough	20-7N-3W	773
E	NEA YES, Inc.	Stoggsdill Comm. No. 1	Shelby	19-14N-2E	632
F	Magnolia Petroleum	E. M. Young No. 1	Clark	19-10N-13W	571
G	Kingwood Oil	C. Castor No. 1	Madison	22-4N-7W	484
H	H. F. Robinson	V. Buckhorn No. 1	Randolph	6-6S-6W	531
I	Magnolia Petroleum	Reuscher-Froemling No. 1	Jackson	11-7S-4W	659
J	Superior Oil	Schallert Unit No. 1	Jefferson	18-1S-2E	561
K	Texaco, Inc.	E. Cuppy No. 1	Hamilton	6-6S-7E	393
L	Texaco, Inc.	J. M. Walters No. 1	Gallatin	29-9S-9E	372

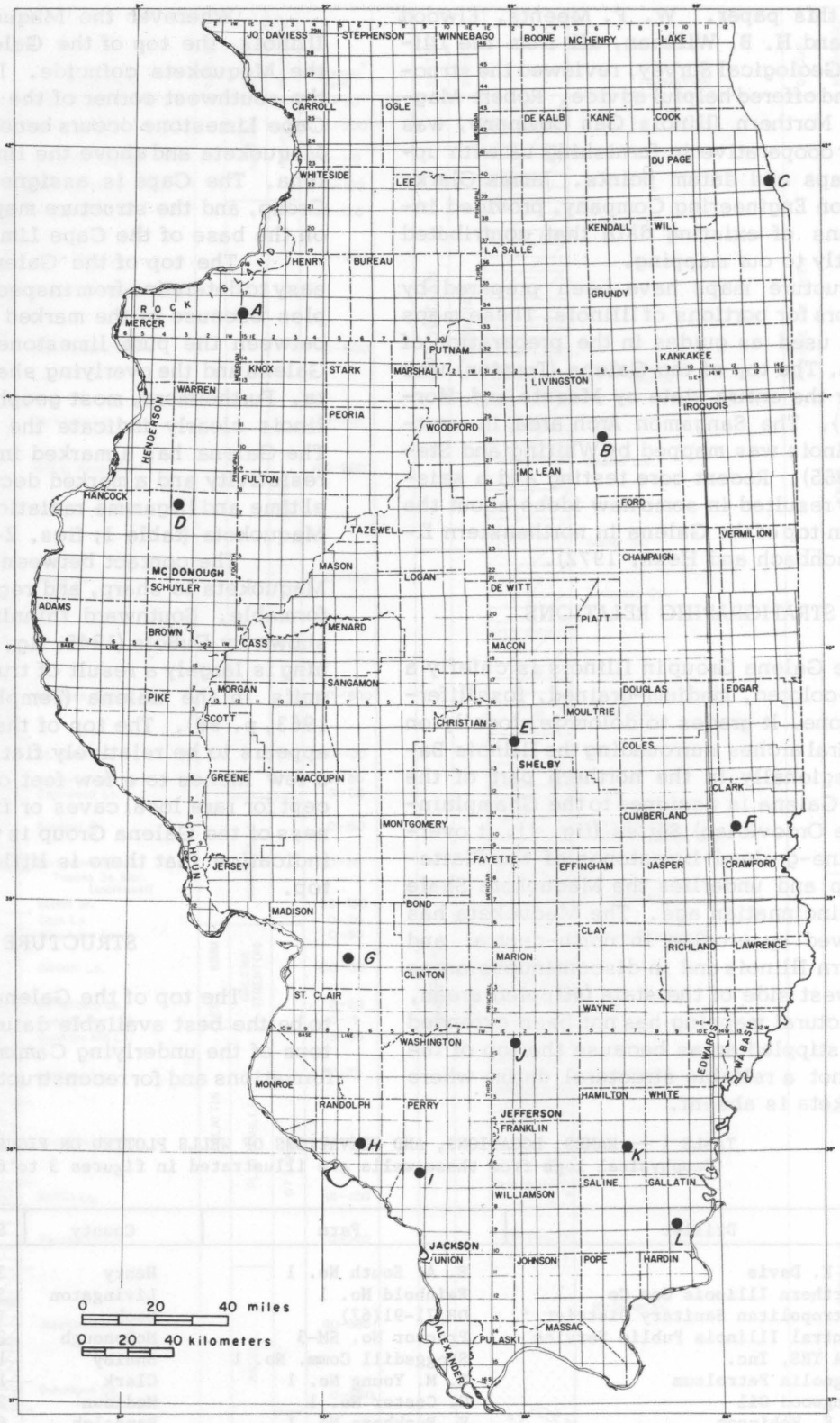

Fig. 2 - Locations of wells from which geophysical logs are illustrated in figures 3 to 6. (See table 1 for identifications of wells.)

ments that have occurred since the beginning of Cincinnatian (late Ordovician) time. Our structure map shows the top of the Galena to be about 6500 feet below sea level in the deepest part of the Illinois Basin (pl. 1). From there this surface rises gently in all directions; in its area of outcrop in northwestern Illinois, it reaches an elevation of 1000 feet above sea level. Most major structural features of Illinois and the bordering states (fig. 7) are well defined by a structure map drawn on the top of the Galena (Bristol and Buschbach, 1971).

Significant faults are shown on the structure map (pl. 1). In many cases a single line on the map represents a complex zone of faulting a mile or more wide, thus indicating only the net effect of the faulting. The Fluorspar Area Fault Complex, present mainly in Hardin and Pope Counties and adjacent parts of Kentucky, is depicted (pl. 1) by the major faults, which trend generally northeast. The complex lies south of the Shawneetown Fault Zone, and it disappears under the late Cretaceous deposits in the Mississippi Embayment to the south. Not shown at the scale of plate 1 are the numerous cross faults that extend in all directions between the major displacements to form a complex mosaic pattern.

Data are relatively abundant in the northern part of the state, and most of the structural control there is based on wells that reach the Galena. However, in the southern half of the state the datum points are sparse (fig. 8). There structural control is based primarily on projections from the structural configurations of the shallower Devonian-Silurian Hunton (Stevenson and Whiting, 1967) and Chesterian Beech Creek (Bristol, 1968). The structural mapping south of the Rough Creek Lineament* is especially speculative because the area is highly faulted and it contains very few test holes drilled to the Galena.

*The term "Rough Creek Lineament" is applied to a series of faults and fault zones extending generally east-west across southern Illinois and western Kentucky. It includes the Rough Creek Fault System of Kentucky as far east as the Little Hickman Fault. In Illinois it includes the east-west portion of the Shawneetown Fault Zone and the Cottage Grove Fault System .

(Text continued on p. 12)

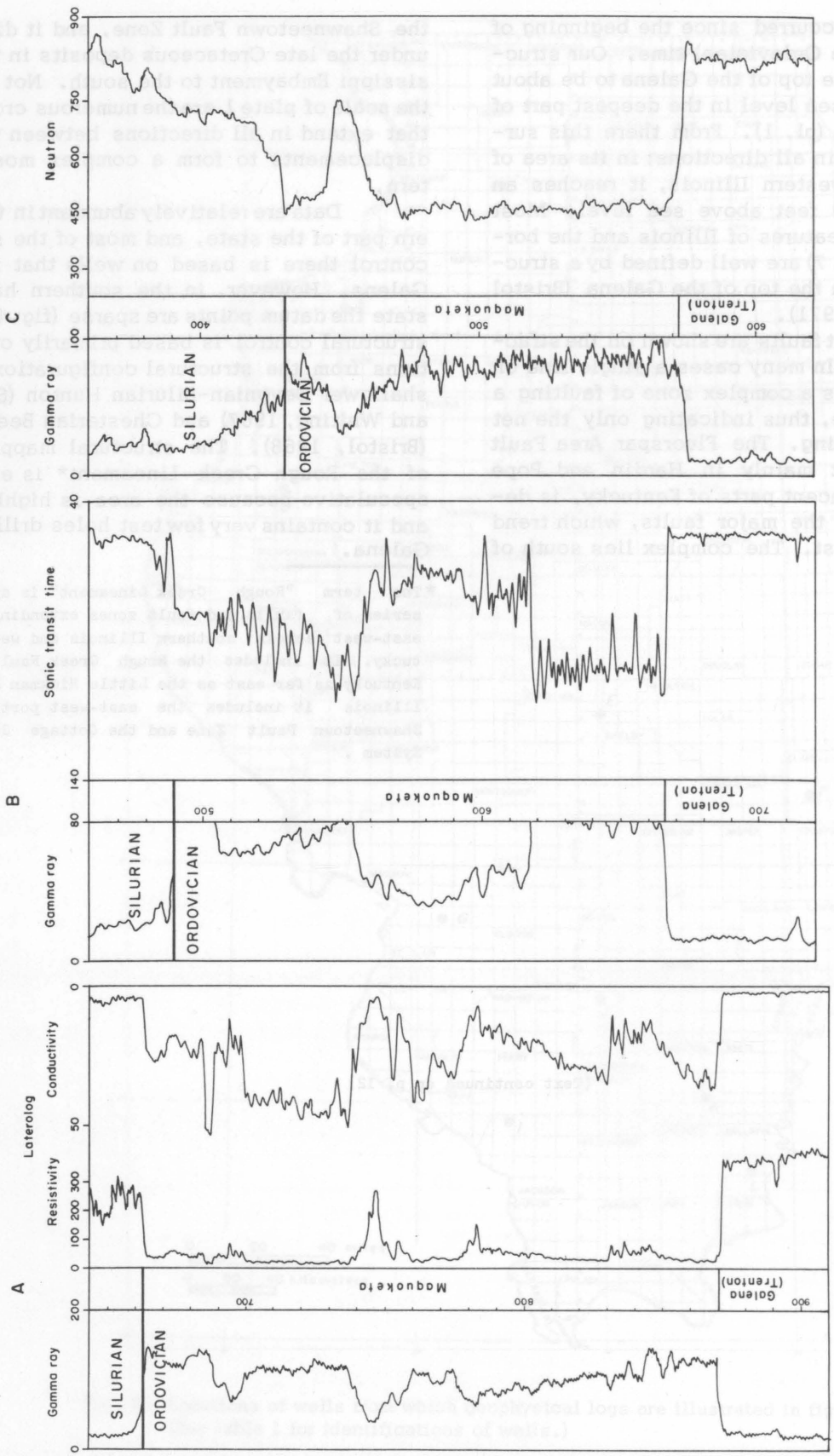

Fig. 3 - Geophysical logs from wells in northern Illinois indicating relationship of the top of the Galena to the overlying Maquoketa Shale Group. Log C shows Maquoketa thinned by pre-Silurian erosion. Locations of wells are shown in figure 2 and table 1.

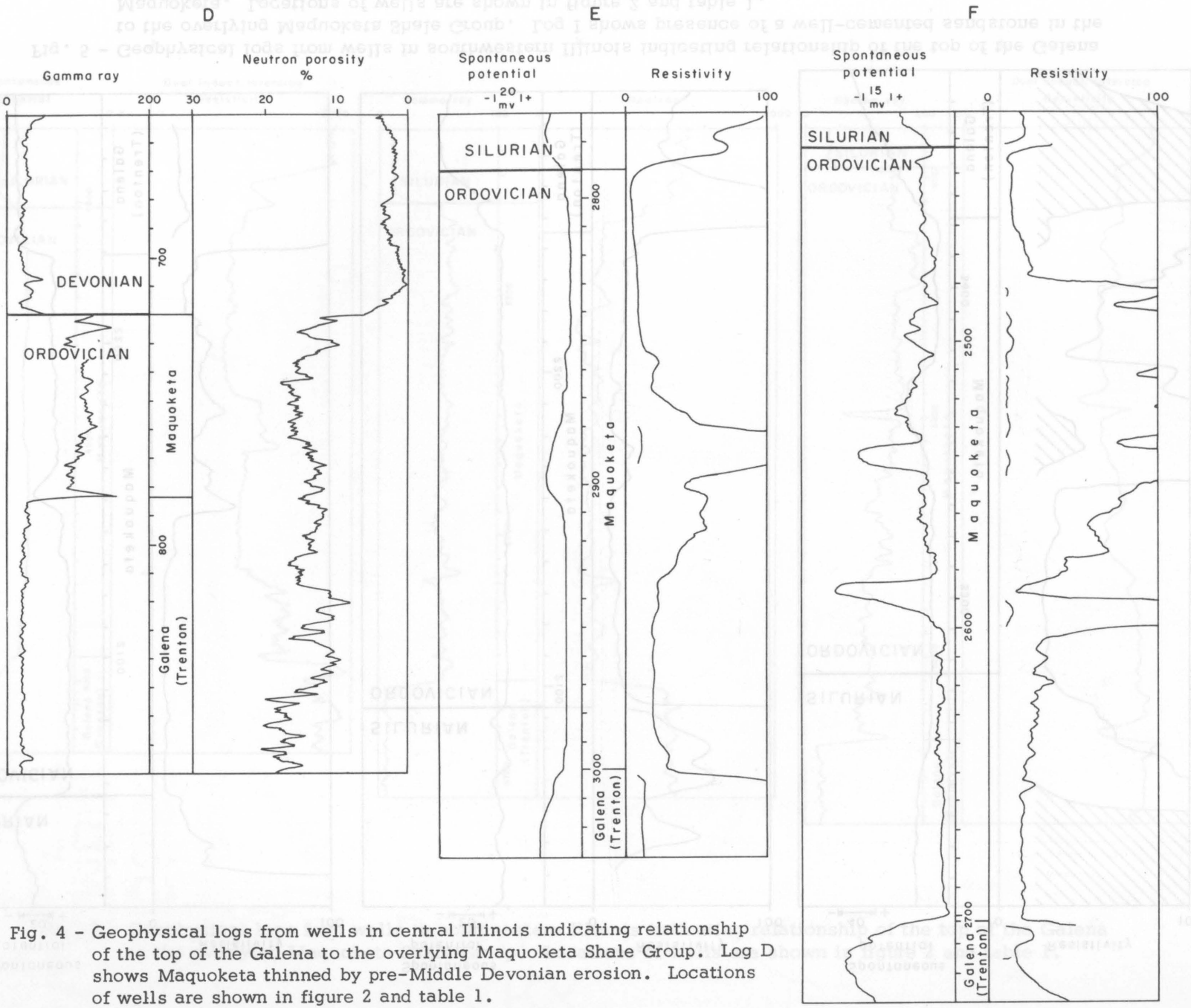

Fig. 4 - Geophysical logs from wells in central Illinois indicating relationship of the top of the Galena to the overlying Maquoketa Shale Group. Log D shows Maquoketa thinned by pre-Middle Devonian erosion. Locations of wells are shown in figure 2 and table 1.

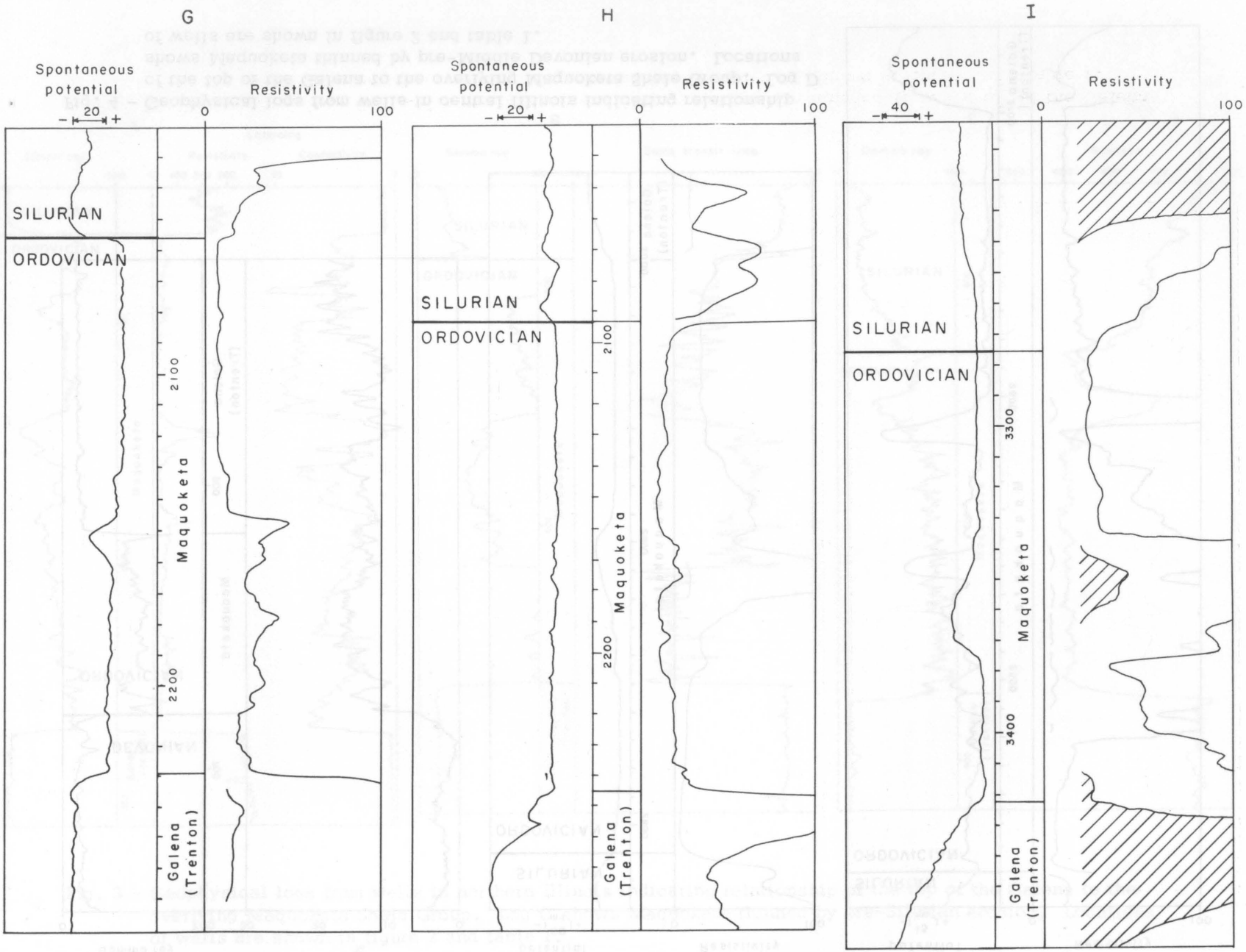

Fig. 5 - Geophysical logs from wells in southwestern Illinois indicating relationship of the top of the Galena to the overlying Maquoketa Shale Group. Log I shows presence of a well-cemented sandstone in the Maquoketa. Locations of wells are shown in figure 2 and table 1.

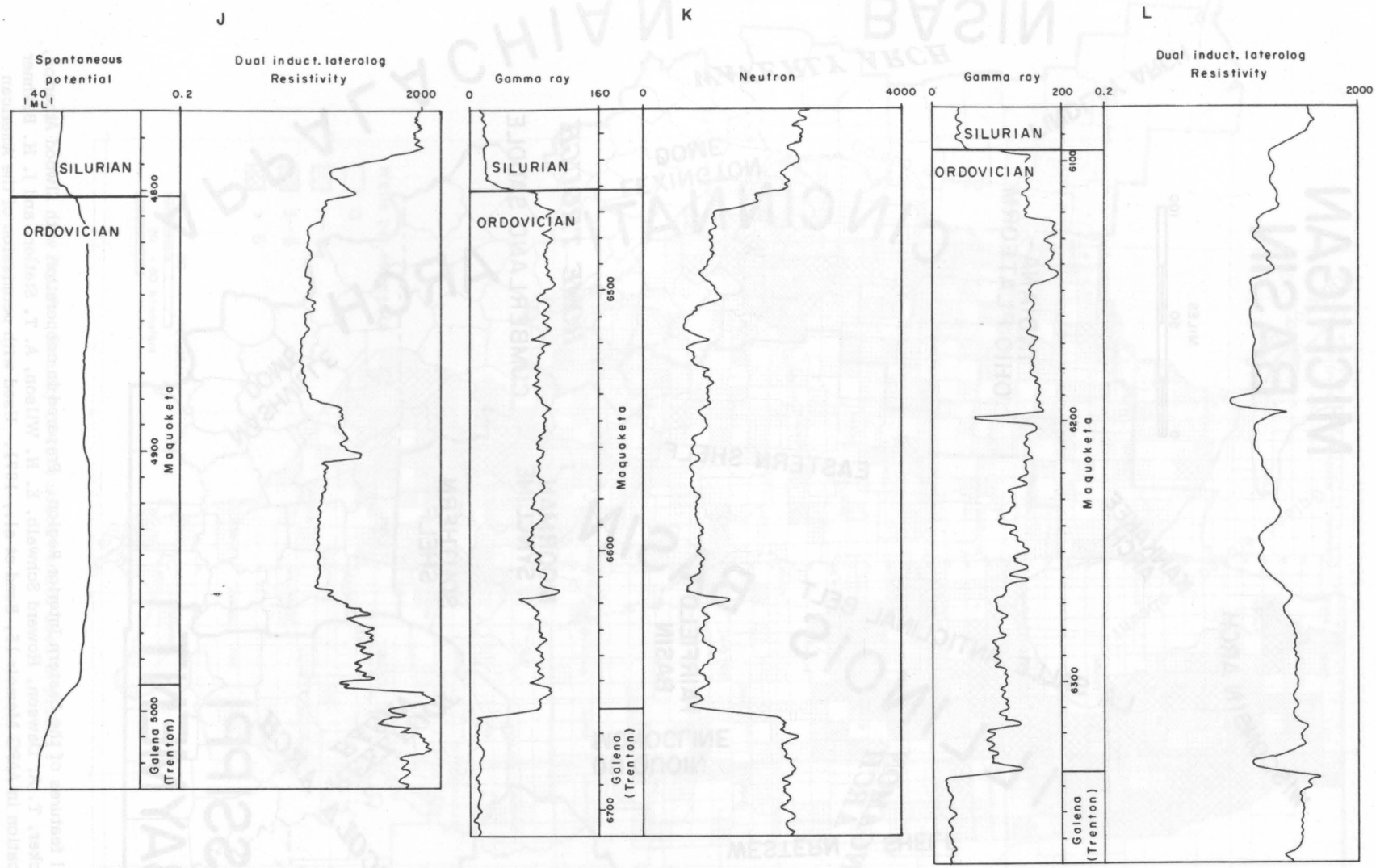

Fig. 6 - Geophysical logs from wells in southeastern Illinois indicating relationship of the top of the Galena to the overlying Maquoketa Shale Group. Locations of wells are shown in figure 2 and table 1.

Fig. 7 - Structural features of the Eastern Interior Region. Prepared in cooperation with Elwood Atherton, L. E. Becker, T. A. Dawson, Howard Schwalb, E. N. Wilson, A. T. Statler, and J. H. Buehner for publication in AAPG Memoir 15, Bond et al., 1971. Used with permission of the American Association of Petroleum Geologists.

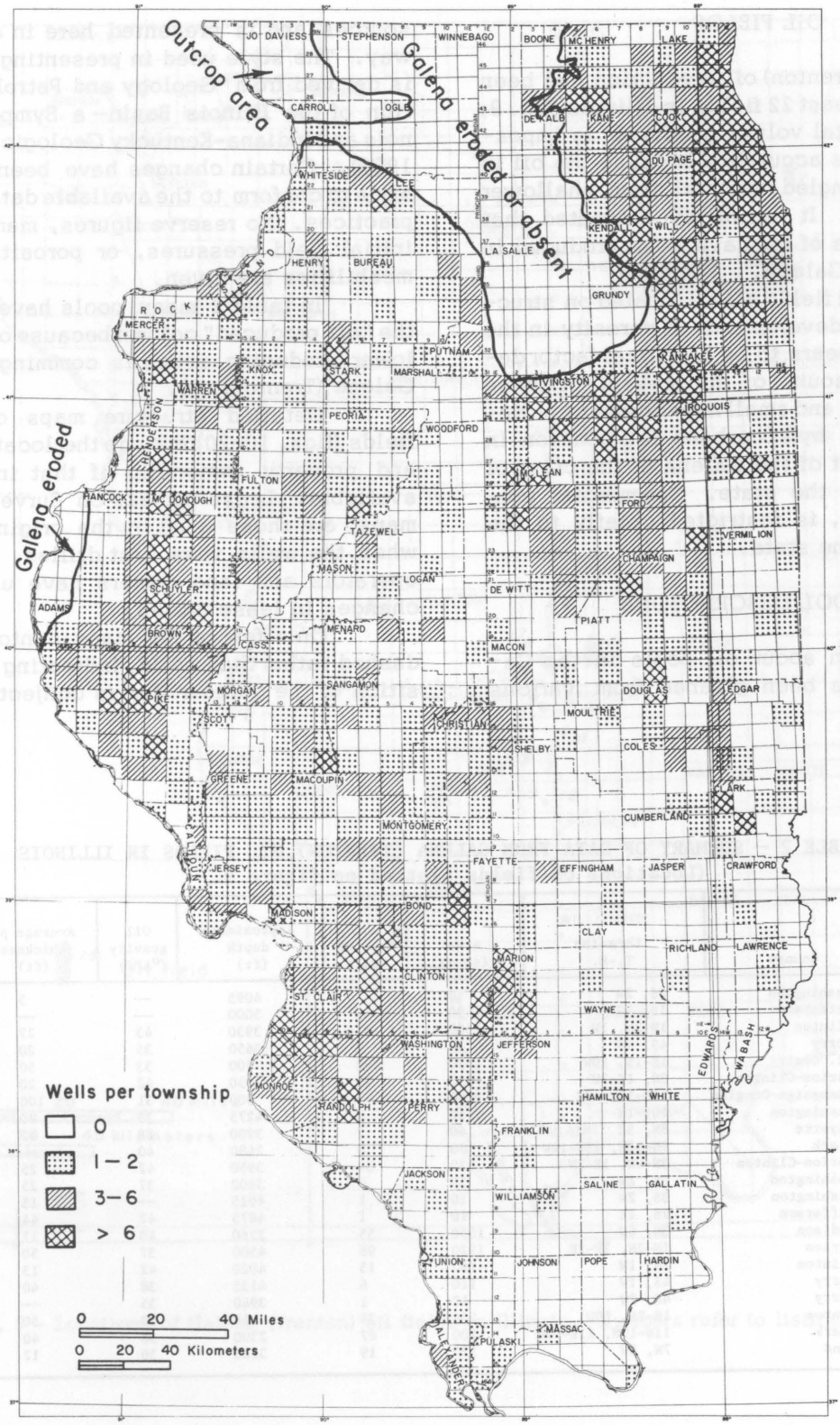

Fig. 8 - Density of subsurface control used in plate 1.

OIL FIELDS

Galena (Trenton) oil production has been recorded from at least 22 fields in Illinois (fig. 9; table 2). The total volume produced is impossible to determine accurately because the oil is commonly commingled with oil from shallower producing zones. It is roughly estimated that 20 million barrels of oil have been produced in Illinois from the Galena.

Galena oil fields are all located on structural highs. The development of porosity in the upper 150 feet appears to be a critical factor determining the amount of oil present in these highs. Oil stains and small non-commercial deposits of viscous hydrocarbons are common in the upper few feet of the Galena at the crest of domes throughout the state. Commercial production, however, is restricted chiefly to the southern half of the state.

OIL POOL DESCRIPTIONS

Information about oil pools in the Galena (Trenton) has been gleaned from various sources and is presented here in a distinctive way. The style used in presenting the material is derived from "Geology and Petroleum Production of the Illinois Basin—a Symposium" (Illinois and Indiana-Kentucky Geological Societies, 1968). Certain changes have been made in the style to conform to the available data and Survey practices. No reserve figures, markets for oil, initial field pressures, or porosities and permeabilities are given.

In table 2 many pools have no figure in the "oil produced" column because oil from shallower producing zones is commingled with the Galena (Trenton) oil.

Detailed structure maps of the larger fields (figs. 10-20) include the location of wells and property ownership if that information is available. Lease names, on Survey-originated maps, are those used by the original operators when the wells were first drilled. Subsequent operators and land owners have usually made changes in lease names.

On a few of the maps contour lines are dashed rather than solid, indicating that the position of the contour line is conjectural.

TABLE 2 — SUMMARY OF DATA FROM GALENA (TRENTON) OIL FIELDS IN ILLINOIS
(Locations of fields plotted on figure 9.)

No.	Field	County	Location T.-R.	Area (acres)	No. of wells	Approximate depth (ft)	Oil gravity (°API)	Average pay thickness (ft)	Oil production from Trenton (barrels) cum. 1-1-72
1	Beaucoup	Washington	2S, 2W	10	1	4095	—	5	—
2	Boyd	Jefferson	1S, 2E	30	2	5000	—	—	—
3	Centralia	Clinton	1N-2N, 1W	1100	62	3930	43	22	—
4	Craig	Perry	4S, 4W	10	2	3650	35	20	3,000
5	Dupo	St. Clair	1N-1S, 10W	1020	292	700	33	50	2,875,000
6	Fairman	Marion-Clinton	3N, 1E-1W	230	16	3950	42	20	309,660
7	Hayes	Champaign-Douglas	16N-17N, 8E	480	43	900	31	100	150,000
8	Irvington	Washington	1S, 1W	110	4	4275	39	90	—
9	Louden	Fayette	8N, 3E	40	2	3900	28	12	—
10	Martinsville	Clark	9N-10N, 13W-14W	70	5	2680	40	—	—
11	Patoka	Marion-Clinton	3N-4N, 1E-1W	630	34	3950	42	25	900,000
12	Posen	Washington	3S, 2W	50	4	3900	37	25	95,000
13	Posen N.	Washington	3S, 2W	10	1	4015	—	15	4,000
14	Roaches N.	Jefferson	2S, 1E	10	1	4875	42	44	—
15	St. Jacob	Madison	3N, 6W	1050	55	2260	40	17	3,900,000
16	Salem	Marion	1N-2N, 1E-2E	1920	98	4500	37	50	5,060,000
17	Shattuc	Clinton	2N, 1W	180	15	4020	42	13	—
18	Tamaroa	Perry	4S, 1W	110	6	4135	38	40	—
19	Turkey Bend	Perry	4S, 2W	10	1	3940	35	—	42,000
20	Waterloo	Monroe	1S-2S, 10W	230	38	410	30	50	238,000
21	Westfield	Clark	11N-12N, 11E-14W	1700	87	2300	38	40	—
22	Woburn C	Bond	7N, 2W	320	19	3200	39	12	—

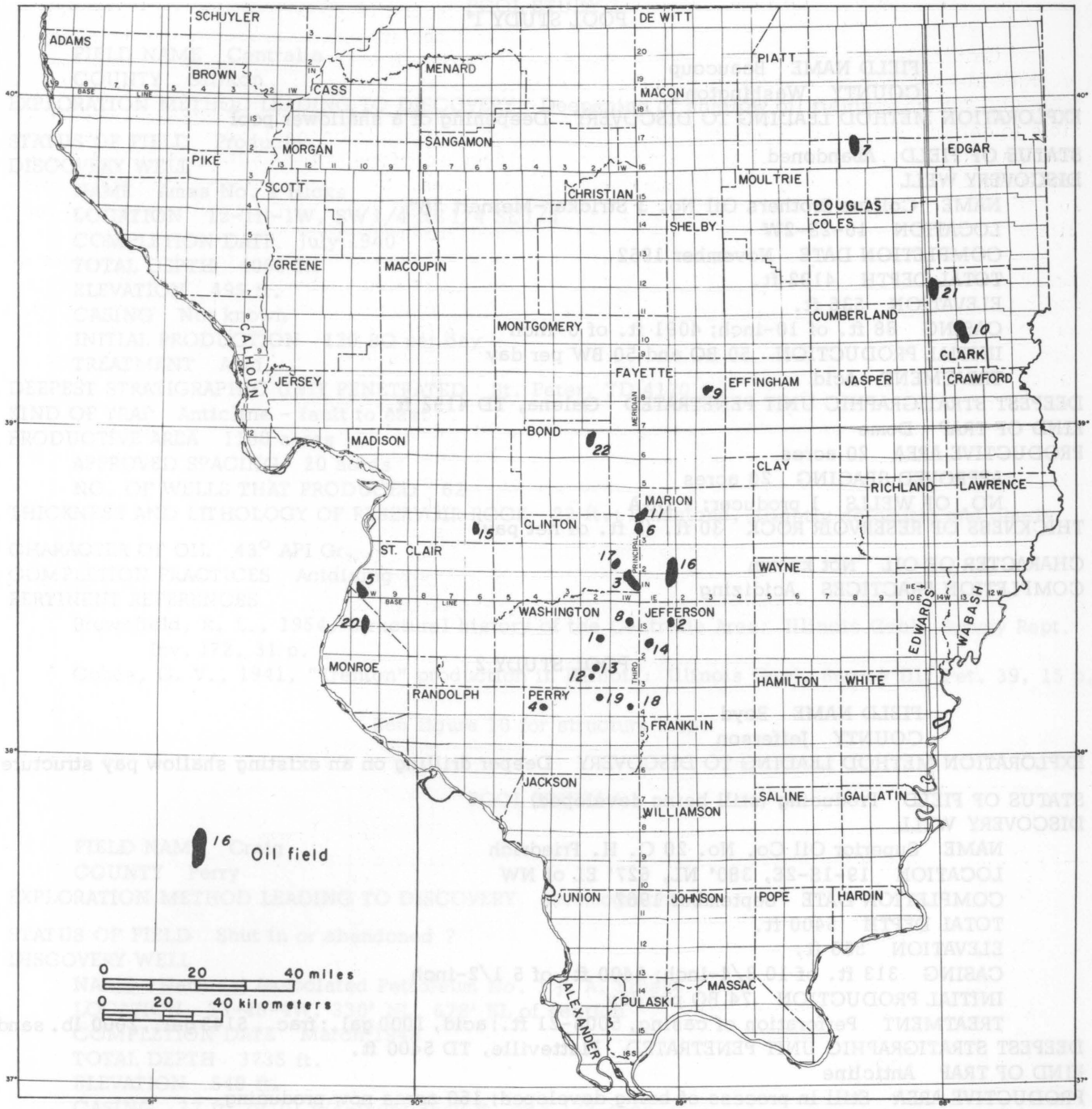

Fig. 9 - Locations of Galena (Trenton) oil fields in Illinois. Numbers refer to listing in table 2.

POOL STUDY 1*

FIELD NAME Beaucoup
COUNTY Washington
EXPLORATION METHOD LEADING TO DISCOVERY Deepening of a shallower pool

STATUS OF FIELD Abandoned
DISCOVERY WELL
NAME Collins Brothers Oil No. 3 Stricker-Meinert "B"
LOCATION 10-2S-2W
COMPLETION DATE November 1952
TOTAL DEPTH 4192 ft.
ELEVATION 536 ft.
CASING 88 ft. of 10-inch; 4091 ft. of 5-inch
INITIAL PRODUCTION 50 BO and 50 BW per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4192 ft.
KIND OF TRAP Dome
PRODUCTIVE AREA 20 acres
APPROVED SPACING 20 acres
NO. OF WELLS 1 producer; 1 D&A
THICKNESS OF RESERVOIR ROCK 30 ft. (5 ft. of net pay)

CHARACTER OF OIL Not known
COMPLETION PRACTICES Acidizing

POOL STUDY 2

FIELD NAME Boyd
COUNTY Jefferson
EXPLORATION METHOD LEADING TO DISCOVERY Deeper drilling on an existing shallow pay structure

STATUS OF FIELD Producing (still being developed)
DISCOVERY WELL
NAME Superior Oil Co. No. 20 C. H. Friedrich
LOCATION 19-1S-2E, 380' NL, 627' EL of NW
COMPLETION DATE September 1967
TOTAL DEPTH 5400 ft.
ELEVATION 555 ft.
CASING 313 ft. of 10 3/4-inch; 5400 ft. of 5 1/2-inch
INITIAL PRODUCTION 74 BO per day
TREATMENT Perforation of casing, 5006-21 ft.; acid, 1000 gal.; frac., 5143 gal., 2000 lb. sand
DEEPEST STRATIGRAPHIC UNIT PENETRATED Platteville, TD 5400 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA Still in process of being developed; 160 acres now producing
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 4
THICKNESS OF RESERVOIR ROCK 50 ft.

CHARACTER OF OIL Not known
COMPLETION PRACTICES Setting pipe through, perforating, and acidizing

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*The following abbreviations are used in the pool studies: API - American Petroleum Institute; BO - barrels of oil; BW - barrels of water; D&A - dry and abandoned; frac. - hydraulic fracturing; Gr. - gravity; TD - total depth.

POOL STUDY 3

FIELD NAME Centralia
COUNTY Clinton
EXPLORATION METHOD LEADING TO DISCOVERY Deepening of shallow oil fields

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Ames No. 2 Hicks
LOCATION 12-1N-1W, SW 1/4 NE 1/4 SE 1/4
COMPLETION DATE July 1940
TOTAL DEPTH 4068 ft.
ELEVATION 495 ft.
CASING Not known
INITIAL PRODUCTION 120 BO per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED St. Peter, TD 4170 ft.
KIND OF TRAP Anticline - fault to east
PRODUCTIVE AREA 1100 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 62
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK 22 ft.; limestone, slightly dolomitic and cherty

CHARACTER OF OIL 43° API Gr.
COMPLETION PRACTICES Acidizing
PERTINENT REFERENCES

Brownfield, R. L., 1954, Structural history of the Centralia Area: Illinois Geol. Survey Rept. Inv. 172, 31 p.
Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Ill. Pet. 39, 15 p.

See figure 10 for structure map.

POOL STUDY 4

FIELD NAME Craig
COUNTY Perry
EXPLORATION METHOD LEADING TO DISCOVERY Seismographing

STATUS OF FIELD Shut in or abandoned ?
DISCOVERY WELL
NAME National Associated Petroleum No. 1 J. A. Ernest
LOCATION 23-4S-4W, 330' NL, 678' EL of section
COMPLETION DATE March 1948
TOTAL DEPTH 3735 ft.
ELEVATION 549 ft.
CASING 37 ft. of 10 3/4-inch; 3640 ft. of 5 1/2-inch
INITIAL PRODUCTION 22 BO per day
TREATMENT Acid - stages
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 3735 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 10 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 1
THICKNESS OF RESERVOIR ROCK Not known

CHARACTER OF OIL 35° API Gr.
COMPLETION PRACTICES Acidizing

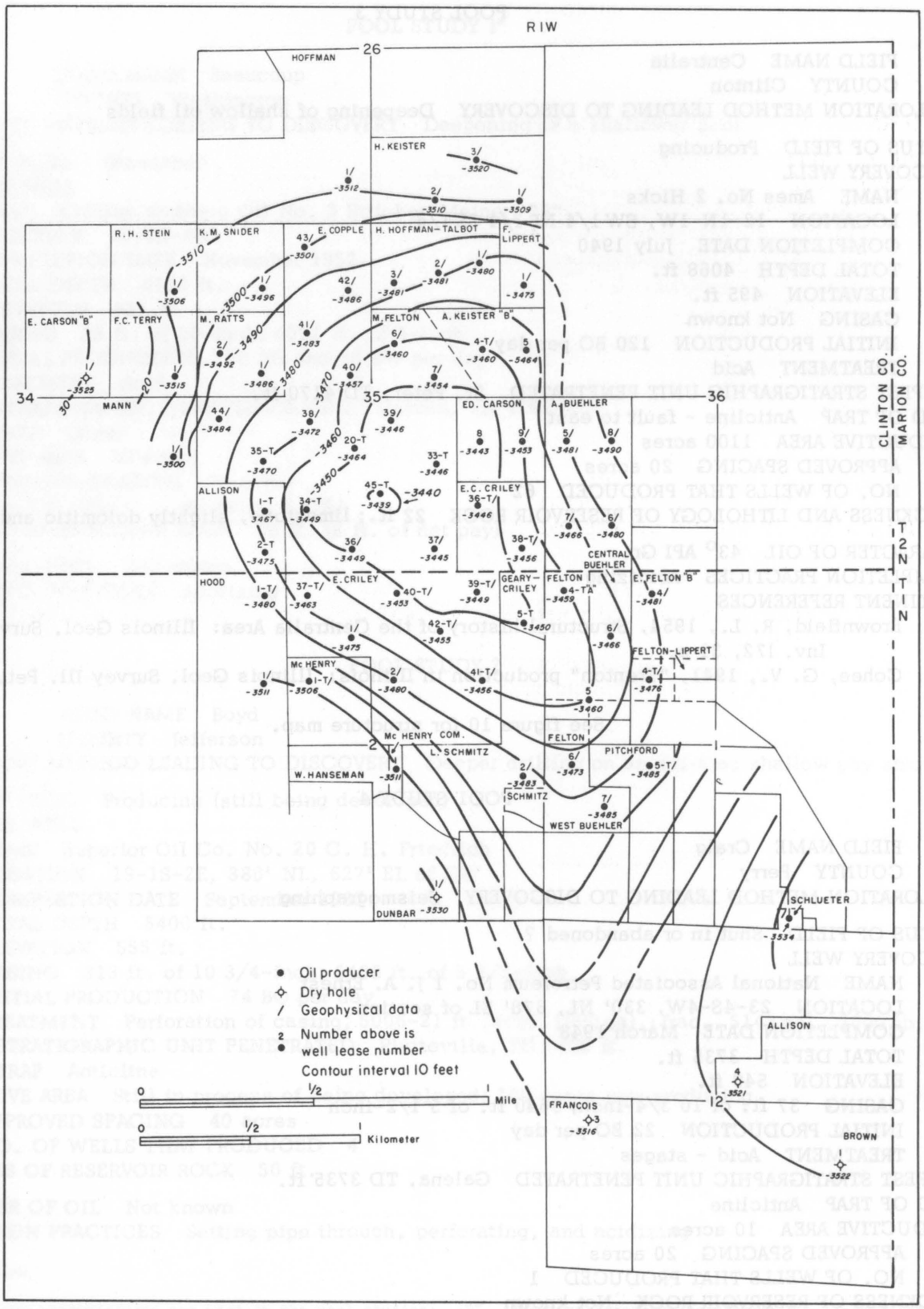

Fig. 10 - Structure on top of the Galena (Trenton) in the Centralia oil field.

POOL STUDY 5

FIELD NAME Dupo
COUNTY St. Clair
EXPLORATION METHOD LEADING TO DISCOVERY Surface geology and trend geology

STATUS OF FIELD Producing in part
DISCOVERY WELL
NAME Ohio Oil Co. No. 1 Tarleton
LOCATION 28-1N-10W, SW 1/4 SE 1/4 SE 1/4
COMPLETION DATE November 1928
TOTAL DEPTH 702 ft.
ELEVATION 663 ft.
CASING Not known
INITIAL PRODUCTION 150 BO per day
TREATMENT None
DEEPEST STRATIGRAPHIC UNIT PENETRATED Mt. Simon, TD 3111 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 1020 acres
APPROVED SPACING Random
NO. OF WELLS THAT PRODUCED 321
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK Limestone in upper 100 ft.; porosity partially due to weathering

CHARACTER OF OIL 32.7° API Gr.
COMPLETION PRACTICES Generally natural; some wells shot, and later some wells acidized
PERTINENT REFERENCES

Bell, A. H., 1929a, The Dupo oil field: Illinois Geol. Survey Illinois Petroleum 17, p. 1-14.
Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Illinois Petroleum 39, 15 p.
Schwalb, Howard, 1968, Typical oil occurrence—Selected pool studies from the Illinois Basin: Dupo Field, St. Clair County, Illinois, in Illinois and Indiana-Kentucky Geological Societies, Geology and petroleum production of the Illinois Basin—a symposium: Schulze Printing Co., Evansville, IN, p. 91-95.

See figure 11a for structure map, figure 11b for town lot drilling map.

POOL STUDY 6

FIELD NAME Fairman
COUNTY Marion
EXPLORATION METHOD LEADING TO DISCOVERY Deepening of shallow pool

STATUS OF FIELD Producing
DISCOVERY WELL
NAME National Associated Petroleum No. 1 A. Ververs
LOCATION 18-3N-1E, NE 1/4 NE 1/4 NW 1/4
COMPLETION DATE May 1957
TOTAL DEPTH 4052 ft.
ELEVATION 471 ft.
CASING 125 ft. of 8-inch; 4049 ft. of 5-inch
INITIAL PRODUCTION 82 BO per day
TREATMENT Acidized with 4000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4100 ft.
KIND OF TRAP Anticline

(Pool study 6 continued on p. 21)

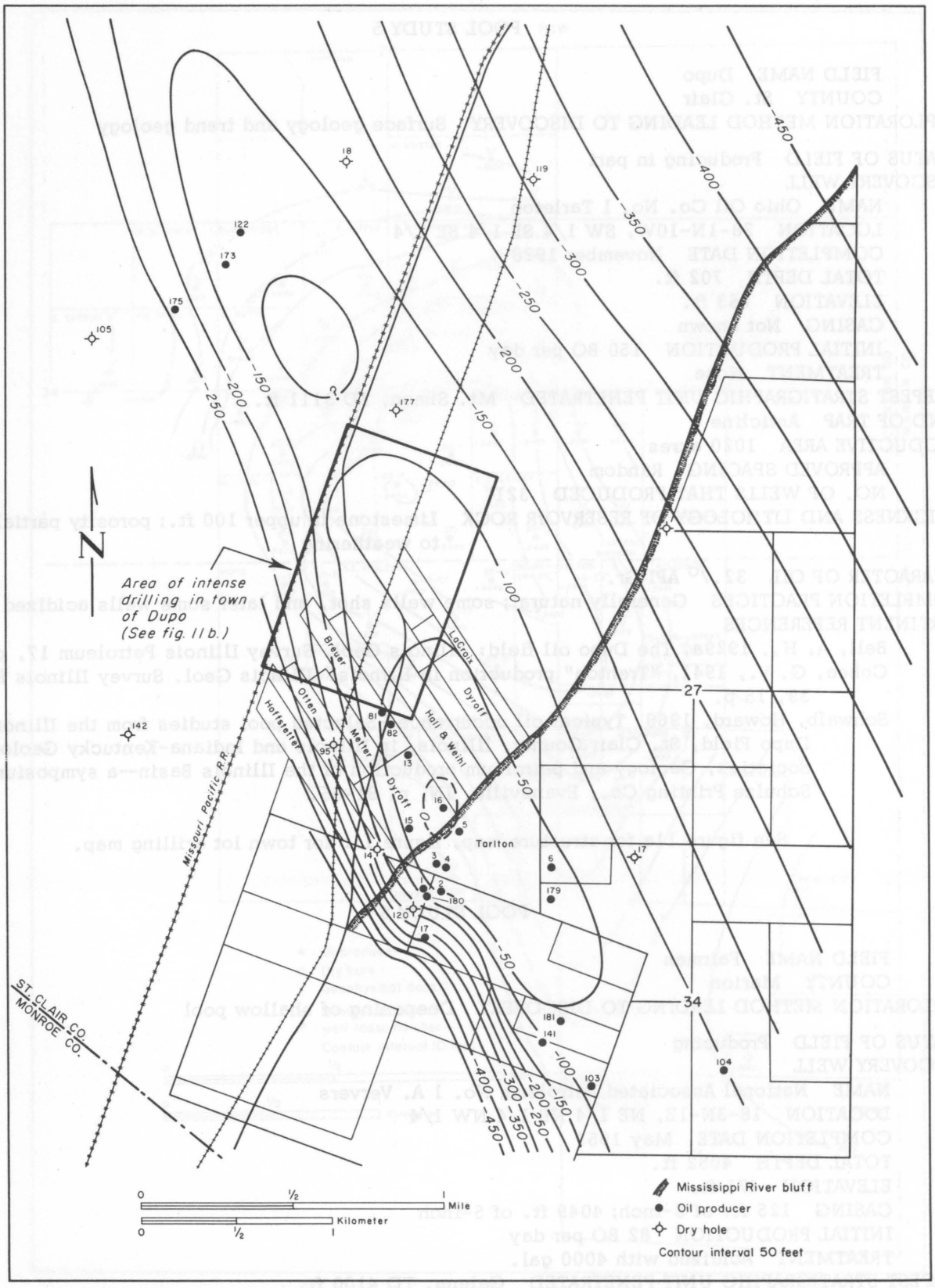

Fig. 11(a) - Structure on top of the Galena (Trenton) in the Dupo oil field (modified from Bell, 1929a).

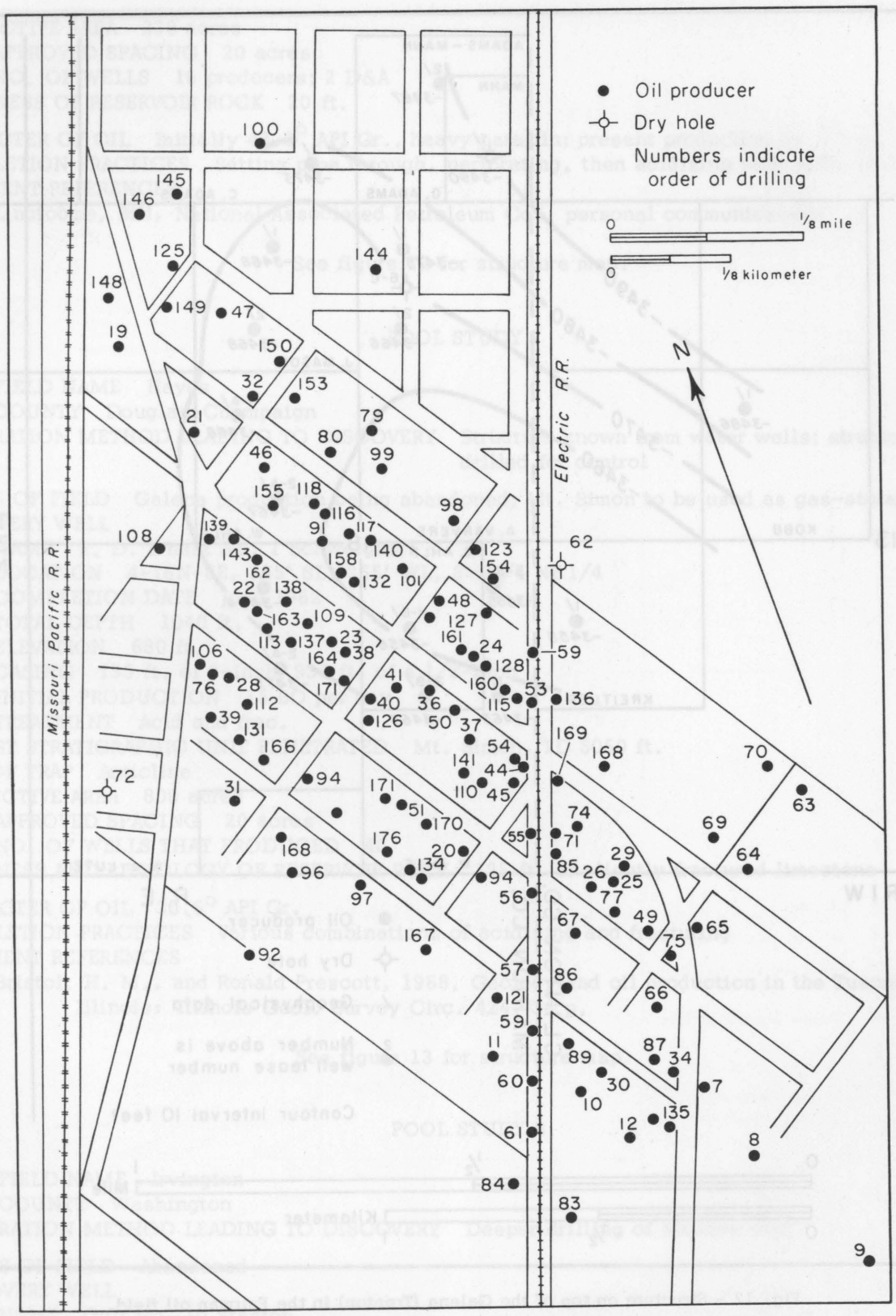

Fig. 11(b) - Town lot drilling in Dupo oil field (modified from Bell, 1929a).

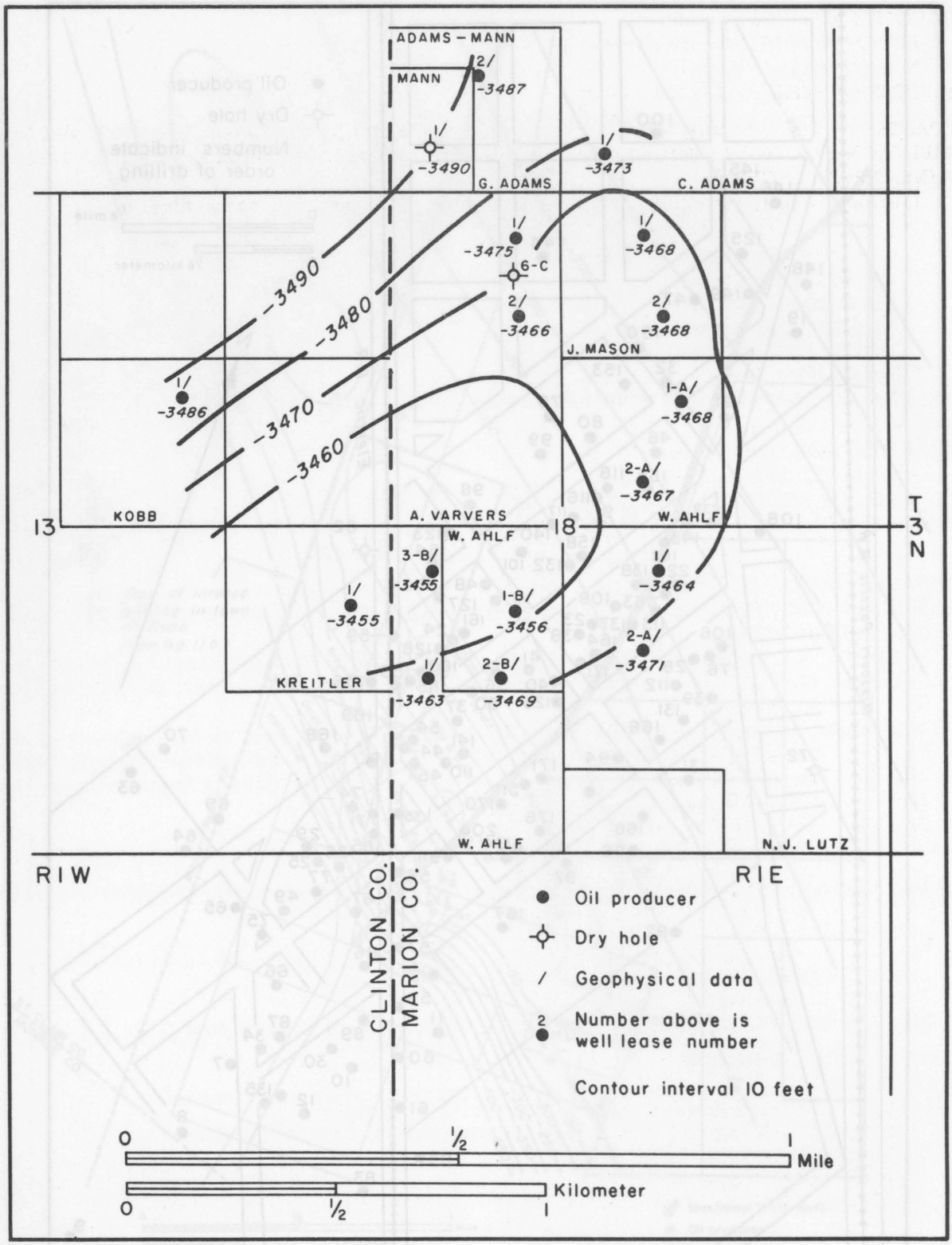

Fig. 12 - Structure on top of the Galena (Trenton) in the Fairman oil field.

PRODUCTIVE AREA 230 acres
APPROVED SPACING 20 acres
NO. OF WELLS 16 producers; 2 D&A
THICKNESS OF RESERVOIR ROCK 20 ft.
CHARACTER OF OIL Initially 42.3° API Gr., heavy paraffin; present production 37.3° API Gr.
COMPLETION PRACTICES Setting pipe through, perforating, then acidizing with 1000-10,000 gal.
PERTINENT REFERENCES
Lincicome, Bill, National Associated Petroleum Co., personal communication.

See figure 12 for structure map.

POOL STUDY 7

FIELD NAME Hayes
COUNTY Douglas-Champaign
EXPLORATION METHOD LEADING TO DISCOVERY Structure known from water wells; structure coring drilled for control
STATUS OF FIELD Galena production being abandoned; Mt. Simon to be used as gas-storage reservoir
DISCOVERY WELL
NAME R. D. Ernest No. 1 Schweighart
LOCATION 4-16N-8E, 365' SL, 365' WL, SW 1/4 NE 1/4
COMPLETION DATE June 1962
TOTAL DEPTH 1040 ft.
ELEVATION 680 ft.
CASING 135 ft. of 7-inch; 930 ft. of 4 1/2-inch
INITIAL PRODUCTION 15 BO per day
TREATMENT Acid and frac.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Mt. Simon, TD 5050 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 800 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 40
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK 125 ft. of slightly fractured limestone
CHARACTER OF OIL 30.6° API Gr.
COMPLETION PRACTICES Various combinations of acidizing and fracturing
PERTINENT REFERENCES
Bristol, H. M., and Ronald Prescott, 1968, Geology and oil production in the Tuscola area, Illinois: Illinois Geol. Survey Circ. 424, 34 p.

See figure 13 for structure map.

POOL STUDY 8

FIELD NAME Irvington
COUNTY Washington
EXPLORATION METHOD LEADING TO DISCOVERY Deeper drilling of shallow pool
STATUS OF FIELD Abandoned
DISCOVERY WELL
NAME Gulf No. 10 Stanton
LOCATION 26-1S-1W, NE 1/4 NE 1/4 NW 1/4
COMPLETION DATE February 1956

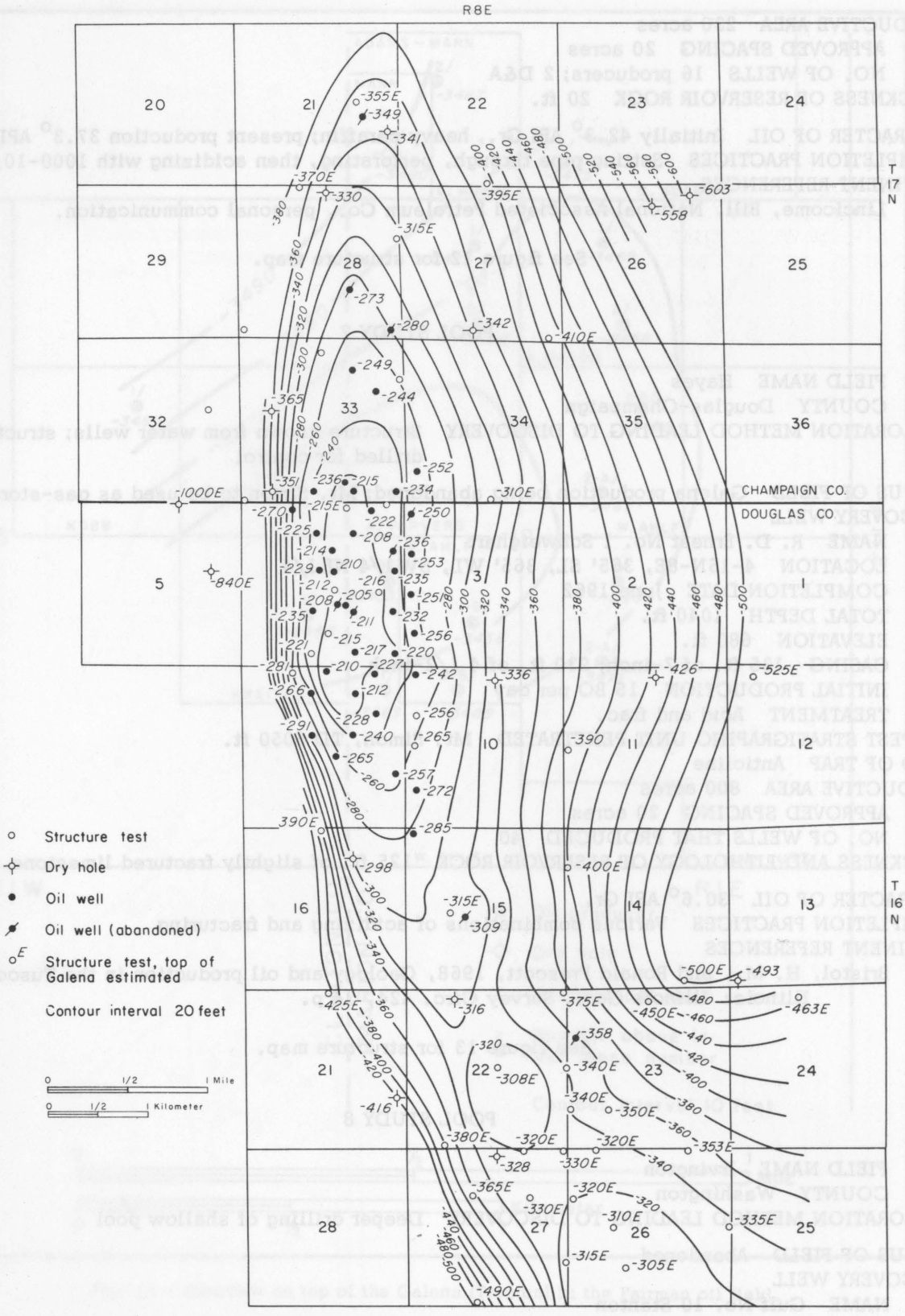

Fig. 13 - Structure on top of the Galena (Trenton) in the Hayes oil field portion of the Tuscola Anticline (after Bristol and Prescott, 1968).

TOTAL DEPTH 4399 ft.
ELEVATION 544 ft.
CASING 92 ft. of 10 3/4-inch; 4389 ft. of 5 1/2-inch
INITIAL PRODUCTION 72 BO and 12 BW per day
TREATMENT Perforation, 4361-72 ft.; 4351-57 ft.; 4338-51 ft.; 4320-25 ft.; 4289-4318 ft.; acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4440 ft.
KIND OF TRAP Porosity on a structural nose
PRODUCTIVE AREA 110 acres
APPROVED SPACING Initially 20 acres; now 40 acres
NO. OF WELLS THAT PRODUCED 6
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK 90 ft. of limestone
CHARACTER OF OIL 39° API Gr.
COMPLETION PRACTICES Setting pipe through, perforating, and acidizing; some frac.

POOL STUDY 9

FIELD NAME Louden
COUNTY Fayette
EXPLORATION METHOD LEADING TO DISCOVERY Surface work; seismographing; deeper drilling of shallow field
STATUS OF FIELD Abandoned in Galena
DISCOVERY WELL
NAME Carter No. 7-T I. Boles
LOCATION 21-8N-3E, 660' NL, 664' EL, NW 1/4 SW 1/4
COMPLETION DATE November 1955
TOTAL DEPTH 4126 ft.
ELEVATION 602 ft.
CASING 4040 ft. of 4 1/2-inch
INITIAL PRODUCTION 21 BO and 400 BW per day
TREATMENT Perforations 3824-3886 ft.; acid, 6000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Precambrian, TD 8616 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 20 acres
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 2
THICKNESS OF RESERVOIR ROCK Not known
CHARACTER OF OIL Not known
COMPLETION PRACTICES Perforating and acidizing

POOL STUDY 10

FIELD NAME Martinsville
COUNTY Clark
EXPLORATION METHOD LEADING TO DISCOVERY Not known
STATUS OF FIELD Producing
DISCOVERY WELL
NAME Trenton Rock Oil Co. No. 1 McFarland
LOCATION 19-10N-13W, SE 1/4 SE 1/4 NW 1/4
COMPLETION DATE November 1921
TOTAL DEPTH 2765 ft.

(Pool study 10 continued on p. 24)

ELEVATION 568 ft.
CASING 147 ft. of 12-inch; 498 ft. of 10-inch; 1365 ft. of 8 1/4-inch; 2345 ft. of 6 1/4-inch
INITIAL PRODUCTION 125 BO per day
TREATMENT Shot with 180 qt.
DEEPEST STRATIGRAPHIC UNIT PENETRATED St. Peter, TD 3411 ft.
KIND OF TRAP Dome
PRODUCTIVE AREA 70 acres
APPROVED SPACING 20 acres - most drilled before spacing regulations went into effect
NO. OF WELLS THAT PRODUCED 5
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK Crystalline limestone; thickness unknown
CHARACTER OF OIL 40° API Gr.
COMPLETION PRACTICES Shooting
PERTINENT REFERENCES

Clegg, K. E., 1965, The La Salle Anticlinal Belt and adjacent structures in east-central Illinois: Illinois Acad. Sci. Trans., v. 58, no. 2, p. 82-94; Illinois Geol. Survey Reprint 1965-H, 13 p.
Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Illinois Petroleum 39, p. 15.
Moulton, G. F., 1926, Areas for further prospecting near the Martinsville pool, Clark County, Illinois: Illinois Geol. Survey Illinois Petroleum 4, p. 1-5.
Mylius, L. A., 1927, Oil and gas development and possibilities in east-central Illinois (Clark, Coles, Douglas, Edgar, and parts of adjoining counties): Illinois Geol. Survey Bull. 54, 205 p.

POOL STUDY 11

FIELD NAME Patoka
COUNTY Marion
EXPLORATION METHOD LEADING TO DISCOVERY Shallow drilling indicated the presence of a Galena structure
STATUS OF FIELD Producing
DISCOVERY WELL
NAME Sohio Oil No. 1-T S. E. Pugh
LOCATION 29-4N-1E, 398' NL, 398' EL, NW 1/4 SE 1/4
COMPLETION DATE March 1956
TOTAL DEPTH 4056 ft.
ELEVATION 493 ft.
CASING 146 ft. of 10-inch; 3957 ft. of 5-inch
INITIAL PRODUCTION 139 BO and 22 BW per day
TREATMENT Acid, 6000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4056 ft.
KIND OF TRAP Anticlinal ridge
PRODUCTIVE AREA 630 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 34
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK Porous limestone in top 50 ft.
CHARACTER OF OIL 42° API Gr.
COMPLETION PRACTICES Acidizing
PERTINENT REFERENCES

Smoot, T. W., 1958, Relation of Silurian reefs to Ordovician structure in the Patoka oil area: Illinois Geol. Survey Circ. 258, 20 p.

For other references on shallow pays in this field, see Willman, H. B., J. A. Simon, B. M. Lynch, and V. A. Langenheim, 1968, Bibliography and index of Illinois geology through 1965: Illinois Geol. Survey Bull. 92, p. 325.

See figure 14 for structure map.

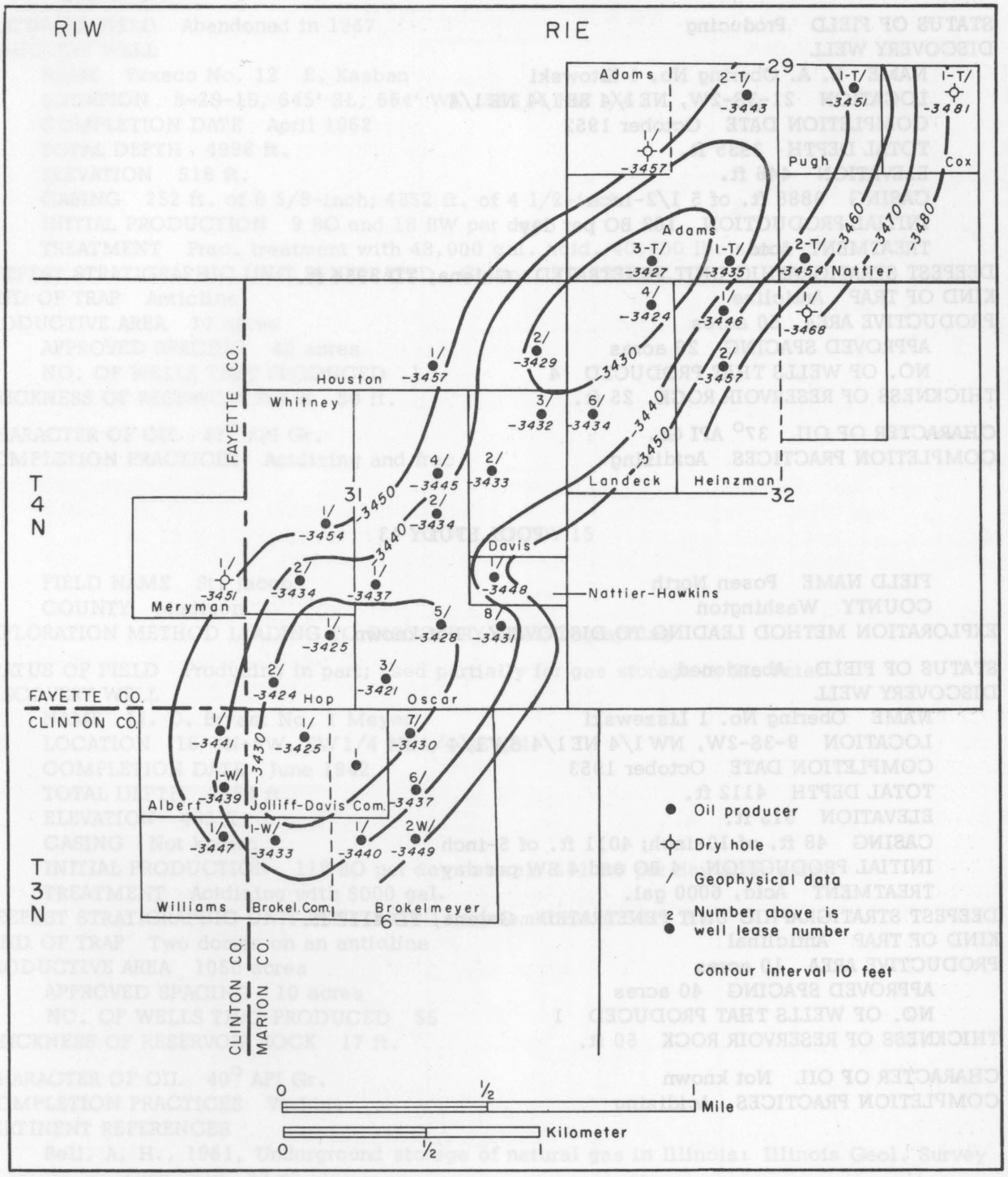

Fig. 14 - Structure on top of the Galena (Trenton) in the Patoka oil field.

POOL STUDY 12

FIELD NAME Posen
COUNTY Washington
EXPLORATION METHOD LEADING TO DISCOVERY Not known - probably seismographing

STATUS OF FIELD Producing
DISCOVERY WELL
NAME E. A. Obering No. 1 Kitowski
LOCATION 21-3S-2W, NE 1/4 SE 1/4 NE 1/4
COMPLETION DATE October 1952
TOTAL DEPTH 3935 ft.
ELEVATION 446 ft.
CASING 3888 ft. of 5 1/2-inch
INITIAL PRODUCTION 182 BO per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 3954 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 50 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 4
THICKNESS OF RESERVOIR ROCK 25 ft.

CHARACTER OF OIL 37° API Gr.
COMPLETION PRACTICES Acidizing

POOL STUDY 13

FIELD NAME Posen North
COUNTY Washington
EXPLORATION METHOD LEADING TO DISCOVERY Not known

STATUS OF FIELD Abandoned
DISCOVERY WELL
NAME Obering No. 1 Liszewski
LOCATION 9-3S-2W, NW 1/4 NE 1/4 SW 1/4
COMPLETION DATE October 1953
TOTAL DEPTH 4112 ft.
ELEVATION 515 ft.
CASING 48 ft. of 10-inch; 4011 ft. of 5-inch
INITIAL PRODUCTION 4 BO and 4 BW per day
TREATMENT Acid, 6000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4112 ft.
KIND OF TRAP Anticlinal
PRODUCTIVE AREA 10 acres
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 1
THICKNESS OF RESERVOIR ROCK 50 ft.

CHARACTER OF OIL Not known
COMPLETION PRACTICES Acidizing

POOL STUDY 14

FIELD NAME Roaches North
COUNTY Jefferson
EXPLORATION METHOD LEADING TO DISCOVERY Deepening of a shallower pool

STATUS OF FIELD Abandoned in 1967
DISCOVERY WELL
NAME Texaco No. 12 E. Kasban
LOCATION 8-2S-1E, 645' SL, 664' WL, SE 1/4 NW 1/4
COMPLETION DATE April 1962
TOTAL DEPTH 4996 ft.
ELEVATION 518 ft.
CASING 252 ft. of 8 5/8-inch; 4852 ft. of 4 1/2-inch
INITIAL PRODUCTION 9 BO and 18 BW per day
TREATMENT Frac. treatment with 48,000 gal. acid, 40,000 lb. sand
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4996 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 10 acres
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 1
THICKNESS OF RESERVOIR ROCK 50 ft.

CHARACTER OF OIL 42° API Gr.
COMPLETION PRACTICES Acidizing and frac.

POOL STUDY 15

FIELD NAME St. Jacob
COUNTY Madison
EXPLORATION METHOD LEADING TO DISCOVERY Seismographing

STATUS OF FIELD Producing in part; used partially for gas storage in St. Peter
DISCOVERY WELL
NAME M. D. Bryant No. 1 Meyer
LOCATION 16-3N-6W, SW 1/4 NE 1/4 SE 1/4
COMPLETION DATE June 1942
TOTAL DEPTH 2354 ft.
ELEVATION 493 ft.
CASING Not known
INITIAL PRODUCTION 118 BO per day natural, 401 BO per day after acid
TREATMENT Acidizing with 5000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Precambrian at 5019 ft.
KIND OF TRAP Two domes on an anticline
PRODUCTIVE AREA 1050 acres
APPROVED SPACING 10 acres
NO. OF WELLS THAT PRODUCED 55
THICKNESS OF RESERVOIR ROCK 17 ft.

CHARACTER OF OIL 40° API Gr.
COMPLETION PRACTICES Various
PERTINENT REFERENCES

Bell, A. H., 1961, Underground storage of natural gas in Illinois: Illinois Geol. Survey Circ. 318, 27 p.

Buschbach, T. C., and D. C. Bond, 1967, Underground storage of natural gas in Illinois: Illinois Geol. Survey Illinois Petroleum 86, 54 p.

(Pool study 15 continued on p. 28)

Spitznagel, K. A., 1942, Trenton enhances Illinois discovery prospect: Oil Weekly, v. 107, no. 3, p. 41-44.

Sterrett, E., 1942, Trenton strike gives western Illinois area new life: Oil Weekly, v. 106, no. 9, p. 17-21.

See figure 15 for structure map.

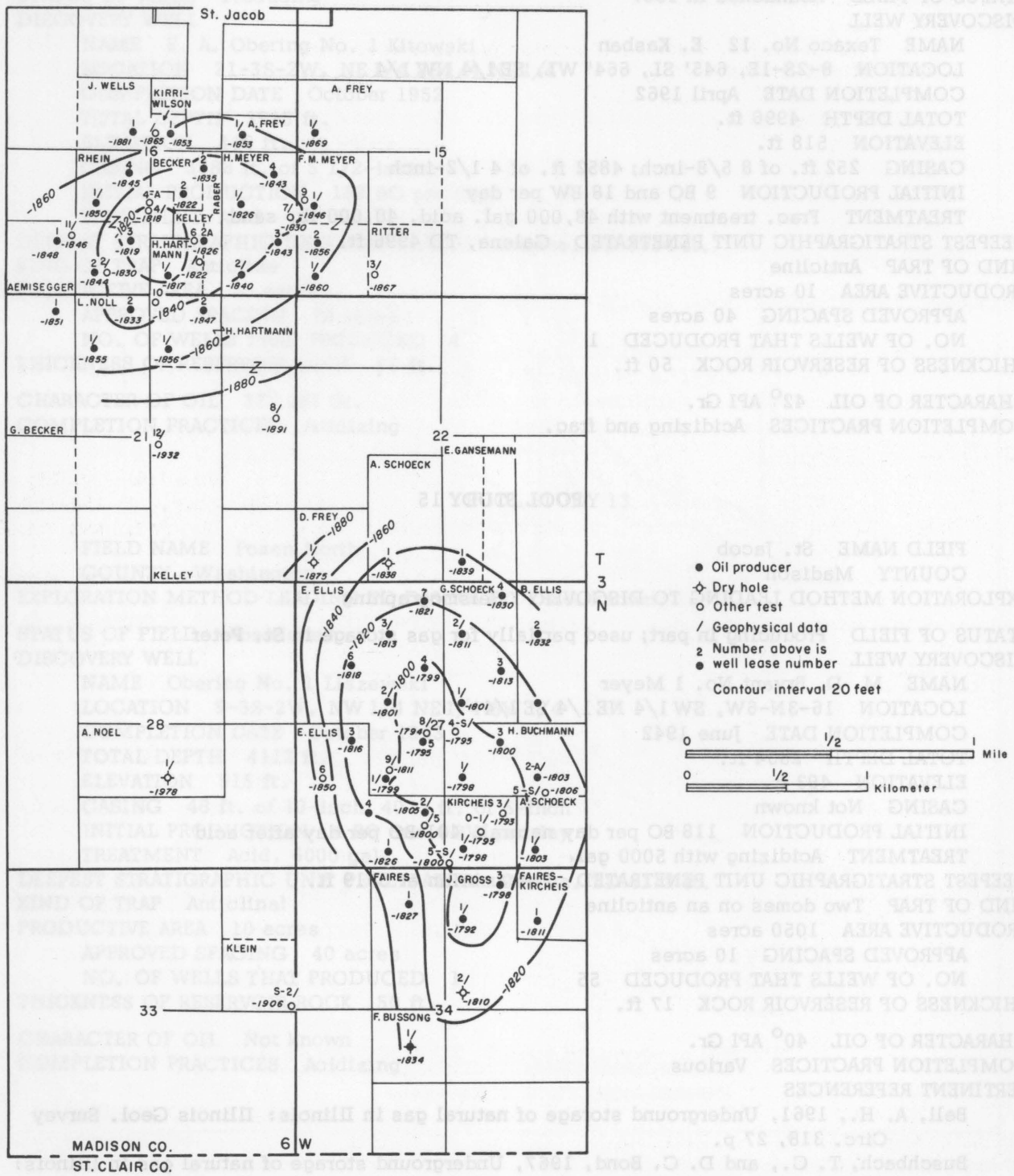

Fig. 15 - Structure on top of the Galena (Trenton) in the St. Jacob oil field.

POOL STUDY 16

FIELD NAME Salem
COUNTY Marion
EXPLORATION METHOD LEADING TO DISCOVERY Deeper drilling on a producing shallow field

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Paul Rossi No. 8 Brooks (Devonian producer deepened)
LOCATION 29-2N-2E
COMPLETION DATE February 1941
TOTAL DEPTH 4620 ft.
ELEVATION 540 ft.
CASING 5 1/2-inch through original 7-inch, to 4515 ft.
INITIAL PRODUCTION 130 BO per day
TREATMENT Acid, 5000 gal.
DEEPEST STRATIGRAPHIC UNIT PENETRATED Precambrian at 8629 ft., TD 9215 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 1920 acres
APPROVED SPACING 20 acres; 10 acres initially, some drilled later on 40 acres
NO. OF WELLS THAT PRODUCED 98
THICKNESS OF RESERVOIR ROCK Pay is confined to top 100 ft. of the Galena; top 50 ft. is best

CHARACTER OF OIL 37° API Gr.
COMPLETION PRACTICES Acidizing
PERTINENT REFERENCES

Arnold, H. H., Jr., 1939, Salem oil field, Marion County, Illinois: AAPG Bull., v. 23, no. 9, p. 1352-1373; Kansas Geol. Soc. Guidebook, 13th Ann. Field Conf., p. 154-158.

Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Illinois Petroleum 39, 15 p.

Hunzicker, A. A., 1949, Geophysical history of the Salem oil field, Marion County, Illinois: Geophys. Case Histories, v. 1, p. 471-480.

Love, R. W., 1955, Water flood operations Lake Centralia—Salem Field—Salem Unit: Interstate Oil Compact Comm. Rept.; Illinois Geol. Survey Illinois Petroleum 73, p. 39-53.

See figure 16 for structure map.

POOL STUDY 17

FIELD NAME Shattuc
COUNTY Clinton
EXPLORATION METHOD LEADING TO DISCOVERY Seismographing

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Talbot No. 1-T Gullick
LOCATION 28-2N-1W, 330' SL, 660' EL, NE 1/4
COMPLETION DATE November 1948
TOTAL DEPTH 4071 ft.
ELEVATION 474 ft.
CASING 129 ft. of 10 5/8-inch; 4007 ft. of 5 1/2-inch
INITIAL PRODUCTION 50 BO and 40 BW per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4078 ft.
KIND OF TRAP Anticline

(Pool study 17 continued on p. 31)

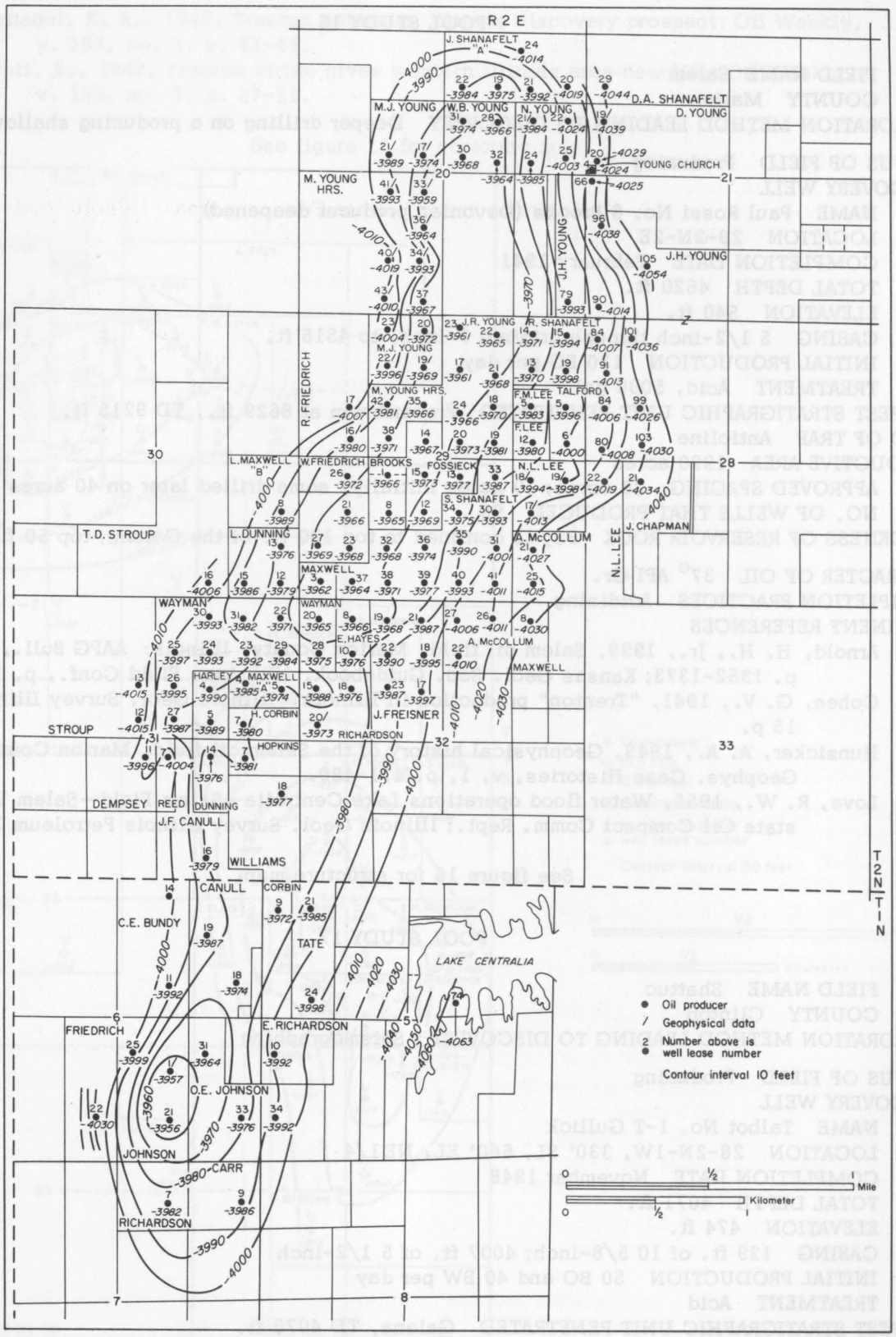

Fig. 16 - Structure on top of the Galena (Trenton) in the Salem oil field.

PRODUCTIVE AREA 180 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 15
THICKNESS OF RESERVOIR ROCK 20 ft.

CHARACTER OF OIL 42° API Gr.
COMPLETION PRACTICES Acidizing
PERTINENT REFERENCES

Brownfield, R. L., 1954, Structural history of the Centralia area: Illinois Geol. Survey Rept. Inv. 172, 31 p.

See figure 17 for structure map.

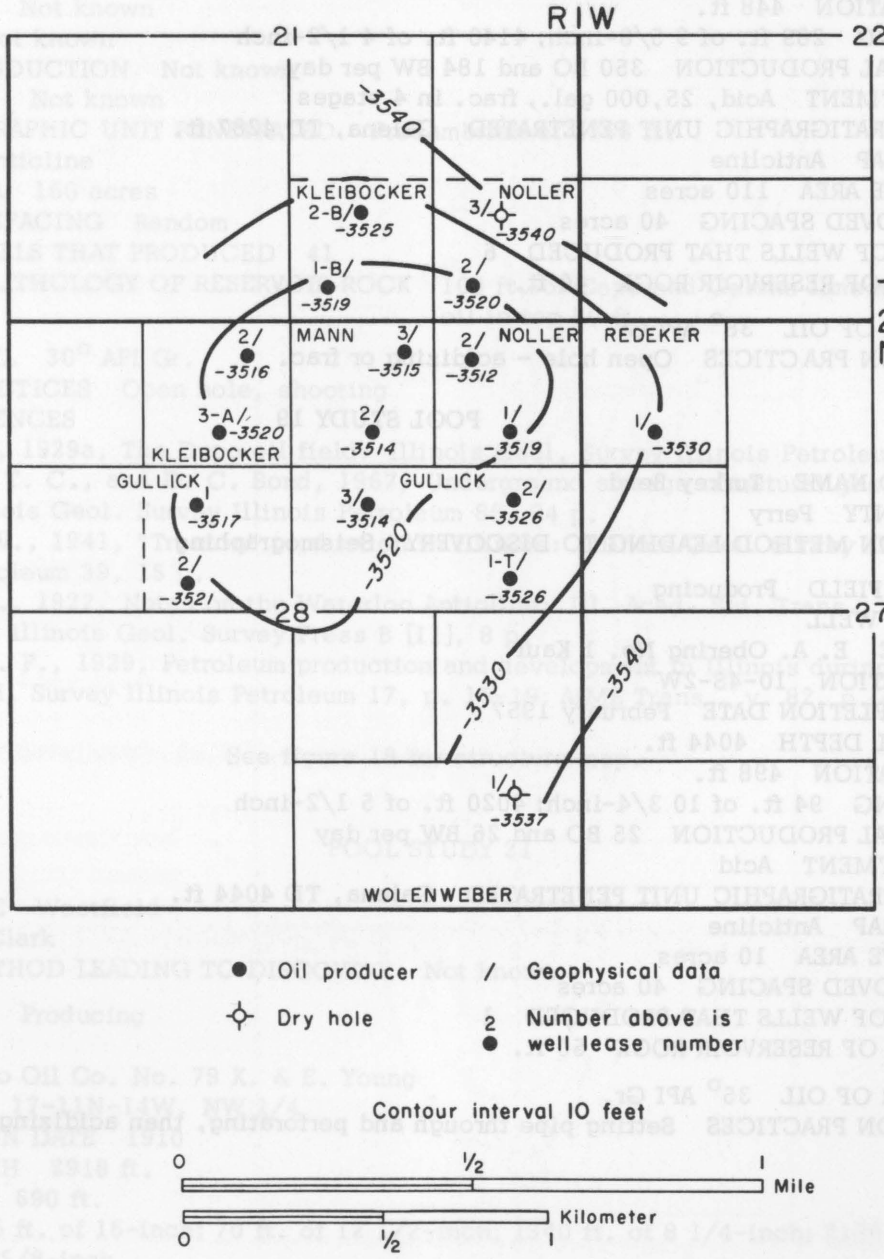

Fig. 17 - Structure on top of the Galena (Trenton) in the Shattuc oil field.

POOL STUDY 18

FIELD NAME Tamaroa
COUNTY Perry
EXPLORATION METHOD LEADING TO DISCOVERY Seismographing

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Texaco No. 1 J. Majewski
LOCATION 23-4S-1W, 660' NL, 660' WL, NW 1/4 SW 1/4
COMPLETION DATE June 1964
TOTAL DEPTH 4275 ft.
ELEVATION 448 ft.
CASING 289 ft. of 9 5/8-inch; 4140 ft. of 4 1/2-inch
INITIAL PRODUCTION 350 BO and 184 BW per day
TREATMENT Acid, 25,000 gal., frac. in 4 stages
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4287 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 110 acres
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 6
THICKNESS OF RESERVOIR ROCK 40 ft.

CHARACTER OF OIL 38° API Gr.
COMPLETION PRACTICES Open hole - acidizing or frac.

POOL STUDY 19

FIELD NAME Turkey Bend
COUNTY Perry
EXPLORATION METHOD LEADING TO DISCOVERY Seismographing

STATUS OF FIELD Producing
DISCOVERY WELL
NAME E. A. Obering No. 1 Kaul
LOCATION 10-4S-2W
COMPLETION DATE February 1957
TOTAL DEPTH 4044 ft.
ELEVATION 498 ft.
CASING 94 ft. of 10 3/4-inch; 4020 ft. of 5 1/2-inch
INITIAL PRODUCTION 25 BO and 26 BW per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 4044 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 10 acres
APPROVED SPACING 40 acres
NO. OF WELLS THAT PRODUCED 1
THICKNESS OF RESERVOIR ROCK 50 ft.

CHARACTER OF OIL 35° API Gr.
COMPLETION PRACTICES Setting pipe through and perforating, then acidizing

POOL STUDY 20

FIELD NAME Waterloo
COUNTY Monroe
EXPLORATION METHOD LEADING TO DISCOVERY Surface work

STATUS OF FIELD Galena abandoned, converted to gas storage (St. Peter and other Ordovician), 1952; gas storage abandoned, 1972
NAME Waterloo Condensed Milk Co.
LOCATION 2S-10W
COMPLETION DATE 1920
TOTAL DEPTH Not known
ELEVATION Not known
CASING Not known
INITIAL PRODUCTION Not known
TREATMENT Not known
DEEPEST STRATIGRAPHIC UNIT PENETRATED Precambrian at 2768 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 160 acres
APPROVED SPACING Random
NO. OF WELLS THAT PRODUCED 41
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK 100 ft. of Cape and Galena limestone; oil in top 50 ft.

CHARACTER OF OIL 30° API Gr.
COMPLETION PRACTICES Open hole, shooting
PERTINENT REFERENCES

Bell, A. H., 1929a, The Dupo oil field: Illinois Geol. Survey Illinois Petroleum 17, p. 1-14.
Buschbach, T. C., and D. C. Bond, 1967, Underground storage of natural gas in Illinois: Illinois Geol. Survey Illinois Petroleum 86, 54 p.
Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Illinois Petroleum 39, 15 p.
Lamar, J. E., 1922, Notes on the Waterloo Anticline: Ill. Acad. Sci. Trans., v. 15, p. 398-404; Illinois Geol. Survey Press B [11], 8 p.
Moulton, G. F., 1929, Petroleum production and development in Illinois during 1928: Illinois Geol. Survey Illinois Petroleum 17, p. 15-19; AIME Trans., v. 82, p. 468-470.

See figure 18 for structure map.

POOL STUDY 21

FIELD NAME Westfield
COUNTY Clark
EXPLORATION METHOD LEADING TO DISCOVERY Not known

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Ohio Oil Co. No. 79 K. & E. Young
LOCATION 17-11N-14W, NW 1/4
COMPLETION DATE 1910
TOTAL DEPTH 2918 ft.
ELEVATION 690 ft.
CASING 56 ft. of 16-inch; 70 ft. of 12 1/2-inch; 1340 ft. of 8 1/4-inch; 2126 ft. of 6 5/8-inch
INITIAL PRODUCTION 65 BO per day

(Pool study 21 continued on p. 35)

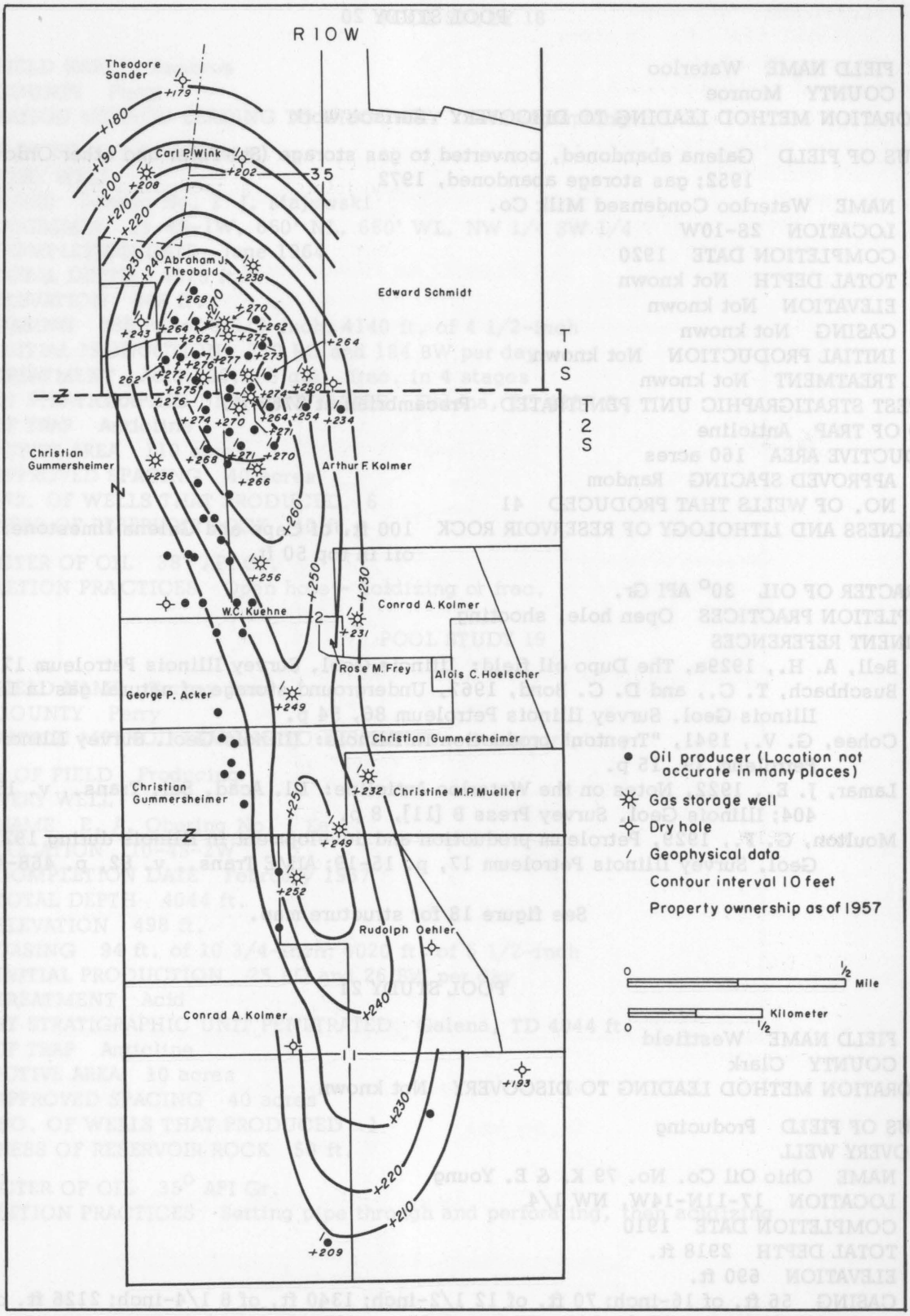

Fig. 18 - Structure on top of the Galena (Trenton) in the Waterloo oil field (modified from Mississippi River Fuel Corp. map, 1957; Trenton data by authors).

TREATMENT Shot with 220 qt., 2385-2445 ft.
DEEPEST STRATIGRAPHIC UNIT PENETRATED St. Peter, TD 3009 ft.
KIND OF TRAP Dome
PRODUCTIVE AREA 1710 acres
APPROVED SPACING 20 acres; earlier drilling - random
NO. OF WELLS THAT PRODUCED 87
THICKNESS AND LITHOLOGY OF RESERVOIR ROCK 140 to 160 ft. of dolomitic limestone with fractures and joints; best production from upper 50 ft.

CHARACTER OF OIL 38.2° API Gr.
COMPLETION PRACTICES Shooting, 4 to 5 qt. per foot generally
PERTINENT REFERENCES

Clegg, K. E., 1965, The La Salle Anticlinal Belt and adjacent structures in east-central Illinois: Illinois Acad. Sci. Trans., v. 58, no. 2, p. 82-94; Illinois Geol. Survey Reprint 1965-H, 13 p.

Cohee, G. V., 1941, "Trenton" production in Illinois: Illinois Geol. Survey Illinois Petroleum 39, 15 p.

Mylius, L. A., 1927, Oil and gas development and possibilities in east-central Illinois (Clark, Coles, Douglas, Edgar, and parts of adjoining counties): Illinois Geol. Survey Bull. 54, 205 p.

See figure 19 for structure map.

POOL STUDY 22

FIELD NAME Woburn Central (south)
COUNTY Bond
EXPLORATION METHOD LEADING TO DISCOVERY Deeper drilling on a shallow pay structure

STATUS OF FIELD Producing
DISCOVERY WELL
NAME Horton No. 1 F. Stoecklin
LOCATION 16-6N-2W, SW 1/4 SE 1/4 SE 1/4
COMPLETION DATE August 1948
TOTAL DEPTH 3179 ft.
ELEVATION 565 ft.
CASING 180 ft. of 8 5/8-inch; 3162 ft. of 5 1/2-inch
INITIAL PRODUCTION 45 BO per day
TREATMENT Acid
DEEPEST STRATIGRAPHIC UNIT PENETRATED Galena, TD 3279 ft.
KIND OF TRAP Anticline
PRODUCTIVE AREA 320 acres
APPROVED SPACING 20 acres
NO. OF WELLS THAT PRODUCED 19
THICKNESS OF RESERVOIR ROCK 12 ft.

CHARACTER OF OIL 39° API Gr.
COMPLETION PRACTICES Acidizing

See figure 20 for structure map.

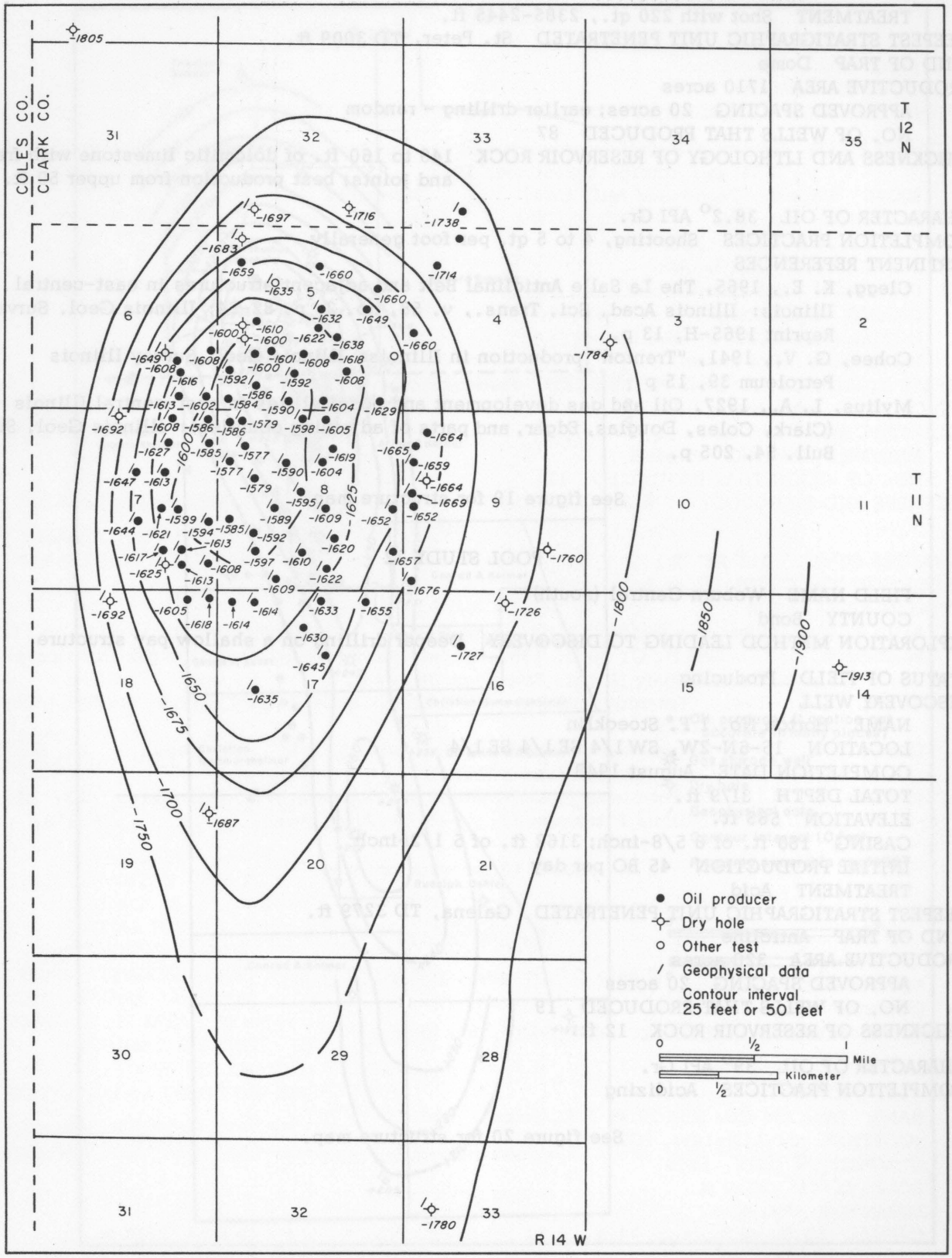

Fig. 19 - Structure on top of the Galena (Trenton) in the Westfield oil field.

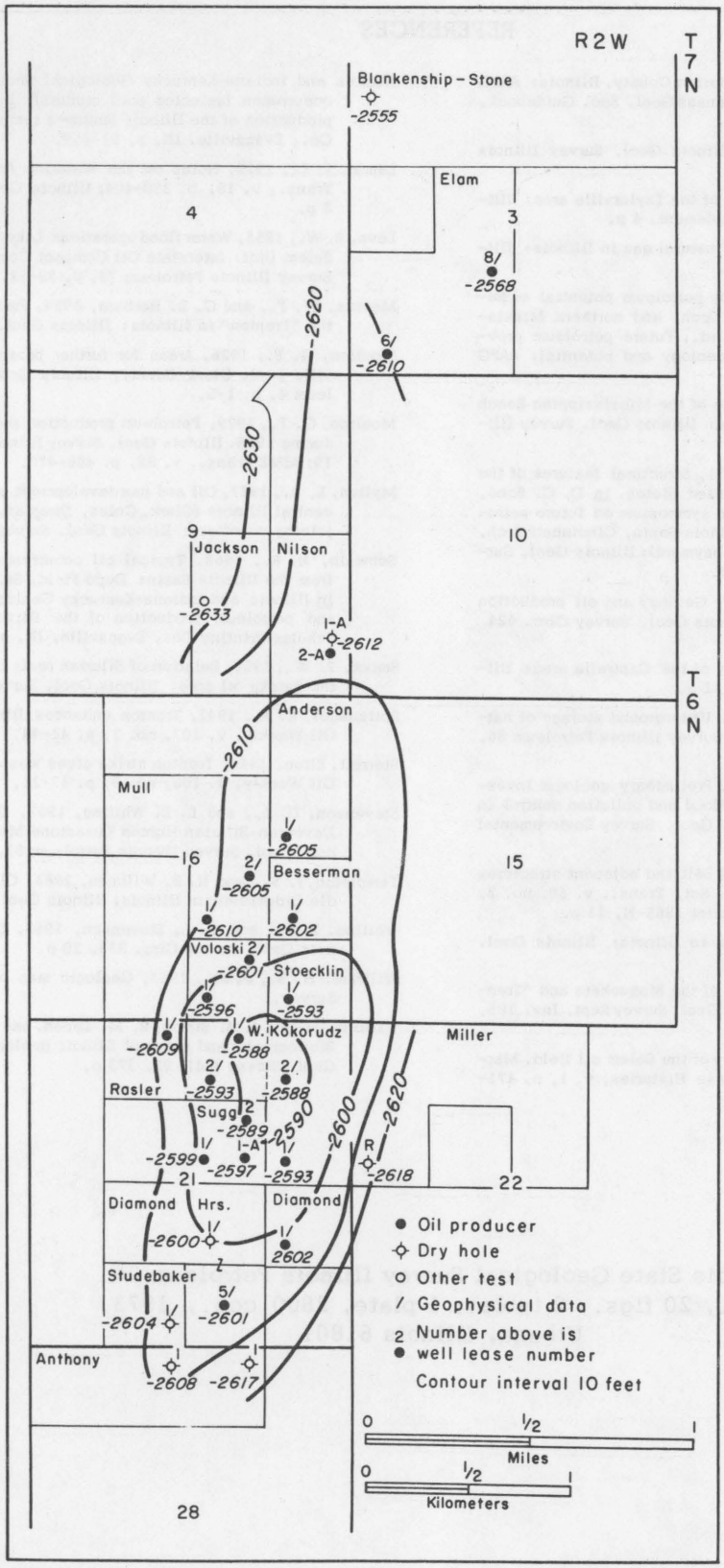

Fig. 20 - Structure on top of the Galena (Trenton) in the Woburn Consolidated oil field.

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Arnold, H. H., Jr., 1939, Salem oil field, Marion County, Illinois: AAPG Bull., v. 23, no. 9, p. 1352-1373; Kansas Geol. Soc. Guidebook, 13th Ann. Field Conf., p. 154-158.

Bell, A. H., 1929a, The Dupo oil field: Illinois Geol. Survey Illinois Petroleum 17, p. 1-14.

Bell, A. H., 1929b, Revised structure map of the Taylorville area: Illinois Geol. Survey Rept. Inv. 1 Supplement, 4 p.

Bell, A. H., 1961, Underground storage of natural gas in Illinois: Illinois Geol. Survey Circ. 318, 27 p.

Bond, D. C., et al., 1971, Possible future petroleum potential of Region 9—Illinois Basin, Cincinnati Arch, and northern Mississippi Embayment, in Ira H. Cram, ed., Future petroleum provinces of the United States—their geology and potential: AAPG Memoir 15, v. 2, p. 1165-1218.

Bristol, H. M., 1968, Structure of the base of the Mississippian Beech Creek (Barlow) Limestone in Illinois: Illinois Geol. Survey Illinois Petroleum 88, 12 p.

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STRUCTURE ON TOP OF THE GALENA GROUP (TRENTON) IN ILLINOIS

H. M. Bristol and T. C. Buschbach

1973

Contour, interval 100 feet; datum sea level

Closed depression

Maquoketa absent, top of Galena eroded

Fault, downthrown side indicated

0 10 20 30 Miles

0 10 20 30 Kilometers