STATE OF ILLINOIS
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TISKILWA DRIFT-GAS AREA
Bureau and Putnam Counties, Illinois

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DIVISION OF THE
ILLINOIS STATE GEOLOGICAL SURVEY
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ABSTRACT

The Tiskilwa drift-gas area, adjacent to the "Big Bend" in the Illinois River in Bureau and Putnam counties, Illinois, has 49 producing drift-gas wells scattered over nearly 28 square miles. The noncommercial gas, which is used for farmhouse heating and cooking units, comes from the Sankoty Sand of the Pleistocene System.

The slightly consolidated sand was deposited as a partial fill in the Ancient Mississippi Valley and crops out along the Illinois River bluffs. The gas apparently is contaminated with air near the river bluffs but is purer farther back from the bluff line, as indicated by 30 gas gravity samples. Records of gas well pressures and barometric pressures show close correlation.

INTRODUCTION

The Tiskilwa gas area, directly southwest of the "Big Bend" of the Illinois River between the towns of Tiskilwa in Bureau County and Putnam in Putnam County is one of sixty drift-gas areas in Illinois (fig. 1). There are 457 producing drift-gas wells in Illinois, 250 of which are flowing pressure wells and 207 vacuum pumped wells. Of the producers, 249 have been tested for volume capacities and pressures. The majority of the wells are producing gas from a well developed Sangamon soil zone where it underlies morainic ridges of glacial drift.

The Tiskilwa gas-producing area covers about 28 square miles and has 51 gas wells, 49 of which produce gas from the Sankoty Sand and only two of which produce from the Sangamon Soil.

The first gas well drilled in the Tiskilwa area, which was drilled about 50 years ago, was a flowing pressure well. The 49 wells producing gas from the Sankoty Sand are now vacuum pumped although they will flow under slight pressure on days when the atmospheric pressure is low. Well-head pressures and suctions, barometric pressures, and air temperatures have been recorded and charted (fig. 7). There is nearly perfect correlation between the three sets of readings, especially gas pressure versus barometric pressure.

STRATIGRAPHY

In the area under discussion most of the Pleistocene deposits (fig. 2) are typical for northeastern Illinois. An oil test hole in the SW 1/4 SW 1/4 NE 1/4 sec. 24, T. 15 N., R. 9 E., Bureau County, penetrated formations to a total depth of 1045 feet, and a detailed description (by Horberg, 1953) of the drilling samples through the Pleistocene deposits follows.

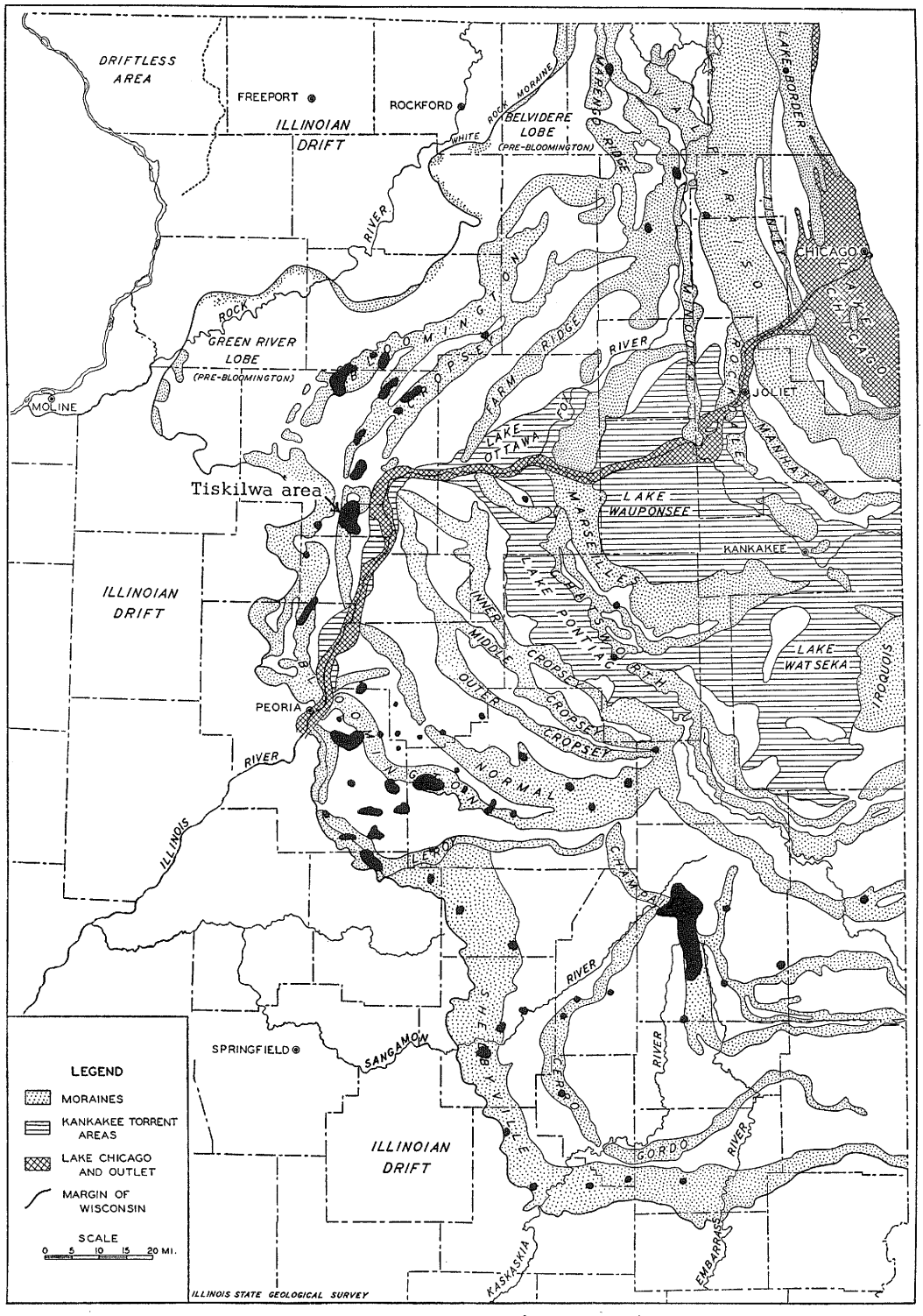

Fig. 1. - Drift-gas in northeastern Illinois (solid black), by Meents, 1958 shown in relation to glacial geology (Ekblaw, 1942).

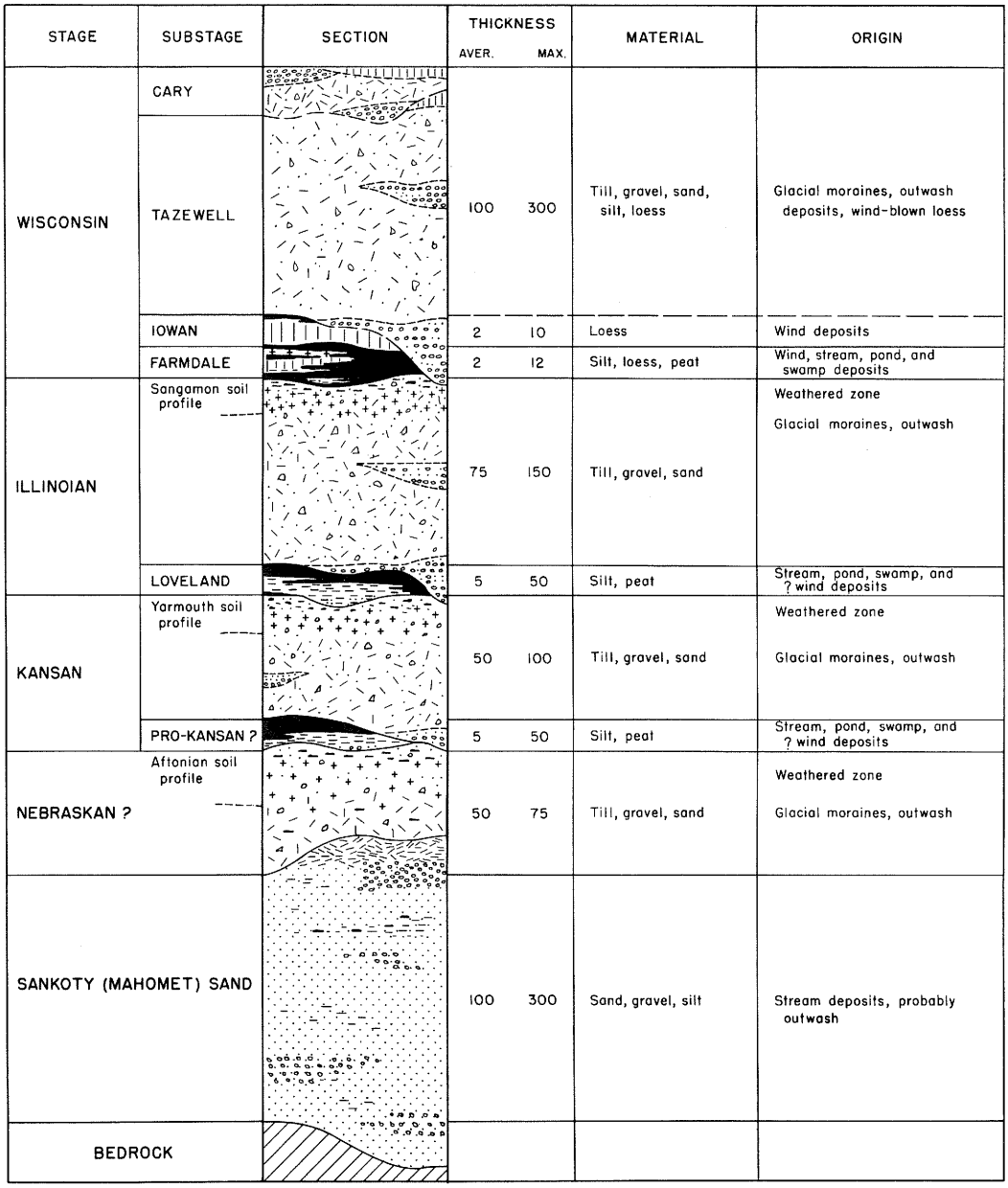

Fig. 2. - Graphic section of Pleistocene deposits in northeastern Illinois (after Horberg, 1953, p. 11).

	Thickness Feet	Depth Feet
Pleistocene System		
Wisconsin drift		
Tazewell loess		
Silt, calcareous, oxidized, yellow	4	4
Same, some sand grains	4	8
Tazewell drift		
Till, calcareous, oxidized, yellow	4	12
Gravel, up to 1 inch, sandy, calcareous, buff to gray	3	15
Same, largely granular	3	18
Sand, medium to coarse, gravelly, calcareous, yellow to gray	3	21
Gravel, granular, sandy, yellow to gray	4	25
Same, very silty, partly cemented	3	28
Sand, medium to coarse, and granular gravel, calcareous, yellow to gray	5	33
Same, gravel up to 1/2 inch	4	37
Granular gravel, sandy, calcareous, yellow to gray	8	45
Sand, fine to coarse, gravelly, clean, calcareous	25	70
Illinoian (?) drift		
Till, calcareous, pinkish-gray	24	94
Sand, fine to coarse, some granular gravel, gray	7	101
Till, calcareous, pinkish gray	39	140
Till, calcareous, silty, gray	12	152
Sand, fine to medium, calcareous, gray	6	158
Pre-Illinoian drift (Sankoty)		
Silt and sand, slightly calcareous, oxidized, yellow, coherent	12	170
Sand, medium to coarse, largely quartz, numerous polished rounded pink grains, partly cemented, some gravel (gas zone)	20	190
Gravel, up to 3/8 inch, oxidized grains, some sand	10	200
Sand, as above, silty	25	225
Sand, as above, coarse, some granular gravel, clean	10	235
Sand, as above, coarse, gravelly, slightly silty	15	250
Gravel, up to 3/8 inch, angular, mixed lithographic, clean	10	260
Sand, as above, coarse, some granular gravel, clean	5	265

	Thickness Feet	Depth Feet
Pennsylvanian System		
Shale, carbonaceous, pyritic, black	5	270
Limestone, medium crystalline, light gray	10	280
Shale, silty, sandy, light gray, sideritic	5	285
Sandstones, limestones, and shales	155	440
Devonian System		
Limestone	30	470
Silurian System		
Dolomite	540	1010
Ordovician System		
Maquoketa Formation		
Shale	35	1045

Several outcrop sections along the bluffs of Bureau Creek were studied by Leland Horberg (1953) and a typical description follows. The section is in the bank on the southwest side of Bureau Creek Valley at its junction with Illinois Valley, NE 1/4 SE 1/4 SW 1/4 sec. 18, T. 15 N., R. 10 E., Bureau County.

	Thickness Feet	Thickness Inches
Pleistocene System		
Wisconsin (Bloomington-Normal) drift		
Till, calcareous, pink	19	
Illinoian drift		
Till, calcareous, partly oxidized at top, brown to slate gray	8	
Till, calcareous, slate gray	1	6
Silt, calcareous, yellow		3
Till, calcareous, slate gray	9	
Till, calcareous, yellowish brown		6
Sand, medium, pebbly, buff, horizontal bedding	5	
Till, calcareous, brown	1	6
Sankoty Sand (gas zone)		
Sand, medium to coarse, buff with pink tint, about 90 percent quartz; well sorted, numerous rounded, polished and frosted grains; abundant pink grains with hematitic coatings, current cross-bedding, some pebbles	26	

Another oil test hole, the Fogerty No. 1 Magoon Kane, drilled in the NE 1/4 NE 1/4 NW 1/4 sec. 9, T. 14 N., R. 9 E., Bureau County, encountered the following rock formations.

	Thickness Feet	Depth Feet
Pleistocene System		
Wisconsin and Illinoian drifts	163	163
Sankoty Sand (gas zone)	103	266
Pennsylvanian System	174	440
Devonian System	60	500
Silurian System	505	1005
Ordovician System		
Maquoketa Formation	185	1190
Galena "Trenton" Formation	67	1257

GAS-PRODUCING ZONE

The Sankoty Sand of the Pleistocene System is the gas-producing zone in this area (figs. 1, 2, 3, and 4). The sand is slightly consolidated, medium to coarse, buff to pinkish, and extends as a valley fill the full length of the Ancient Mississippi Valley through central Illinois. The top of the Sankoty Sand ranges in elevation from 455 to 555 feet. In the Tiskilwa area the top of the gas sand in the producing wells ranges from 470 feet to 532 feet in depth, the average being about 500 feet.

Two wells shown in figure 5, with elevations on top of the gas sand at 610 feet in the SE 1/4 sec. 7, T. 14 N., R. 9 E., Bureau County, and at 603 feet in sec. 28, T. 14 N., R. 9 E., Bureau County, are producing from upper sands probably associated with the Sangamon Soil.

All of the gas wells are free of water except those which have faulty casings. Water is reached, usually at the 460-foot elevation level, directly below the gas sand. The Illinois River floodplain and associated lakes range in elevation from about 450 feet to 460 feet, which accounts for the water in the gas wells being below the 460-foot level.

The gas may have originated from the decomposition of organic matter, such as old peat beds, or possibly from the coal beds that lie about 55 feet below the base of the gas sand. Wood chips in the Sankoty Sand have been found in drilling samples taken from several of the wells in the area, evidence that favors the theory that the gas is derived from the decomposition of organic matter.

METHOD OF SAMPLING

Gas samples were collected in evacuated 96 cubic inch steel bottles under pressure, the same as those used by aviators for oxygen supplies. Pressure was obtained by pumping the gas into the bottles with a hydraulic double-check valve pump. Gas systems in most of the homes operate on pressures of 1/4 pound to 1/2 pound per square inch. Samples, therefore, had to be pumped up to at least 10 pounds per square inch for gravity analysis and up to 20 or more pounds per square inch for complete Orsat analysis. In most systems the sample was obtained from the output side of the gas holder, although in a few cases connections were made directly to the output side of the rotary vacuum pump (fig. 6). Gas samples were analyzed by the Illinois State Geological Survey's laboratory in Urbana.

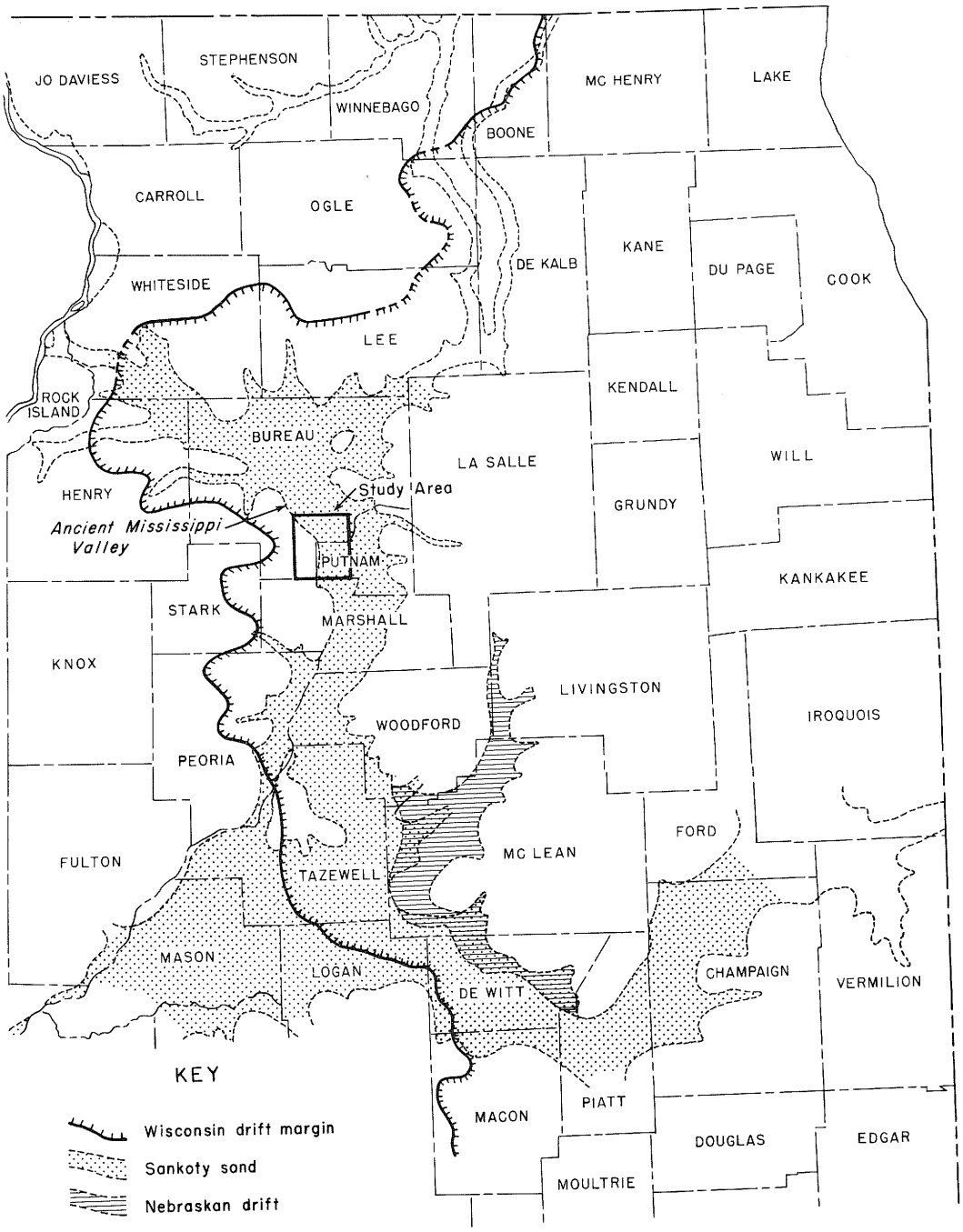

Fig. 3. - Areas underlain by Sankoty-Mahomet sand (after Horberg, 1953, p. 15).

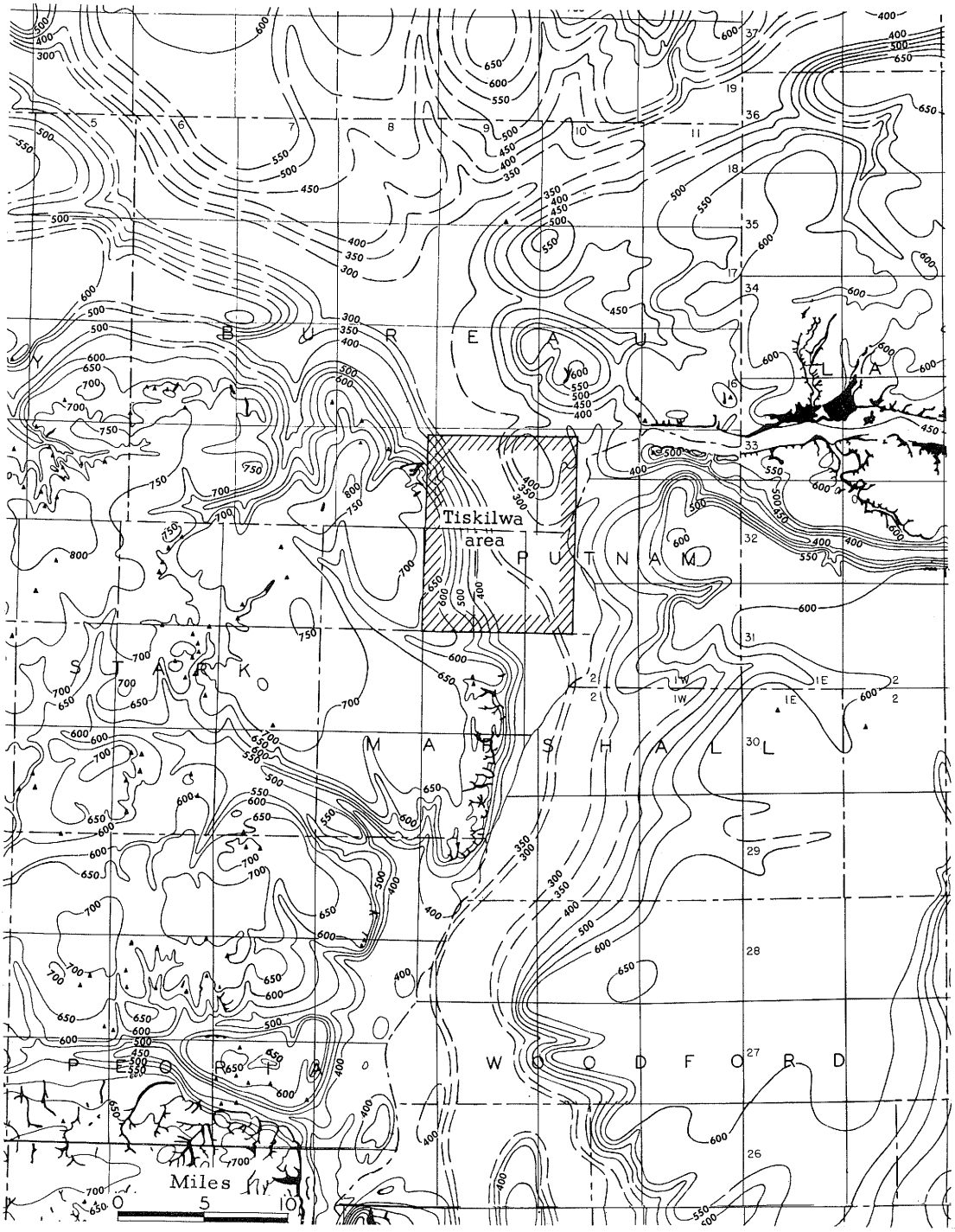

Fig. 4. - Bedrock surface (modified after Horberg, 1950, pl. 1).

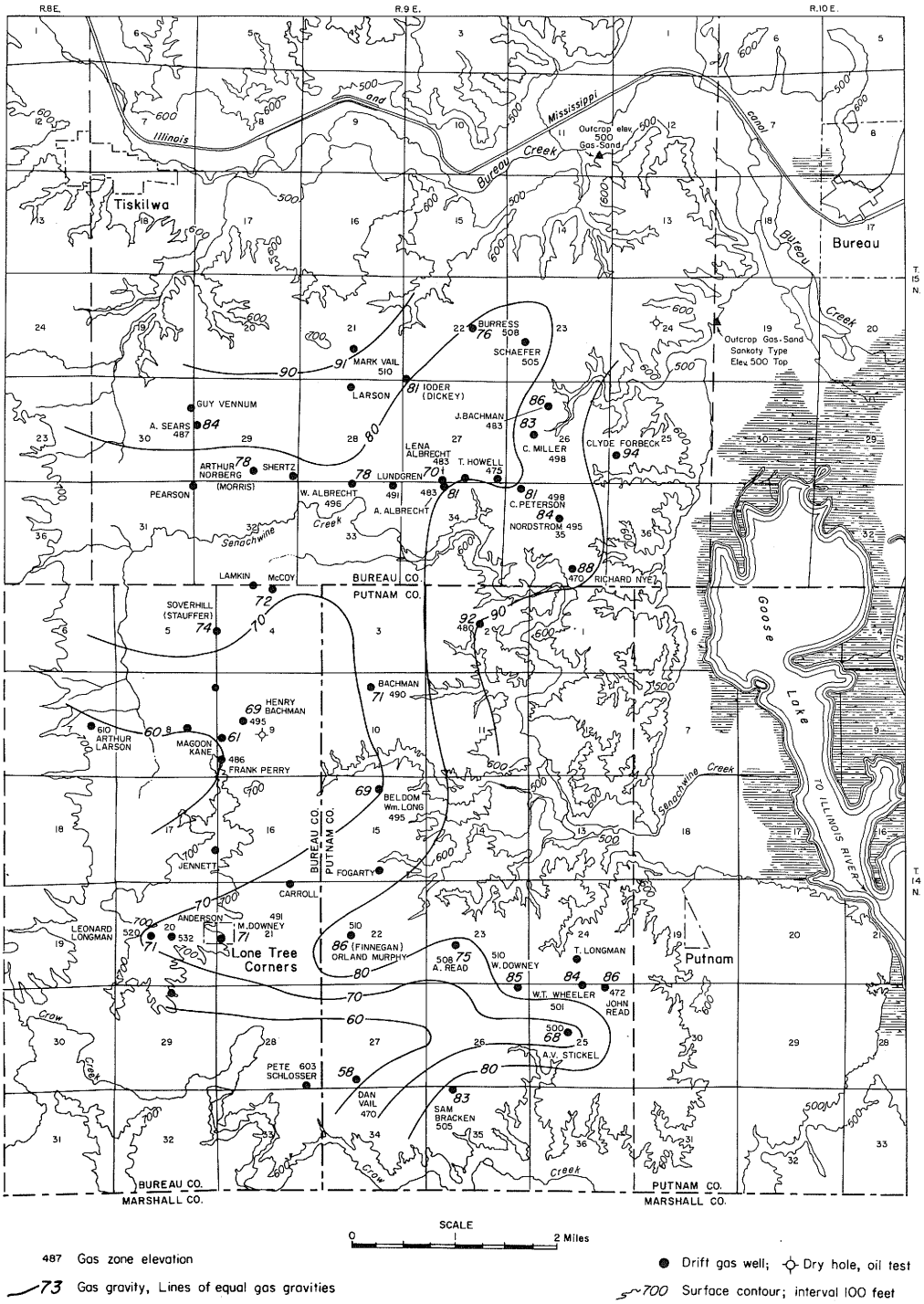

Fig. 5. - Drift-gas wells and gas gravities in the Tiskilwa area.

GAS GRAVITIES

The specific gravity of gases in this area was measured by the effusion method, using the U. S. Bureau of Standards type of specific gravity apparatus. The effusion method is the comparison of the specific gravity of a gas to the specific gravity of air, air being 1.00 and pure methane being 0.55. The gas gravities measured compared favorably with the calculated gravities calculated from the Orsat absorption analyses (table 1). The gravities of this type of gas are governed by the amount of nitrogen versus the amount of methane, other constituents being minor. The more methane present, the lighter the gas (the lower the gravity number on fig. 5), and vice versa. Some contamination could have resulted from vacuum pump oil vapors passing into the gas sampling pump, but such contamination would not affect the gravity readings.

GRAVITY MAP

Gas gravities vary from low in the western part of the Tiskilwa area, where the overburden is thick, to high in the eastern part, where the overburden is thin (fig. 5). The Sankoty Sand crops out along the Illinois River bluffs at about 500 feet above sea level and extends west and southwest into the gas-producing area. Near the river bluff exposures, the gas is contaminated by air so that a lower quality of gas is produced in the marginal wells.

For simplicity, gas gravities (fig. 5) are shown without the decimal point, because all figures are less that 1.00. Gravities range from a low of 58 in sec. 27, T. 14 N., R. 9 E., to a high of 94 in sec. 25, T. 15 N., R. 9 E., near the river bluff. The 94 gravity gas is not "burnable."

The highest gravity gas that is burnable (92) is found in sec. 21, T. 15 N., R. 9 E., and can be used only for furnace heat. The high-gravity gas will not burn in a cookstove or a standard gas furnace because of its low methane content, but it can be used in a specially constructed furnace that must be started with a blow torch or an oil-soaked rag.

Another well in the SE 1/4 sec. 35, T. 15 N., R. 9 E., is similar but has a gas gravity of 88.

Figure 5 shows lines of equal gas gravities, which indicate that the gas is purer on the west side of the area and under high ridges that extend east or northeast toward the Illinois River valley than it is near the river bluffs.

The high nitrogen content of gas from wells near the river bluff is due to the entry of air through the outcrop of the gas sand.

Several deep ravines along the Illinois River cliff have springs that bubble gas, according to some of the local farmers. In such situations the Sankoty Sand is probably covered with a few feet of wet surface soil which causes gas bubbling. In the areas of purer gas the overburden above the gas horizon measures as much as 215 feet thick, but in the more contaminated marginal cliff-line wells the overburden is as thin as 140 feet.

GAS PRESSURES

The readings shown in the graph (fig. 7) were recorded by Mr. Alvin Albrecht, a farmer, whose home is in the NE 1/4 NE 1/4 NW 1/4 of sec. 34, T. 15 N., R. 9 E., Bureau County. Mr. Albrecht was a part-time water well driller for many years and has given valuable information on the subsurface of the area.

Table 1. - Gas Analyses

A. Magoon Kane

SW NW SW 9-14N-9E, Bureau County

Absorption Method (Orsat)

	Percent
Carbon dioxide	0.6
Illuminants	0.9
Oxygen	0.8
Carbon monoxide	0.0
Hydrogen	0.6
Methane	73.3
Ethane	0.7
Nitrogen	23.1
Total	100.0

Specific gravity	BTU per cubic foot
Calculated = 0.65	Gross = 773.0
Measured = 0.67	Net = 696.0

B. Tom Lawson (Mark Vail)

SW NW SE 21-15N-9E, Bureau County

Absorption Method (Orsat)

	Percent
Carbon dioxide	0.79
Illuminants	0.00
Oxygen	0.34
Carbon monoxide	0.11
Hydrogen	0.11
Methane	16.82
Ethane	0.00
Nitrogen	81.83
Total	100.00

Specific gravity	BTU per cubic foot
Calculated = 0.90	Gross = 170.9
Measured = 0.91	Net = 153.8

Table 1. - Continued

C. Alvin Albrecht

NE NE NW 34-15N-9E, Bureau County

Absorption Method (Orsat)

	Percent
Carbon dioxide	0.6
Illuminants	0.1
Oxygen	1.0
Carbon monoxide	0.4
Hydrogen	0.1
Methane	57.9
Ethane	1.3
Nitrogen	38.6
Total	100.0

Specific gravity	BTU per cubic foot
Calculated = 0.73	Gross = 612.6
Measured = 0.77	Net = 551.9

D. Ben Nordstrom

SW SW NE 35-15N-9E, Bureau County

Absorption Method (Orsat)

	Percent
Carbon dioxide	0.43
Illuminants	0.06
Oxygen	0.18
Carbon monoxide	0.25
Hydrogen	0.25
Methane	32.82
Ethane	0.00
Nitrogen	66.01
Total	100.00

Specific gravity	BTU per cubic foot
Calculated = 0.83	Gross = 343.5
Measured = 0.84	Net = 309.1

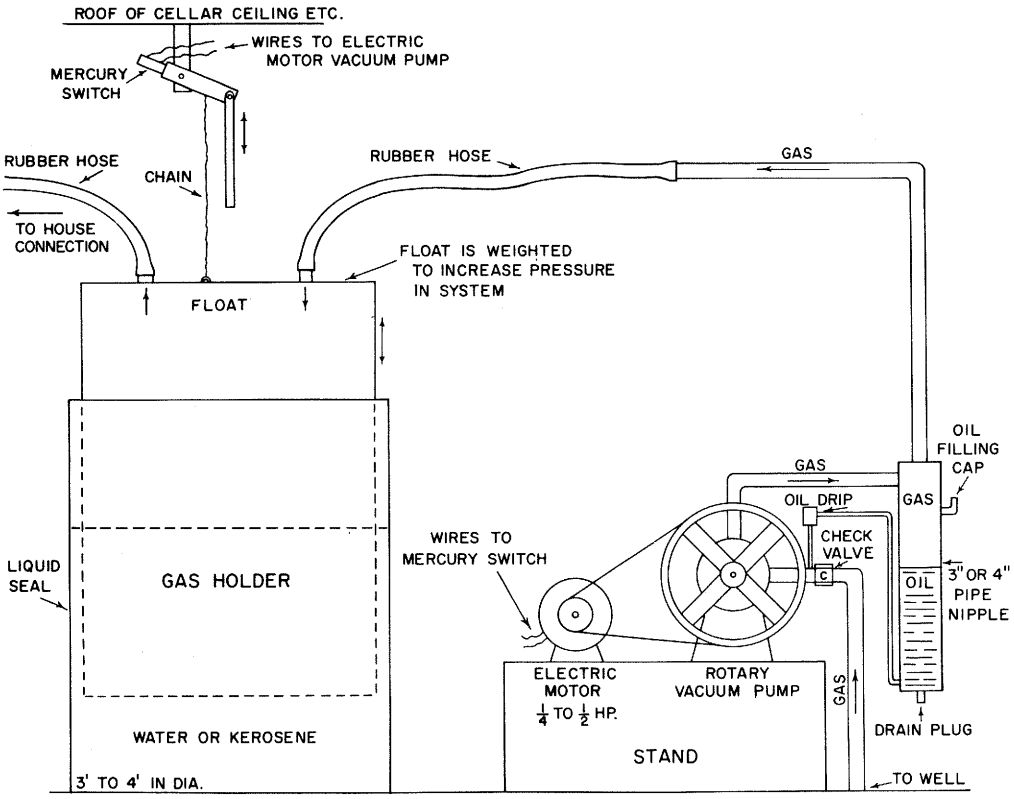

Fig. 6. - Typical vacuum gas pump installation.

Figure 8 is a sketch of Mr. Albrecht's well hookup showing the glass U-tube with oil levels that fluctuate according to well pressures and atmospheric changes. He recorded the well pressure in inches of oil up or down, the barometric pressure, and the air temperature twice a day, at 7:00 A.M. and 5:00 P.M., from November 16, 1949, through January 9, 1950. The aneroid barometer lent to Mr. Albrecht by the Geological Survey was checked against a mercury barometer and was found to have been .68 inch too high. As the increments were accurate, however, the chart figures need only be corrected for the .68-inch difference.

A close correlation appears between the gas pressure and the barometer readings, and a fairly close correlation between the gas pressure and the air temperature. About a fourth of the time during the recording period the well was flowing gas, but the other three-fourths of the time the well was under suction. Well pressures ranged from a low of -10.4 inches of oil to a high of +6.7 inches or a total of 17.1 inches of oil. Barometric pressures ranged from a low of 29.73 inches to a high of 30.55 inches, or a total of 0.82 inch. Air temperatures ranged from a low of 4°F. to a high of 59° F. or a total of 55°.

Mr. Albrecht's well has been producing gas for nearly 50 years and was a good continuous flowing gas well for about 25 years. Gas wells in this area

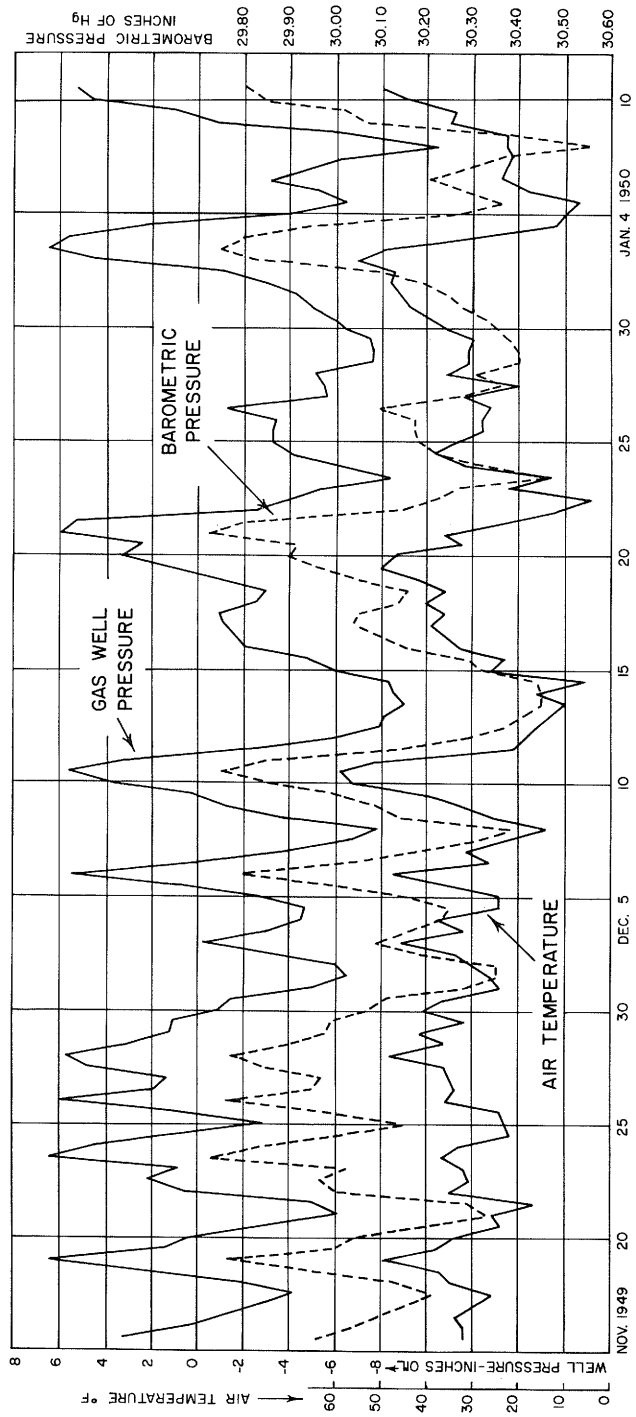

Fig. 7. - Record of gas-well pressures, barometer readings, and air temperatures during a two-month period, November 1949 to January 1950, for the Alvin Albrecht farm gas well, sec. 34, T. 15 N., R. 9 E., Bureau County.

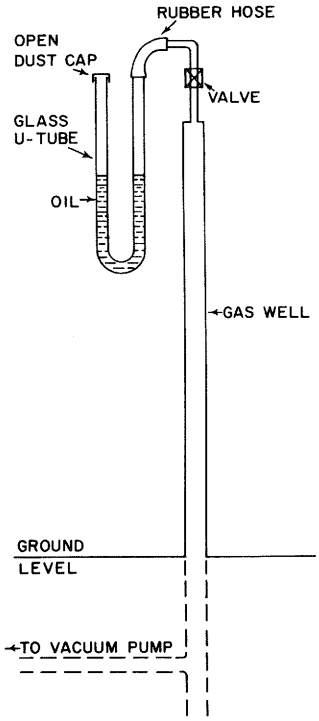

Fig. 8. - Typical gas well U-tube installation.

will flow enough gas for furnace use only in times of high well pressures. Vacuum pumps are, therefore, used continuously.

The producing formation in the drift-gas area near Danvers, about 50 miles south of Tiskilwa, has a continuous vacuum pull of 14.3 inches of mercury. Forty wells within the city limits are pumping against this vacuum.

REFERENCES

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