The "Clinton" Sands in Canton, Dover Massillon, and Navarre Quadrangles, Ohio

GEOLOGICAL SURVEY BULLETIN 1003-A

The "Clinton" Sands in Canton, Dover Massillon, and Navarre Quadrangles, Ohio

By JAMES F. PEPPER, WALLACE de WITT, JR., *and* GAIL M. EVERHART

OIL AND GAS GEOLOGY OF THE "CLINTON" SANDS OF OHIO

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The geology of three "Clinton" sands as interpreted from a study of well records. Includes map showing location of wells

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FOREWORD

By Ralph L. Miller

This report, in a series of separate chapters, describes the geology of the so-called Clinton sands of early Silurian age in Ohio. The data presented were compiled from a detailed study of drillers' records supplemented by study of available cuttings from wells. Each chapter covering four or more contiguous 15-minute quadrangles, includes maps that show by symbols the location of wells drilled into or through the Clinton sands, by isopach lines the thickness of each, and by color overprint the wells that encountered oil and gas. The text accompanying each chapter discusses the subsurface stratigraphy and the sedimentation of the Clinton sands in that particular area and the possibilities of locating additional productive areas. The last chapter of the report will discuss the over-all stratigraphy and sedimentary history of the Clinton sands throughout Ohio and their relationship to rocks of equivalent age in other parts of the Appalachian basin.

The Clinton sands of Ohio are of Silurian age, but they are not equivalent to the stratigraphically higher Clinton formation of New York, which is also of Silurian age. The name "Clinton sand" has been in continuous use in Ohio by drillers and others since 1887, when it was applied to a sand encountered in a well at Lancaster, Ohio, at about the same stratigraphic position as the limestone that was named "Clinton" by Orton in 1870. As the Clinton sands do not crop out in Ohio, their stratigraphic relationships to rocks above and below can be determined only from drillers' records and from well cuttings. In this report, the name "Clinton" is used in an informal sense and is not considered a formal stratigraphic name.

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OIL AND GAS GEOLOGY OF THE "CLINTON" SANDS OF OHIO

THE "CLINTON" SANDS OF EARLY SILURIAN AGE IN CANTON, DOVER, MASSILLON, AND NAVARRE QUADRANGLES, OHIO

By JAMES F. PEPPER, WALLACE DE WITT, JR., and GAIL M. EVERHART

ABSTRACT

The Canton, Dover, Massillon, and Navarre quadrangles cover about 880 square miles in eastern Ohio. Canton is the largest city in the mapped area. In these four quadrangles, the well drillers generally recognize three "Clinton" sands—in descending order, the "stray Clinton", the "red Clinton", and the "white Clinton". The Clinton sands of Ohio are of early Silurian age and probably correlate with the middle and upper part of the Albion sandstone in the Niagara gorge section in western New York.

The study of drillers' logs and examination of well samples show that of the three so-called Clinton sands, the red is most readily recognized. The "Packer shell", a probable equivalent of the Clinton formation of New York, and the Queenston shale—the drillers' "red Medina"—are also good units for short distance correlations.

Each of the Clinton sands consists of a thin layer that contains long narrow lenses of thicker sand. Although the pattern of the trend of the lenses varies for each of the Clinton sands, the trend generally is westward across the mapped area. It is thought that these lenses represent deposition in channels, probably offshore from a large delta.

Production of gas and oil from the so-called Clinton apparently is closely related to the sorting, porosity, and permeability of the sand. Stratigraphic traps contain the oil or gas, and structure appears to be relatively unimportant in localizing the accumulation of the petroleum.

East of the mapped area, the Clinton sands have not produced oil or gas in commercial quantities. Several parts of the mapped area may hold additional amounts of gas.

INTRODUCTION

LOCATION AND SELECTION OF THE AREA

This report is the first of a series to be published on the oil and gas sands of early Silurian age in Ohio which are called the Clinton sands by the well drillers.

As shown in figure 1, the area described in this first chapter lies in eastern Ohio. It covers the Canton, Dover, Massillon, and Navarre quadrangles, an area of about 880 square miles, and includes much of western and central Stark County, northern Tuscarawas County, part of southern Summit County, eastern Wayne County, and part of eastern Holmes County.

In this area the drillers generally record three so-called Clinton sands—in descending order, the "stray Clinton", the "red Clinton", and the "white Clinton" or "Clinton". Their relative position is shown on plates 1 and 2. Because the red Clinton is present in most of this area, it was selected as the subject for the first chapter on the preliminary study of the Clinton sands. Where the red Clinton is present, fairly reliable correlations can be made with little difficulty. Where the red Clinton is absent, it is difficult to make satisfactory correlation.

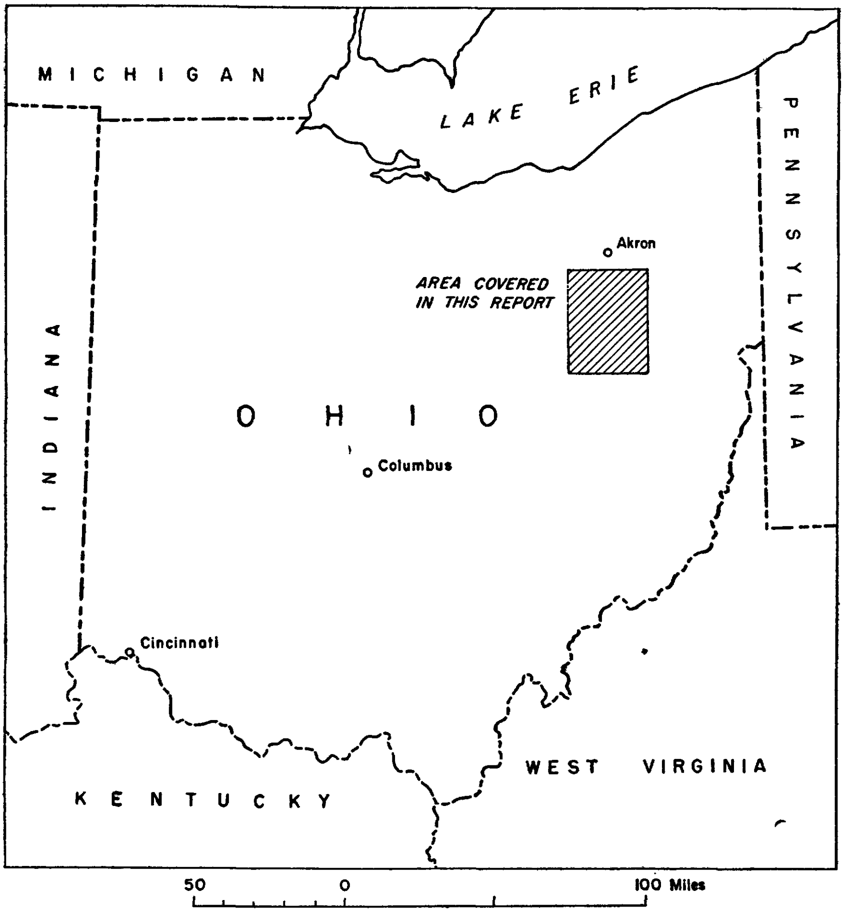

FIGURE 1.—Map showing area of this report.

METHOD OF INVESTIGATION

The locations and drillers' records of the "Clinton" wells were collected from State and private organizations. The locations were plotted on township maps showing land ownership and transferred to the topographic base of the present maps. The position of some wells in relation to roads on the accompanying maps may appear to be incorrect because the topographic maps were issued many years earlier than some of the township maps and differ from them where roads have been relocated or lands resurveyed.

Although an attempt was made to obtain locations of all wells known to have been drilled to the Clinton sands, some locations may be lacking because the wells were drilled in the early 1900's and their locations were never recorded. The locations shown on the accompanying maps are nearly complete to January 1950; they number more than 1,700.

The information contained in the drilling records used in this study varies greatly in accuracy and completeness. Many records of wells drilled before 1930 are lacking in such details as the subdivision of the Clinton into sands of different color; the position, thickness, and color of the lenses of shale or "breaks" that separate the Clinton at many places; and the depths at which oil or gas occurred. In a gas pool where many wells have been drilled in a small area, fairly accurate correlations of the strata can be made. Where only scattered "wildcat" wells have been drilled, correlations are conjectural.

Five complete sets and 25 fairly complete sets of cuttings through the Clinton sequence were available for study in the mapped area. The data derived from examination of these cuttings aided materially in interpreting the drillers' descriptions of the rocks.

ACKNOWLEDGMENTS

The writers wish to express their gratitude to all the organizations and individuals who aided in this study by furnishing well records, locations, and production data. They are especially grateful to the Ohio Division of Mines for its cooperation in permitting the copying of its well records; to the Geological Department of The Ohio Fuel Gas Company for its generous assistance in making available well records and locations and in supplying much data for individual wells; and to John Bird, of Hanley & Bird, who supplied much pertinent data from wells drilled by that company and by others in the Canton area.

The writers wish to acknowledge the assistance of J. W. Wiggins, F. T. Fischer, G. W. Colton, and L. E. Miller in compiling some of the data for the accompanying maps.

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STRATIGRAPHY

The name "Clinton sand" has been in continuous use in Ohio by drillers and others since 1887, when it was applied to a sand encountered in a well at Lancaster, Ohio, at about the same stratigraphic position as the limestone in western Ohio that was named Clinton by Orton (1870, p. 142–143). This term is used as a convenient descriptive name in this report for sands of Silurian age in Ohio, which are not equivalent to the rocks of the Clinton formation in New York.

CORRELATIONS

The so-called Clinton sands do not crop out in Ohio, and their stratigraphic relationship to rocks above and below can be determined only from drillers' records or from well cuttings. The Clinton and associated rocks are equivalent in part to the rocks of early Silurian age in western and central New York. This relationship has been discussed by Rittenhouse (1949) and by Lockett (1949).

The following table shows the sequence of the rocks between the basal part of the "Big lime" and the upper part of the "red Medina" as recorded by the drillers in the area of this report, and tentative correlations with the Silurian sequence in western New York based on the writers' interpretation of available data. Because the study of the Clinton is still in progress, these correlations are preliminary.

Correlation of the rock sequences in the mapped area with the rocks exposed in the vicinity of Niagara Falls, New York

	Mapped area [1]	Niagara Falls area, New York [2]	Remarks
Silurian	Basal Big lime.	Lockport dolomite.	
	Shale, gray to greenish-gray.	Rochester shale.	
	Packer shell.	Irondequoit limestone. Reynales limestone.	Probable equivalents of the Dayton limestone in western Ohio.
	Shale, gray, greenish-gray, and red.	Neahga shale.	Approximate equivalents.
	Sand, stray Clinton.	Thorold sandstone.	
	Sand, red Clinton.	Grimsby sandstone.	
	Sand, white Clinton or Clinton.	Cabot Head shale.	The white Clinton sand of Ohio has no equivalent sand in western New York. It is equivalent to some of the upper part of the Tuscarora sandstone of Pennsylvania.
	Shale and shells.	Manitoulin shale.	
	Shale, gray.	Whirlpool sandstone.	
Ordovician	Shale, red Medina.	Queenston shale.	

[1] Rock units as recorded by drillers.
[2] Gillette, 1940, 1947.

The interval between the base of the Big lime and the top of the Packer shell as recorded by the drillers is variable. Beds of magnesian limestone that occur in the upper part of this interval at some places may be included in the drillers' Big lime. The base of the Big lime is not a satisfactory key horizon for correlations, therefore, but it can be used sometimes as a check on correlation.

The Packer shell, so-called because the drillers generally use this hard unit as a seat for casing or production tubing, is a medium to coarsely crystalline limestone or magnesian limestone containing some interbedded greenish-gray shale. It is 10 to 40 feet thick and lies from 80 to 130 feet below the base of the Big lime and from 10 to 30 feet above the stray Clinton. A study of well cuttings shows that the drillers are not consistently correct in their identification of the top and bottom of this unit. Beds of light-gray finely crystalline dolomite that occur at some places in the lower part of the shale above the Packer shell may be included in the drillers' Packer shell, whereas shale present at some places in the lower part of the Packer shell may be omitted from the unit. The Packer shell is most useful for correlation in local areas where comparison can be made between the drillers' records and data derived from examination of drill cuttings.

The study of drill cuttings shows that a layer of hematite is present at the base of the Packer shell in much of the mapped area. In some wells the driller records red shale at the stratigraphic position of this hematite. If generally recorded, this characteristic bed would be useful in correlating between wells.

Correlation of the Clinton sand sequence between wells is difficult because of the lateral variation of the rocks. Many of the beds of fine-grained sandstone, siltstone, and shale are lenticular. Furthermore, the lithologic units intergrade vertically in some places. The drill may penetrate shale, silty shale, silt, and fine-grained sand in descending order and the driller is unable to determine any sharp contact between them. In such a sequence, he records as sand the first hard bed encountered by the drill.

The study of well cuttings shows that the stray Clinton is usually thicker than the drillers record it. In most of the area, the stray Clinton is a well-cemented coarse-grained quartz siltstone containing some fine or very fine grained quartz sand. Because siltstone commonly breaks under the drill and wears the drill bit in a manner similar to limestone or dolomite, the driller may record the upper part of the stray Clinton as a limestone or as a lime shell where it is a very fine grained siltstone. At some places the driller has included the upper part of the stray Clinton in the basal part of his Packer shell.

Comparison of drill cuttings and drillers' records shows that the red Clinton is the best unit for correlation throughout the area of the present map. The change in color from the white stray sand to the red Clinton below is very evident in the drill cuttings and mud bailed from a well. The change from red to white at the base of the red Clinton where it is in contact with the white Clinton is less evident because the drilling mud bailed from the white Clinton is stained red by fragments from the red sand above. Between these two sands a shale "break" of a few feet commonly occurs throughout the mapped area except in Jackson, Plain, Canton, Bethlehem, and Pike Townships, Stark County. In those townships the white Clinton is generally recorded directly below the red. The base of the red or the top of the white Clinton is usually recorded correctly by the driller within a range of 10 feet, and is a useful key horizon for correlating between wells.

The base of the white Clinton is distinct in some wells. In many wells, however, especially in the southern part of the mapped area, drillers record shale and shells below the white Clinton or record the formation as "broken." The study of well cuttings shows that the basal part of the white Clinton consists of thin sands and silts interbedded with shale and that the proportions of sand, silt, and shale vary greatly from place to place.

Most of the wells were completed in or a few feet below the white Clinton sand. Some, however, reached the red Medina (Queenston shale) of Ordovician age. The top of the red Medina is a good key horizon for subsurface correlation, as it is generally accurately recorded. The abrupt change in color from the greenish gray of the overlying Silurian beds is easily observed by the driller.

GENERAL CHARACTER AND DISTRIBUTION OF THE "CLINTON" SANDS

Stray Clinton sand.—The stray Clinton sand of the drillers consists of white or very light gray coarse- to medium-grained quartz silt and some fine to very fine grained quartz sand. The grains are subround to subangular; the shape of some has been modified by overgrowths of secondary silica. In most of the mapped area the sand is tightly cemented by silica. Consequently the permeability and porosity of the sand are very low.

The thickness of the stray Clinton averages about 25 feet but in a few places is as much as 50 feet. The thickness is shown on the accompanying map (pl. 3) by means of isopach lines, printed in blue, which connect points of equal thickness. Where the wells are more widely spaced, the isopach lines are generalized and the patterns of deposition are less clearly shown. In areas where only a few wells have been drilled and data are insufficient to draw isopach lines, the thickness of the stray Clinton is noted by a figure in blue beside the well symbol on the accompanying map.

Red Clinton sand.—The so-called red Clinton is composed of very fine grained quartz sand and coarse-grained quartz silt containing a small amount of gray, greenish-gray, and red silty shale. The grains of sand and silt range from subangular to subround. The red Clinton contains much secondary silica cementing the grains. A small amount of secondary calcite cement is present at some places. Hematite, which produces the red color, usually cements the grains where secondary silica cement is absent. Where secondary silica is present, the hematite occurs in minute grains on the surface of the original grains or as a corona suspended in the clear secondary silica cement.

Although the drillers usually record the red Clinton as a "red sand", the study of well cuttings shows that hematite is not always present throughout the total thickness of the drillers' red Clinton. At many places, especially in the southern half of the Dover quadrangle, lenses of light-gray to white sand or silt and gray or greenish-gray shale are present in the predominantly red rock. The sand is usually more porous and permeable in the lower part and more tightly cemented in the upper part, although lenses of porous sand may occur at any place within the sand body.

The thickness of the red Clinton, which in the eastern part of the mapped area is as much as 50 feet, is shown on plate 4 by means of isopach lines in blue.

White Clinton sand.—The white Clinton sand of the drillers is a white to light-gray, fine to very fine grained quartz sand which grades downward into a coarse- to medium-grained quartz siltstone. The grains range from subangular to subround. Some have been greatly modified by overgrowths of secondary silica. Secondary silica is the cementing mineral; some calcite and clay minerals are also present. The white Clinton generally appears most porous in the upper part although lenses of porous sand may occur at any horizon in the sand body.

As shown in plate 5, the sand at some places is as much as 60 feet thick, reaching its maximum thickness in the eastern part of the mapped area. At some places, for example in the southern part of the Dover quadrangle, where much shale is interbedded in the sand, the driller records the white Clinton as "broken" or "shale and shells". Wells so recorded are indicated on the map by the notation "BKN" in blue beside the well symbol.

In some places the records of the wells were not sufficiently detailed to permit the determination of the thickness of the white Clinton. For example, in Paint Township, Holmes County, where most of the wells were drilled in the 1920's and the records are not detailed, the thickness of the white Clinton in many wells could not be determined. Where recorded or determined, the thickness has been noted on the map by a figure beside the well symbol. In the Chippewa gas field in the northwestern part of the Massillon quadrangle the records of wells drilled in the early 1920's show a white Clinton sand ranging from 40 to 84 feet in thickness. In the early 1940's, several wells were drilled in this field as input wells for gas storage. The rock sequence in these wells is recorded in much greater detail than in earlier records and the presence of all three Clinton sands is shown. The later records were used, therefore, to determine the position of the thickness lines in the Chippewa field.

STRUCTURE

The depth to the Clinton sands increases from northwest to southeast across the mapped area. The regional structure is monoclinal, dipping S. 60° E. at about 50 feet per mile (Stout and others, 1935, p. 899). Locally the dip varies slightly, producing small terraces or noses on the regional monocline. The regional dip greatly increases the depth to the Clinton to the southeast. For example, the top of the stray Clinton occurs at a depth of about 3,550 feet in the northwestern part of the Massillon quadrangle and at about 4,900 feet in the southeastern part of the Dover quadrangle.

The relatively small size of the lenses of porous sand, and the absence of closed structures and of water drive in the so-called Clinton sands make structure a factor of small importance in the localization of oil and gas in the mapped area.

SEDIMENTATION

On the maps (pls. 3, 4, and 5) accompanying this report, the thickness of the individual Clinton sands is shown by means of isopach lines printed in blue. In areas where wells are closely spaced, the isopach lines show patterns and trends that reflect the depositional history. In the Clinton the accumulation of gas or oil is largely dependent upon the porosity and permeability of the sand. Porous zones were formed during original deposition. In some places these porous zones were probably changed in outline or modified by secondary deposition of silica or by base exchange between the original minerals in the sand. An understanding of the conditions of deposition of the sand and the relation of its porous and permeable parts to the thickness trends shown by the isopach lines aids in locating areas that may contain more gas or oil.

White Clinton sand.—The isopach map of the white Clinton (pl. 5) shows a general east-west trend of thick elongate bodies separated by similar trending bodies of thinner sand. As shown in plate 6 and figure 2 in the Canton and Massillon quadrangles the bodies trend roughly N. 70° W. In the northern part of the Dover quadrangle the trend appears to shift to about S. 80° W. The thick sand

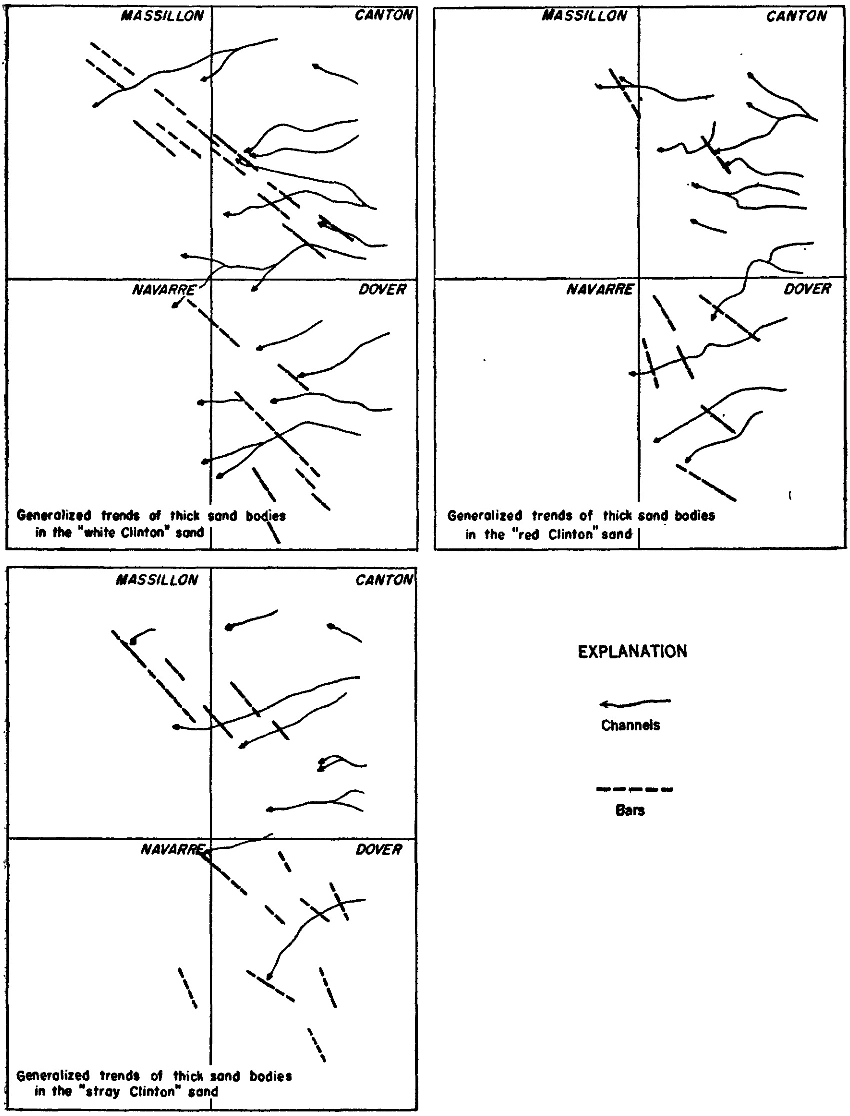

FIGURE 2.—Map showing the generalized trends of bodies of thick sand in the "stray", "red", and "white Clinton" sands.

bodies may represent deposition in channels scoured in the surface of a delta on the east side of the mapped area and to some extent the accumulation of bars offshore. The currents that transported the white Clinton sediment across the area apparently sorted the sand most thoroughly where the currents were strongest. In the Canton and Massillon quadrangles, sorting by stream currents seems to have been the dominant factor controlling the deposition and the porosity and permeability of the lenses. In the Dover quadrangle, longshore currents apparently moved and sorted sand into porous lenses trending roughly parallel to the delta shoreline and nearly at right angles to the trend of the lenses of porous sand lying in the stream channels.

Stray and red Clinton sands.—The isopach lines of the red Clinton (pl. 4) show a pattern of thick elongate bodies separated by areas of thinner sand, all trending generally east-west. The isopach lines of the stray Clinton (pl. 3) show a similar pattern. At some places the belts of thicker stray Clinton overlie thinner belts in the red Clinton. The configuration in the two sands is about the same. The thick sand of the stray Clinton fills channels that were cut into and at some places through the red sand. The profiles of several of these channels can be seen in plate 2. These channels may have been formed by near-shore scour of the sea floor by distributary streams from the delta on the east. The thicker bodies in the red Clinton may represent either the uneroded remnant of a sheet sand or sand-bar accumulation. Possibly both features are present in the red Clinton.

The elongate bodies of the stray Clinton trend about S. 70° W. in the Canton and Massillon quadrangles. At some places, notably in the western part of the Canton quadrangle and the eastern part of the Massillon quadrangle, this trend is obscured by a second, less well marked group of sand bodies that trend approximately N. 45° W. This group that trends N. 45° W. may have formed as beaches and bars along a shifting strand line. In the Dover quadrangle the two groups of sand bodies cross each other more nearly at right angles. The linear and sinuous nature of the east-west trending bodies suggests deposition in stream channels. The grid pattern may have originated from the deposition of sediment in a series of west-flowing streams which emptied into a shallow sea whose shoreline trended northwest-southeast across the mapped area.

ACCUMULATION OF GAS AND OIL

The production from the "Clinton" in the area covered by the present report has been mainly gas; only a few wells produced oil. Much of the gas has been produced from the white Clinton; somewhat less from the red Clinton; and only a small amount from the stray Clinton. Some wells produced from two or all three sands. The general production practice of anchoring tubing above the Clinton and collecting gas from all the producing parts of the Clinton makes it impossible to determine the relative amount of gas coming from each sand. On the accompanying maps, therefore, some wells shown as yielding gas from all three sands may have produced gas profitably only from the basal white Clinton.

Production of each sand is shown on a separate map by color overprint—red for gas and green for oil. Gas- or oil-well symbols not covered by red or green overprint indicate that the gas or oil occurred in one of the other two sands.

Stray Clinton sand.—Small amounts of gas have been found in this sand at many places in the mapped area. However, few wells yielded sufficient gas from the stray Clinton to be commercially profitable. The initial open flow of gas from a few wells was as much as 200,000 cubic feet per day. Even these wells might have been abandoned if additional gas had not been found in the other Clinton sands. The wells shown on the map of the stray Clinton (pl. 3) as producing gas had initial open flows of gas from that sand in excess of 100,000 cubic feet. Very little oil has been found in the stray Clinton in the mapped area.

Red Clinton sand.—Except in the several townships along the eastern edge of the mapped area, the red Clinton generally contains some gas. As shown by plate 4, gas has been found in commercial quantities in the red sand in the vicinity of Canton, Stark County, in a few places in the rest of the Canton quadrangle outside the Canton field, in scattered wells in the Massillon quadrangle, and in Paint Township, Holmes County, in the Navarre quadrangle.

The red Clinton has been most productive in the immediate vicinity of Canton, where some wells have yielded as much as 2,000,000 cubic feet of gas per day. Some operators believe, however, that the gas came in part from the underlying white Clinton. In tubing the wells the operators commonly anchor the packer above the Clinton, and the hole below the packer is uncased. In a well that has been shut in for some time, gas may migrate under pressure from the white Clinton into lenses of porous sand or silt in the red Clinton sand and spread to wells in the red sand beyond the limits of porous zones in the white Clinton.

From Canton Township, the area in which the red sand yields gas extends southward including Bethlehem and Pike Townships in Stark County, and Fairfield, Franklin, Lawrence, and Sandy Townships in Tuscarawas County. In general the percentage of wells producing gas from the red Clinton increases from north to south and seemingly from east to west. The red Clinton contains gas in some areas where the white Clinton sand is broken and dry.

The initial open flow of gas from the red Clinton generally is smaller than from the white Clinton. Most of the wells drilled to the so-called Clinton were shot with nitroglycerine to increase the flow of gas. Shooting usually increases the flow of gas from the white Clinton but does not appreciably increase the flow of gas from the red sand. In many wells the flow of gas from the red sand decreased markedly after the wells were shot.

Shows of oil have been found in the red Clinton at many places. Generally, however, the amount of oil was insufficient to make its recovery profitable, although some gas wells have yielded small amounts of oil.

White Clinton sand.—As shown by plate 5, the white Clinton has been productive of gas over much of the mapped area. A few wells had initial open flows of gas in excess of 6,000,000 cubic feet per day from this unit. The average initial open flow is about 1,000,000 cubic feet per day. The total amount of gas recovered varies from place to place, but the greatest yield generally has been in the Canton and Massillon quadrangles. To the south and west the initial open flows and the total yield of gas have been smaller. Many of the wells in the Dover quadrangle are near the lower limit of profitable recovery because the cost of drilling and maintenance leaves only a small margin of profit when extended over the productive life of the well.

A few of the wells on the southeast side of the Canton field yielded oil in the white Clinton. The potential amount of oil ranged from 5 to 15 barrels per day. The wells were plugged, however, because this amount of oil is insufficient for profitable recovery. In the mapped area four wells are reported as producing only oil in the white Clinton sand.

The productive part of the white Clinton is not confined to the thicker parts. The gas-producing portions are usually thin in relation to the total thickness, and the gas may occur at any place where the sand is sufficiently porous. The porous zones occur in belts of better sorted sand, which may represent beaches, bars, or channels where current or wave action was greatest. Generally, these zones in which the gas is present lie in or near the upper part. A large gas pool may include several belts of thick sand each of which contains several porous zones. A study of the rock pressures of adjacent wells indicates that the individual lenses of porous sand may range in length from a quarter of a mile to several miles and in width from less than 300 feet to 1 mile.

Gas apparently accumulated in the white Clinton soon after deposition and at about the time of introduction of the secondary silica cement. Possibly the secondary cement aided in forming barriers to the migration of the gas and in part may have controlled the shape of the pools by cementing the less well sorted and less porous sand along the margins of the pools. Possibly the pore spaces in the lenses of productive sand remained open because the amount of secondary silica was insufficient to fill them.

Along the eastern side of the mapped area and in the adjacent quadrangles to the east the Clinton is tightly cemented and highly quartzitic. As shown in plate 7 only small amounts of gas and oil have been found in the so-called Clinton in this area to date.

AREAS OF POSSIBLE FUTURE PRODUCTION

An area extending northward across central and western Navarre and Massillon quadrangles is largely untested for gas or oil except in Paint Township, Holmes County, and Chippewa Township, Wayne County. Many of the scattered wells in the generally undrilled area were dry or contained only shows of gas. Some operators believe that throughout that area the white Clinton generally contains much shale and is too broken to contain commercial amounts of gas. In the Chippewa pool, Chippewa Township, Wayne County, much of the gas has come from the white Clinton, which apparently is less shaly and more porous there than to the south. Records for many of the wells in Paint Township, Holmes County, do not indicate the producing sand, but apparently some wells produced gas from the white Clinton and a greater number from the red Clinton.

Although future prospecting undoubtedly will prove financially hazardous, small pools similar to those in Chippewa and Paint Townships may be discovered in this untested area.

The sparsely drilled area of central and western Lake Township, Stark County, and eastern Green Township, Summit County, may contain more gas. The few dry holes in central and western Lake Township do not condemn the entire area.

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