STATE OF OHIO
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL SURVEY
Horace R. Collins, Chief

Report of Investigations No. 100

SILURIAN ROCKS IN THE SUBSURFACE OF NORTHWESTERN OHIO

by

Adriaan Janssens

Columbus
1977

DEPARTMENT OF NATURAL RESOURCES

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Cartographers: James A. Brown and Donald R. Camburn

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ABSTRACT

The Silurian rocks in the subsurface of northwestern Ohio have been studied in the area from Erie County in the east to the Indiana line in the west and as far south as latitude 40°45′ N. The complete stratigraphic succession consists, in ascending order, of the Cataract Group (Brassfield Formation and Cabot Head Formation), Dayton Formation (expanded name), Rochester Formation, Lockport Group (Gasport Dolomite, Goat Island Dolomite, and Guelph Dolomite) or Lockport Dolomite, Salina Group (units A through G in the east; Greenfield Dolomite, Tymochtee Dolomite, and undifferentiated dolomite in the west), and Bass Islands Dolomite.

The Brassfield Formation is 25 to 65 feet thick and consists of largely dolomitized coarse-grained limestone that in its lower part in the eastern half of the area is chert bearing, glauconitic, and silty. The formation grades into the overlying Cabot Head Formation, which is 60 to 115 feet thick where it can be differentiated and consists of interbedded green and reddish-brown shale and dolomitized partly hematitic coarse-grained limestone. The Brassfield and Cabot Head are in facies relationship with the "Clinton" sandstone and shale of eastern Ohio. In the eastern part of the area the Cabot Head is overlain with sharp contact by the Dayton Formation, which is 5 to 57 feet thick and made up of two thin dolomitized limestone members that locally are separated from each other by as much as 15 feet of green shale. As originally defined by Orton, the Dayton consisted of only the upper limestone member, the lower member being absent in the type area. As expanded, the Dayton Formation correlates with the drillers' "Packer Shell" of north-central Ohio. The Dayton is overlain with sharp contact by the Rochester Formation, which in the central and eastern parts of the study area is 5 to 26 feet thick and consists of gray, green, and dark-brown shale and argillaceous dolomite.

West of Toledo, the Silurian rocks below the Lockport Dolomite or Lockport Group are virtually shale-free dolomite that cannot be differentiated into the formations recognized to the east.

The Lockport is treated as a group where the chert-bearing Goat Island Dolomite is present and as a formation where this dolomite is absent. The basal Gasport Dolomite is composed of crinoidal gray dolomite that reaches a maximum thickness of 64(?) feet. The overlying Goat Island is a finely crystalline brown dolomite that contains white, gray, and brown chert and has a maximum thickness of 57 feet. The formation is not recognized in the west-central and northwestern parts of the study area. The Guelph Dolomite is the oldest unit exposed at the surface in numerous quarries, where it consists of coarsely crystalline vuggy gray and white dolomite which in the eastern part of the study area is overlain by and in facies relationship with microcrystalline brown dolomite. The thickness of the Lockport in areas where the unit is overlain by a normal Salina section ranges from 89 feet to about 200 feet.

The contact of the Lockport with the Salina Group is considered regionally conformable, although there are a few wells and quarry sections where the contact is apparently disconformable.

The evaporites of the Salina Group of eastern Ohio extend into the eastern tier of counties of the report area; for these rocks the Salina nomenclature of eastern Ohio is used. The group consists, in ascending order, of units A through G. In this area the salt beds are replaced by bedded anhydrite. The Salina Group is about 600 feet thick and is overlain by the Bass Islands Dolomite, a microcrystalline brown and gray dolomite that has an average thickness of 55 feet in the extreme northeastern part of the report area. To the west the formation has been removed by post-Silurian, pre-Middle Devonian erosion.

In the western part of the report area the basal Salina unit is the Greenfield Dolomite, a stromatolitic brown dolomite ranging in thickness from 30 to 97 feet. It is overlain by the Tymochtee Dolomite, a partly argillaceous microcrystalline gray to brown dolomite with some dark-colored shale; the Tymochtee has an average thickness of about 100 feet. It is overlain by undifferentiated microcrystalline brown and gray Salina dolomite that has a maximum thickness of 425 feet. In the counties bordering the Ohio-Michigan line, the shaly Salina C and E units can be recognized within this undifferentiated dolomite.

West of the formation's type section the Bass Islands Dolomite is believed to be absent below the Devonian rocks.

The Lockport and Salina rocks are believed to be in facies relationship in areas along the Indiana line, in Lucas County, and in the east-central part of the report area: Ottawa, Sandusky, Seneca, Crawford, and Richland Counties. Evidence is presented that shows that Salina rocks become indistinguishable from vuggy gray Lockport dolomite, which in these areas reaches thicknesses of as much as 455 feet.

Gypsum is produced from the Salina F unit in a mine and a quarry in eastern Ottawa County. The report suggests areas where additional bedded gypsum may be found.

INTRODUCTION

The Silurian rocks of northwestern Ohio have not been studied extensively, though they form the bedrock in much of the area. These rocks have been discussed in a few reports based on exposures, which, because of drift cover, consist mainly of quarry pits. Subsurface investigations have been even fewer in number, probably mostly because in this part of Ohio the Silurian rocks have not produced large quantities of hydrocarbons. As a result, little is known of the regional stratigraphy, lithology, and thickness of these rocks.

From a regional point of view, knowledge of the Silurian rocks (fig. 1) of northwestern Ohio is essential to understanding the stratigraphy of equivalent rocks in adjacent areas of Indiana, where investigations are continuing, and in Michigan and eastern Ohio, where these rocks have been studied in some detail as a result of an active search for mineral resources. Though blanketing much of the tri-state area, the Silurian rocks, because of facies changes, have been difficult to correlate over long distances from one state into the next, or even in some cases over relatively short distances within one state. Our understanding of the Silurian rocks in the tri-state area will remain incomplete until

[1] Manuscript completed December 1973.

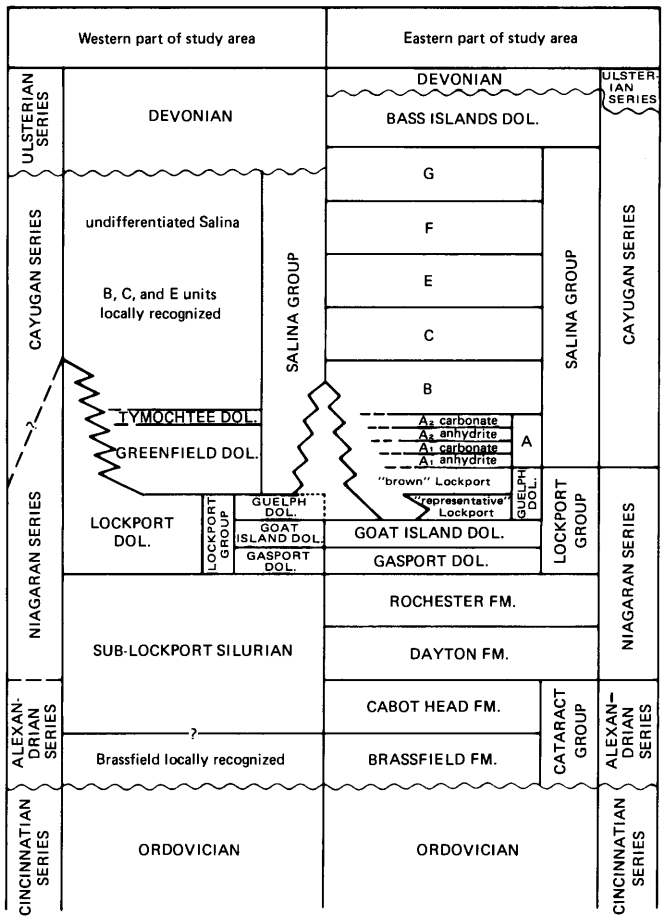


FIGURE 1.–Stratigraphic column of the Silurian rocks of northwestern Ohio.

accurate correlations can be made.

In practical terms, there is a close relationship between the stratigraphy of these rocks and the availability of ground water (Ohio Division of Water, 1970, table 2), so that the information presented in this report can be used to predict at what depths the several Silurian aquifers (Lockport, Greenfield, and Tymochtee Dolomites) will be reached. Much of the report area has Silurian bedrock, and several of the formations are extensively quarried. The geologic map (fig. 2) accompanying this report shows the distribution of Silurian bedrock formations in the report area and may aid in planning for future development of it. The map differs from Bownocker's (1920) geologic map in that it differentiates the Upper Silurian and includes bedrock information gained from a large number of recent control wells. The Lockport Dolomite (or Lockport Group) (Middle Silurian), besides being extensively quarried, is an important freshwater aquifer in a large part of the report area. Maps showing the thickness of Lockport rocks (fig. 15) and the elevation of the base of the Lockport (fig. 3) may aid in future development of the water resources of the region.

The primary purpose of this study is to describe the Silurian rocks in the subsurface of northwestern Ohio. The study area extends from the Indiana line east to Erie County and from the Michigan line south approximately to latitude 40°45′ N. The eastern boundary was chosen to include within the study area a section that is fairly representative of the Upper Silurian rocks of eastern Ohio. The southern boundary of the report area coincides approximately with the southern limit of hydrocarbon production from the Trenton Limestone (Middle Ordovician). Farther south, well control is sparse and inadequate for a detailed stratigraphic study.

The report is based on examination of well cuttings and on information derived from nuclear logs. Drillers' logs generally do not differentiate the Silurian formations–or the Devonian formations, where these overlie the Silurian rocks–but list the entire section as "Big Lime." This is especially true in the area west and southwest of Toledo, where shale is virtually absent in the Silurian. East and southeast of Toledo, shale below the Lockport thickens and can be recognized relatively easily in the cuttings, and in this area the drillers' "Big Lime" comprises the Silurian (and Devonian locally) carbonates down to the base of the Lockport. In the same area red shale occurs immediately below the Silurian, and its presence is recorded by most drillers.

Nuclear logs are especially useful in recognizing marker beds that may be too thin to be detected in the cuttings. In addition, these logs almost without exception permit a more accurate determination of the thickness of marker beds than is possible from the cuttings alone.

The wells used in this report and the formations they penetrate are summarized in Appendix A, which also indicates which formational contacts have been drawn from nuclear logs. Sample descriptions of selected wells are presented in Appendix B.

REGIONAL SETTING

Northwestern Ohio has three regionally important structural elements, all of which are post-Silurian in age. The western portion of the area is part of the southern margin of the Michigan Basin; the northward dip in this area steepens toward the Michigan line (fig. 3). The central portion of the area forms the Findlay Arch, the axis of which runs slightly west of north from northeastern Hardin County to western Lucas County. The area east of the Findlay Arch is part of the western margin of the Appalachian Basin. The Findlay Arch, the boundary between the Michigan and Appalachian Basins in Ohio, is also the locus of the Bowling Green monocline, shown in figure 3 as the area in western Wood and Lucas Counties where the rocks have a relatively steep westward dip. The monocline may be locally faulted.

Lockport dolomite is the oldest rock exposed in northwestern Ohio. Silurian rocks are bedrock in the area very roughly coincident with the area in which the top of the Rochester Formation is above sea level (fig. 3). Devonian or younger rocks are bedrock downdip toward the Michigan and Appalachian Basins (fig. 2).

The Silurian rocks of northwestern Ohio form the connecting link between two major Silurian depositional basins, the Appalachian Basin to the east and the Michigan Basin to the northwest. Upper Silurian evaporite beds and dolomite and shale having an aggregate thickness of several thousand feet characterize these basins. The questions of what caused the basinal restrictions and what, if any, causal role was played in these restrictions by Silurian geology in northwestern Ohio and adjacent Indiana have remained without a definitive answer thus far.

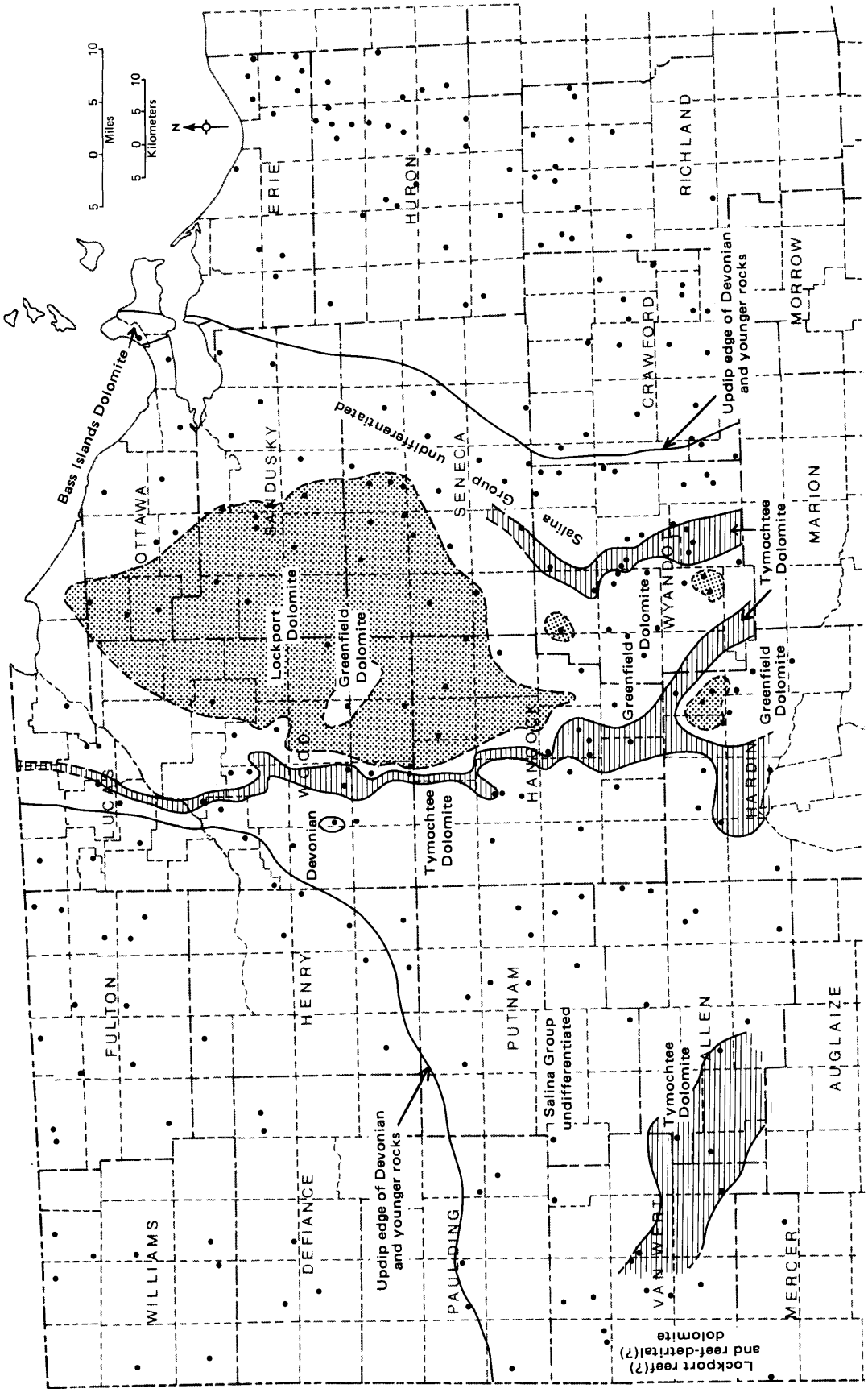


FIGURE 2.—Silurian bedrock geology of northwestern Ohio. Small outliers of Salina rocks within the main area of Lockport Dolomite not shown. See figure 3 and Appendix A for well identification; figure 3 for township identification.

Two sets of nomenclature exist today for the Upper Silurian rocks of Ohio. One was proposed for the evaporite-bearing rocks of the Michigan Basin and is used with some modifications for the evaporite-bearing rocks in the subsurface of eastern Ohio; the other was proposed and is used for the exposed rocks in Ohio. Each set of nomenclature can be used with a fair to excellent degree of consistency, but attempts to relate one to the other have been unsuccessful. The reason appears to be that until a few years ago the control necessary to trace the subsurface evaporite beds to the exposed rocks or vice versa did not exist. These correlation difficulties reflect differences in depositional or structural history between areas. Recent work (Pinsak and Shaver, 1964; Shaver and others, 1971) in northeastern Indiana provides an excellent example of how correlations can influence interpretations of Silurian depositional history.

PREVIOUS WORK

The earliest work on the outcropping Silurian rocks of northwestern Ohio was that of Gilbert (1873) and Winchell (1873, 1874) in a series of county reports in which the occurrences of dolomite now known as Lockport and Salina were described. The stratigraphic nomenclature of the reports was that used by the New York Geological Survey and recognized, in ascending order, the Medina, Clinton, Niagara, Salina, and Waterlime or lower Helderberg Groups (Newberry, 1873, p. 62-65, 126-139). The Medina Group, exposed in southwestern Ohio, consisted of 10 to 20 feet of green and red shale that has since been assigned to the Ordovician. The name Medina is still used in Ohio as a drillers' term for the Queenston Shale (Ordovician) and for the basal Silurian sandstone in eastern Ohio. The Clinton Group, also exposed in southwestern Ohio, comprised the formations now known, in ascending order, as the Brassfield and Cabot Head. The "Niagara Group" consisted, in ascending order, of the "Dayton Stone" (Orton, 1871a, p. 143), "Niagara shale" (Rochester Formation), "Niagara limestone" (probably the Bisher and Lilley Formations of Adams and Highland Counties), and "Guelph limestone." Gilbert (1873, p. 574) used the name Guelph in his report on Lucas County but did not explain how Guelph dolomite differed from "Niagara" dolomite.

The Salina Group was considered the correlative of the Onondaga Salt Group of New York, and to it were assigned the gypsum-bearing beds exposed in eastern Ottawa County:

> Although the geological relation of the rock containing the gypsum cannot be ascertained by examining outcrops within Ottawa county, it is believed to hold a place within the Salina, since neither the Niagara nor the Waterlime is known to afford this mineral in workable quantities in other parts of the country; yet the lithological features of the rock containing it are very similar to those of the Waterlime seen in Wyandot and Allen counties. Although it here has a thickness of at least thirty feet, at Genoa [in western Ottawa County] it is reduced to less than a foot, and is seen in the form of a green shale, which also, on weathering, turns blue and falls to pieces. It is best seen at the bottom of the quarry of Messrs. Newman and Ford, but is penetrated also in Wyman and Gregg's (Winchell, 1874, p. 230).

The "Salina shale" was noted by Winchell also in Sandusky County (1873, p. 599-600), but he found it absent in the only locality in neighboring Seneca County where the contact between the Niagara and the Waterlime was exposed:

> The green shale, which, in Sandusky county, represents the *Salina,* has nowhere been seen in Seneca county. The only place within the county where the "junction" of the Niagara and Waterlime has been observed, is in the quarries at Tiffin. Within the corporate limits . . . a quarry has been opened in the left bank of the Sandusky [River] . . . . The Niagara here shows in a broad surface exposure, over which the river spreads, except in its lowest stage. The quarry has not penetrated it, but the overlying Waterlime beds have been stripped off, showing a section of twelve feet in their beds belonging to *phase No.* 3 [of the Waterlime]. This lies conformably on the Niagara, so far as can be seen, the separating surface presenting no unusual flexures or irregularities. The only trace of the Salina is in the tendency of the color and texture of the Niagara toward those of the Waterlime, visible through its last three or four inches. It is bluish-drab, porous, crystalline, with some indistinct, greenish lines and spots. It contains much calcite and some galena. From this character it passes immediately into a bluish-gray, crystalline rock, in thick, firm beds, with spots of purple, heavy and slightly porous, the cavities being nearly all filled with calcite (p. 616-617).

The generalized lithology of the Waterlime in northwestern Ohio was described by Winchell (1874, p. 230-231) from its occurrences in Ottawa County:

> Over the Salina shale the *Waterlime* is found. This has three distinct lithological characters within the limits of the county. It most frequently occurs–
>
> 1st. As a coarse brecciated, gray, or drab-gray, limestone with rough, cavernous surfaces, indistinct bedding, or massive, with no fossils. It has this character at some points in the western part of the county, but its typical exposure is in the upper and central portions of the bluffs about the south end of Put-in-Bay Island [South Bass Island], and in the island of Gibraltar which incloses Put-in-Bay Harbor.
>
> 2d. Massive or even-bedded, coarse-grained, harsh, dirty buff limestone, non-fossiliferous, magnesian and soft, very much like some parts of the Lower Corniferous; beds fifteen to thirty inches, sometimes with curly bituminous films . . . . This character of the Waterlime is believed to be confined, in Ottawa county, to its lowest fifteen feet although it probably occupies less than that thickness. It has not been met in actual outcrop within the county, but it is in outcrop along the Portage [River], in Wood county, in such proximity to the Niagara that its place in the formation may be pretty nearly determined . . . .
>
> 3d. The Waterlime may appear as it does in the upper part of the quarries at Messrs. Newman and Ford, and of Wyman and Gregg, at Genoa [in western Ottawa County]. It is there in beds of about three inches–though they are very often seen at other places less than an inch–and of a drab color. The texture is close, and the grain is fine . . . . Its bedding is uniformly separated by bituminous films or colored sedimentation, which often give the surfaces of the beds a blue cast when exposed to the weather, although the films themselves are at first nearly black. The surfaces of the beds are also usually marked with a stylolitic or wavy contour. This condition of the Waterlime is often fossiliferous.

In the description of the Waterlime of Wyandot County Winchell (1873, p. 632-634) remarked:

> The *Waterlime formation,* which in counties further north presents three distinct, general lithological characters, in Wyandot county is mainly reduced to one. That aspect of the Waterlime designated "phase No. 3" on a former page, passes, with the addition of much bituminous matter, into a thin-bedded, even slaty, condition, which, first black, weathers blue on the sides of the bedding, or lastly a chocolate color, while the fractured edge is a very dark drab. Throughout the county it is known as "blue slate." When the bituminous matter is more evenly distributed through the rock, instead of being confined to the thin partings, the beds are thicker, and of a blue color.
>
> The principal outcrop of the Waterlime within the county is along the left bank of the Tymochtee creek, in Sections 27 and 34, in Crawford township. The banks of the creek expose perpendicular sections of four to eight feet of these thin beds. The dip being

continuously toward the south-west, a connected section of 84 feet 10 inches may be made out . . . .

Nos. 7, 8, and 9 have very much the same general lithological *facies*, and may be appropriately included in the general designation of *Tymochtee slate.*

In subsequent reports on Auglaize, Hancock, and Wood Counties Winchell (1874, p. 407, 375, 361) described strata similar to the Tymochtee "slate" and so named them. Orton (1871b, p. 287-294) had previously named dolomite overlying the "Niagara" near Greenfield in Highland County, in southwestern Ohio, the Greenfield "stone," but that formation name was not mentioned by Winchell.

The occurrence of Salina rocks in Ohio was discussed by Orton (1888a, p. 196-197) in the description of gypsum (and anhydrite; Orton apparently did not in every instance differentiate between the two minerals) penetrated in a well in the city of Sandusky, in Erie County:

. . . gypsum of northern Ohio is not confined to a single formation, viz., the Salina, as held by Dr. Newberry. The Salina group, at the best, is but doubtfully identified in our geological scale, but gypsum is certainly distributed through the whole thickness of the lower Helderberg, and possibly through the Niagara also. Gypsum is known to be found in typical Niagara rock at Lockport, New York, as will be remembered.

Elsewhere (1890, p. 21) Orton wrote:

Salt and gypsum are geological accidents, and can not well be used in determining the geological order of regions that are separated by intervals of hundreds of miles.

The reference of distinct portions of our geological scale to the Salina period must accordingly be discarded for the present, at least.

An expansion of the nomenclature was introduced by Lane and others (1907) when they proposed the name Monroe and its several subdivisions. The Monroe "beds" were defined in Michigan (Lane *in* Wadsworth, 1893) to extend from the base of the Dundee Limestone (Middle Devonian) down to the "lowest gypsiferous beds." The salt beds of Michigan were included in the Monroe as originally defined, but were subsequently excluded (Grabau, 1908, p. 622). Lane and others (1907) assigned to the Lower Monroe the Greenfield dolomite, the Tymochtee shales and limestones, the Put-in-Bay dolomites, and the Raisin River dolomites, in ascending order, and stated (p. 554) that the Lower Monroe overlies the Salina. Implicit in this statement is that the foot or less of green shale underlying the Greenfield represents the featheredge of the thick evaporite-bearing beds of the Michigan Basin. Of the Tymochtee, Lane and others (1907, p. 554) wrote:

The thickness there [at Winchell's type section] is something over a hundred feet, but the relation to the overlying and underlying formation is unknown. Its fauna is likewise unknown, and the formation must be considered a tentative division of the Lower Monroe. It is not impossible that it represents in part one or more members recognized elsewhere.

The upper divisions of the Lower Monroe were described by Lane and others (1907, p. 554-555) as

The Put-in-bay dolomites.—This name is proposed for the extensive fossiliferous series of waterlime exposed on Put-in-bay island, one [South Bass] of the Bass islands, and characterized by the fauna comprising *Spirifer ohioensis* Grabau, *Goniophora dubia* Hall, *Eurypterus eriensis* Whitfield, and Leperditia. From the abundance of the pelecypod, the paleontologic zone may be called that of *Goniophora dubia.* Something over a hundred feet of strata is exposed on Put-in-bay island, where the higher beds are in contact with the succeeding zone. The formation is also known from Marion county, Ohio. Its thickness is over 100 feet, but the base is unknown.

The Raisin River dolomites.—This name is proposed for the highest division of the lower Monroe exposed in Lucas and Wood counties, Ohio, and in Monroe county, Michigan, especially along the Raisin river. It is perhaps 200 feet thick and contains several oolite zones. Its known fauna comprises nearly 20 species, of which the most significant are *Whitfieldella prosseri* Grabau and *Pterinea lanii* Grabau. These are restricted to this horizon, so far as known. *Spirorbis laxus* and numerous minute gastropods, besides plant remains, further characterize this horizon. From the abundance of the brachiopod mentioned, which is everywhere found and characteristic, the faunal zone is designated as that of *Whitfieldella prosseri.*

The name Bass Islands "series" was proposed by Lane and others (1907, p. 554) for their Lower Monroe beds

from the group of islands of that name in western Lake Erie. No other appropriate term seems to be available, though characteristic exposures of all the divisions are not found in these islands.

It may be noted parenthetically that it is not clear whether recognition by Lane and others (1907) of a particular Bass Islands member away from its type locality was based on lithologic or faunal criteria.

The statement in the quote above that the Put-in-Bay dolomite is found in Marion County was explained by Carman (1927, p. 494):

Whitfield reported the presence of *Goniophora dubia* in the Lower Helderberg group at Middletown (now called Prospect), Marion County. This fossil was later designated by Grabau as the type fossil of the Put-in-Bay member, and apparently upon its reported presence at Middletown by Whitfield, Grabau stated that the Put-in-Bay member was present at Middletown (Prospect).

Carman then continues:

The presence of the Put-in-Bay member is indicated in Franklin County [Columbus] by the statement by Stauffer that *Spirifer ohioensis*, which is limited to the Put-in-Bay member by Grabau and Sherzer, has been found in the Monroe of the Columbus quadrangle.

Carman's (1927) report is still the definitive regional study of the Upper Silurian rocks exposed in western Ohio. The entire Upper Silurian was assigned to the Bass Island Formation, which he subdivided into four members. The oldest of these, the Greenfield, is described (p. 486) as

. . . a drab, fine-grained dolomite with carbonaceous partings and commonly in beds of 2-6 inches, although at places with thicker beds or massive ledges. This massive phase is rough textured and vesicular, with corals and stromatoporoids, and is a kind of reef rock which at places can be seen to pass laterally into the even-grained, bedded type. The thickness of the Greenfield is apparently between 75 and 100 feet, but a complete section is not known at any place.

Many exposures showing the contact of the Greenfield with the Niagaran below have been found in northern Ohio. A few of these indicated a slight disconformity, but most of the exposures, covering parts of Wood, Ottawa, Sandusky, and Seneca counties, show apparent conformity with very characteristic transition changes and with very widespread uniformity of the beds just below and just above the contact. No outcrop is known showing the relation of the Greenfield to the Tymochtee above.

The discussion of the Tymochtee, the second member, gives (p. 488) the lithology of this member and explains its poorly understood stratigraphic position:

The rocks of the Tymochtee Creek exposures are gray to drab, thin-bedded dolomite, with partings or thin layers of carbonaceous, argillaceous material. Similar strata are found at various other places over the Monroe area, indicating a division of rather wide extent. These various outcrops cannot be traced into one another, and none of them can be traced into the Tymochtee Creek exposure, but the general similarity of the stone is such that it should all be called Tymochtee until something definitely against such an interpretation is determined. At none of these exposures is the superposition of the Tymochtee above the Greenfield proved by outcrop, but the geographical position of the outcrop is in every case in accord with such an interpretation. The Tymochtee member is drab, thin-bedded, laminated, argillaceous dolomite with much carbonaceous material as partings along the bedding planes. It is the most shaly member of the Monroe and at places contains distinct zones of shale. The thickness is about 150 feet, but no complete exposure exists.

Few exposures of the upper members, the Put-in-Bay and Raisin River, in ascending order, were available to Carman, who described (p. 490-491) the former as

... most typically a gray-drab, brecciated, rough-textured, massive dolomite that weathers with irregular knobby surface, but the member contains some bedded stone in layers of 2-6 inches, and it was apparently in this form that all the stone was laid down. The member is best exposed in the cliffs on the northwest part of Catawba Island [Ottawa County] and around South Bass Island. At both places the exposure shows about 50 feet, which is apparently the practically complete thickness of the member, although the upper contact is not shown. In both of these exposures there are commonly two horizons of breccia separated by bedded strata. The upper zone of breccia is commonly about 25 feet thick, the lower zone about 10 feet thick, and the intervening bedded stone from 5 to 10 feet thick. There are, however, many lateral changes from brecciated to bedded stone and vice versa, so that the thickness of the brecciated and bedded units vary from place to place, and locally practically the whole thickness of the member is brecciated.

The Holland quarry, now abandoned, in Lucas County is the only exposure Carman listed (p. 491) as showing the full stratigraphic thickness (34 feet) of the Put-in-Bay. The overlying Raisin River member had a full stratigraphic thickness of 50 feet in the same quarry and was described (p. 492) as

... blue-gray to drab, banded, argillaceous dolomite with carbonaceous partings along the bedding planes.

Regarding the stratigraphic position of Monroe rocks exposed in Franklin and Delaware Counties in central Ohio, Carman wrote (1927, p. 495):

On the basis of the data now available it can only be stated that the Monroe which outcrops near the Columbus-Monroe boundary in western Delaware and Franklin Counties is in the Bass Island formation above the Tymochtee member and probably below the Raisin River member, in the general horizon of the Put-in-Bay member 300-350 feet above the base of the Monroe. However, the rock is not brecciated like the typical Put-in-Bay dolomite of northern Ohio, and the characteristic Put-in-Bay fossils have not been found, although such meager faunal evidence as exists favors this member. It is probable that the fossils used to distinguish the Put-in-Bay and Raisin River members in northern Ohio do not exist or do not show the same associations here, and the exposures of the region are so few and scattered that it has not been possible as yet to establish different members if such exist.

Although Carman (1927, p. 485) noted that gypsum occurs within the Monroe, he did not specifically include the beds exposed near Gypsum in Ottawa County in the Tymochtee member where he described the member in the text. However, on his geologic map (p. 482) the area around Gypsum is mapped as having Tymochtee bedrock. No mention was made by Carman of the Salina problem that had engaged the attention of earlier workers, nor did he discuss the stratigraphic position of the gypsum beds exposed near Gypsum in relation to the more than 600 feet of evaporite-bearing rocks penetrated in a well located in Sandusky in Erie County and earlier described by Orton (1890, p. 23). The significance of the more than 600 feet of evaporite-bearing rocks in relation to the outcropping section was obscured by Carman's belief (p. 494) that where in north-central Ohio the "Monroe" forms the bedrock, the dip is "slight," and that therefore "the thickness of the Monroe cannot be very great." It is now known that in that area the dip exceeds 40 feet per mile and that thinning below the Devonian is largely by truncation.

Reef-bearing Guelph dolomite was described by Cumings (1930) in several localities in Seneca, Wyandot, and Marion Counties; the most striking occurrence is in two klintar that rise about 100 feet above the surrounding bedrock near Carey in Wyandot County. The Guelph making up the klintar is "flanked, and in some places capped, by unconformable Greenfield dolomite" (Cumings, 1930, p. 202).

A report by Mohr (1931) on the geology of the Bass Islands added some details to Carman's (1927) rather generalized description. Mohr fixed the contact between the Tymochtee and the Put-in-Bay members at the top of 6 inches of shaly blue dolomite exposed along the shore of South Bass Island. The Tymochtee as interpreted by Mohr shows only 20 inches of exposure and is overlain by the Put-in-Bay, to which she assigned a thickness of 45 to 50 feet. Mohr could not locate the contact with the Raisin River, a member described as having a very dense texture and as breaking with conchoidal fracture. Without its stratigraphic boundaries, the Raisin River was given a tentative thickness of less than 5 feet.

Mohr's interpretation of the origin of the breccias found especially in the Put-in-Bay paralleled that stated by Carman (1927, p. 491):

... it is probable that the partly consolidated sediments were plowed up and broken up by great storm waves and that the fragments settled back with the interstices filled in with finer material. The whole mass was then compacted and cemented.

Stout (1941), in a report emphasizing the chemical composition of the carbonates exposed in western Ohio, gave somewhat generalized descriptions of numerous quarry sections. Upper Silurian rocks were assigned to the undifferentiated Monroe Formation.

A cross section of the Michigan Basin was extended into Wyandot County, Ohio, by Landes (1945), in his pioneering study of the Upper Silurian rocks of the Michigan Basin. His detailed sample study

... led to the discovery that the Salina-Bass Island rocks could be subdivided into traceable units which have been labeled A to H, A being the oldest .... Of these eight units only H is believed to be Bass Island in age. The Salina formation consists of three shaly units (C, E, and G), three salt units (B, D, and F) which do not crop out, and a basal outcropping dolomite unit, A, which also contains salt in the Michigan basin.

Landes' cross section showed that the three salt units do not extend into northwestern Ohio and that the G and H (Bass Islands) units are truncated at the surface between Fulton and Putnam Counties. Landes (1945) revived the

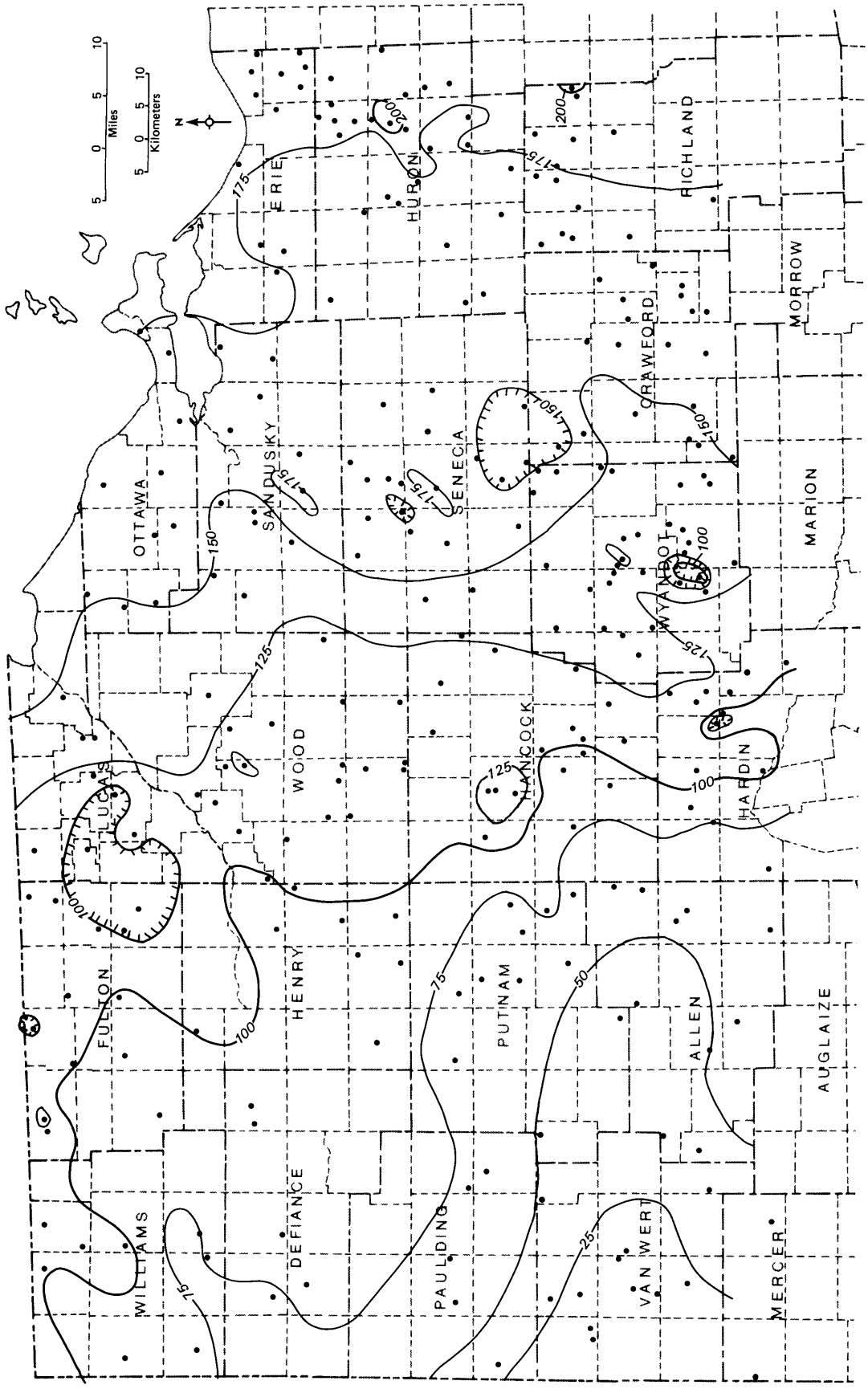


FIGURE 4.–Thickness of sub-Lockport Silurian rocks. See figure 3 and Appendix A for well identification; figure 3 for township identification.

question of whether Salina rocks crop out in northwestern Ohio:

> Obviously the much thicker part of the Salina section [of the Michigan Basin] must also crop out in Ohio. For many years surface stratigraphers have referred to these rocks as lower Bass Island, although petroleum geologists have recognized their continuity with the Salina of the Michigan basin, and J. S. Newberry identified them as Salina in 1873.

In the discussion of the C unit he remarked:

> It is obvious from the cross section that the non-salt units of the Salina formation reach the bedrock-surface in northern Ohio. The shales and dolomites of units C, E, and G may correlate with the Tymochtee beds of the surface, heretofore placed in the Bass Island dolomite.

The possibility, mentioned by Landes (1945), of a depositional connection between the salt beds of the Michigan Basin and those of northeastern Ohio and New York was verified for northeastern Ohio by Ulteig (1964). Ulteig traced the units defined by Landes into Ohio and by means of sample and nuclear-log study established the generally similar stratigraphy between the Michigan and Appalachian Basins. The units shown by Ulteig (1964) in northeastern Ohio are discussed elsewhere in the report (p. 23).

In reports on the geology of Ottawa County by Sparling (1965, 1970), the Silurian rocks, both in the subsurface and in outcrop, in this part of the state were for the first time examined in detail. Sparling (1965) recognized, in ascending order, the Cataract Group, consisting of the Manitoulin (Brassfield) Dolomite and Cabot Head Shale, the Clinton Dolomite, the Lockport Dolomite, and the Bass Islands Formation. To the Bass Islands he assigned the members that Carman (1927) had assigned to it, with the exception of the Tymochtee. Sparling (1965, p. 94) considered the Tymochtee rocks of the type section to be equivalent to the lower part of the evaporite-bearing Salina rocks of Ottawa County. Subsequently, the name Tymochtee was substituted for Salina (Sparling, 1970).

A significant finding by Ulteig (1963, inset to fig. 10, fig. 11; 1964, figs. 11, 12, 13) was that Upper Silurian units under cover of Devonian carbonates are truncated in a southwesterly direction in central Ohio. The discovery of this relationship invalidated reports that Put-in-Bay or Raisin River rocks underlie the Devonian in Marion, Delaware, and Franklin Counties in central Ohio and in counties farther south and cast doubt on the reported occurrence of these rocks in northwestern Ohio. Enough subsurface control is available today to explain the earlier erroneous stratigraphic designations by the lithologic similarity in Upper Silurian dolomites.

Although Ulteig (1964) had shown that the Salina nomenclature first used by him in northeastern Ohio was applicable also in eastern Ottawa County, Sparling (1965, 1970) did not attempt to relate the newly introduced nomenclature to the existing outcrop nomenclature beyond stating that the Greenfield is equivalent to the lower part of the A unit—specifically to the A_1 carbonate. The subdivision of the A unit into the A_1 evaporite, A_1 carbonate, A_2 evaporite, and A_2 carbonate, in ascending order, has evolved from studies of the Salina Group in the Michigan Basin following Evans' (1950, p. 59) proposal to subdivide the A unit into A_1 and A_2 members. This subdivision has since been shown to be applicable in the Michigan and Appalachian Basins.

Janssens (1968) reported on the Silurian rocks in a small area in eastern Erie County, Ohio, where the evaporite-bearing Salina rocks approach the outcrop. During 1968 and 1969 he examined the cuttings of 76 wells drilled in northwestern Ohio by the Ohio Division of Water. The results of this preliminary work led to the recognition that the Tymochtee Formation occupies a much lower stratigraphic position in the Salina section than was previously known and that, consequently, more than 300 feet of strata lie between the Tymochtee and Carman's (1927) Put-in-Bay (Janssens, 1971). Another finding was that the Fort Wayne bank, mapped by Pinsak and Shaver (1964) in eastern Indiana, probably extends into Paulding and Van Wert Counties in west-central Ohio. This preliminary work provided the impetus for extension of the study to all available samples and other control in northwestern Ohio.

STRATIGRAPHY

SUB-LOCKPORT ROCKS

Dolomite, shale, and limestone with a thickness that ranges from about 200 feet in the east to about 25 feet in the southwest (fig. 4) overlie the Ordovician and underlie the Lockport Group (or Lockport Dolomite) in the report area. In the eastern part these strata are divided into four formations. Toward the west the sub-Lockport rocks lose the shale, and the carbonate units become lithologically indistinct; as a result, it is not practical to subdivide the sub-Lockport rocks in the western part of the report area. In the discussion below, the formations recognized in the eastern part of the report area are described. Following that is the description of the undifferentiated sub-Lockport rocks in the western part. The existence of possible unconformities bounding or within the sub-Lockport rocks is discussed last.

Cataract Group

The Cataract Group (Schuchert, 1913; Bolton and Liberty, 1955, p. 18) in western Ohio consists, in ascending order, of the Brassfield and Cabot Head Formations. These two formations can be recognized on nuclear logs as separate formations as far west as the western boundary of Hancock and Wood Counties. Farther west shale is virtually absent in the Cabot Head; the two units consist of lithologically similar dolomite and therefore cannot be distinguished (fig. 5).

Brassfield Formation.—The Brassfield Formation (Brassfield Limestone of Foerste, 1906, p. 27) consists of largely dolomitized fossiliferous predominantly coarse-grained light-gray or brown limestone that has a thickness of 25 to 65 feet. In the eastern part of the report area the lower portion of the formation is chert bearing, glauconitic, and silty. Fossils, especially bryozoans that in many wells have been replaced by hematite, generally occur in the upper part. Along the eastern edge of the report area the Brassfield contains thin beds of very fine-grained light-greenish-gray sandstone. To the east this sandstone thickens, becomes interbedded with shale, and occupies the stratigraphic position of the entire Cataract Group, which to drillers in eastern Ohio is known under the informal and stratigraph-

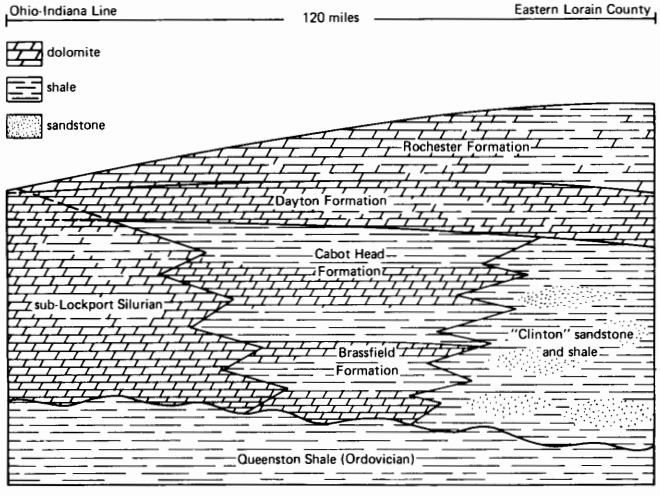


FIGURE 5.–Generalized cross section of sub-Lockport strata.

ically incorrect name of "Clinton" sandstone (figs. 5, 6).

The Brassfield is 25 to 30 feet thick in the eastern tier of counties (fig. 7) in the report area. Westward the formation thickens to between 50 and 60 feet as interbedded shale and dolomite of the Cabot Head are replaced by shale-free dolomite that is indistinguishable from the underlying Brassfield; the dolomite is assigned to the Brassfield for that reason.

The Brassfield is underlain by red shale that is the western featheredge of the Queenston Shale of New York. West of the Queenston red shale boundary shown in figure 6, red shale occurs in thin beds 10 to 100 feet below the Brassfield. Immediately underlying the Brassfield in this area is green shale or dolomitized partly argillaceous fossil-fragmental greenish-gray limestone. The basal contact of the Brassfield is sharp in the samples and on nuclear logs.

Cabot Head Formation.–The Cabot Head Formation (Cabot Head Shale of Grabau, 1913, p. 460) consists of green and reddish-brown shale interbedded with dolomitized fossiliferous partly hematitic predominantly coarse-grained light- and medium-grayish-brown limestone that becomes more abundant toward the base. Reddish-brown shale is found as far west as the boundary shown on figure 6. Near the western boundary of Hancock and Wood Counties the Cabot Head consists entirely of dolomite, except for trace amounts of shale in the samples. Because the dolomite is lithologically similar to that of the underlying Brassfield, west of these counties it is not possible to distinguish the two formations, and the Cabot Head is included with the Brassfield.

To the east, shale cavings in the samples tend to obscure the gradational contact with the underlying Brassfield; the contact is best placed on nuclear logs, on which the shale-free Brassfield can be differentiated accurately from the interbedded shale and limestone of the Cabot Head.

Thickness of the Cabot Head decreases from 100 to 115 feet near the eastern edge of the map area to 60 to 70 feet near the western boundary of Hancock and Wood Counties.

Dayton Formation

The Dayton Formation is expanded in this report to include the strata between the top of the Cabot Head Formation and the base of the Rochester Formation. The stratigraphic interval of the redefined formation thereby includes a carbonate unit and a thin shale unit previously left unnamed by the author in a report (Janssens, 1968) on Erie County.

The name "Dayton Stone" was used by Orton (1871a, p. 149) for exposures at Dayton, Montgomery County, Ohio, of 5 to 10 feet of limestone separated from the Brassfield Formation by 2 to 6 inches of "marl." The "marl" beds were included by Orton in the Brassfield. Subsequent work by Foerste (1906, p. 41-43), Kaufmann (1964, p. 83-100), and Rexroad and others (1965; fig. 8 of this report) has shown that locally in east-central Kentucky and southwestern Ohio Orton's Dayton and its Kentucky equivalent, the Waco Limestone (Foerste, 1906, p. 52-59), are underlain in descending order by up to 13 feet of green shale, the Lulbegrud Clay (Foerste, 1906, p. 50-52), and up to 10 feet of dolomitic limestone, the Oldham Limestone (Foerste, 1906, p. 47-50). The Oldham is in turn separated from the Brassfield by approximately 7 feet of calcareous clay, the Plum Creek Clay (Cabot Head Formation) (Foerste, 1906, p. 44-47). Locally, as in its type section, the Dayton rests directly on the Brassfield because of pre-Dayton erosion.

Recent work by Horvath (1967) and by Janssens (unpublished work in Pike, Ross, Scioto, and Licking Counties; 1968, p. 2-5; fig. 9 of this report) shows that Orton's Dayton (upper member of the Dayton on fig. 9) is persistent in central Ohio and that in many places it is underlain by the Oldham or its equivalent. Up to 15 feet of green shale separates the two carbonate units.

It is proposed that the stratigraphic interval of the Dayton as defined by Orton be expanded for subsurface usage to include all strata between the top of the Cabot Head Formation and the base of the Rochester Formation (fig. 8). Thus expanded, the Dayton includes the Oldham Limestone and the Lulbegrud Shale Members of the Noland Formation of east-central Kentucky and Adams County, Ohio (Rexroad and others, 1965), and is the formal and stratigraphic equivalent of the drillers' "Packer Shell" of north-central Ohio.

The Dayton Formation in the eastern part of the report area is 5 to 57 feet thick (fig. 10) and consists of two carbonate members that are locally separated by green shale. The lower carbonate member is a dolomitized probably fossiliferous fine- to coarse-grained medium- to dark-gray to grayish-brown limestone that is locally hematitic. Thickness of the lower member is 0 to 40 feet; it changes considerably within relatively small areas. In Huron County, for example, its known range is from 7 to 36 feet.

The lower member is underlain by red and green shale and gray to brown fossiliferous limestone or dolomite of the Cabot Head. The contact is distinct both in samples and on nuclear logs but can be more accurately drawn by means of the latter.

Green shale with a thickness of up to 15 feet separates the lower carbonate member of the Dayton from the upper member. The upper member is a dolomitized locally hematitic slightly fossiliferous predominantly very fine-grained very light-yellowish-brown limestone that is slightly glauconitic in most places. Thickness of the upper member ranges from 5 to 20 feet.

The upper member has a lithology that is distinct from

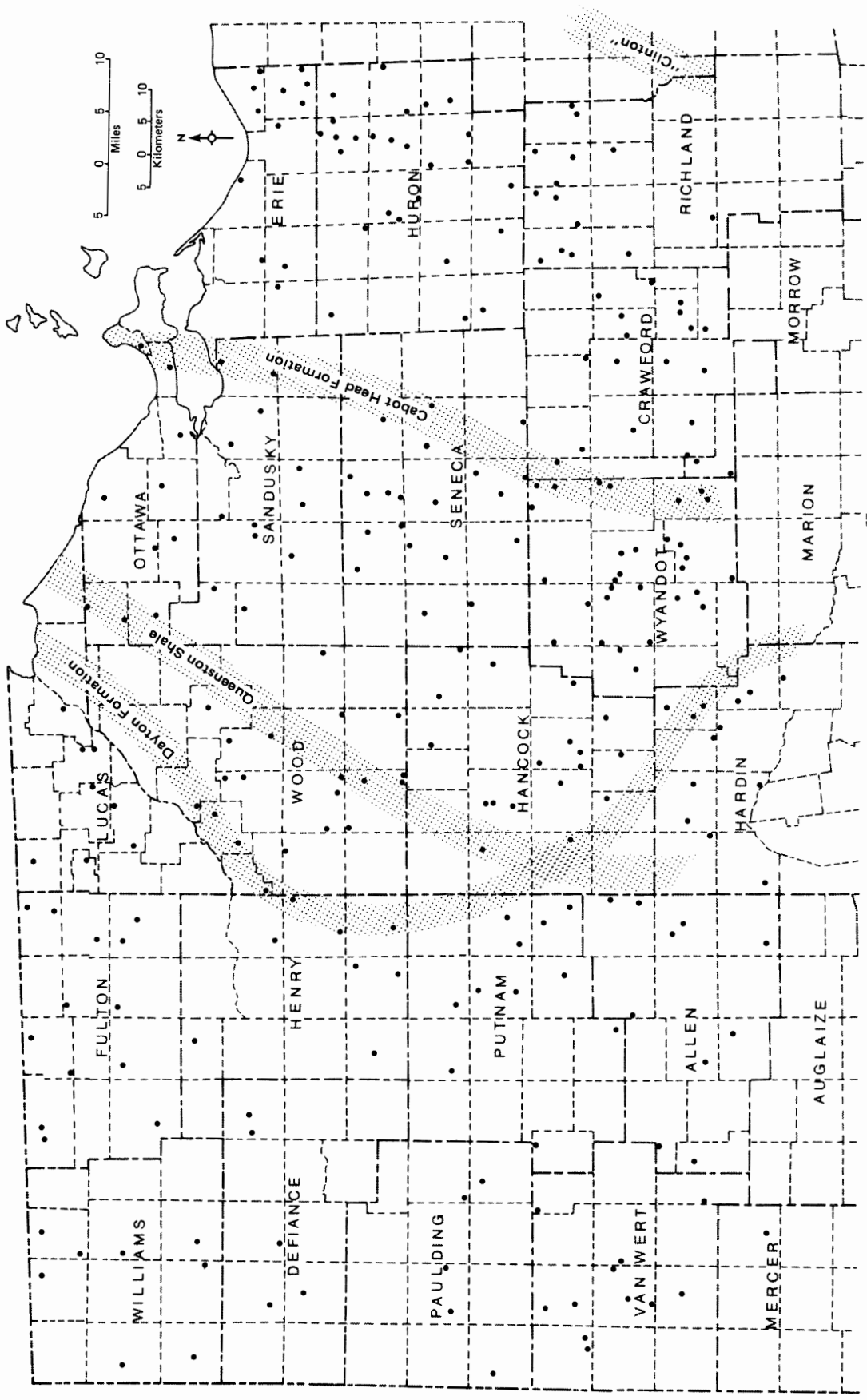


FIGURE 6.—Generalized boundaries of sub-Lockport Silurian rocks. See figure 3 and Appendix A for well identification; figure 3 for township identification.

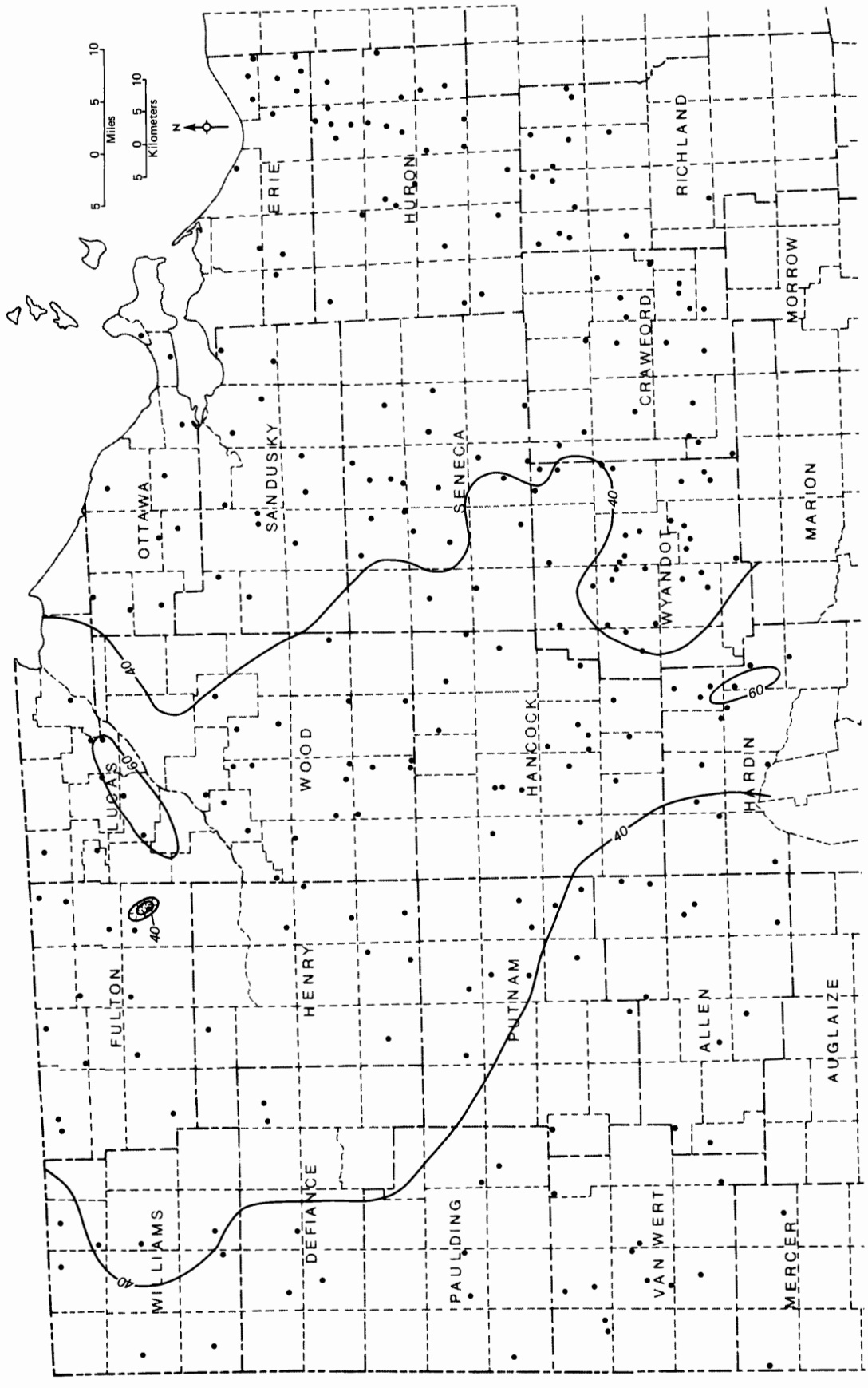


FIGURE 7.–Thickness of the Brassfield Formation. See figure 3 and Appendix A for well identification; figure 3 for township identification.

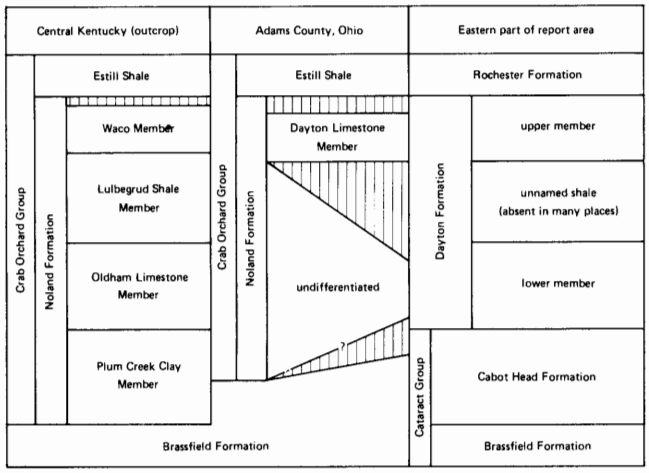


FIGURE 8.–Relationship between the sub-Lockport Silurian rocks of the central Kentucky outcrop and Adams County, Ohio (from Rexroad and others, 1965, fig. 2), and those of the eastern part of the report area.

that of carbonates underlying and overlying the Dayton and is therefore recognized in most cuttings. The presence of the lower member, and the thickness of both members, are best determined from nuclear logs. Differentiation of the two carbonate members is not possible, except in cores, in areas where the members are not separated by the green shale. The western boundary of the Dayton as a mappable formation is shown in figure 6.

Rochester Formation

The Rochester Formation (Rochester shale of Hall, 1839, p. 289) consists of gray, green, and dark-brown dolomitic shale and argillaceous to very argillaceous microcrystalline light- to medium-greenish-gray to brownish-gray dolomite. To the west, shale in the Rochester thins and becomes virtually absent near the western boundary of Hancock and Wood Counties. The formation thins from a maximum of 26 feet in Richland County to 5 feet or less in the western parts of Hancock and Wood Counties.

The Rochester is underlain by nonargillaceous slightly glauconitic dolomite of the Dayton Formation. The contact is distinctive both in the samples and on nuclear logs.

Undifferentiated sub-Lockport rocks

Rocks assigned to the Cataract Group and Dayton and Rochester Formations in the eastern part of the report area cannot be differentiated with certainty in the western part in cuttings or on nuclear logs because in the latter area these rocks are virtually without shale, are lithologically similar, and, with the exception of the Brassfield, are too thin to be recognized as individual units.

The Brassfield Formation consists of dolomitized very fine- to coarse-grained white, light-gray, and light- and medium-brown limestone that locally has a silicified (cherty) matrix and contains probably nodular white and light-gray chert. The formation is fossiliferous and probably fragmental, but dolomitization and the size of the cuttings prevent a precise determination of the fossil content and fragmental texture of the formation. Quartz, silt, glauconite, and hematite, which are common in the Brassfield in the eastern part of the report area, are absent in the western part.

The boundaries of the Brassfield become generally uncertain as the formation is traced westward. West of the red shale boundary (fig. 6), the contact with the underlying Ordovician has been placed in this report at the base of nonargillaceous dolomite below which is found slightly argillaceous fossiliferous greenish-gray dolomite that is interbedded with green shale. This boundary is distinct on the gamma ray curves. In the two westernmost tiers of counties the upper Ordovician carbonates locally contain no shale or argillaceous dolomite, and the boundary then can be drawn only arbitrarily. A transitional lower Brassfield boundary "in many sections" has been described in adjacent Indiana by Pinsak and Shaver (1964, p. 22).

The upper Brassfield boundary is transitional in the cuttings; it appears to lie within a section of dolomitized medium- and coarse-grained light- and medium-brown limestone in which chert content decreases downward. On gamma ray curves, however, this section appears slightly argillaceous and in contrast to the underlying clean nonargillaceous dolomite. Arbitrarily, therefore, the contact is placed on gamma ray curves on top of the nonargillaceous dolomite.

Overlying the Brassfield is dolomitized medium- and coarse-grained white and light- and medium-brown limestone that contains up to 5 percent white chert. The chert-bearing dolomite is overlain by slightly argillaceous microcrystalline and very finely crystalline gray and greenish-gray dolomite and is the approximate western equivalent of the undifferentiated Cabot Head and Dayton Formations; thickness of this dolomite decreases from 50 to 60 feet in the northeast part of the study area to probably less than 10 feet in the southwest. The overlying argillaceous dolomite is the western equivalent of the Rochester Formation. The lithology shows in cuttings only in trace amounts and its thickness as determined from gamma ray logs is less than 5 feet. The boundary between the Rochester-equivalent argillaceous dolomite and the overlying clean Lockport Dolomite is distinct on gamma ray logs.

Unconformities

Evidence obtained from cuttings and nuclear logs in this study is not sufficient to prove or disprove the existence of unconformities bounding or within the sub-Lockport rocks. Unconformities have been postulated to lie at the base of the Brassfield Formation, between the Brassfield and the Rochester Formations, and between the Rochester and Lockport rocks.

The contact of the Brassfield with the underlying Ordovician in the report area is sharp, except locally in the western half where the contact appears to fall within a clean carbonate section. Where control is relatively abundant, as in Huron and Erie Counties, the thickness of the Brassfield is relatively uniform, and changes, where they occur, affect the transitional upper boundary of the formation. Elsewhere in the report area changes in thickness of the Brassfield either occur at the top of the formation or cannot be specifically related to lower or upper parts of the formation.

Evidence for an unconformity at the base of the Brassfield has been obtained from the subsurface in adjacent Indiana by Pinsak and Shaver (1964, p. 16, 17):

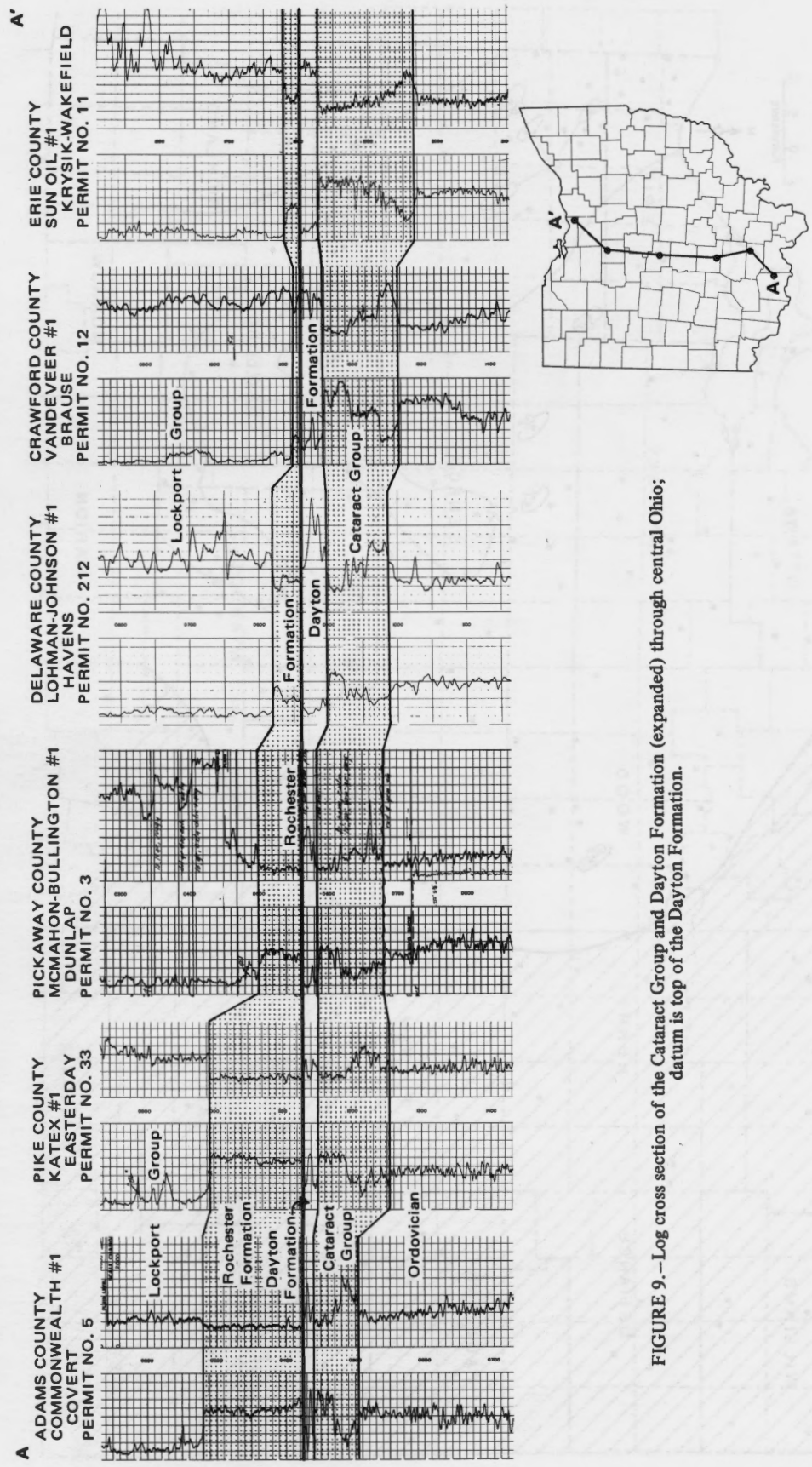


FIGURE 9.–Log cross section of the Cataract Group and Dayton Formation (expanded) through central Ohio; datum is top of the Dayton Formation.

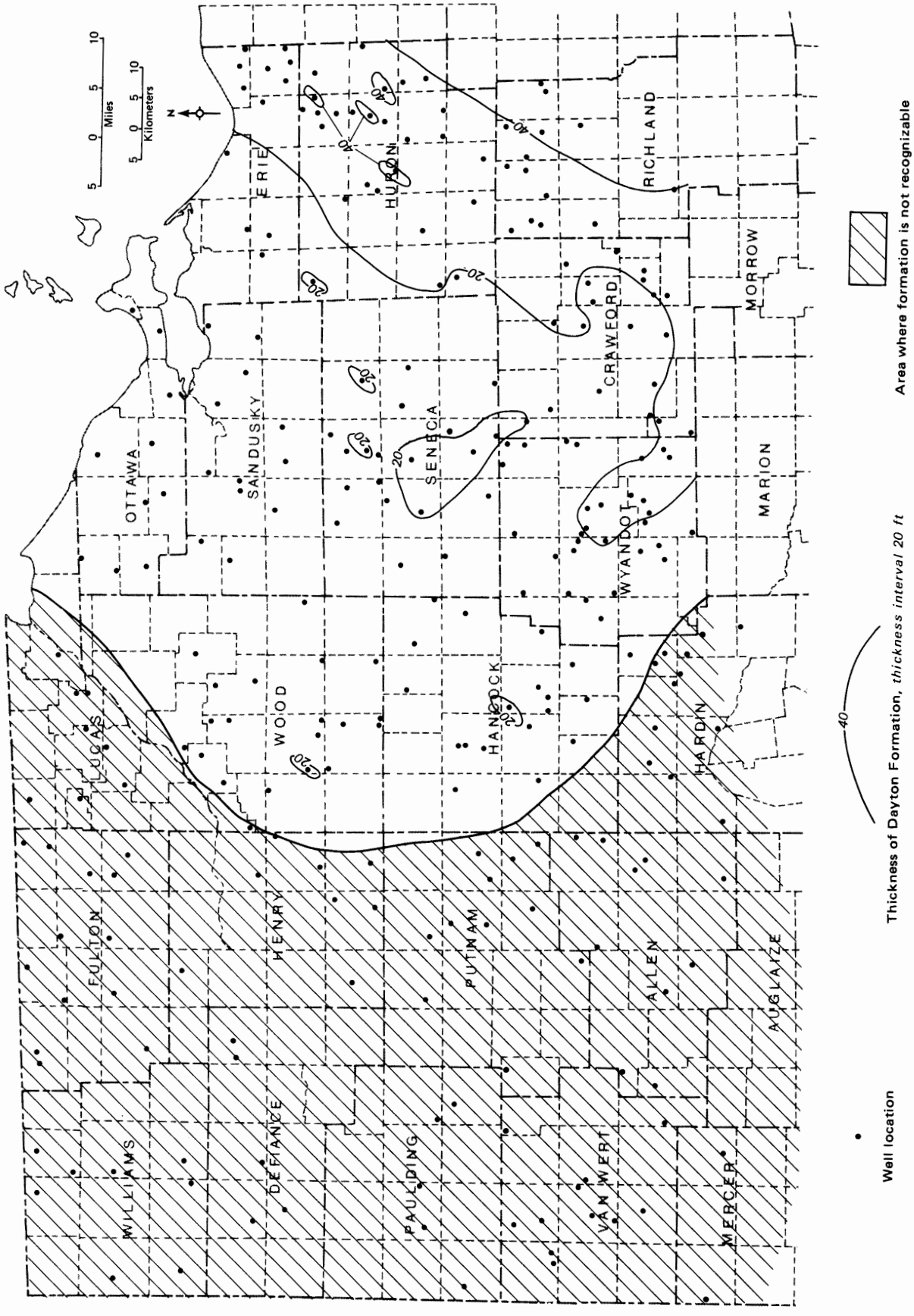


FIGURE 10.–Thickness of the Dayton Formation. See figure 3 and Appendix A for well identification; figure 3 for township identification.

The boundary [between the Ordovician and Silurian] is fixed within a few feet by means of conodonts that are found in most of the 75 insoluble residues of cores from nine wells in the area between Richmond and Chicago. The Silurian fauna is sparse and is dominated by simple cones, whereas the Ordovician conodont fauna is abundant and consists of many complex well-known Cincinnatian forms in addition to simple cones. The faunal determination allows lithologic characterization of the residues by age . . . .

To understand late Ordovician and early Silurian events in northern Indiana, this faunal evidence should be considered together with the westward-thinning Cincinnatian section, a Silurian section that thickens northeastward and southwestward from the area of study, and the occurrence of reworked Ordovician detritus in basal Silurian rocks, including Ordovician conodonts as high as 30 feet above the systemic contact in one core. This evidence permits the assumption of some differential movement and erosion prior to and during Silurian deposition in northern Indiana; lowermost Silurian rocks may not be exactly the same age everywhere in northern Indiana. Fixing of the Ordovician-Silurian boundary by faunal means, however, in conjunction with the physical correlations made here, refutes the concept, prevalent in classic literature, of any Silurian prototype of the Cincinnati Arch that could cause a northeastward wedging out of all the lowermost Silurian rock units against the postulated arch or barrier in northern Indiana. On the contrary, the same objectively named lower Silurian rock units can be recognized nearly everywhere at expectable heights above the systemic boundary in the area of study.

Evidence in outcrop was obtained previously in southeastern Indiana by Foerste (1904, p. 327), who described Brassfield limestone containing pebbles that carry Ordovician fossils.

The author assumes that the observations by Pinsak and Shaver (1964) are valid also for northwestern Ohio, and he therefore postulates an unconformable contact at the systemic boundary.

Unconformities have been postulated bounding and within the Dayton Formation as defined in this report. Rexroad and others (1965, p. 16) mention two unconformities, one within and one on top of the unit, in the outcropping Dayton in north-central Kentucky and southwestern Ohio. In this area the lower unconformity locally represents the lower carbonate member of the Dayton, and the Cabot Head Formation is absent because of either erosion or nondeposition, so that here the upper carbonate member of the Dayton rests directly on the Brassfield. This is the stratigraphic succession in the type area of the Dayton Formation as defined by Orton (1871a). The upper unconformity is at the contact of the Dayton with the overlying Rochester Formation (Estill Shale of Kentucky) (fig. 8). Rexroad and others (1965, fig. 2) use conodont data to prove the unconformable nature of this contact. This contact had been examined in southwestern Ohio by Bowman (1956, p. 19, 27), who described it as sharp but conformable.

Two widespread unconformities in the lower Silurian rocks of southwestern Ontario have been described by Sanford (1969). The lower unconformity lies stratigraphically on top of the Cataract Group. The second lies stratigraphically on top of the Fossil Hill Formation (the approximate equivalent of the lower carbonate member of the Dayton Formation of this report). Sanford (1969, p. 7, 9) reports extensive bevelling along both unconformities.

An unconformity on top of the Rochester Formation was reported by Rittenhouse (1949). He tentatively explained the absence of the Rochester locally in southern Ontario and the abnormal thinness of the formation locally in southern Ontario and east-central Ohio as the result of erosion. Sparling (1965, p. 53) examined the Silurian rocks of Ottawa County, Ohio, and adjacent areas and stated that

The existence of an erosional unconformity at the base of the Lockport [top of the Rochester Formation] in the Findlay Arch region is quite certain. Over much of northwestern Ohio the Clinton [Dayton and Rochester Formations of this report] is completely missing.

Where the contact beween the Rochester and the overlying Lockport has been examined in outcrop in southwestern Ohio, it has been reported as sharp but conformable (Bowman, 1956, p. 27; Kaufmann, 1964, p. 112).

The evidence with regard to these unconformities in Silurian rocks in the report area is discussed below.

The author considers it quite improbable that the unconformity described by Sanford (1969) at the top of the Cataract Group in southwestern Ontario extends into northwestern Ohio. All available evidence gathered for this report indicates that the westward thinning (and facies changes) of the Cabot Head is depositional. Apparent local changes in thickness are related to facies changes in the lower part of the formation.

The unconformities postulated in outcropping Dayton as defined in this report cannot be recognized in the subsurface of northwestern Ohio. Their existence can probably be confirmed only through detailed lithologic and faunal studies of numerous cores. It is significant to note in this respect that Pinsak and Shaver (1964) and Shaver and others (1971) have not noted unconformable relationships in core studies of equivalent rocks in adjacent Indiana.

The disconformable contact interpreted by Rexroad and others (1965, fig. 2, p. 24, 32) to exist between the Dayton and the Rochester in southwestern Ohio and adjacent Kentucky cannot be recognized in northwestern Ohio. Their interpretation was based on the recognition of a significant microfaunal break at the contact and not on lithologic evidence. Though thin, the upper carbonate member of the Dayton is still recognized high on the present Cincinnati Arch in the Lewisburg mine in Preble County (Alberts, *in* Shaver and others, 1961, p. 5). No place in Ohio is known to the writer where the Dayton is demonstrably absent below the Rochester, except possibly in the two tiers of counties adjacent to the Indiana line, where Dayton and Cabot Head rocks cannot be differentiated.

The unconformity tentatively postulated on top of the Rochester by Rittenhouse (1949) is believed by the writer not to exist in northwestern Ohio. The available evidence indicates that the westward thinning of the Rochester is depositional instead of erosional. The nature of the upper contact of the Rochester is especially important in northwestern Ohio because the contact is the only one below the Lockport that is readily mappable on the basis of cuttings and nuclear logs.

LOCKPORT GROUP (LOCKPORT DOLOMITE)

The Lockport Group (Lockport limestone of Hall, 1839, p. 289) or Dolomite is present throughout the report area, where these rocks are the oldest exposed. Though these rocks are lithologically relatively uniform, changes do take place that determine the nomenclature and the placement of their upper stratigraphic boundary. These changes are discussed in detail elsewhere (p. 18) in the description of the Lockport, but a brief and generalized statement is offered here so that subregional and regional stratigraphy can be related to one another.

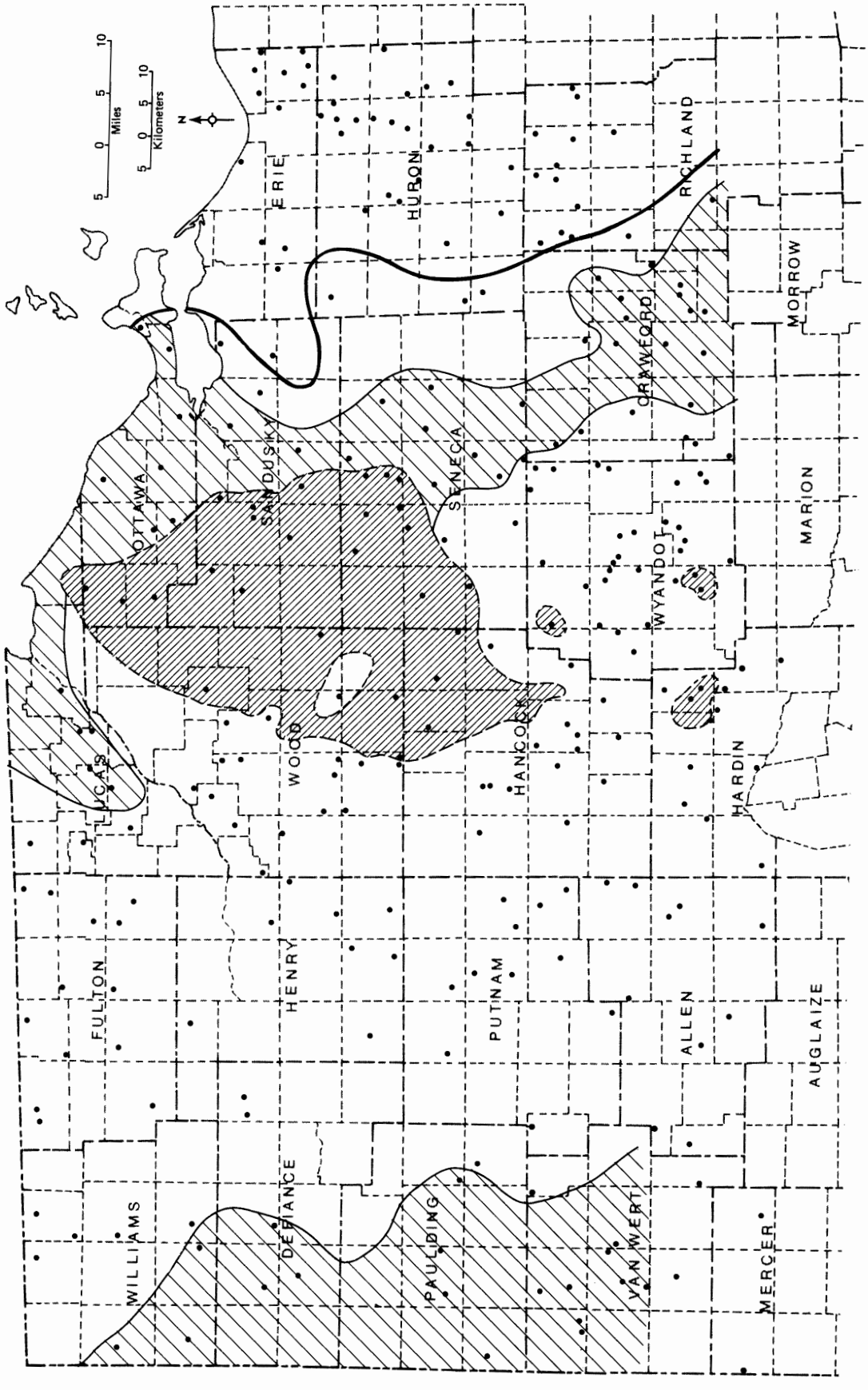


FIGURE 11.—Western limit of the Salina A_1 anhydrite, areas of Lockport outcrop, and areas in which Lockport lithology is found in Salina rocks. See figure 3 and Appendix A for well identification; figure 3 for township identification.

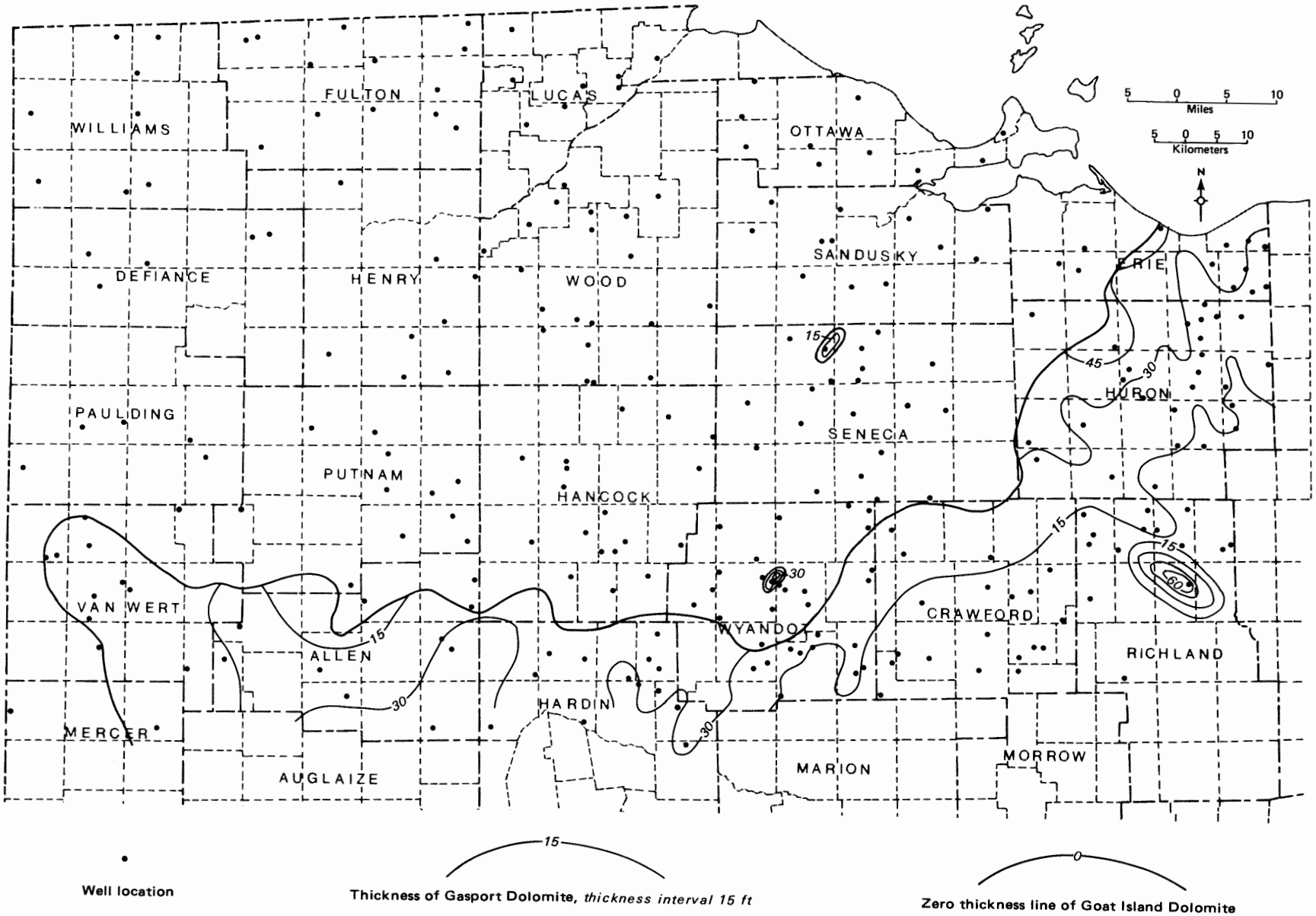


FIGURE 12.–Thickness of the Gasport Dolomite. See figure 3 and Appendix A for well identification; figure 3 for township identification.

The Lockport is treated as a group where a distinctive subsurface chert-bearing unit, the Goat Island Dolomite (fig. 13), is recognized. The Goat Island is underlain by the Gasport Dolomite and overlain by the Guelph Dolomite. Beyond the boundary shown in figure 13 the Goat Island is absent by facies change, and the Lockport rocks are treated as a formation.

The proper upper stratigraphic boundary of the Lockport Group is its contact with the A_1 anhydrite of the Salina Group. As shown in figure 11, this anhydrite occurs only in the eastern part of the report area; it disappears to the west by facies change.

In the central portion of the report area, between the western limit of the A_1 anhydrite and the Lockport outcrop (fig. 11), the position of the upper stratigraphic boundary of the Lockport is uncertain, either because the A_1 anhydrite is absent or because of the occurrence of Lockport-type lithologies in stratigraphic positions that are demonstrably within the Salina Group in the area where the A_1 anhydrite is recognizable. Similar lithologic changes, but at lower stratigraphic positions, take place also in Lucas County and in the counties adjacent to the Indiana line. In the remainder of the area the Lockport is overlain by the Greenfield Dolomite of the Salina Group.

The name Lockport as group or formation for the section between the Rochester and the Salina is used in this report because the name is well established in that sense in Ohio. It differs from the use in southwestern Ontario, where the Lockport Group comprises only the Gasport and Goat Island Formations (Koepke and Sanford, 1966, fig. 7).

Gasport Dolomite

The Gasport Dolomite (Gasport Limestone of Kindle and Taylor, 1913, p. 7) is the basal unit of the Lockport Group and consists of microcrystalline to coarsely crystalline medium- to dark-gray dolomite that is mottled white in part. In good samples the mottled areas can be seen to consist of crinoid stems. In most wells the base of the formation is slightly pyritic and has a slightly argillaceous appearance. West of central Crawford County (fig. 12) the Gasport lightens in color and resembles the Guelph or supra-Goat Island Lockport; in this area the formation is recognizable only because it lies between the distinctive chert-bearing Goat Island and the argillaceous sub-Lockport rocks. The lithology of the Gasport persists west of the mapped area shown in figure 12, but the top of the Gasport is quite gradational in the absence of the Goat Island Dolomite and cannot be recognized on nuclear logs.

The Gasport is regionally thickest (fig. 12) in Erie, Huron, and Richland Counties. The greatest local thickness (64? feet) is found in a well in Franklin Township of Richland County. Samples through the Gasport section in the well are not reliable, but the samples and the gamma ray log suggest that the basal 30 feet of the Gasport resembles the overlying chert-bearing Goat Island. This is the only location in which this apparent stratigraphic anomaly has been recognized.

The contact of the Gasport with the overlying Goat Island is distinct both in samples and on nuclear logs and is best placed by means of the latter. In samples the chert-bearing brown Goat Island is distinct from the chert-free gray Gasport; on nuclear logs the chert causes a characteristic increase in gamma radiation that makes the Goat Island's lower boundary a marker. Therefore on nuclear logs, the Gasport lies between two marker beds, the Goat Island above and the Rochester or sub-Lockport below.

Goat Island Dolomite

The Goat Island Dolomite (Goat Island Member of Howell and Sanford, 1947, p. 34) in the report area consists of microcrystalline to very finely crystalline chert-bearing slightly silty very light-brown to light-grayish-brown dolomite that locally is very slightly glauconitic. The chert is white or very light gray or brown. In Eden Township, Wyandot County, the formation has the lithology (microcrystalline to coarsely crystalline white and light-gray dolomite) of the overlying Guelph Dolomite but retains the chert.

A change similar to that in Wyandot County takes place west and north of the mapped area shown in figure 13, that is, Goat Island rocks undergo a facies change and become lithologically similar to the overlying Lockport dolomite. In addition, the Goat Island loses the chert. Beyond the boundary shown in figure 13 the Goat Island cannot be recognized, and the term Lockport Dolomite is used for the section between the Rochester or its equivalent and the Salina rocks.

From a maximum of 57 feet in southeastern Erie County the Goat Island thins westward in the county to extinction by facies change (fig. 13). In the southwestern part of the report area similar thinning takes place northward from a maximum of 36 feet in Allen County.

The boundary of the Goat Island and the overlying Guelph Dolomite is distinct in the samples because of the presence of chert below the boundary. Where the Guelph consists of white or gray dolomite, the boundary is distinct also because of the change to the slightly brownish color and finer grain size of the Goat Island. On nuclear logs the boundary is distinct only where the Goat Island is overlain by white or gray Guelph. Where the Guelph is light brown in color it contains quartz impurities that are undetectable in routine sample examination but which cause a gamma response similar to that of the chert in the Goat Island, with the result that the log boundary is indistinct.

Guelph Dolomite and undifferentiated Lockport Dolomite

The Guelph Dolomite (Logan, 1863, p. 336-338) in the report area is mapped only where it is underlain by the Goat Island Formation. Where the Goat Island is absent, Guelph rocks and the rocks equivalent to the Gasport and Goat Island are treated as undifferentiated Lockport Dolomite. Guelph and Lockport rocks are discussed below, starting with the eastern part of the report area. Of special interest because of lithologic changes affecting the upper stratigraphic boundary of the Guelph and undifferentiated Lockport rocks are the western halves of counties adjacent to the Indiana line, Lucas County, and parts of Ottawa, Sandusky, Seneca, and Crawford Counties; these three areas are discussed (p. 30) separately following the discussion of Salina rocks.

In Erie, Huron, and Richland Counties the Guelph Dolomite consists of two dominant types of dolomite and, except in the westernmost parts of these counties, is overlain by the A_1 anhydrite of the Salina Group. The lower of the

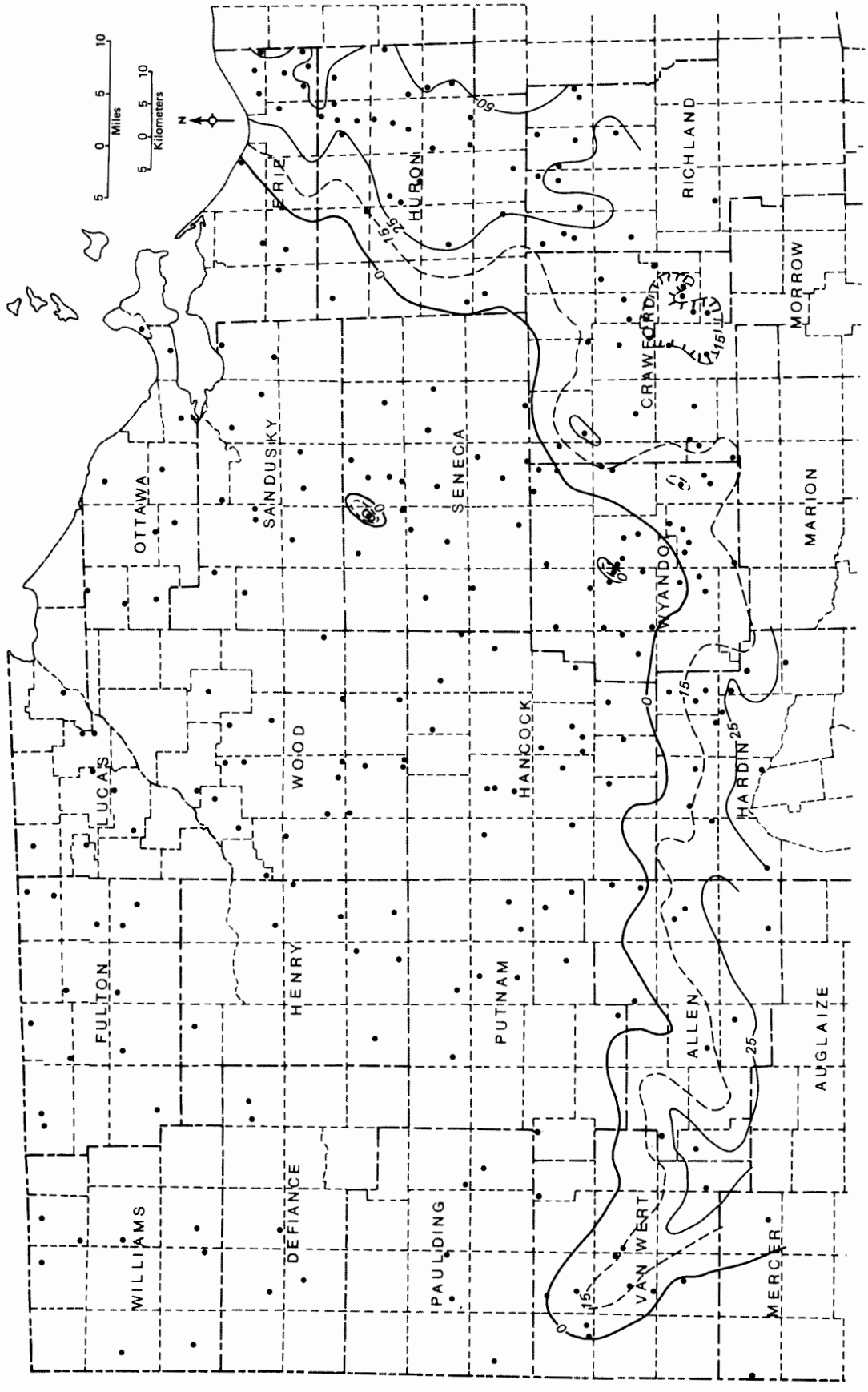


FIGURE 13.–Thickness of the Goat Island Dolomite. See figure 3 and Appendix A for well identification; figure 3 for township identification.

two types of dolomite may be called "representative" Guelph or "representative" Lockport because it is the lithology most commonly exposed in Lockport quarries in northwestern Ohio. "Representative" Guelph is a predominantly coarsely crystalline vuggy white to light-gray dolomite that is in large part fossiliferous or fossil-fragmental. Overlying this dolomite and in facies relationship with it is a microcrystalline very light- to medium-brown dolomite, "brown" Guelph or "brown" Lockport, that locally in Huron and Richland Counties contains white and light-gray chert. In one well in Richland County (well P-286, Blooming Grove Township) the uppermost 15 feet of "brown" Guelph consists of brachiopod-bearing micrograined very light- to medium-brown limestone.

The facies relationship that exists between the lower "representative" Guelph and upper "brown" Guelph is illustrated in figures 14 and 15. The thickness of "representative" Guelph in the northeast part of Townsend Township, Huron County, increases from zero to 93 feet in a distance of 3,200 feet (fig. 14). The change in thickness of "representative" Guelph is illustrated in figure 15, which also shows that the thickness of the Guelph remains essentially constant despite the lithologic changes that occur within it, except that in the well (P-78) with the thickest "representative" Guelph section the Guelph thickens by slightly less than 40 feet. A similar facies change in Florence Township, Erie County, has been interpreted (Janssens, 1968) as a possible biohermal buildup of the Guelph. The regional thickness of the Guelph in Erie, Huron, and Richland Counties increases from approximately 100 feet in the southeast to 140 feet in the west and north.

The upper boundary of the Guelph is its contact with the A_1 anhydrite of the Salina Group. The contact is considered conformable and is distinct on nuclear logs, in samples, and in cores. The Guelph-A_1 anhydrite contact has economic significance because of the occurrence locally of a porous zone in the Guelph immediately below the contact. The zone of porosity, characterized by pinpoint vugs in the "brown" Guelph, is one of several porosity zones known in Ohio as the "Newburg" zone, named after its discovery in Newburg (now Newburgh Heights?), a suburb of Cleveland (Rothrock, 1949).[2]

The counties (Crawford, Seneca, Sandusky, and Ottawa) immediately west of Erie, Huron, and Richland Counties constitute one of the three areas where the position of the upper boundary of the Guelph or Lockport is in doubt because of lithologic changes in the section that lithostratigraphically is equivalent to the Salina farther east. These three problematical areas are excluded from the following discussion of the Guelph and undifferentiated Lockport in the report area.

In the central and western parts of the report area Guelph Dolomite is mapped in a small strip in the south where the Goat Island is found. North of this strip the Goat Island is absent and the uncommonly uniform lithology of the Guelph occupies the entire Lockport interval. The Guelph Dolomite or undifferentiated Lockport Dolomite consists of predominantly coarsely crystalline vuggy white

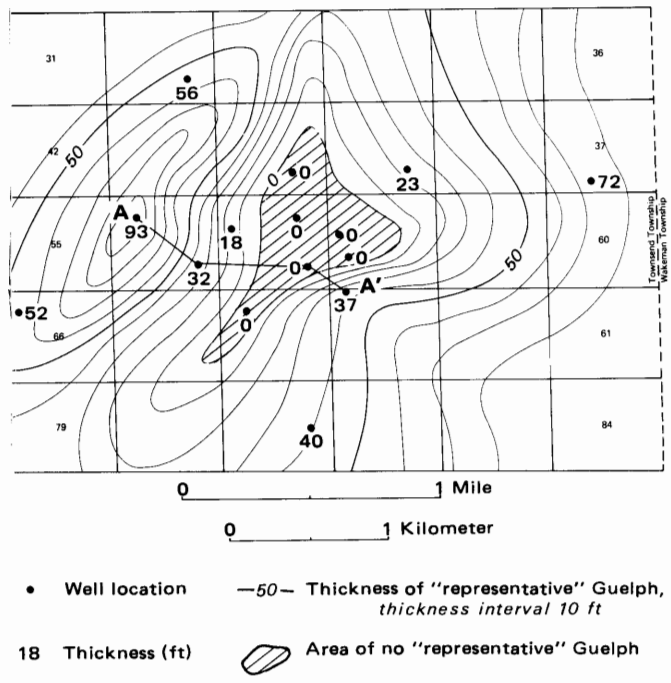


FIGURE 14.—Thickness of "representative" Guelph (biohermal? facies) in part of Townsend Township, Huron County. A-A' is the line of cross section in figure 15.

to medium-gray dolomite that is in large part fossiliferous or fossil-fragmental. The undifferentiated Lockport generally is dark gray and slightly argillaceous and pyritic in its basal 10 to 20 feet. In section 17, Clinton Township, Fulton County, 10 feet of chert-bearing dolomitized vuggy fine-grained very light-brown calcarenite lies 25 feet below the top of the Lockport. The chert is white and slightly fossiliferous. The lithology of this 10-foot section is similar to that of chert-bearing dolomite found above undoubted Lockport in the three problematical areas.

The thickness of the Lockport Group and undifferentiated Lockport Dolomite under cover of Salina rocks increases from 89 feet in Liberty Township, Hardin County, to 200 feet or more in the easternmost tier of counties and in the anomalous areas (fig. 16). Where the Lockport is overlain by the Salina A_1 anhydrite in the eastern part of the report area its thickness increases from about 160 feet or less in southeastern Huron County and adjacent Richland County to 200 feet toward the western limit of the A_1 anhydrite and to 239 feet in western Vermilion Township, Erie County. West of Crawford County thin (125 feet or less) Lockport extends irregularly from Hardin and Wyandot Counties to central Henry County. From this area the Lockport thickens to about 300 feet toward each of the three areas where the upper boundary of the Lockport is in doubt (fig. 16).

The contact of the Lockport with the Greenfield Dolomite (Salina Group) is generally transitional in samples and is drawn at the base of microcrystalline very light- to light-brown to yellowish-brown dolomite that is underlain by generally coarsely crystalline white to light-gray dolomite. Additional comments on the Lockport-Salina contact will be made in the discussion of the three problematical areas (p. 30).

[2] There are a number of so-called "Newburg" pools in eastern Ohio. With the exception of the Mayfield pool near Cleveland (Rothrock, 1949), little is known about the stratigraphy of the Silurian rocks at the stratigraphic position of the type "Newburg." There are no samples or nuclear logs of the "Newburg" zone in the Mayfield pool, so that its stratigraphic position is not well understood in relation to the zone in the report area.

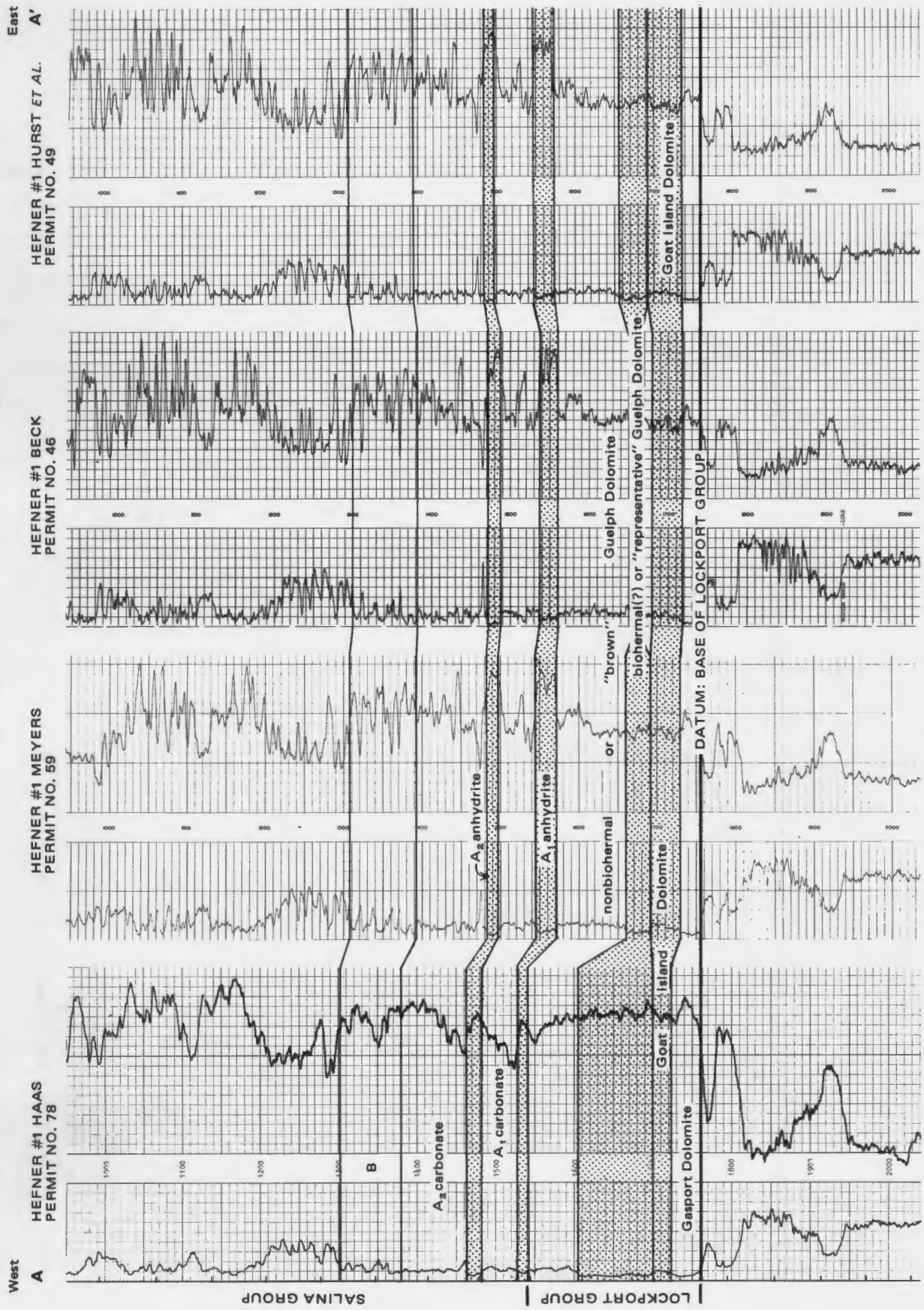


FIGURE 15.–Log cross section of carbonate bank in Guelph Dolomite in Townsend Township, Huron County (see figure 14 for locations of wells); datum is base of the Lockport Group.

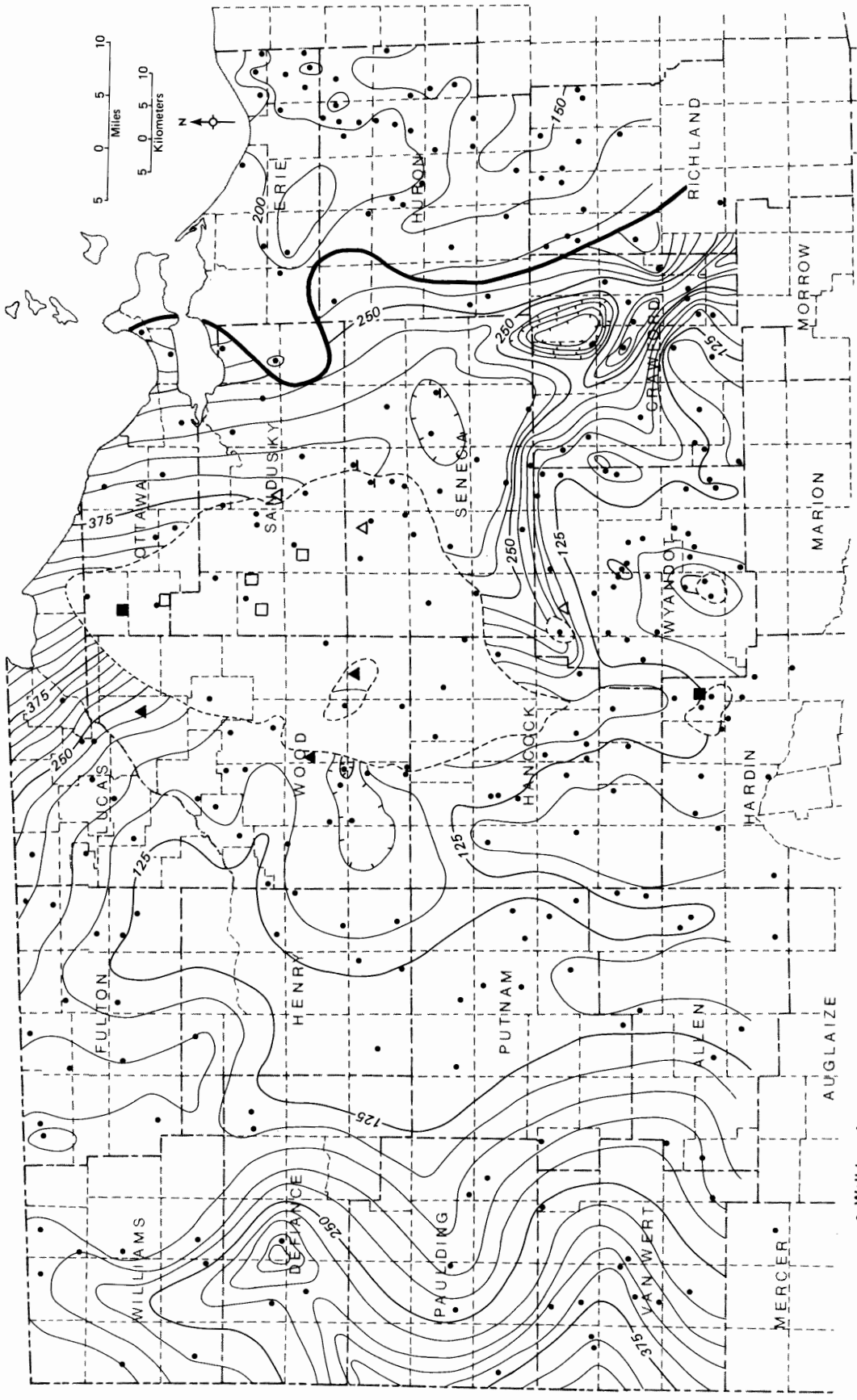


FIGURE 16.–Thickness of the Lockport Group (Lockport Dolomite). See figure 3 and Appendix A for well identification; figure 3 for township identification.

SALINA GROUP

The evaporite-bearing Salina Group of northeastern Ohio was defined by Ulteig (1964, p. 20, 31), adhering in part to Landes' (1945) letter designations, as extending from the base of the stratigraphically lowest anhydrite in the A unit (Ulteig's Greenfield) to the top of the stratigraphically highest anhydrite (G anhydrite). This is the sense in which the name Salina Group is used in this report for both outcropping and subsurface Silurian rocks superjacent to the Lockport Group or Dolomite.

Salina Group in this sense includes units stratigraphically higher than those that have been included previously in the Salina in studies of outcropping rocks. Lane and others (1907) concluded that stratigraphically the rocks of the Lake Erie Bass Islands directly overlie the beds that Winchell (1873) designated Tymochtee in Wyandot County. This concept was accepted as recently as 1951, when Ehlers and others (1951, chart 1) placed the Greenfield and Tymochtee formations in the Salina Group and the overlying Put-in-Bay and Raisin River Dolomites in the Bass Islands Group. Alling and Briggs (1961, fig. 5) questioned for the first time the stratigraphic position of the Tymochtee type section with respect to the Salina rocks of eastern Ohio and tentatively correlated the type Tymochtee with the C unit and the Put-in-Bay (lower part of Ulteig's Bass Islands Group) with the H unit of Landes (1945). Although Alling and Briggs erred in their Tymochtee correlation, their recognition that the Tymochtee equivalent in eastern Ohio is relatively low in the Salina section remains important.

The evidence obtained in this report affords a refinement of Alling and Briggs' (1961) tentative Tymochtee correlation and proves that Salina, not Bass Islands, rocks overlie the Tymochtee in northwestern Ohio. It will be shown that with the exception of those on the Lake Erie Bass Islands and vicinity, all exposures of supra-Tymochtee Silurian rocks are in the Salina Group.

The Salina Group is discussed below, first in the eastern part of the report area where it contains evaporites, and next in the remainder of northwestern Ohio where the Lockport-Salina boundary is not in doubt. The Lockport and Salina in the three problematical areas will be discussed together.

Salina Group in Erie, Huron, and Richland Counties

The Salina Group of Erie, Huron, and Richland Counties consists of dolomite, anhydrite, and shale (fig. 17) and has an average thickness of 600 feet where it is overlain by the Bass Islands Dolomite. The Salina Group in these three counties represents an important updip facies of the salt-bearing Salina rocks of eastern Ohio. Salt beds disappear from the Salina in the two tiers of counties east of Erie, Huron, and Richland Counties, and in the far western parts of Erie, Huron, and Richland Counties the anhydrite beds begin to disappear. In the area immediately west of these three counties the Salina is truncated westward by pre-Devonian and post-Devonian unconformities, the preserved Salina section continues to lose bedded anhydrite toward the west, and the basal part of the Salina undergoes a facies change to include a westward-thickening Lockport-type lithology. For these reasons the Salina in Erie, Huron, and Richland Counties is important as a reference section against which stratigraphic and depositional changes in the Salina of northwestern Ohio can be measured.

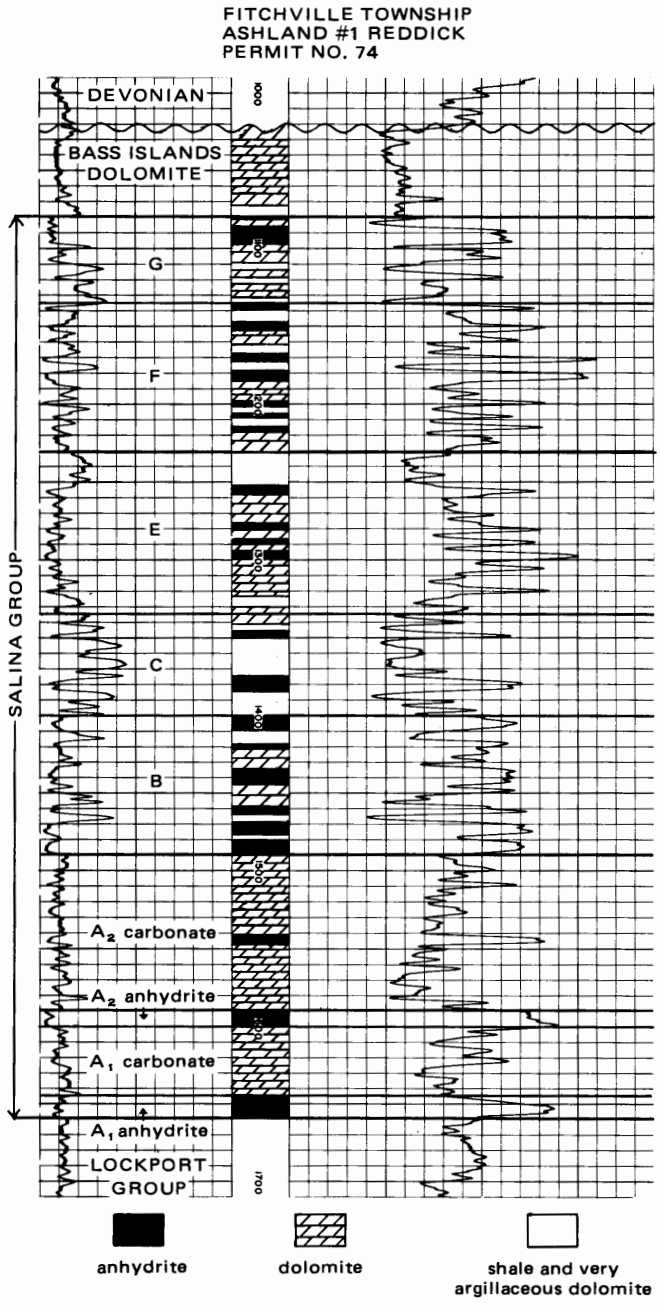


FIGURE 17.—Representative nuclear log of the Salina Group in Huron County.

This assertion is valid also for Salina sections just south of the Michigan line; figure 18 shows that the thicknesses of the supra-Rochester Silurian rocks are similar in two representative wells in Erie and Fulton Counties, which are separated by the Findlay Arch, and that shale beds can be accurately correlated across this arch. The one major change in thickness takes place at the top of the section in Fulton County, where pre-Devonian truncation has reduced the thickness of the supra-E unit Silurian by more than 100 feet.

A unit.—The A unit consists, in ascending order, of the

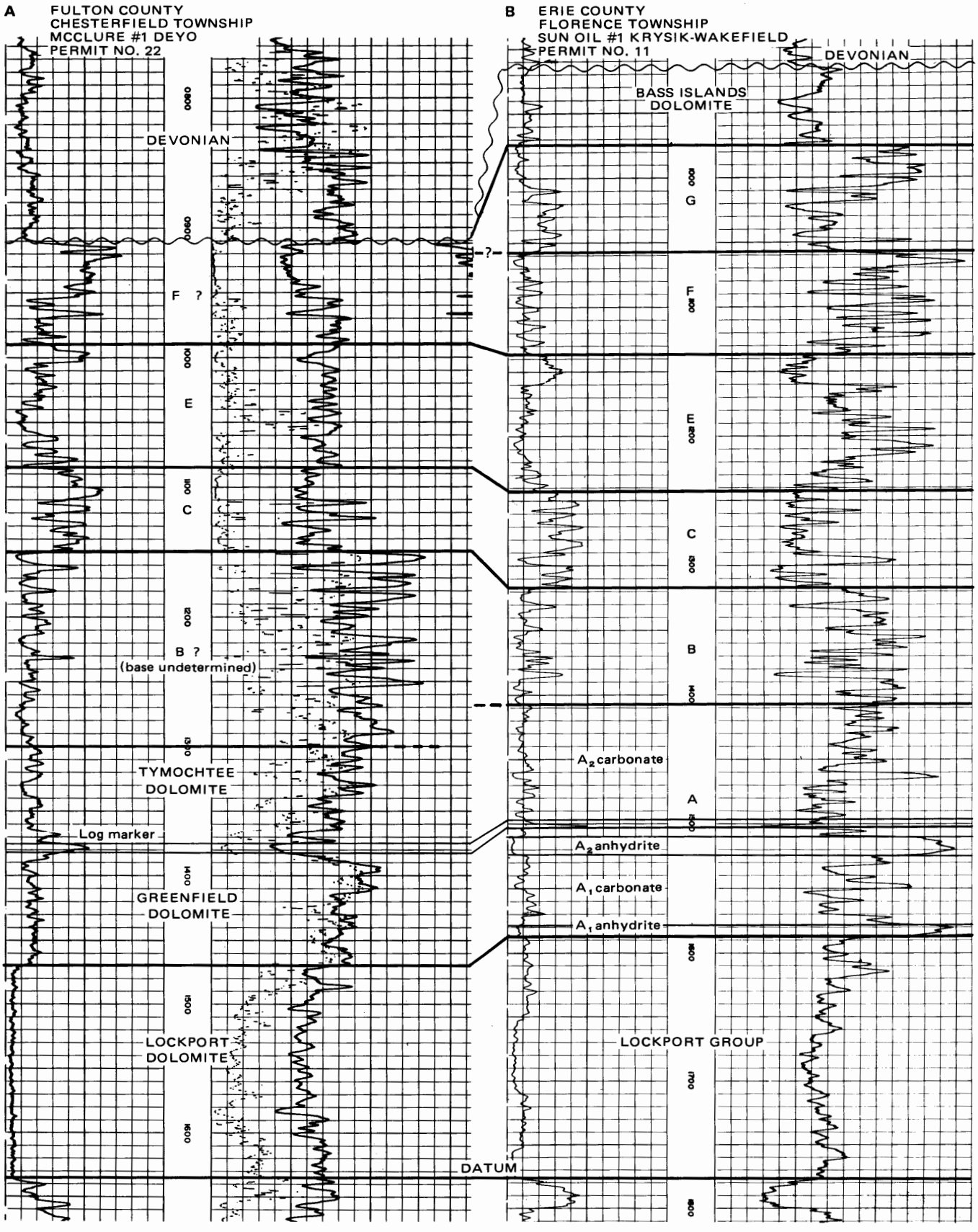


FIGURE 18.–Correlation of representative nuclear logs of Silurian rocks in Fulton and Erie Counties; datum is base of the Lockport Group (Lockport Dolomite).

A_1 anhydrite, A_1 carbonate, A_2 anhydrite, and the A_2 carbonate (fig. 17) and has an average aggregate thickness of 170 feet. The range in thickness of the A_1 anhydrite is 9 to 36 feet, and that of the A_2 anhydrite is 5 to 35 feet. Both anhydrites are dolomitic in part. The A_1 and A_2 carbonates consist of microcrystalline slightly anhydritic predominantly medium- and dark-brown dolomite. Locally in Erie County the A_1 carbonate includes up to 15 feet of lithographic dark-brown limestone. Thickness of the A_1 carbonate ranges from 25 to 63 feet and averages 45 feet. The A_2 carbonate ranges in thickness from 75 to 110 feet and averages 85 feet. The contact with the overlying B unit is drawn at the base of a bedded anhydrite that shows a characteristic double peak on the gamma ray curve (fig. 17).

B unit.—The B unit consists of dolomitic anhydrite interbedded with minor amounts of anhydritic microcrystalline dark-brown dolomite and dark-gray dolomitic shale. Thickness of the unit ranges from 65? to 117 feet and averages 85 feet. The contact with the overlying C unit is placed at the top of the highest anhydrite in a predominantly anhydrite section, above which lies a section consisting predominantly of greenish-gray dolomitic shale or argillaceous dolomite (fig. 17).

C unit.—Anhydritic silty argillaceous greenish-gray dolomite that grades into shale characterizes the C unit. Bedded anhydrite with a thickness of about 10 feet occurs in the middle of the unit, which ranges in thickness from 50? to 110 feet and averages 80 feet. A persistent feature of the C unit here and throughout Ohio is the presence of scattered very fine- to medium-grained rounded frosted quartz sand. A similar observation was made in southwestern Ontario by Sanford (1969, p. 18), who attributed an eolian origin to the sand and for that reason considered the C unit a reliable time-stratigraphic marker.

The base of the C unit as drawn in this report differs from that of Ulteig (1964, p. 25) and of Ells (1967, fig. 5), who drew the base at the top of the bedded anhydrite in the middle of the unit as defined here. As drawn in this report, the base of the unit coincides with the base of the shale or argillaceous dolomite section and is the same base used in Ontario (Beards, 1967, enclosure 8), New York and Pennsylvania (Rickard, 1969, p. 9), and eastern Ohio (Clifford, 1973, p. 6, 8).

D unit.—The D unit, not recognized in the report area, is essentially a salt-bearing unit in northeastern Ohio.

E unit.—The E unit consists of partly anhydritic and argillaceous microcrystalline brown dolomite and thin anhydrite beds (fig. 17). The top 10 to 20 feet of the unit is generally very argillaceous, in contrast to the underlying and overlying rocks, and is therefore a marker both in samples and on nuclear logs. Thickness of the unit ranges from 69 to 113 feet and averages 90 feet. The contact with the overlying F unit is drawn at the top of the persistent 10 to 20 feet of very argillaceous dolomite, which is overlain by anhydritic dolomite or interbedded dolomite and anhydrite.

F unit.—The F unit consists of anhydrite, anhydritic microcrystalline brown dolomite, and dolomitic dark-gray shale that grades into argillaceous dolomite (fig. 17). Anhydrite in the unit has in part been altered to gypsum; the degree of alteration generally increases toward the west, but the net amount of gypsum tends to decrease because of increased leaching in the same direction. In the westernmost townships of Huron and Richland Counties the F unit directly underlies the Devonian, the G unit and Bass Islands Dolomite having been truncated by pre-Middle Devonian erosion; in this area the thinning of the unit is therefore erosional. The occurrence of gypsum in the F and G units is discussed in some detail in the section on gypsum occurrences. Thickness of the F unit under cover of the G unit ranges from 66 to 93 feet and averages 80 feet.

G unit.—The G unit is divisible into a lower argillaceous dolomite or dolomitic shale section and an upper anhydrite section (fig. 17). The lower section consists of argillaceous and partly anhydritic microcrystalline medium- to dark-gray to greenish-gray dolomite that grades into shale and has a thickness of about 40 feet. The upper portion, where not altered by postdepositional changes, consists of 20 to 40 feet of partly dolomitic anhydrite. The anhydrite is replaced westward by gypsum, but leaching and truncation decrease the net amount of gypsum in the same direction. The G unit is truncated westward by pre-Middle Devonian erosion in the western half of the area and is absent in the westernmost townships of Huron and Richland Counties.

Thickness of the G unit under cover of the Bass Islands Dolomite averages 75 feet. The contact of the G unit and Salina Group with the Bass Islands is drawn at the top of the anhydrite section. The anhydrite is overlain by nonanhydritic dolomite of the Bass Islands, and the contact is therefore a good marker in samples and on nuclear logs (fig. 17).

Salina Group in western part of the report area

In the area west of Ottawa, Sandusky, Seneca, Crawford, and eastern Wyandot Counties, but excluding the western parts of Williams, Defiance, Paulding, Van Wert, and Lucas Counties, the Salina Group consists, in ascending order, of the Greenfield Dolomite, Tymochtee Dolomite, and undifferentiated dolomite. The stratigraphic upper boundary of the group is absent west of the Findlay Arch owing to post-Silurian erosion.

Greenfield Dolomite.—The Greenfield Dolomite (Greenfield stone of Orton, 1871b, p. 291) consists of microcrystalline dolomite that darkens from very light yellowish brown at the base to light and medium brown at the top. Carbonaceous partings are common. In several quarries the Greenfield is stromatolitic, but these structures are generally not recognizable in well samples. The thickness of the formation under cover of the Tymochtee Dolomite ranges from 30 feet (well 150, Liberty Township, Hancock County) to 97 feet (well 153, Blanchard Township, Hancock County). Rapid lateral changes in thickness such as that in Hancock County are not uncommon and are accompanied by complementary changes in thickness of the underlying Lockport rocks. In the absence of a regional unconformity between Lockport and Greenfield rocks, these relationships point to the existence of facies changes across the boundary. Additional comments on this facies relationship are presented in the discussion of the three problematical areas (see also Shaver, 1974, p. 89-95).

The contact of the Greenfield with the overlying Tymochtee Dolomite is generally distinct in samples and is placed at the top of microcrystalline light- to medium-brown dolomite overlain by microcrystalline grayish-brown dolomite containing shaly black partings in many places. The available evidence suggests strongly that this contact corresponds to the contact between the A_2 anhydrite and A_2 carbonate in the eastern part of the report area. Earlier in this report (p. 23) the observation was made that the supra-Rochester Silurian rocks on the east and west sides of the Findlay Arch have similar thicknesses except for the effects of post-Silurian erosion, and that shale marker beds

(C and E units of the Salina Group) can be accurately correlated across the arch. Figure 18 shows a log marker immediately above the A_2 anhydrite in Erie County. This marker is not recognizable in cuttings, but in a nearby core (NASA well, Perkins Township) the marker consists of approximately 4 inches of dark-gray to black shale. The shale is a log marker on the east side of the Findlay Arch, though in places it becomes relatively obscure because of thinning. The log marker shown on figure 18 on the west side of the arch similarly is not recognizable in the samples, and cores are not available in this area. In view of both the persistence across the arch of other and thicker shale beds in the Salina Group and the similar stratigraphic position of the thin log marker, it appears to the writer that this marker should be considered correlative across the arch. If this correlation be accepted, then it follows, in the absence of any evidence of unconformity, that the beds underlying the marker, the top of the Greenfield west of the arch and the A_2 anhydrite east of the arch, are also correlative. West of the Findlay Arch the position of the log marker represents the lowest stratigraphic position of anhydritic dolomite.

Tymochtee Dolomite.—The Tymochtee Dolomite (Tymochtee slate of Winchell, 1873, p. 632-634) consists of microcrystalline light- to dark-grayish-brown dolomite that is argillaceous and silty and contains shaly black partings in many places. Locally in western Hancock County the formation is medium to dark gray and argillaceous to very argillaceous and grades generally into dolomitic shale. Thin beds of microcrystalline medium-brown dolomite are common in the formation and, analogous to outcrop sections (Kahle and Floyd, 1971, p. 2078), probably are stromatolitic. The formation contains traces of anhydrite which diminish southward; layered gypsum nodules are exposed near the base of the Tymochtee in a quarry in sec. 26, Henry Township, Wood County.

About 90 feet of lithographic partly argillaceous medium-brown to gray limestone overlies the Greenfield Dolomite and is the bedrock in two wells in sec. 11, Shawnee Township, Allen County. By reason of its stratigraphic position, this limestone is assigned to the Tymochtee Dolomite, though its lithology is not representative of the formation.

Thickness of the Tymochtee under cover of undifferentiated Salina dolomite ranges from 0 in the western and southeastern parts of the area under discussion to 122 feet in Blanchard Township, Hancock County. Thinning toward the west and southeast margins of the area is depositional and is accompanied by complementary increases in thickness of underlying and overlying rocks. Lenses of Tymochtee lithology may still occur where the Tymochtee as a formation is absent because of this facies relationship, but aggregate thickness of the lenses has not been mapped because the proper stratigraphic boundaries of the unit are not recognizable. Because of these facies changes the Tymochtee cannot be mapped as a formation beyond about 12 miles east of its type section in Crawford Township, Wyandot County.

The upper contact of the Tymochtee Formation is generally transitional and is drawn at the top of the microcrystalline grayish-brown dolomite that is overlain by microcrystalline brown dolomite.

Undifferentiated Salina dolomite.—Undifferentiated Salina dolomite overlies the Tymochtee Dolomite and underlies Devonian sandy dolomite and sandstone. Recognized in the undifferentiated Salina are two marker beds, the C and E units, also found on the east side of the Findlay Arch; in addition, there is evidence that an anhydritic dolomite underlying the C unit locally in Lucas and Fulton Counties correlates with the B unit of the east side of the arch.

Undifferentiated Salina rocks consist of microcrystalline predominantly light- to dark-brown and yellowish-brown dolomite with minor amounts of light- and medium-gray dolomite. The dolomite is in part argillaceous, laminated, and pelletal, and locally in Lucas, Henry, Fulton, and Williams Counties is anhydritic. Solution of pellets and anhydrite has created pinpoint porosity that in some wells has been reduced by the precipitation of secondary gypsum.

A lithologic and log marker, the base of the C unit, lies 116 to 207 feet above the top of the Tymochtee. Immediately underlying the C unit is a section of microcrystalline light- to medium-brown dolomite that in the area shown in figure 19 is anhydritic to very anhydritic and grades into anhydrite, which is probably bedded. The anhydrite, which contains impurities, is about 40 feet thick in Amboy Township, Fulton County, and thins in all directions except probably to the north. This anhydrite section grades downward into the Tymochtee.

The stratigraphic position of this anhydrite unit immediately below the C unit on the west side of the Findlay Arch and the fact that on the east side of the arch the beds (B unit) immediately below the C unit are anhydritic show that the beds west of the arch should be considered correlative with the B unit. The stratigraphic base of the B unit west of the Findlay Arch cannot be determined because the anhydrite marker bed used to draw the contact east of the arch does not occur in this area.

The C unit west of the arch is lithologically similar to the C unit east of the arch and consists of light- and

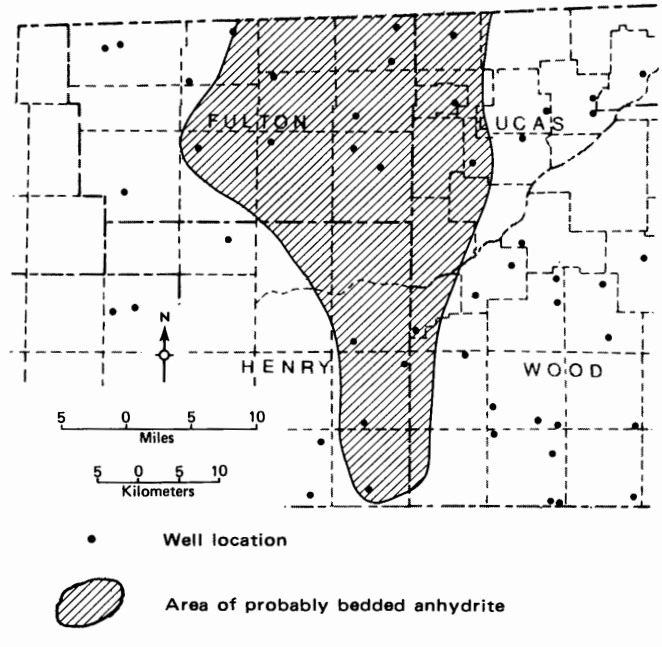


FIGURE 19.—Areal extent of probably bedded anhydrite in the Salina B unit west of the Findlay Arch. See figure 3 and Appendix A for well identification; figure 3 for township identification.

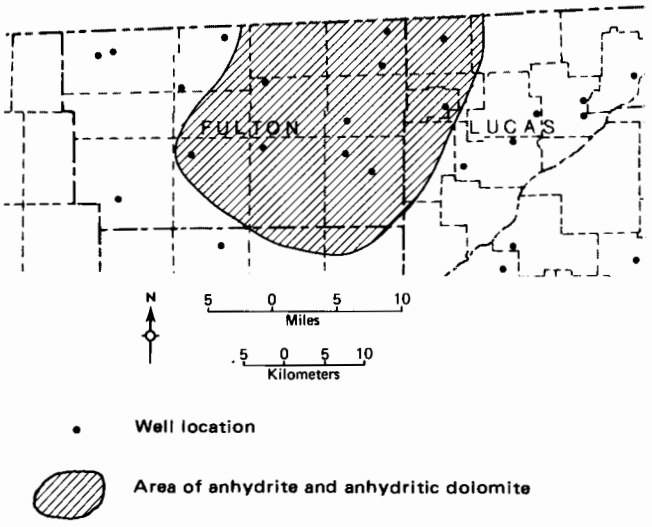


FIGURE 20.–Areal extent of anhydrite and anhydritic dolomite in the Salina C unit west of the Findlay Arch. See figure 3 and Appendix A for well identification; figure 3 for township identification.

medium-gray, green, and greenish-gray argillaceous and silty dolomite that grades into shale. In most places the shale contains a few frosted sand grains. The dolomite and shale are locally interbedded with anhydrite and anhydritic dolomite. The area in which anhydrite is found in the C unit is shown in figure 20. Thickness of the C unit under cover of younger Silurian rocks decreases depositionally from 92 feet in Gorham Township, Fulton County, to 0 in western Williams, Defiance, and Paulding Counties. Sparse control indicates that the unit also thins depositionally to 20 feet or less in northern Putnam County, and that with a thickness of between 50 and 90 feet it is truncated by post-Devonian erosion in western Hancock, Wood, and Lucas Counties.

Overlying the C unit with a gradational contact is microcrystalline very light- to medium-brown and gray dolomite that is virtually anhydrite-free. The dolomite is in part argillaceous to very argillaceous and locally grades into shale, especially near the top of the unit. Locally the dolomite is chert bearing and pelletal. An argillaceous zone with a thickness of 10 to 30 feet lying 60 to 110 feet above the C unit in Fulton and adjacent Williams, Henry, and Lucas Counties correlates with the E marker bed found on the east side of the Findlay Arch. Thickness of the supra-C unit Silurian under cover of the Devonian decreases from 250 feet in Richfield Township, Lucas County, to 84 feet in Richfield Township, Henry County, and to 23 feet in Farmer Township, Defiance County. The contact with the Devonian is a regional unconformity and is at the top of nonsandy dolomite or shale that is overlain by sandstone or sandy dolomite. The period of erosion that led to the southward truncation of the undifferentiated Salina prior to Devonian time also led to the westward truncation, first described by Ulteig (1964), of the Silurian in the eastern part of the report area. Figure 21 shows the pre-Devonian geology of northwestern Ohio, restored in the area where Upper Silurian and Devonian rocks have been removed by probably post-Paleozoic erosion. Similar maps for southern Michigan have been prepared by Ells (1958, fig. 6; 1962, fig. 2).

BASS ISLANDS DOLOMITE

Bass Islands Dolomite in the subsurface

The Bass Islands Group in the subsurface of northeastern Ohio was defined by Ulteig (1964, p. 31-34) as the rocks overlying the stratigraphically highest anhydrite in the Salina Group and underlying generally sandy and cherty Devonian limestone or dolomite. Ulteig (1964, p. 32), quoting Alling and Briggs (1961, p. 525) on the difficulties of subdividing the Bass Islands rocks, treated these rocks as an undifferentiated group because he was not able to recognize the Put-in-Bay and Raisin River Dolomites, the two formations that in some surface classifications comprise the group. Janssens (1968, p. 8) examined these rocks in the subsurface of eastern Erie County and, because he could not differentiate the rocks, changed the name Bass Islands Group to Raisin River Dolomite. This name change was influenced by Summerson's (1963, p. 53, 54) observation that

> failure to recognize [the Put-in-Bay Dolomite] elsewhere [beyond the type section and the Holland quarry in Lucas County] strongly suggests that it is a local facies and very likely should be considered a member of the Raisin River dolomite.

Another factor influencing the change in name was that usage of the name Bass Islands in two senses, one for supra-G unit Silurian and the other for the entire Upper Silurian, might be misleading and was therefore undesirable. In a later but still preliminary report on the Upper Silurian of northwestern Ohio Janssens (1971, p. 34) stated:

> This writer knows of no criteria to apply outcrop nomenclature to the post-Tymochtee section in the reference well in Lucas County or in the more than 40 additional wells in western Ohio for which he has examined the samples. It is obvious from the literature that the Put-in-Bay and Raisin River are not suitable mapping units for regional studies. Given the fact that the lithology of the Tymochtee in its type section in western Ohio is well defined and easily recognizable, there does not seem to be any advantage in expanding the name so as to include all higher strata that cannot be assigned to a formation at this time. Locally these higher strata may include the stratigraphic equivalents of the Put-in-Bay and Raisin River. To this writer the most logical solution to this nomenclatural problem is to trace the Bass Islands strata from the evaporite basin to the outcrop where the name Bass Islands Formation would be applied to all Silurian rocks above the base of the surface equivalent, and to designate a new type section for the strata above the Tymochtee and below the Bass Islands Formation. The advantages of this solution are: (1) for the first time, surface and subsurface stratigraphers would refer to the same stratigraphic unit when discussing the Bass Islands Formation, and (2) the name Tymochtee would be used only for rocks typical of that formation.

This study has shown that the probable base of the Bass Islands rocks as defined by Ulteig (1964) can be recognized with a precision of a few feet on South Bass Island and on the adjacent mainland in Ottawa County. For this reason and because the name Bass Islands is well established and has been used in the subsurface for a well-defined stratigraphic interval, the name Bass Islands Dolomite is reestablished for the supra-G unit Silurian rocks of Ohio.

In the subsurface of Erie, Huron, and Richland Counties the Bass Islands Dolomite is a microcrystalline light-gray and light- and medium-brown dolomite that locally contains traces of brown chert and inclusions of small anhydrite crystals. Leaching of these crystals has resulted in pinpoint porosity. Trace amounts of dark-gray or black shale are

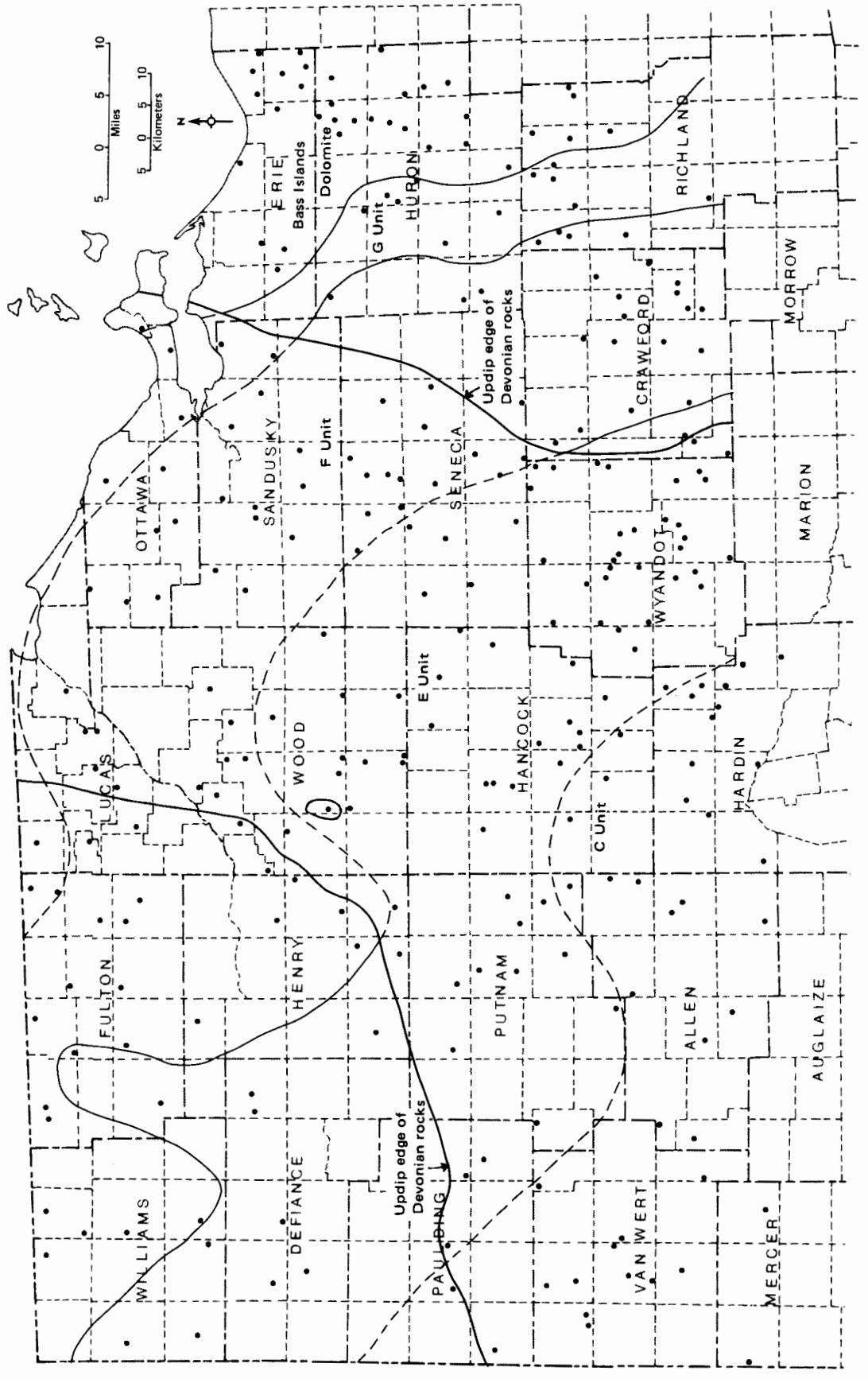


FIGURE 21.–Pre-Devonian geology of northwestern Ohio. See figure 3 and Appendix A for well identification; figure 3 for township identification.

found with the dolomite.

Thickness of the Bass Islands Dolomite averages 55 feet in the two easternmost tiers of townships in the area. A regional unconformity overlies the formation and truncates it westward across the area. Because of erosion the Bass Islands is entirely absent in the western halves of Huron and Richland Counties.

Bass Islands Dolomite in outcrop

From the discussion (p. 5) of the nomenclatural history of the Put-in-Bay and Raisin River formations, it is evident that Lane and others (1907) did not define these units precisely. Their chief omissions were properly defined stratigraphic boundaries of the units and proof for their a priori statement that the Raisin River in its type area in Monroe County, Michigan, stratigraphically overlies the Put-in-Bay in its type area on South Bass Island. The first omission was only in part rectified by Carman (1927, p. 490), when in the description of the units he stated that

> in Lucas and Ottawa Counties the very shaly strata assigned to the Tymochtee are directly overlaid by the Put-in-Bay member.

Subsequently, however, Carman (quoted in Stout, 1941, p. 422) remarked that the base of the Put-in-Bay is placed "arbitrarily" because the unit "grades downward into the Tymochtee shelly dolomite." It was Mohr (1931), working under Carman, who for the first time detailed the nature of the contacts of the Put-in-Bay and Raisin River units on the Bass Islands (in the geographical sense). Doubt is cast (p. 6 of this report) on her lower Put-in-Bay boundary in view of the just-quoted statement by Carman. The assertion by Lane and others (1907) that the Raisin River overlies the Put-in-Bay was accepted by both Carman (1927) and Mohr (1931). The Bass Islands was redefined by Landes (1945) in terms of basin stratigraphy. His statement that

> It is probable that at least the upper part of the H [Bass Islands] beds correlates with the Raisin River rocks, which crop out in Monroe County [Michigan]

shows an emphasis on basin stratigraphy rather than on the importance of the Raisin River as a formal stratigraphic unit whose boundaries should be traced from the outcrop into the basin. Ulteig (1964, fig. 13) shows the line of truncation of the Bass Islands below the Devonian and the area in which the Bass Islands crops out in Erie and Ottawa Counties. He does not discuss the lower contact of the unit in outcrop, but does assign the unit a thickness of 80 feet in a well, the #3 Wiechel, drilled in the outcrop area, in sec. 26, Catawba Island Township, Ottawa County. Cuttings of this well are not available for the intervals 0 to 37 feet, 40 to 45 feet, and 53 to 94 feet. From the available evidence, including control not available to or examined by Ulteig, the writer concludes that the base of the Bass Islands Dolomite in the well lies at a depth of approximately 25 feet or at an elevation of approximately 570 feet. The #3 Wiechel is located 3,000 feet south of bedrock exposures in the Lake Erie cliffs on the north side of Catawba Island Township (fig. 22). The base of these exposures is the level of Lake Erie, or approximately 571 feet above sea level. A maximum of 15 to 20 feet of section is exposed, of which 10 to 15 feet consists of brecciated microcrystalline dolomite. This breccia is also exposed along the west shore of South Bass

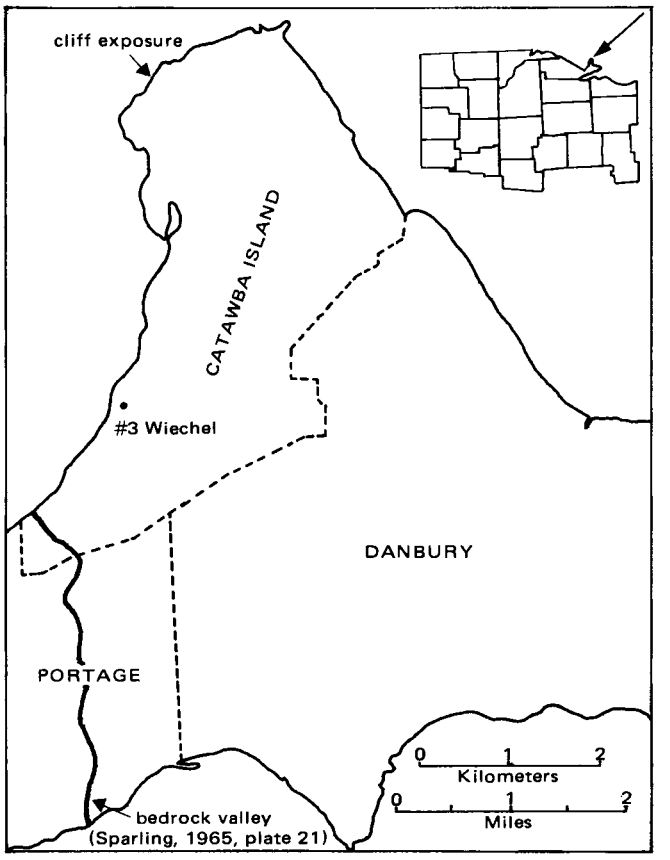


FIGURE 22.—Postulated pre-Devonian outcrop of Salina G anhydrite in eastern Portage Township and western Catawba Island Township, Ottawa County.

Island, where the sharp and laterally persistent contact with the underlying dolomite is well displayed. Locally along the north shore of Catawba Island Township the base of the brecciated dolomite dips below lake level.

The persistence of the sharp lower contact of the breccia, together with the evidence from the subsurface to the southeast that suggests that the stratigraphic base of the Bass Islands should be exposed near lake level in eastern Ottawa County, leads the writer to postulate that the contact of the brecciated dolomite with the underlying dolomite marks the former position of the G anhydrite. Pre-Middle Devonian tilting subjected the anhydrite to ground-water action that resulted in solution of the evaporite, which possibly was first hydrated to gypsum. Supporting this postulate is the existence of a 40-foot-deep bedrock valley one-half mile to one mile updip from the #3 Wiechel and the cliff exposures (fig. 22). The valley, mapped by Sparling (1965, pl. 21), is located at about the position where the available evidence suggests the G anhydrite was bedrock after having been tilted.

Ulteig's (1964) work clearly shows that the Bass Islands Dolomite is absent in outcrop south of Ottawa County. The appropriate name for supra-Tymochtee Silurian exposures in central and northwestern Ohio is undifferentiated Salina Group. It is true that Carman (1927, p. 491, 493) has described Put-in-Bay and Raisin River dolomites from the now-abandoned Holland quarry in Monclova Township, Lucas County, but nearby well control indicates that these

then-exposed rocks lie a maximum of 250 feet above the top of the Tymochtee, or several hundred feet below the base of the Bass Islands Dolomite as defined by Ulteig (1964) and as used in this report.

It is evident from figure 21 that the truncated Salina rocks thicken considerably to the north in Lucas County. In view of this thickening it is possible, though not proven, that in its type area in Monroe County, Michigan, the Raisin River fits stratigraphically in the Bass Islands interval.

AREAS IN WHICH LOCKPORT-SALINA CONTACT IS ANOMALOUS

Mention has been made previously in several places in this report of three areas in northwestern Ohio in which the Lockport-Salina contact appears anomalous. The three areas are (1) parts of Ottawa, Sandusky, Seneca, and Crawford Counties, (2) Lucas County, and (3) the western halves of the counties adjacent to the Indiana line. There is no question that these anomalies exist; evidence of their existence has been noted in the past by several investigators whose studies were either too restricted or too general in scope to permit recognition of the regional significance of the anomalies. In addition, much of the sample control necessary for a relatively detailed study of the anomalies has become available only in the past decade. Bownocker (1920) shows Lockport bedrock extending northward into southwestern Van Wert County and a northwestward-trending upper boundary that is at an angle with the regional northward-dipping Trenton structure. As shown on Bownocker's map the Lockport can only be interpreted as thickening into Van Wert County. More recently, Norris and Fidler (1971, fig. 2) show Lockport bedrock extending northward through western Van Wert County into Paulding County. Without evidence that the structural configuration in this area is anomalously shallow, this bedrock map can only be interpreted to show significant thickening of the Lockport.

A Lockport thickness in excess of 400 feet in Ottawa County is shown by Sparling (1965, fig. 15), but this thick Lockport section is not related to an anomalous Lockport-Salina contact (Sparling, 1965, p. 76-77; 1970, p. 15; 1971, p. 24), which he (1965, p. 76; 1970, p. 15; 1971, p. 20) considered locally disconformable in Ottawa County and other areas of the Findlay Arch region.

A stromatolite mound in the Greenfield Dolomite exposed in the Maumee quarry in sec. 35, Monclova Township, Lucas County (Summerson, 1963, p. 44), is important in this regard because, according to Alling and Briggs (1961, p. 539),

> The contemporaneity of reef growth and salt deposition is illustrated by the occurrence of a large algal reef at the southeast edge of the Michigan basin at Maumee, Ohio. The bioherm is exposed for approximately 100 feet in thickness and several hundred yards in diameter in the basal Salina beds (Greenfield dolomite) overlying Guelph dolomite. The algal reef grew at the basin margin apparently at the same time that salt and anhydrite were being deposited in the A-unit overlying Guelph dolomite farther out in the Michigan basin.

The mound was subsequently examined in petrographic detail by Textoris and Carozzi (1966), who concluded (p. 1387) that it was deposited in a "shallow subtidal to high intertidal or supratidal" environment that transgressed in a southeasterly direction toward the "axis of the Findlay arch and probably low exposed carbonate land."

The quarry was subsequently deepened to expose 40 feet of Guelph and 115 feet of Greenfield (Kahle and Floyd, 1972, p. 70-83). According to Kahle and Floyd (p. 75),

> The Guelph dolomite exposed in the Maumee quarry is of unusual interest among exposures of this unit in northwestern Ohio because it was subaerially exposed, probably repeatedly.

The evidence obtained in this study regarding the anomalous Lockport-Salina boundary is presented below. Generally, each of the areas in which the Lockport thickens includes a chert-bearing section (except in Lucas County) that is not present elsewhere in the report area, that is similar to reef-detrital dolomite assigned to the Louisville Formation of eastern Indiana, that is overlain by brown dolomite that is considerably coarser in grain size than is the Greenfield Dolomite or the A unit, and that may be found to be reef-detrital in origin. The evidence indicates that most if not all of the Lockport thickening takes place through a change of facies of Salina rocks so that the upper boundary is a facies boundary.

Our understanding of the significance of the facies changes is hampered by the absence in these rocks of recognizable time planes and marker beds that can be considered as datum planes and by the removal by post-Silurian truncation of a thick section (probably 400 to 500 feet) in which the entire stratigraphic span of the facies changes was recorded.

Ottawa, Sandusky, Seneca, and Crawford Counties

The Lockport and Salina rocks described from Erie, Huron, and Richland Counties undergo several lithologic changes as they are traced westward into Ottawa, Sandusky, Seneca, and Crawford Counties. The first of these changes, in ascending stratigraphic order, is that the Goat Island disappears by facies change in much of the area. Above the stratigraphic position of the Goat Island, the coarsely crystalline white and gray ("representative") Lockport or Guelph dolomite thickens and in its upper half is split in many places by fine- and medium-grained chert-bearing medium-brown dolomite. That the chert-bearing dolomite is stratigraphically higher than the Goat Island is shown by the fact that in a few wells in Crawford County (*e.g.*, well 12 in Liberty Township, and well 15 in Whetstone Township) the Goat Island is found below the upper chert-bearing dolomite. This dolomite reaches a maximum thickness of 158 feet in Hopewell Township, Seneca County (fig. 23), and thins rapidly to extinction toward the west, south, and east. This chert-bearing dolomite occurs in a separate area in central Crawford County, where it has a maximum known thickness of 73 feet in well 12 in Liberty Township. Eastward the dolomite without the chert is found in the upper part of the Lockport in western Richland County.

The A_1 and A_2 anhydrites disappear by facies change in the western parts of Erie, Huron, and Richland Counties. This disappearance is accompanied westward by a coarsening of the grain size of the enclosing dolomite and by the local occurrence of "representative" Lockport dolomite in the stratigraphic position of the A unit. For example, in well 285 in Sharon Township, Richland County, about 15 feet of "representative" Lockport dolomite is found about 100 feet below the base of the B unit. Cross sections A-A', B-B', and C-C' of figure 24 illustrate the several changes that have been described.

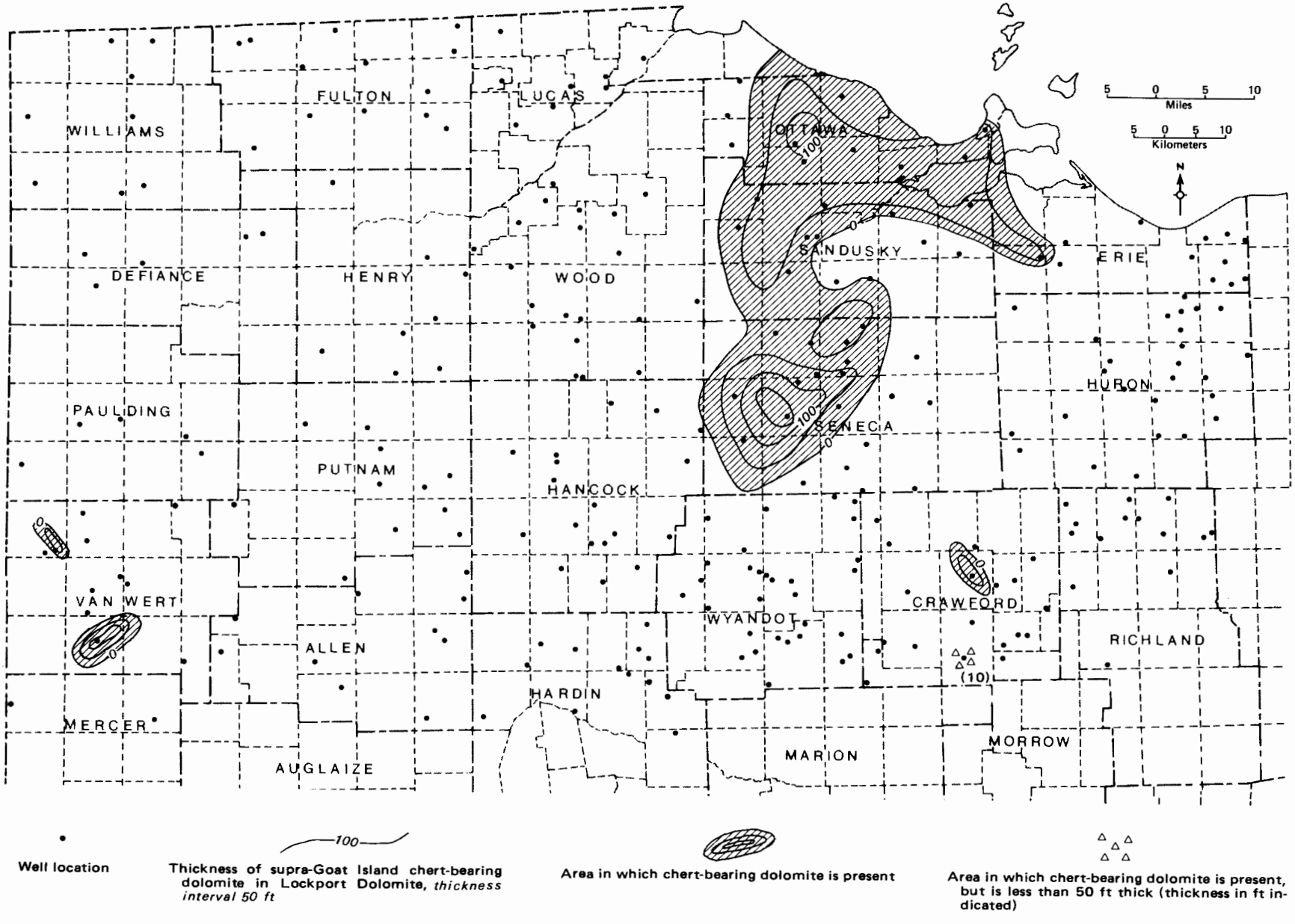
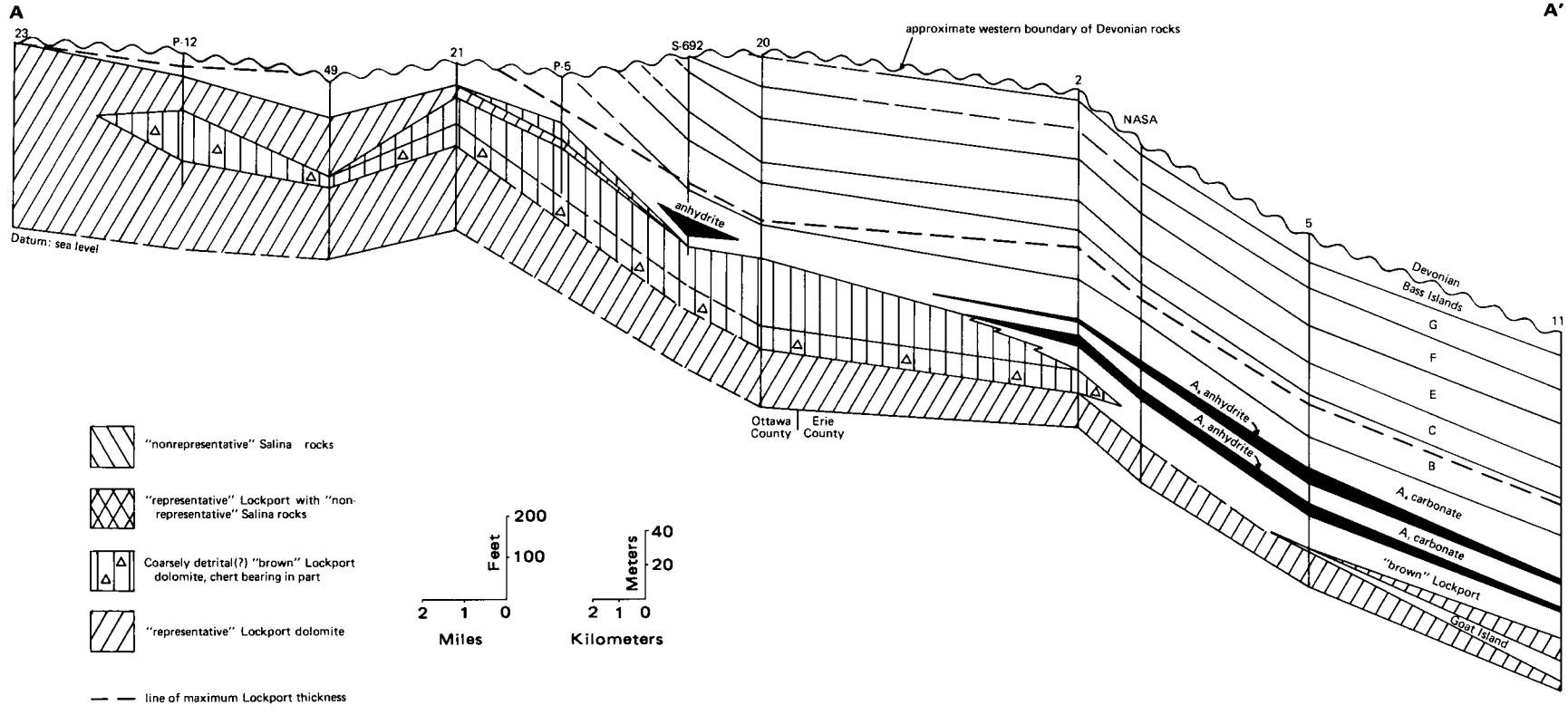
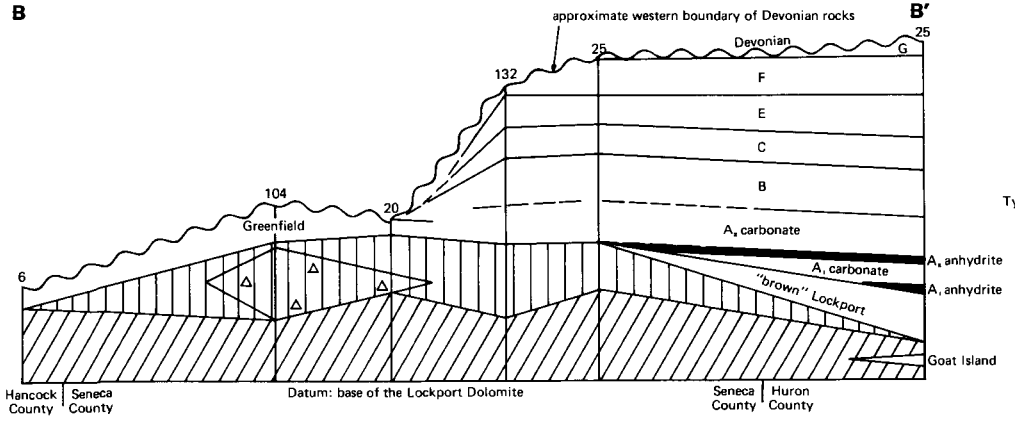
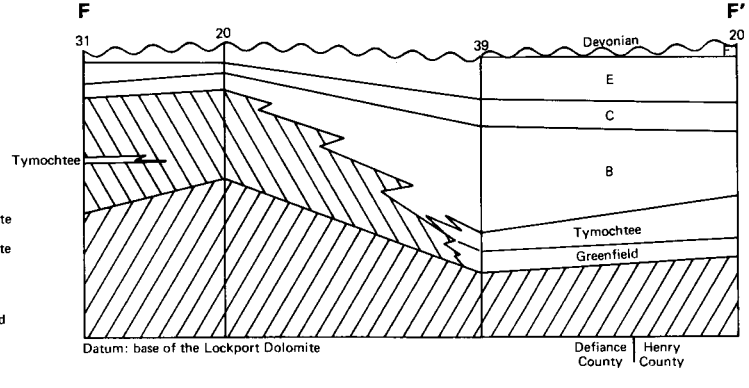


FIGURE 23.—Thickness of supra-Goat Island chert-bearing dolomite in the Lockport Dolomite. See figure 3 and Appendix A for well identification; figure 3 for township identification.


A
A'
23
P-12
49
21
P-5
S-692
20
approximate western boundary of Devonian rocks
2
NASA
5
11
Datum: sea level
anhydrite
Devonian
Bass Islands
G
F
E
C
B
A, anhydrite
A, anhydrite
A, carbonate
A, carbonate
"brown" Lockport
Goat Island
Ottawa County
Erie County
"nonrepresentative" Salina rocks
"representative" Lockport with "non-representative" Salina rocks
Coarsely detrital(?) "brown" Lockport dolomite, chert bearing in part
"representative" Lockport dolomite
line of maximum Lockport thickness
Feet
200
100
2 1 0
Miles
Meters
40
20
2 1 0
Kilometers


B
B'
approximate western boundary of Devonian rocks
25
Devonian
25
G
132
F
E
C
B
104
Greenfield
20
A, carbonate
A, anhydrite
A, carbonate
A, anhydrite
"brown" Lockport
6
Goat Island
Hancock County
Seneca County
Datum: base of the Lockport Dolomite
Seneca County
Huron County


F
F'
31
20
39
Devonian
20
E
C
B
Tymochtee
Tymochtee
Greenfield
Datum: base of the Lockport Dolomite
Defiance County
Henry County

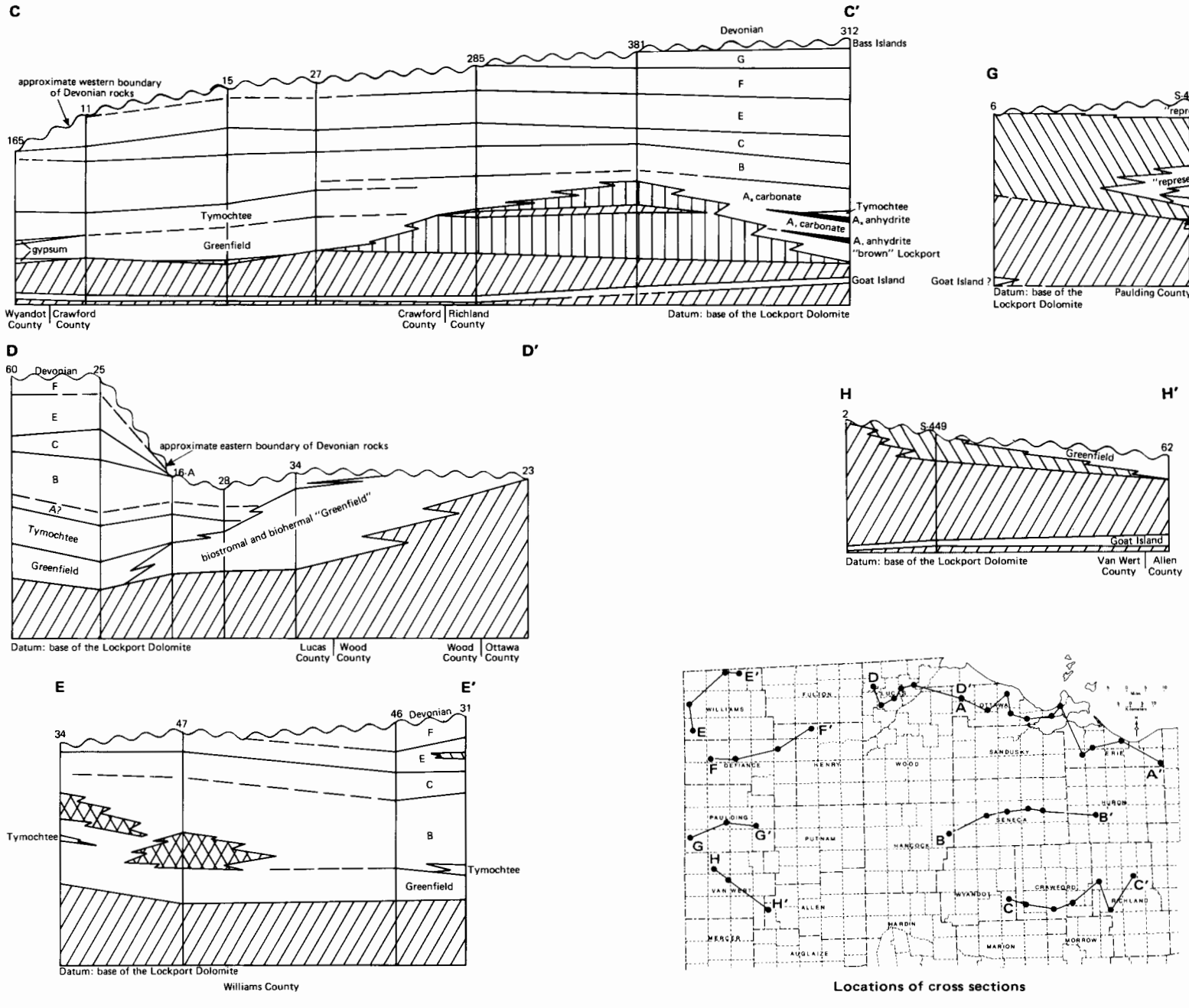


FIGURE 24.–Cross sections of Lockport and Salina rocks. See figure 3 for detailed locations of sections; Appendix A for well descriptions.

Cross section A-A' extends from western Ottawa County to southeastern Erie County and is drawn as a structural section because several wells used in it do not reach the Rochester Formation. From the easternmost Erie County well, with the exception of the disappearance of the Goat Island, the strata maintain their normal regional lithology and thickness as far west as the NASA well in Erie County. In Erie County well 2 a chert-bearing probably detrital fine-grained light-brown dolomite is wedged between "representative" Lockport below and microcrystalline "brown" Lockport above. In Ottawa County well 20 "representative" Lockport is overlain by the chert-bearing dolomite, which in turn is overlain by chertless probably detrital fine- and medium-grained medium-brown dolomite that displaces both the A_1 and A_2 anhydrites and extends up into the stratigraphic position of the A_2 carbonate. A 500-foot core from Ottawa County well S-692, drilled in sec. 9, Portage Township, in the immediate vicinity of the only active gypsum quarry in the state, in sec. 10, Portage Township, penetrates a normal Salina section as far as the upper part of the A unit. Seventy feet below the top of the A unit lies a 40-foot section consisting predominantly of anhydrite. Thirty feet of A unit was penetrated below the anhydrite. The basal 20 feet of core consists of probably detrital fine- and medium-grained medium- and dark-gray dolomite that on cross section A-A' has been included in the detrital(?) "brown" Lockport dolomite. The next well to the west, Ottawa County well P-5, does not reach the Rochester Formation, but bottoms in detrital(?) "brown" Lockport that is split in its upper part by 28 feet of "representative" Lockport. In Ottawa County well 21 and the next two wells to the west, "representative" Lockport underlies the Salina and is split by detrital(?) "brown" Lockport that is chertless in its upper part in Ottawa County well 21. In the westernmost well, Ottawa County well 23, "representative" Lockport is bedrock and is 455 feet thick.

To show the relationship between Lockport thickening and the Salina units, cross section A-A' includes a line representing the 455-foot maximum Lockport thickness shown on the cross section. In this context, Ottawa County well 20 is especially important, because it shows a facies relationship between the westward-thickening Lockport section and the evaporite-bearing Salina rocks. When this facies relationship is considered in light of the 455 feet of maximum Lockport thickness, the writer concludes that the Lockport facies extends stratigraphically into the upper part of the B unit.

In the author's view, cross section A-A' shows also that the basal Salina rocks overlying the Lockport rise stratigraphically to the west, and he considers it therefore erroneous to assign the basal Salina to the Greenfield Dolomite in areas where in fact the basal Salina may lie stratigraphically several hundred feet above the Greenfield. However, with present control and in the absence of marker beds in the Salina west of Ottawa County well S-692, the suggested relationship, though highly probable, cannot be proved. Cross section B-B' is a stratigraphic section drawn on the base of the Lockport Group from eastern Hancock County to western Huron County. "Representative" Lockport thickens westward and in eastern Seneca County (wells 25 and 132) is overlain by detrital(?) "brown" Lockport that stratigraphically displaces the A unit minimally through the A_2 carbonate. In central and western Seneca County (wells 20 and 104) detrital(?) chert-bearing brown dolomite is wedged between "representative" Lockport below and chertless detrital(?) "brown" Lockport above. The latter is overlain by microcrystalline brown dolomite that is the stratigraphic equivalent of the Salina A unit and that is lithologically similar to the Greenfield. For that reason it has been labelled Greenfield on cross section B-B'.

Cross section C-C' is a stratigraphic section drawn on the base of the Lockport Group from western Wyandot County to central Richland County. In the two westernmost wells (381 and 285) in Richland County a 20-foot lens of "representative" Lockport lies 100 to 130 feet above the main body of "representative" Lockport and is separated from it by detrital(?) "brown" Lockport. In Richland County well 381 the lens is overlain by approximately 70 feet of this detrital(?) dolomite. The well is located 6 miles northeast of the Pan American #1 Windbigler, in southwestern Troy Township, Morrow County; the #1 Windbigler penetrates 374 feet of probably biohermal predominantly white and gray Lockport dolomite that extends well up into the stratigraphic position of the A unit. In Richland County well 381, the detrital(?) "brown" Lockport and the lens of "representative" Lockport occupy nearly the entire stratigraphic interval of the A unit.

West of Richland County well 285 the detrital(?) "brown" Lockport decreases in grain size and becomes indistinguishable from the Greenfield Dolomite except that in Crawford County well 15 "representative" Lockport is overlain by 10 feet of chert-bearing detrital(?) brown dolomite.

Lucas County

The anomalous Lockport-Salina relationship in Lucas County is schematically illustrated in cross section D-D', figure 24, a stratigraphic section drawn on the base of the Lockport Dolomite from western Lucas County to western Ottawa County. Lockport and Salina sections with normal regional thicknesses and lithologies are penetrated by Lucas County well 60 and Lucas County well 25. In Lucas County well 16-A, the normal Greenfield lithology of microcrystalline medium-brown dolomite has been replaced by partly finely crystalline sparry porous light-yellowish-brown to medium-brown dolomite that is probably stromatolitic in large part. East of Lucas County well 16-A this facies thickens at the expense of the overlying sub-C Salina units and becomes in part medium crystalline, fossiliferous (crinoidal, coralline), quite sparry and porous, and very light gray. This is the Greenfield lithology described from the nearby Maumee quarry (fig. 25) by Summerson (1963, p. 44), Textoris and Carozzi (1966), and Kahle and Floyd (1972, p. 70-81).

The maximum known thickness, 230 feet, of this fossiliferous facies is penetrated in Lucas County well 34, where it has replaced the Tymochtee Dolomite and probably extends up into the stratigraphic position of the B unit.

The probable areal extent of the fossiliferous facies is shown in figure 25. The facies disappears in west-central Lucas County and is absent in the Lime City quarry in Wood County (fig. 25), described by Kahle and Floyd (1972, p. 50-52). In view of the fact that there is little structural relief in eastern Lucas County and adjacent Ottawa and Wood Counties, it appears that between central Lucas County and northwestern Ottawa County the fossiliferous facies is replaced eastward by "representative" Lockport.

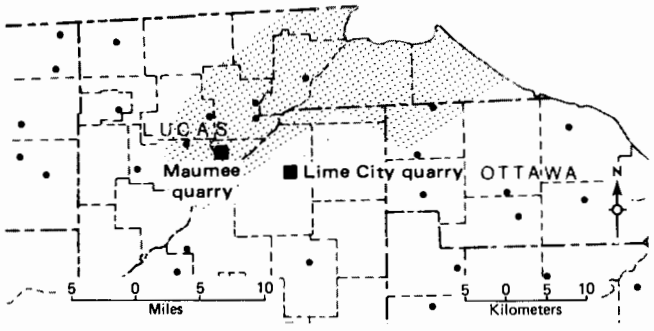


FIGURE 25.–Areal extent of biostromal and biohermal "Greenfield" dolomite in Lucas, Wood, and Ottawa Counties.

Counties adjacent to Ohio-Indiana line

The third area in which the contact between Lockport and Salina rocks is stratigraphically anomalous is located along the Ohio-Indiana line between Williams County on the north and Van Wert County on the south. The areal distribution of the stratigraphic anomaly is approximately parallel to part of a Silurian reef system in eastern Indiana known as the Fort Wayne bank (Pinsak and Shaver, 1964, fig. 4) and is separated from this bank by a distance that ranges from 5 to 15 miles. In general, the Lockport thickens toward the state line in the Ohio border counties, and the Salina, which thins in the same direction, loses its normal lithology and is replaced by sparry fossiliferous granular(?) dolomite. This fossiliferous dolomite is interbedded locally with dolomite that is indistinguishable from "representative" Lockport dolomite. These changes are most pronounced in western Van Wert and Paulding Counties.

Both Lockport and Greenfield have normal regional lithologies and thicknesses in eastern Williams County (cross section E-E', fig. 24), but the Tymochtee, which in adjacent Fulton County has an average thickness of 90 feet, is reduced by facies change to a thickness of 26 feet. Higher in the Salina a 20-foot lens of sparry porous very finely crystalline light-brown dolomite occurs within the E unit in Williams County well 31. Because this lithology contrasts sharply with the normal microcrystalline Salina dolomite mudstone, it is labelled "nonrepresentative" Salina. Both Tymochtee and "nonrepresentative" Salina are absent in Williams County well 46, but thick lenses containing both "representative" Lockport and "nonrepresentative" Salina lithologies are found to the west, and a 10-foot lens of Tymochtee overlies thick porous relatively coarse-grained Greenfield(?) in Williams County well 34, in which the Lockport has thickened to 230 feet.

In central Defiance County (cross section F-F', fig. 24) the Lockport thickens westward from 140 feet in well 39 to 345 feet in well 20. In the same direction most of the Salina is replaced by "nonrepresentative" Salina that includes lenses of "representative" Lockport lithology. "Nonrepresentative" Salina is 192 feet thick in well 20. Farther west the boundary between Lockport and "nonrepresentative" Salina becomes transitional and therefore arbitrary. In Defiance County well 31 a 10-foot lens of Tymochtee lies within the "nonrepresentative" Salina 110 feet above its arbitrary base.

Within Paulding County (cross section G-G', fig. 24), the Greenfield and Tymochtee are replaced westward by "nonrepresentative" Salina that overlies with gradational contact the westward-thickening Lockport. Similarly, from Allen County northwestward into Van Wert County (cross section H-H', fig. 24) the Greenfield is replaced by pelletal crinoidal fine-grained very light-brown dolomite that in turn is replaced to the northwest by "representative" Lockport dolomite. Rocks represented in the Van Wert County cross section dip structurally to the north and in a normal stratigraphic section should include Salina rocks in Van Wert County well S-449 and Van Wert County well 2. The latter well is located approximately 3 miles south of the Union quarry, in sec. 8, Union Township, where normal supra-Tymochtee Salina laminated dolomite mudstone is exposed.

DISCUSSION

In three areas in northwestern Ohio Salina rocks change from microcrystalline dolomite to fine- to coarse-grained detrital(?) dolomite or, in Lucas County, to sparry porous probably stromatolitic biostromal or biohermal dolomite. In each area the Lockport Group or Dolomite thickens to more than 300 feet, and its contact with the overlying Salina rocks is uncertain and therefore somewhat arbitrary. An ancillary change is the disappearance of shale in the Salina C and E units in Williams, Defiance, and Paulding Counties adjacent to the Indiana line and in eastern Crawford and Seneca Counties. The disappearance of the shale marker beds is significant when it is considered that they are found throughout Michigan, eastern and part of northwestern Ohio, southwestern Ontario, western Pennsylvania, and adjacent West Virginia, but that they thin and are absent adjacent to the areas where the Salina lithologies are anomalous.

To this writer, the relationships described above are best interpreted as indicating that the environments in which the "representative" Lockport sediments accumulated persisted with minor variations during part of the time in which "representative" Salina sediments, including evaporites, accumulated in the basin areas north and east of northwestern Ohio. That variations in environmental conditions existed within the three areas is shown by the occurrence of granular (detrital?) brown dolomite within and above "representative" Lockport dolomite and vice versa.

The interpretation offered here–that there is contemporaneity of deposition of "representative" Lockport and evaporite-bearing Salina sediments–though novel for Ohio, has been advanced for the largely reefal rocks of the Fort Wayne bank and the Salina rocks that butt against them in northern Indiana (Pinsak and Shaver, 1964, p. 40-47; Shaver and others, 1971, p. 43, 45). The view expressed by Alling and Briggs (1961, p. 539) concerning contemporaneity of reef growth and evaporite deposition has already been referred to (p. 30 of this report); a similar view has been expressed for the situation locally in southwestern Ontario (Liberty and Bolton, 1956, p. 168).

The determination that Lockport biohermal and biostromal rocks and Salina evaporite-bearing rocks are locally facies of one another can be made definitively only when the depositional time relationships are known through either time-marker beds or index faunas. Time-marker beds have not been recognized in these strata and, although fossils are common in Lockport rocks, to this writer's knowledge no useful index fossils have been reported; fossils are generally

absent in Salina rocks. In the absence of time or time-stratigraphic data, the existence of Lockport-Salina facies changes can be discussed only in terms of lithostratigraphy. The evidence for such facies changes in northwestern Ohio has been presented above. The chief objection raised against this facies concept is the reported existence of a disconformity separating the Lockport and Salina rocks.

A disconformity on top of the Lockport in Ottawa County near Genoa and in Sandusky County was observed by Winchell (1873, p. 599-600; 1874, p. 230), who noted (1873, p. 616-617) that the disconformity was apparently absent near Tiffin in Seneca County. No detailed studies of the Lockport and Salina rocks in northwestern Ohio have been published heretofore, but Summerson and Swann (1970, p. 484) concluded:

> Following the Niagaran submergence, limited uplift is recognizable on the basis of stratigraphic evidence, primarily along the axis of the Cincinnati arch. This uplift was coincidental with a change in environmental conditions from open marine waters to restricted circulation, increasing salinities, and probable increasing aridity. In Ohio, evidence for the emergence is the sharp lithologic change to the Greenfield-type dolomites; the increase of two to four times the amount of insoluble residue, mainly in the form of fine angular silt; and pockets of a light green mud at the contact with the underlying Niagaran dolomites. Probable continuous deposition in the basins limits the identification of the hiatus to the structural highs. Faunal studies underway support the presence of an unconformity in that they suggest that Niagaran rocks at the erosion surface in south-central Ohio are older than those at the contact in northern Ohio.

Figure 16 shows the geographically limited distribution of the evidence of disconformity in the form of green shale or argillaceous dolomite in quarries and well samples in northwestern Ohio; it is clear from the figure that in most quarries and in the vast majority of wells the Lockport-Salina contact is apparently conformable. From the evidence available from several hundred wells in northwestern and central Ohio, the existence of a regional disconformity on top of the Lockport should be considered improbable, though diastems or disconformities locally do exist. Indeed, because reefal sediments are generally deposited at shallow depths, evidence of local disconformity should be expected.

The idea that a regional disconformity exists on top of the Lockport, though poorly documented in Ohio and improbable in view of the available evidence, received renewed emphasis when Gill and Briggs (1970, p. 848) reported that in the Michigan Basin a conglomerate derived from the uppermost part of a "Niagaran" reef had been found adjacent to the reef and 400 feet below its crest under cover of the A, anhydrite. Gill (1972, p. 721) asserts that

> Following their growth to a height of about 400 feet above the surrounding contemporary sea floor in late Niagaran time, the full vertical extent of the Guelph reefs became subaerially exposed due to a drastic drop in sea level, brought about by intensive evaporation in early Cayugan time.

There can be no question but that a significant regional unconformity would be evident if sea level at the end of Niagaran time were lowered by 400 feet.

The chief reason for postulating an unconformity on top of the "Niagaran" reef rocks of the Michigan Basin appears to be that such unconformity would provide a convenient solution to the troublesome stratigraphic relationship between "Niagaran" reefs and Salina evaporite-bearing rocks. Besides providing a neatly ordered layer-cake separation of "Niagaran" and Salina rocks, an unconformity would explain how reefs can be overlain and surrounded by evaporite-bearing rocks, in that the two rock types would represent two successive periods of deposition. Without an unconformity, one would have to explain how in small local areas both reefs and evaporites could accumulate, each requiring special and seemingly mutually exclusive environmental conditions.

This study has not provided the information required to solve the environmental puzzle posed by the "Niagaran" reef rocks and adjacent Salina rocks in the Michigan Basin, but two observations, one of which is based in part on this study, can be made. One is that there are no modern analogs to explain the accumulation of such thick evaporite beds as are found in the Salina of the Michigan and Appalachian Basins. Secondly, the results of this investigation show that in northwestern Ohio "representative" Lockport biostromal or biohermal dolomite is found above and wedged between "representative" Salina dolomite. This relationship has been described also from northern Indiana (Pinsak and Shaver, 1964, fig. 5; Shaver and others, 1971, p. 48). Indeed, the lithologic and stratigraphic changes described from the Lockport and Salina rocks in Williams, Defiance, Paulding, and Van Wert Counties culminate in the reefal Fort Wayne bank. These examples show that reef growth did not stop at the end of "Niagaran" time, but continued well into Cayugan time, and they obviate the need for a disconformity to explain the stratigraphic relationship of Lockport and Salina rocks. For these reasons the writer believes that the green shale or argillaceous dolomite, indicative of a disconformity, found in a few places in northwestern Ohio between the Lockport and Salina is local in extent and should not be assigned regional stratigraphic significance.

GYPSUM OCCURRENCES

Gypsum, a hydrous sulfate mineral ($CaSO_4 \cdot 2H_2O$), is an essential commodity in the building industry and has an important use in soil conditioning. Its minor uses include those in the brewery and glass industries and in wood, paint, and paper industries. Gypsum has been produced in Ohio almost continually since 1822, and reserves are believed to be ample to ensure continued production for a considerable number of years.

An historical account of gypsum production in Ohio has been given by Lintner (1944). According to Lintner, the first gypsum quarry was opened in 1822 along the north shore of Sandusky Bay near the present town of Gypsum, in Portage Township, Ottawa County, and the first of several underground mines in the area was opened in 1901. South of Sandusky Bay, about 2½ miles northwest of Castalia, in Margaretta Township, Erie County, an underground mine was opened in 1912 and stayed in operation until 1918. Today, Celotex Corporation operates a quarry in sec. 10, Portage Township, Ottawa County, and U. S. Gypsum Company operates an underground mine in the same section.

The localization of commercial amounts of gypsum in the Gypsum-Castalia area is determined by a combination of geologic factors that is unique to this area in Ohio. The Salina rocks were tilted and part of the section was truncated prior to Devonian time and again in Recent time. After each truncation, hydration by percolating ground water transformed the anhydrite to gypsum; the gypsum in some instances was leached. The gypsum in the B and F

units is either overlain or enclosed by impermeable shale beds that have tended to protect the gypsum from leaching downdip from the truncated (exposed) edge. Though anhydrite is ubiquitous in much of eastern Ohio, most of it lies at great depths and was not subjected to hydration. Only in eastern Ottawa and Sandusky Counties and in westernmost Erie County are all conditions met for the localization of commercial gypsum deposits.

It is true that there are references to gypsum being present elsewhere in the state, but they were based either on erroneous rock identification or on inaccurate stratigraphic concepts. For example, Lintner (1944, p. 10) quotes Orton (1888b, p. 697):

> At various other points, gypsum is found in the outcrops of the formation [Waterlime], and notably in the vicinity of Sylvania, Lucas county, while in the deep wells recently drilled through northern and central Ohio, it is the exception to miss deposits of gypsum in the samples of drillings. The last case reported is three feet of pure fibrous gypsum from a depth of 150 feet at Upper Sandusky.

The occurrence of gypsum in the vicinity of Sylvania was probably first described by Gilbert (1873, p. 583):

> *Gypsum, etc.*—Some years ago announcement was made of the discovery of gypsum in digging for the foundation of a mill on Ten Mile creek, just below the village of Sylvania. The place is not now accessible, but I am led—by the statement of Mr. Warren of Sylvania, that he applied the substance in question to a portion of his garden without visible effect on the vegetation—to suppose that the announcement was premature. The locality, however, is below the middle of the Waterlime series, and not far above the horizon of the gypsum deposits in Ottawa county; and salt, the frequent associate of gypsum, is represented in the immediate neighborhood by pseudomorphous cavities after its hopper-shaped crystals. Calcite occurs in cavities of the arenaceous limestones of the Corniferous at Fish's quarry, and at Loeb's quarry. At the latter place it is associated with strontianite. At Waterville, calcite and petroleum are found together, in cavities within some rugose, calcareous concretions, often several feet in diameter, which abound in a stratum of argillaceous limestone of the Water-lime group, and are laid bare in the river bed.

The rocks referred to by Gilbert are Middle Devonian in age and probably belong to the Detroit River Group; they are not part of the "Waterlime series" (Upper Silurian). Anhydrite and gypsum in noncommercial amounts have been noted in the Detroit River of northwestern Ohio (Janssens, 1970, p. 7).

A thickness of 200 feet of gypsum reportedly (Morrison, 1943) penetrated more than 2,500 feet below the surface in a deep mine at Barberton, in Norton Township,

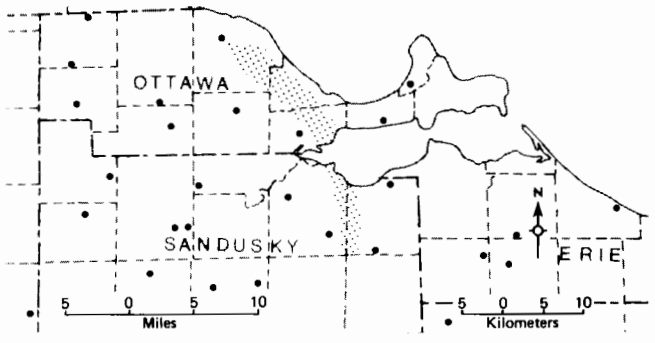


FIGURE 26.—Area where the Salina B unit may contain economic deposits of gypsum.

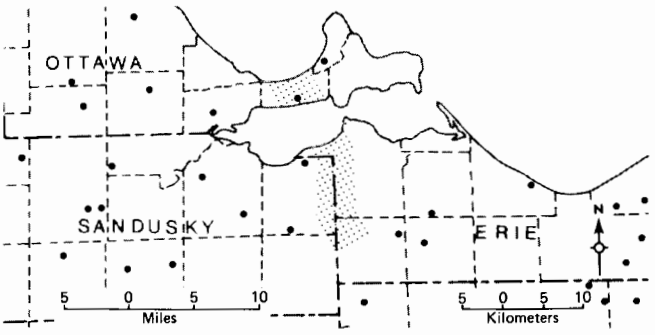


FIGURE 27.—Area where the Salina F unit may contain economic deposits of gypsum.

Summit County, is cited by Lintner (1944, p. 29) to emphasize the areal extent of gypsum. However, Stauffer (1944, p. 269) described the deposit as "gypsum (anhydrite) and gypsiferous shale." The identification or description of anhydrite as gypsum is not uncommon. Orton (1888b, p. 697), for example, mentioned the occurrence of "gypsum" in a well drilled near Sandusky, in Erie County:

> In the deep well drilled in 1886 at Sandusky, a bed [of gypsum] nine feet in thickness was reported by the driller at a depth of 272 feet, or about 150 feet below the base of the Corniferous limestone. It was also reported in smaller amount at many other points in the next 800 feet of rock passed by the drill. It is, however, possible that the gypsum which actually occurs in the drillings from a considerable number of points in the descent may have been, in part, at least, derived from the highest deposits by the action of the rope and the passage of the tools in drilling.

At Sandusky the Salina G unit subcrops below the Middle Devonian carbonates (Orton's "Corniferous limestone"), and in this locality the unit may contain either gypsum or anhydrite; the lower Salina units in this locality contain only anhydrite that probably includes the 9-foot bed referred to by Orton.

Areas of reported gypsum occurrence in Ohio (Ohio Geological Survey, 1959, p. 45) encompass the northeastern part of the state, but there can be no doubt that practically all reported gypsum is anhydrite.

Stratigraphic relations reveal that the only area in the state where gypsum is likely to be present in commercial amounts is located in eastern Ottawa and Sandusky Counties and in western Erie County. In Ottawa County the mineral is being produced from the Salina F unit in Portage Township and possibly can be produced from the Salina B unit farther west. Both B and F units may be productive in eastern Sandusky County, and the F unit may be productive in westernmost Erie County. These possibilities can only be confirmed by core drilling.

The areas mentioned above meet the requirements of having shallow anhydrite beds that are thick in the aggregate sense and that may have been hydrated to gypsum by percolating ground water. The hydration either must be of Recent age or, if effected farther back in geologic history, must have been arrested and the rocks protected from further hydration, for gypsum is an unstable mineral and is relatively easily leached and eroded.

In a previous section of this report it has been shown that the A unit, including its anhydrite, is replaced westward at a depth of several hundred feet or more by detrital(?)

Lockport dolomite. In Antrim Township, Wyandot County, however, two thin (less than 5 feet) beds of gypsum with dolomite impurities lie 20 and 60 to 80 feet, respectively, above the top of the Lockport, which in this area lies at depths exceeding 350 feet. One of these beds may have been referred to by Orton (1888b, p. 697; p. 37, this report) when he mentioned a 3-foot bed of gypsum penetrated at a depth of 150 feet near Upper Sandusky, in Crane Township, Wyandot County. These two beds probably belong to the A unit and are either local in extent or continue to the southeast beyond the map area.

The area where gypsum in the B unit may be productive is shown in figure 26. The unit is protected by a cover of impermeable shale (C unit) that has restricted the intake of ground water to the updip (west) exposed edge. South of Sandusky Bay the thickness of evaporites is probably not sufficient to be commercial, if indeed gypsum does occur in this area. The western limit of the evaporites is either their updip erosional edge or, in Ottawa County, possibly the boundary with their dolomite facies equivalent.

The B unit in central Lucas County lies directly below Pleistocene surface deposits and has a steep westward dip, but, because anhydrite is absent in the subsurface in the western part of the county, it is not likely that gypsum will be found near the surface in the central part.

The F unit, the only other Salina unit containing significant amounts of gypsum near the surface, is productive in the quarry and the underground mine in Ottawa County and was probably the productive unit in the abandoned mine near Castalia, in Erie County. The area where the F unit may contain commercial amounts of gypsum is shown in figure 27.

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APPENDIX A.–

ABBREVI

B bedrock
CP Division of Water well
DF derrick floor
GL ground level
KB Kelly bushing
M Division of Water well
NP not penetrated
P Division of Water well

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
ALLEN COUNTY												
M-15	2431	American	29	water well		810 GL	514	346				296
57		Auglaize	29	Dever	1 MacBurden	1037 DF	627	*465?	?			*410
44	724	Jackson	9	Ransbottom	1 Stoodt	915 T	517	450?	?			398
M-14	2430	Jackson	15	water well		907 GL				(TD 360 ft)		NP
M-23	2437	Marion	1	water well		770 GL	435	?	?	?		*335
M-16	2432	Monroe	19	water well		782 GL						(TD 300
M-9	2425	Richland	12	water well		852 GL						
59		Richland	25	Dever	1 Criblez	881 DF	501	*442	?			*380
71	2359	Shawnee	11	Sohio	1 Vistron	854 KB	556	*350	?			*298
S-644	644	Shawnee	11	water well		860 T	557	368	?			303
62		Spencer	23	Alco	1 Etzkorn	810 DF	500	*353	?			*310
CRAWFORD COUNTY												
11	1232	Bucyrus	19	Shafer	1 Miller	973 DF	257	*862	*834	*746	*732	*716
5	1122	Bucyrus	22	Plains Expl.	1 Blicke	1004 KB	129	*1026	*1000	*910	*891	*875
50		Chatfield	34	Hawkins & Hawkins	1 Leonhardt	1008 KB	-115	*1278	*1248	*1152	*1132	*1123
4	981	Dallas	11W	Reliance	1 White	952 GL	310?	793	?	677?	657?	642?
42		Dallas	25	Hadson Ohio	1 Harman	966 KB	279	*830	*802	*720	*697	*687
1	797	Holmes	28	Ohio Drillers	1 Shawk	990 T		1002?	?	?	?	?
46	2258	Jefferson	13	Sun	1 App	1126 KB	-217	*1503	*1475	*1382	*1356	*1343
55		Jefferson	18	Duncan	1 P.R.R.	1150 DF	-307	*1620	*1590	*1497	*1474	*1457
27	1326	Jefferson	23	Chess Well	1 Eichhorn	1085 KB	-214	*1469	*1430	*1340	*1320	*1299
12	1496	Liberty	15	Vandeveer	1 Brause	1030 KB	-82	*1267	*1240	*1158	*1122	*1112
44		Lykens	31	Piggott, Jr.	1 Spitler-Brown	977 KB	209	*920	*889	*793	*777	*768
30		Polk	26	Sun	1 Ricker	1102 KB	-208	*1470	*1440	*1362	*1330	*1310
35	1405	Sandusky	13	Mt. Carmel	1 Eckstein	1053 KB	-261	*1472	*1441	*1339	*1324	*1314
16	1258	Sandusky	22	Vandeveer	1 Ruth	1062 KB	-153	*1370	*1340	*1242	*1226	*1215
45	1651	Texas	13	Kin-Ark	1 Flickinger-Zimmer	953 KB	226	*873	*839	*755	*735	*727
40	1444	Vernon	5	Mt. Carmel	1 Strohm-Snyder	1092 KB	-360	*1614	*1583	*1488	*1464	*1452
8		Vernon	33	Sun	1 Krichbaum	1130 KB	-400	*1691	*1662	*1572	*1544	*1530
49		Whetstone	10N	Katex	1 Wagner	1048 KB	-92	*1298	*1268	*1171	*1156	*1140
15	1574	Whetstone	33	Vandeveer	1 Kuehnle	1029 KB	-61	*1250	*1219	*1122	*1104	*1090
DEFIANCE COUNTY												
4-A	753	Adams	16	Archbold	1 Harper	745 GL	?	?	?	?	?	?
39	2809	Adams	18	Sohio	1 Higbea	745 KB	-272	*1101	*1070?			*1017
31	1065	Farmer	29	Wand	1 Saltzman	752 KB	-248	*1071	*1043?			*1000
15	807	Mark	9	Brown Trustee	1 Smucker	726 T	-159	970				885?
20	961	Washington	32	Maumee Valley	1 Boland	715 GL	-187	995				902
ERIE COUNTY												
32	2257	Berlin	9-3 (2Q)	Pennzoil	1 Neiding	780 KB	-874	*1837	*1809	*1701	*1672	*1654
11	1928	Florence	98 (1Q)	Sun	1 Krysik-Wakefield	828 KB	-950	*1966	*1939	*1828	*1799	*1778
24	1997	Florence	68 (1Q)	Murphy	1 Hanko	738 DF	-995	*1920	*1892	*1780	*1753	*1733
25	2043	Florence	54 (2Q)	Tray-Kay	1 Griffith	831 KB	-984	*1999	*1971	*1863	*1833	*1815
26	2001	Florence	18 (4Q)	Neuberger	1 Alaimo	830 DF	-910	*1923	*1896	*1791	*1758	*1740

SUMMARY OF WELL DATA

ATIONS

Q quarter of township
S sample number
S Division of Water well
T topographic
TD total depth of well
tr tract
* depth determined from nuclear log
? identification uncertain

	Depth (ft) to top of																
	Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
	274	260	160	119	15B										15B		
	?		*311	?	?										92B		
	368	350	270?	226	125										33B		
	334	315	255	200	100										5B		
	*310	292	170	127	30B										30B		
ft)	NP	290	230	173	80										20B		
(TD 280 ft)		NP	210	170	90										5B		
			*275	?	?										28B		
	*272	*255	*200	145	60?										30B		
	283	260	210?	155	120?										?		
	*297	*261	*110	40?B											40B		
	*708	*691	*585	*520	457					*312	*268	184?			184		48B
	*864	*845	*770							*450	*385	*299?			299		*142
	*1106	*1088	*968	?	?					*624	*568	?	*450?		*450?		*284
	632?	622	520	420	310?						155	55B			55B		
	*675	*658	?	?	?						*215	140?	55?B		55B		
	?	?		?	570-597						320	242?	225		225		75B
	*1340	*1324		?						*916	*842	?	720?		720		*564
	*1451	*1439		?						*1035	*955	?	*838		*838		*674
	*1294	*1282	*1152	1050?	980?					*871	*808	?	*672		*672		*529
	*1100	*1078	785?							*589	*510?	?	*430		*430		*287
	*749	*713	*628							*347	*252	?	100?		100?		80B
	*1308	*1295	*1136							*882	*792	?	685?		*685?		*540
	*1304	*1280	*1046							*784	*740	*662?	*622		*622		*478
	*1207	*1190								*722	*656	?	520		520		*377
	*701	*690								*267	*200	*133	*103		*103		50?
	?	*1420	1178?							*992	*930	*832	*791?		*791		*639
	*1526	*1508	*1359							*1053	*990	*905	820?		820?		718
	*1134	*1119	*1050							*726	*661	?	*530?		*530?		*380
	*1086	*1072	982		810?					*669	*594	?	480?		480?		347
			845	780	?					472	435	388			382		206
			*877	830	790?					*559	*501				410		228
			730?	?	lens 610-620					*453	*403	380			380		*258
			580?	?	?					?	?	?			291		140?
			557?	?	?					329	307	266			266		122
	*1621?	*1585	*1466			*1430	*1377	*1363	*1269	*1174	*1090	*1001	*924	*854	854	*790?	*524
	*1754	*1707	*1587			*1578	*1523	*1510	*1406	*1317	*1242	*1137	*1057	*975	975	*913?	*637
	*1707	*1650?	*1528			*1508	*1470	*1452	*1350	*1266	*1172	*1083	*1004	*915	915	*860	*588
	*1785	*1740	*1618			*1602	*1552	*1540	*1438	*1350	*1277	*1180	*1100	*1011?	1011?	*958?	*662
	*1709	*1660	*1542			*1522	*1473	*1460	*1360	*1263	*1180	*1100	*1024	*953	953	*890	*613

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
ERIE COUNTY (continued)												
2	774	Groton	10 (2Q)	Sentinel	1 Miller	726 T	-320	1222	?	1070	1054	1046
5	695	Huron	32 (1Q)	Nickel Plate	1 NY C & STL RR	580 GL	-705			1315	1305	1285
10		Oxford	3Q	Long	1 Wensink Bros.	710 DF	-449	*1322	*1294	*1185	*1170	*1159
NASA	2342	Perkins		Fenix & Scisson	1 NASA	648 GL	-452	*1267	*1240	*1123	*1111	*1100
21	1974	Vermilion	9 (tr 1)	Murphy	1 Kukes	764 KB	-985	*1930	*1903	*1791	*1768	*1749
34	2334	Vermilion	11 (tr 2)	E & W	1 Hauff-Miller-Novy	720 DF	-938	*1842	*1815	*1714	*1678	*1658
28	1993	Vermilion	6 (tr 3)	E & W	1 Peck	630 DF	-948	*1758	*1732	*1620	*1597	*1578
FULTON COUNTY												
S-416	416	Amboy	11	water well		726 GL						
S-309	309	Amboy	26	water well		728 GL						
22	1194	Chesterfield	10	McClure	1 Deyo	815 KB	-823	*1735	?			*1638
13	804	Chesterfield	31	McClure	1 Keefer	732 KB	-695	*1528	*1482			*1427
35	2017	Clinton	17	Rock Castle	1 Vonier	765 DF	-568	*1460?	*1408?			*1333
28	1812	Fulton	32S	Liberty	1 Fauble	743 DF	-515	*1371	*1325			*1258
S-2590	2590	German	32	water well								
14	806	Gorham	17	McClure	1 Thomas	788 DF	-784	*1681	?			*1573
36	2037	Gorham	19	McClure	1 Erbskorn	810 DF	-755	*1692	?			*1565
16	911	Pike	32N	Dunn	1 Kirkendall	770 DF	-720	*1596	*1545?	1533?		*1490
51	2637	Swan Creek	17	Houseknecht	1 Zielinski	722 KB	-454	*1275	*1220?			*1176
12	713	Swan Creek	22	Ohio Oil	1 Munn *et al.*	680 GL	-400	1167	1147			1080
18	1012	York	8N	Covey & Null	1 Neuswander	758 DF	-558	*1415	*1360?			*1316
HANCOCK COUNTY												
M-2	2418	Amanda	28	water well		840 GL	662		(TD 220 ft)	189	182	178
6	55	Big Lick	14	Sun	1 Heminger	865 GL	565	423		315	304	300
153	2020	Blanchard	11	Transamerican	1 Lenhart	804 GL	307	?		513	503	497
119	1039	Cass	16	Continental	1 Baker	786 KB	594	*300	251?	*212	?	*192
131	1538	Delaware	12	Jacobs	1 Howard	855 GL	640?	330		235?	220?	215?
143		Eagle	14	O'Neill	1 Stahl	840 KB	548	*380	*330?	?	?	*292
152	1952	Jackson	6	Kin-Ark	1 Drummelsmith	809 KB	584	*332	*285?	*253	*230	*225
118	1040	Jackson	21	Continental	1 Butler	840 KB	572	*379	*320	*281	*270	*268
M-4	2420	Jackson	29	water well		840 KB	573			(TD 310 ft)	?	267
151	1649	Jackson	30	Ashland	1 Cotner	848 KB	582	*362	*317?	*284	*271	*266
44	571	Liberty	9	Ohio Oil	1 Boyd	777 GL	442?	465?		?	?	335?
M-7	2423	Liberty	16	water well		765 GL	436				(TD 330 ft)	329
150	1650	Liberty	28	Ashland	1 Cramer	793 KB	483	*442?	?	?	?	*310?
117	1041	Madison	17	Continental	1 Essex	891 KB	619	*387	*332?	*298	*276	*272
M-6	2422	Union	24	water well		806 GL						
M-5	2421	Van Buren	10	water well		850 GL						
P-2	2461	Washington	19	water well		785 GL	577				(TD 220 ft)	208
P-1	2460	Washington	36	water well		805 GL						
HARDIN COUNTY												
86		Blanchard	34	Turner	1 Lotz	911 DF	699?	*282	*232?			*212?
108	2099	Cessna	26	Teeters	1 Stephens	984 DF	714	*373	*315?		*292	*270
79	1231	Dudley	4	McMahon-Bullington	1 Wolf	971 KB	770	*307	*253?			*201
89		Goshen	7	Turner	1 Winebrenner	944 DF	746	*308	*243?			*198
S-8	2484	Goshen	16	water well		920 GL	755	270			168?	165
M-3	2419	Jackson	7	water well		912 GL						
99	1914	Jackson	24	Turner	1-A Kellogg	926 DF	771	*257	*201			*155
74	1015	Jackson	30	Edmund	1 Jones	941 KB	831?	230				110?
75	1119	Liberty	36	Humble	1 Marling	946 DF	654	*367	*332?			*292
CP-1	2644	Marion	29	water well		985 GL						(TD 325
S-446	446	Pleasant	2	water well		1008 GL						
M-13	2429	Washington	20	water well		937 GL						
S-15	2491	Washington	23	water well		965 GL						
HENRY COUNTY												
M-36	2450	Bartlow	28	water well		720 GL						
M-37	2451	Damascus	32	water well		680 GL						
20	907	Freedom	23	Lesh	1 Badenhop	718 KB	-368	*1192	*1141?	*1097	*1092	*1086
30	2369	Marion	1	Nahabedian & Fawcett	1 Brubaker	707 DF	51	*733	?	?		656
M-35	2449	Marion	35	water well		735 GL						

Depth (ft) to top of

Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
		848			825	800?	795?	690	573	500	400?	?	257	257	233?	20
1235	1190?	1110			1080	1030	995	920	820	745	653	563	500	500	430	181
		*940			*930	*885	*871	*780	*696	*602	*512	*436	?	?	?	122?
		*901			*876	*827	*809	*708?	*623	*555	*452	*379	*312	312	285	50
*1722	*1671	*1567			*1550	*1497	*1482	*1374	*1290	*1200	*1118	*1044	*950	950	?	*595
*1628	?	*1481			*1464	*1406	*1388	*1285	*1193	*1120	*1035	*961	*879	879	?	*547
*1542	*1500	*1358			*1349	*1300	*1289	*1188	*1107	*1025	*932	*861	?	?	?	*443
	(TD 1294 ft)	1265	1203	1085					949	890	?	660		660		349
	(TD 1252 ft)	1223	1135	1030					882	813	?	626		626		319
		*1470	*1382	*1300					*1150	*1086	*988	*912?		*912		*572
		*1232	1170	1088					*972	*908	830	754		754		*433
		*1160	1110	1035					855	*800	*725	*668		*668		*385
		*1114	1059	?					*778	*699	*610	*540		*540		*288
	(TD 1180 ft)	1015?	960	930?					?	670	570			570		318
		*1400							*1117	*1025	*947	*894		*894		*573
		*1373	1322	1221					*1103	*1035	*940?	*900?		*900?		*578
		*1332	1248	1173					*1008	*942	*850	775		775		*467
		*1039	955	?					*666	*605	*496	457*		*457		*223
		957	865	770					583	498	*405	370		370		154
		*1180?	*1103?	1027					*848	*782	*718	*618?		*618		*358
		33	13B											13B		
		140	90B											90B		
		402	325	203?										94B		
		40B														
		59	23B											23B		
		*179?	?	?										5B		
		*94	28B											28B		
		*115?	88	14B										14B		
		119	83	20B										20B		
		150	70	18B										18B		
		200?	?	40B										40B		
		186	150	50										22B		
		*190	160	70										10B		
		*154	90	33B										33B		
	(TD 320 ft)	189	150	60										4B		
	(TD 280 ft)	185	135	40										4B		
		42B														
	(TD 220 ft)	36B														
		53?B														
*250	*220	*173	125	94B										94B		
*175?	*148	68?	37?B											37B		
*170	*143	*95	*32?B											32B		
134	115	70	41B											41B		
	(TD 210 ft)	195	128	40B										40B		
*129	*110	30B														
?	?	23B														
*272	*250	*203	*130	73B										73B		
ft) 315	290	230	180	85										38B		
	(TD 176 ft)	132	76B											76B		
	(TD 220 ft)	210	143	30										10B		
	(TD 250 ft)	190	150	40										18B		
								(TD 265 ft)	165?	123?	?	?		76B		
									(TD 300 ft)	273?				140		42B
		*911?	*870	780?					*644	*579	*481	460		*460		*239
	?	519	471	411					*251	*199	*112	*83?		*83		45B
									(TD 350 ft)	*132	70?B			70B		

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
HENRY COUNTY (continued)												
M-34	2448	Pleasant	16	water well		725 GL						
34	2788	Richfield	1	Callander & Kimbrel	1 Staub	676 KB	-57	*835		766	?	*733
12	661	Richfield	33	Murdock	1 Schultz	693 T	-2	783		?	?	695?
HURON COUNTY												
62	2044	Bronson	9 (3Q)	McMahon-Bullington	1 Maxwell	805 DF	-616	*1587	*1550	*1451	*1434	*1421
81	2127	Bronson	9 (4Q)	Lake Shore	1 Knupke	919 DF	-681	*1774	*1747	*1663	*1616	*1600
58	1942	Bronson	32 (4Q)	Kin-Ark	1 Lawrence *et al.*	833 KB	-589	*1586	*1557	*1450	*1434	*1422
72	2045	Clarksfield	3 (2Q)	Reliance	1 Leitner	915 DF	-1036	*2150	*2115	*2013	*1974	*1951
69	1985	Clarksfield	23 (4Q)	Lake Shore	1 Spoerr	943 KB	-950	*2076	*2047	*1952	*1912	*1893
32	1418	Fitchville	6 (1Q)	Roberts	1 Wargo	980 KB	-863	*2009	*1980	*1887	*1853	*1843
43	1834	Fitchville	31 (3Q)	Kin-Ark	1 Clayton-Crecelius	1003 KB	-785	*1957	*1929	*1830	*1800	*1788
74	1992	Fitchville	46 (4Q)	Ashland	1 Reddick	998 KB	-820	*1995	*1967	*1869	*1833	*1818
25	1533	Greenfield	40 (3Q)	Pure	1 Wheeler	891 KB	-460	*1516	*1488	*1390	*1362	*1351
67		Hartland	33 (2Q)	Holtom	1 Metz-Kettel	934 DF	-849	*1960	*1931	*1833	*1798	*1783
84		Hartland	33S (2Q)	Stocker & Sitler	1 Johannsen	949 KB	-785	*1911	*1882	*1789	*1748	*1734
60	1950	Hartland	6 (4Q)	Stocker & Sitler	1 Ernsberger-Gerstenberger	955 KB	-813	*1950	*1920	*1824	*1786	*1768
53	1943	Lyme	29 (3Q)	Katie	1 Yingling	785 DF	-272	*1213	*1187	*1092	*1064	*1057
28	1234	New Haven	107 (1Q)	Reliance	1 Newmeyer	981 DF	-629	*1773	*1747	*1645	*1621	*1610
40	1464	New London	20 (3Q)	Colorado	1 Rumbaugh	949 KB	-989	*2122	*2094	*1994	*1955	*1938
38	1442	New London	14 (4Q)	Hadson Ohio	1 Johnson	989 KB	-1016	*2190	*2161	*2057	*2024	*2005
35	1462	Norwich	14 (4Q)	Horn	1 Hillis	914 DF	-290	*1360	*1333	*1233	*1212	*1204
30	1237	Richmond	5 (3Q)	Reliance	1 Niedermeyer	957 DF	-303	*1422	*1390	*1288	*1269	*1260
34	1416	Ridgefield	1 (4Q)	D.J.	1 Fisher	738 DF	-555	?	?	?	*1308	*1293
36	1505	Ripley	33 (1Q)	Hadson Ohio	1 Willet	1044 KB	-770	*1984	*1956	*1863	*1825	*1814
76	2000	Townsend	128 (1Q)	Ashland	1 Bonigut & Hahn	926 KB	-839	*1945	*1917	*1814	*1782	*1765
73	1988	Townsend	9 (2Q)	Mansfield	1 O'Brien & Lykins	864 KB	-868	*1910	*1882	*1770	*1748	*1732
54		Townsend	37 (2Q)	Trolz & Assoc.	1 Conry	877 KB	-898	*1958	*1930	*1833	*1793	*1775
65		Townsend	64 (2Q)	Hefner	2 Beck	897 KB	-858	*1932	*1903	*1802	*1772	*1755
57	1940	Townsend	77 (3Q)	Kubat	1 Kosa	890 KB	-834	*1900	*1872	*1765	*1740	*1724
71	2057	Wakeman	34 (3Q)	Murphy	1 Tkach	808 KB	-990	1977	?	1830	?	1798
LUCAS COUNTY												
34	864	Adams	8	DiSalle	1 DiSalle	619 GL	65	690?		587		554
S-295	295	Adams	17	water well		624 GL						
60	2811	Harding	9	Liberty	1 Ketring	675 DF	-458	*1220	*1178			*1133
25	714	Monclova	23	Ohio Oil	1 Mohring	663 GL	-232	1002	940	915		895?
16-A	400	Monclova	28	?	1 Butz	636 GL	146	584		520		490
132-A	754	Richfield	6	Colvin	1 Harroun	700 GL	-597	1412?				1297
28	768	Springfield	14	Smoots	1 Myers	615 GL	125	610	550	520	510?	490
S-533	533	City of Toledo		water well		625 GL						
MERCER COUNTY												
119	1256	Black Creek	19	Yoder	1 Buchanan	810 T	560?	280?				250?
138	2038	Union	27	Harner Union	1 Harner	809 GL	589?	265	230?			220?
OTTAWA COUNTY												
23	729	Allen	16	Valley	1 Reeder	611 GL	141	618		497	485?	470
P-16	2473	Allen	34	water well		590 GL						
P-5	2464	Bay	16	water well		580 GL						
P-12	2469	Benton	34-S	water well		602 GL						
49	2126	Carroll	4	Wenner	1 Velliquette	578 DF	51	*683	*651	*541		*527
20	711	Catawba Island	26	Hilliard	3 Wiechel	585 GL	-273	1033			890	858
S-468	468	Clay	33	water well		625 GL	215			(TD 436 ft)	425	410
S-710	710	Harris	11	water well		?						
S-692	692	Portage	9	Celotex	3 Fee	585 GL						
21	723	Salem	3	Valley	1 Robinson	587 GL	140	620?		470	454	447
PAULDING COUNTY												
6	2280	Benton	17	Centurian	1 Lincoln Nat'l Bank	758 DF		?	?			?
5	948	Brown	31	Myers	1 Dobbelaere	720 T	150	644	610			570
S-425	425	Paulding	24	water well		727 GL	132				(TD 625 ft)	595
M-31	2445	Paulding	29	water well		730 GL						
M-29	2443	Washington	9	water well		720 GL						

Depth (ft) to top of																
Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
								(TD 410 ft)	269?	220?	?			115		100B
		*571	536	455					*259	*185	*126	108		108		25B
		535	490	415?					215	152	68			68		30B
*1386	*1358	*1225			*1206	*1160	*1143	*1060	*971	*897	*791	*708	*645	*645		*453
*1576	*1540	*1402			*1380	*1332	*1313	*1227	*1140	*1031	*962	*889	*853	*853		*606
*1390	?	*1240			*1213	*1168	*1158	*1072	*982	*895	*799	*726	*653	*653		*470
*1925	*1880	*1761			*1750	*1705	*1689	*1580	*1500	*1410	*1320	*1241	*1147	*1147	*1092	*829
*1876	*1832	*1702			*1690	*1648	*1633	*1533	*1451	*1365	*1273	*1197	*1122	*1122	*1053	*816
*1829	*1785	*1681			*1672	*1625	*1611	*1508	*1417	*1334	*1245	*1156	*1104	*1104	*1030	*838
*1765	*1725	*1603			*1590	*1543	*1530	*1433	*1348	*1250	*1160	*1063	*1015	*1015	940	*726
*1802	*1771	*1659			*1645	*1601	*1589	*1489	*1400	*1334	*1231	*1137	*1079	*1079	*1023	*835
*1323	*1297	*1167			*1145	*1100	*1087	*1001	*910	*825	*737	*650	*620	*620		*435
*1756	*1710	*1581			*1557	*1514	*1496	*1406	*1313	*1224	*1124	*1050	*972	*972	*910?	*722
*1709	*1667	*1531			*1519	*1471	*1455	*1367	*1279	*1204	*1100	*1023	*942	*942	*870?	*700
*1750	*1710	*1579			*1557	*1519	*1503	*1405	*1318	*1245	*1137	*1050	*980	*980	920	*733
*960?	?	?						*610	*520	*460	*357	*282		*282		68*
*1594	1569	*1432			*1424	*1361	*1346	*1260	*1191	*1081	*996	*902	*855	*855		*692
*1923	*1874	*1758			*1748	*1703	*1687	*1588	*1503	*1410	*1329	*1253	?	?	1082?	*868
*1992	*1941	*1842			*1831	*1783	*1775	*1665	*1584	*1511	*1405	*1323	*1231	1231	*1181?	*947
		?						*826	*732	*668	*567	530		530		*320
*1232	*1224	?				*992	*981	*895	*802	*736	*623	*562?		*562		*393
*1240	*1225	*1104			*1084	?	?	?	?	*760	655	?	527?	527?		327
*1800	1700?	*1660			*1647	*1588	*1571	*1483	*1401	*1308	*1215	*1129	*1073	*1073	*1035	*871
*1740	*1701	*1570			*1545	*1497	*1483	*1393	*1308	*1207	*1125	*1035	*966	*966	920	*704
*1710	*1662	*1535			*1503	*1462	*1442	*1350	*1270	*1189	*1078	*1013	950?	*950?	*863	*633
*1750	*1710	*1572			*1548	*1500	*1482	*1395	*1313	*1205	*1128	*1040	*960	*960	*920?	*680
*1729	?	*1572			*1550	*1504	*1483	*1395	*1311	*1204	*1112	*1046	*958	*958	*900?	*683
*1694	*1669	*1515			*1492	*1444	*1430	*1341	*1257	*1152	*1063	*977	*920	*920	880	*671
1775	1730	*1604			*1583	*1540	*1527	*1424	*1341	*1254	*1151	*1072	*988	*988	910	*673
		360?												90B		
	(TD 525 ft)	133?												75B		
		*963	865	762					*604	*561	*444	*398		*398		*103
		757	680	580					397	310	?	?	?	168		47B
		305	220	140										35B		
		1091	990?	?					776	710	?	?	?	460		180
		300	190	160										72B		
	(TD 500 ft)	190												125B		
		118B														
210?	195	100?	33B											33B		
		15B														
	(TD 360 ft)	24B														
	(TD 350 ft)	180	140											70B		
	(TD 360 ft)	97	38B											38B		
		170												69B		
		500						420	320?	270?	165	90?	25?		5B	
		64												20B		
	(TD 338 ft)	103?												31B		
	(TD 500 ft)	480						345	225	155	60	23B		23B		
		102												40B		
525?	500	265?							?	?				35B		
		390	325	235						38B				38B		
		410	345	310?					?	?				70B		
			(TD 360 ft)	300					?	?				79		31B
	(TD 360 ft)	310	276	170										35B		

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
PUTNAM COUNTY												
S-105	105	Blanchard	22	Hubbell *et al.*	4 Baker	760 T	335	498?	455?			425
M-8	2424	Blanchard	29	water well		730 GL	342				(TD 450 ft)	388
31	156	Liberty	29	Ohio Oil	1 Barlage	740 GL	195	618?	574?			545?
M-28	2442	Monterey	1	water well		720 GL						
M-11	2427	Ottawa	4	water well		730 GL						
S-2312	2312	Ottawa	28	water well		735 T	315				(TD 500 ft)	420
M-12	2428	Palmer	28	water well		715 GL						
M-10	2426	Pleasant	23	water well		755 T						
51	2021	Riley	10	Transamerica	1 Suter	765 DF	385	*457			*420	*380
S-87	87	Riley	23	Wallace	1 Bohr	800 T	432	440				368?
M-17	2433	Sugar Creek	14	water well		770 GL						
RICHLAND COUNTY												
509	2639	Blooming Grove	3	Columbia	1 Pine	1148 DF						
499	2565	Blooming Grove	18	Columbia	1 Daup	1098 DF						
286	1230	Blooming Grove	28	Southern Triangle	1 Barnd	1136 KB	-857	*2179	*2150	*2053	*2011	*1993
329	1430	Butler	29	Huron	1 Evel	1198 KB	-1094	*2495	*2461?	*2373	*2318	*2292
389	1672	Butler	30	Ashland	1 Mast-Johnson	1142 KB	-1058	*2397	*2371?	*2277	*2225	*2200
507	2630	Cass	1	Columbia	1 Seaman	1108 DF						
196	876	Cass	14	Ferguson & Howard	1 Dawson	1050 GL	-760	1982?		1847	1822	1810
303	1281	Cass	28	Hamblin	1 Davies	1072 DF	-619	*1891	*1860	*1762	*1735	*1724
312	1289	Franklin	15	Gallagher	1 Oswalt	1105 KB	-946	*2245	*2220	*2127	*2070	*2051
496	2532	Plymouth	11	Moore	1 Fackler	997 DF						
377	1658	Plymouth	24	Graham	1 Stroup	1099 KB	-551	*1817	*1789	*1688	*1662	*1650
271	2260	Plymouth	25	Hallion	1 Champion	1087 KB	-509	*1764	*1732	*1633	*1608	*1596
285	1252	Sharon	24	Reliance	1 Gwirtz	1121 DF	-509	*1793	*1768	*1670?	*1643	*1630
381	1662	Springfield	33	B.B.M.	1 Wittmer	1421 KB	-679	2273	?	2150	2110	2100
SANDUSKY COUNTY												
S-24	2483	Ballville	12	water well		640 GL						
10	392	Ballville	17	Dever	1 Gillmore	645 T	235	585				410?
P-13	2470	Jackson	4	water well		670 GL						
P-11	2468	Madison	15	water well		645 GL						
S-18	2494	Rice	6	water well		605 GL						
140	1671	Riley	8	Ashland	1 Trick	587 KB	125	*625	*587	*488	*473	*462
210	2745	Riley	26	Ohio Liquid Disposal	1 Ohio Liquid Disposal	620 KB	40	*742	*704	*604	*593	*580
124	1476	Townsend	3	Harris & Schultz	1 Meggit	589 DF	-121	879		755	?	710
77	895	Townsend	33	East Ohio	1 Haff	644 DF	-76	*882	*843	*754	*736	*720
139	1653	Washington	23	Commonwealth	1 Warner	637 DF	260	*514	*490	*388	*377	*372
141	1670	Washington	24	Ashland	1 Miarer	649 KB	281	*514	*489	*384	*375	*368
147	1853	Woodville	36	Maguire	1 Kerbel	647 KB	293	*501	*475	*377	*360	*354
SENECA COUNTY												
161	1989	Adams	27	Ashland	1 Hopfinger	804 KB	69	*892	*859	*765	*742	*735
S-16	2492	Big Spring	2	water well		805 GL						
106	1249	Bloom	34	Jackson	1 Stuckey	965 KB	105	*1007	*979	*882	*869	*860
20	747	Clinton	17	Sun	1 U.A.M.	755 GL	365	565?		420?	395	390
S-17	2493	Eden	1	water well		845 GL						
98	1120	Eden	21	Sun	1 Downs	838 KB	264	*722	*680	*603	*580	*574
102	1153	Eden	35	Plunkett & Shields	1 Hushour	885 KB	252	*781	*750	*663	*640	*633
S-98	98	Hopewell	3	Morrow	1 Hostler	750 GL	395	510		380	363	355
104	1156	Hopewell	21	Floto-Brasel	1 Kummerer	775 DF	324	613		483?	459	451
144	1648	Liberty	8	Hadson Ohio	1 Waldvogel	724 DF	402	*482	*443	*341	*330	*322
150	2090	Liberty	13	McMahon-Bullington	1 McDonald	702 DF	340	*520	*485	*387	*370	*362
103	1392	Liberty	36	McMahon-Bullington	1 Ewald	738 KB	379	*505		*375	*363	*359
S-19	2495	Loudon	14	water well		780 GL					(TD 375 ft)	344
S-2546	2546	Pleasant	3	water well		680 GL						
S-3	2477	Pleasant	16	water well		665 GL						
151	1742	Pleasant	28	Signal	1-A Wise	712 DF	298	566?		447	427	414
S-54	54	Pleasant	33	Jones & Keiner	25 Sours	709 GL	346	520		382	370	363
25	104	Scipio	13	Ohio Oil	1 Bishop	908 T	35	1032		900	880	873
132	1593	Scipio	17	Duncan	1 Oakleaf	838 DF	150	*842	*807	*712	*693	*688
S-411	411	Seneca	26	Roach	1 Heimrich	860 T	360	652		535?	?	500?

Depth (ft) to top of																
Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
		305	235	140?										40B		
		276	205	110										12B		
		430	379	310					105?	87	55B			55B		
	(TD 370 ft)	255	202	100										27B		
	(TD 420 ft)	355	305	220										46B		
		305?	260	160										40B		
	(TD 400 ft)		380	287					100?	80?	45B			45B		
	(TD 320 ft)	250	200	100						?				8B		
		*260	192	125										45B		
		230	172	120										55B		
	(TD 300 ft)	218	170	70										10B		
	(TD 1907 ft)	*1877	lens	1787?	*1871	*1818	*1803	*1708	*1629	*1550	*1453	*1360	*1290	*1290	1265?	*1095
	(TD 1802 ft)	*1723			*1708	*1654	*1641	*1550	*1470	*1392	*1292	*1204	*1143	*1143		*955
?	*1961	*1833			*1824	*1769	*1752	*1666	*1586	*1483	*1402	*1312	*1260	*1260	*1245	*1065
?	?	*2131			*2123	*2079	*2070	*1972	*1890	*1808	*1724	*1642?	*1560	*1560	*1504	*1322
?	?	*2040			*2031	*1983	*1973	*1880	*1796	*1725	*1628	*1547	*1471	*1471	*1425	*1253
	(TD 1809 ft)	*1716			*1698	*1645	*1629	*1541	*1459	*1380	*1277	*1193	*1124?	*1124?		*943
1795	1773	1643			?	?	?	1465?	1390	1319	1211?	1130	1074?	1074?		893
*1713	*1679	*1539			*1533	*1473	*1460	*1377	*1296	*1216	*1120	*1031	1003	1003		*844
*1987	*1970	*1872	1780-1800		*1861	*1812	*1800	*1718	*1647	*1570	*1465	*1374	*1316	*1316	1290?	*1124
	(TD 1355 ft)	*1313			*1294	*1252	*1235	*1163	*1077	*996	*899	*810		*810		*648
*1638	*1617	*1450?			*1446	*1397	*1392	*1311	*1227	*1148	*1056	*981	*966	*966		*802
*1587	*1563	*1370				?	?	*1236	*1152	*1077	*986	*899		*899		*739
*1625	*1608	*1484						*1266	*1182	*1115	*1023	*950?		*950?		*791
?	2060	?				?		1710?	1645	1600?	1500?	1430?	1380	1380		1240
	(TD 160 ft)															
		92?B														
	(TD 280 ft)	20												19B		
	(TD 250 ft)	19B														
	(TD 340 ft)	160?	120?											?		
		?												70B		
		?												65B		
		505?			?	?	?	?	226	153	?			71B		
		*515?			*490	*437	*428	*333	*238	*163	*78B			*78B		
		?												11B		
		?												40B		
		5B														
		*430							*212	*152	*70	44B		44B		
	(TD 310 ft)	?	45B											45B		
		?							*383	*291	*191	?	?	?		
		70?	38?B											38B		
	(TD 395 ft)	215?												115B		
		270							94B					94B		
											8B			8B		
		50B														
		148?												65B		
		20B														
*341	*316	20?B														
		38B														
?	?	40B														
	(TD 300 ft)	150												70B		
	(TD 355 ft)	60?												54B		
		75?B														
		45?B														
		575?							382	319	257?	179?		179		47B
		394?							*210	*143	*72	50B		50B		
														?		

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
VAN WERT COUNTY												
M-27	2441	Jackson	1	water well		725 GL						(TD 360
M-19	2496	Jennings	30	water well		810 GL						325?
S-499	499	Liberty	15	water well		815 GL					(TD 335 ft)	
S-449	449	Pleasant	12	water well		?				(TD 410 ft)	375?	370
S-459	459	Pleasant	21	water well		790 T						
M-24	2438	Pleasant	33	water well		795 T						
S-450	450	Ridge	18	water well		786 GL						(TD 351
M-25	2439	Tully	34	water well		790 GL						
S-546	546	Tully	35	water well		786 GL						
M-26	2440	Union	8	water well		750 GL						
2	200	Union	28	Ohio Oil	1 Balliet-Bauer	767 T	377	413				390?
WILLIAMS COUNTY												
46	2636	Bridgewater	13	Columbia	1 Cook	915 KB	-840	*1856				*1755
37	1429	Center	25	Tamp	1 Wineland	779 KB	-358	*1214				*1137
47	2822	Florence	17	Sohio	1 Lautzenheiser	917 KB	-621	*1628				*1538
28	823	Jefferson	18	McClure	1 Kasper	889 DF	-596	*1588				*1485
30	924	Madison	5	McClure	1 Barnhart	868 DF	-732	*1705	*1653			*1600
31	1005	Madison	15	Mohawk	1 Grimm	876 GL	-840	1823	1788?			1716
43	1934	Pulaski	20	Eastern	1 Sinn	735 GL	-360	1170	1128?			1095
34	1691	St. Joseph	21	Beglinger	1 Kennerk	842 DF	-423	?	1321			1265
WOOD COUNTY												
P-3	2462	Bloom	36	water well		745 GL	553		(TD 230 ft)	205	197	192
237		Center	4	Kin-Ark	1 Carter	673 KB	392	*401	*349	*300	*286	*281
P-9	2466	Center	27	water well		670 GL						
248		Grand Rapids	30	Kin-Ark	1 Neilson	681 KB	-48	*824	*780			*729
215		Henry	6	Good & Good	1 Herringshaw	698 DF	176	*640?	?	*542	*531	*522
283	2323	Henry	11	Universal Major	2 Leathers	697 DF	473	345		?	?	224
P-18	2474	Henry	35	water well		725 GL	528		(TD 300 ft)	216	203	197
287	2333	Henry	36	Nahabedian & Fawcett	1 Stevens	736 DF	551	301			190	185
S-256	256	Liberty	30	Wood County Oil	1 Johnson-Drummer	690 T	100	700		615	590	590
23	573	Liberty	34	Ohio Oil	1 Stockwell	693 T	428	377				265
231		Liberty	36	O'Neill, Jr.	1 Peek	698 KB	456	*351	*300?	*257	*246	*242
239		Middleton	21W	J.R.S.	1 Asmus	670 KB	390	*400	*352	*296	*285	*280
M-38	2452	Milton	2	water well		672 GL						
P-8	2465	Montgomery	24	water well		705 GL						
236	1466	Plain	1	Kin-Ark	1 Smith	677 KB	407	*386	*330	*280	*274	*270
D-9	53	Plain	13	Sun	1 Cross	676 GL	468	345		225	215	208
20	587	Portage	36	Tefft	1 Tefft	700 T	437	367		274	265	263
247		Washington	12	Ashland	1 Freeworth	685 KB	-2	*795	?	*707	*696	*687
211	1043	Washington	32	Continental	1 Euler	668 KB	109	*670	*620	*570	*564	*559
P-14	2472	Webster	25	water well								
WYANDOT COUNTY												
165	1149	Antrim	17	Floto-Brasel	1 Abnett	901 DF	393	*650	*614	*540	*520	*508
S-4	4	Antrim	28	Ohio Oil	1 Chatlain	910 GL	355	703		587?	565?	555
178	1322	Antrim	32	Schoonmaker	1 Gould	921 DF	281?	786		683	645?	640?
172		Crane	16	Fulk	1 Walton	811 DF	561	*390	*353	*276	*255	*250
223	2592	Crane	18	Brown	2 Luthy	842 GL	534	460		337	313	308
181	1360	Crane	18	Texas Coastal	2 Binau	830 GL	508	463		340	328	322
98	531	Crane	27	Keiser	1 Kuenzli	845 GL		445		334?	?	?
72	99	Crawford	18	Ohio Oil	1 Heck	860 GL	649	349		236	225	211
136	705	Crawford	34	Dever	1 Sammet	820 T		400?		?	?	?
211	1706	Eden	3	Minnesota-Ohio	1 Eyestone	942 KB	334	*760?	*720	630	*620	*608
212		Eden	10	Duncan & George	1 Failor	932 DF	350	*720	*693	*613	*596	*582
174	1222	Mifflin	14	Texaco	1 Bowen	845 KB	648	*292	*269	*213	*203	*197
193	1572	Mifflin	25	Clinton	1 Crabarkalee Farms	888 GL	678	300		230?	221	210
189		Mifflin	27	Clinton	1 Needs *et al.*	889 DF	694	*322	*292	*222	*209	*195
S-7	2481	Pitt	7	water well		890 GL	665		(TD 290 ft)	245	235	225
95	520	Pitt	11N	White	1 Stubbs	890 GL		495		?	370?	?
S-5	2479	Pitt	15	water well		840 GL	545			(TD 320 ft)	300	295
S-6	2480	Pitt	17	water well		865 GL	635		(TD 300 ft)	258	244	230
186		Pitt	21	Turner	1 Hull	892 DF	623	*405	*371	*300	*275	*269
S-9	2485	Richland	13	water well		830 GL	647		(TD 200 ft)	204	190	183

Depth (ft) to top of																	
Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
	(TD 260 ft)	250	200	110										20B		
ft) 293	265	155	95	50B										50B		
		?												55B		
350	335	40B														
	(TD 233 ft)	170?												40B		
	(TD 340 ft)	147B														
ft) 320	305	140	60	30?B										30B		
	(TD 280 ft)	?												37B		
	(TD 300 ft)	?												40?B		
	(TD 258 ft)	?												10?B		
383?	370?	25?B														
		*1570	1480						*1287	*1210	*1150	*1066?		*1066		*811
		*890								?				*468		*303
		*1364								*931	880?			880		*675
		*1323	1240	1140?					*1016	*942	*848	*830		*830		*615
		*1400?	1343	1295					*1122	*1075	*1005	*931?		*931		*686
		1530?	1460?	1434					1227	1166	1070			1010		745
		905	835	730					?	560	470?	440		440		285
		1035?	910?	900?					?	660?				?		470?
		20B														
		*119												42B		
	(TD 235 ft)	85	22B											22B		
		*563	?						*246	*158	?			?		?
		*380	*320	200					*80	*39B				39B		
		74	24B											24B		
		50	25B											25B		
		15?B														
		420?	390	305					150?	95	58			58		15B
		118	?	21?B										21B		
		*124	?	12?B										12B		
		*128	?	44B										44B		
													(TD 310 ft)	65B		
	(TD 260 ft)	28B														
		26?B														
		53	30B											30B		
		70	35B											35B		
		*550	?											40B		
		*401	*338	210										112B		
	(TD 250 ft)	50B														
*491	*474	*390	338	247?						74B				74B		
541	535	434?	?	?	?		?		54?B					54B		
624	617	510?	450	379	?		?	?	?		50B			50B		
?	?	*132												45B		
		200	137	71B										71B		
		178?	122	55B										55B		
		?	?	?										42B		
		1B														
		155?	?	56?B										56B		
*583	*568	*434?	388						74B					74B		
*561	*555	*420	?	?		?	?	?	152	79	70B			70B		
?	?	*72?	41B											41B		
193	185	95?B														
*170	*160?	?												?		
210	195	127	82B											82B		
?	?	?												60B		
280	270	185	130	10B										10B		
210	204	140	85	76B										76B		
?	?	?												?		
		73	50B											50B		

Map no.	Sample no.	Township	Section (lot in Huron and Erie Cos.)	Operator	Well no. and name	Elevation at well head (ft above sea level)	Structure elevation (top of Rochester Fm) referred to sea level	Ordovician	Brassfield Formation	Cabot Head Formation	Dayton Formation	Rochester Formation
WYANDOT COUNTY (continued)												
M-1	2417	Richland	27	water well		860 GL	665			216	202	195
S-10	2486	Salem	6	water well		840 GL	650					190?
S-11	2487	Salem	11	water well		800 GL	635				(TD 180 ft)	165
185		Salem	12	Santoro	1 Roszman	832 KB	632	*330	*295	*217	*203	*200
S-547	547	Salem	25	water well		845 T	653		(TD 229 ft)	222	202	192
173		Salem	31	Comanche	1 Frey	868 DF	676	*320	*286?	*225	*204	*192
190		Sycamore	3	Vance	1 Koehl	880 KB	290	*741	*706	*617	*604	*590
S-14	2490	Sycamore	5	water well		800 GL						
171		Sycamore	15	Tri-State	1 Harper *et al.*	853 DF	301	*710	*663	*580	*562	*552
S-114	114	Tymochtee	7	Blackmer	1 Grubel	808 GL	443	505		395	380	365

Depth (ft) to top of																
Gasport Dolomite	Goat Island Dolomite	Lockport Dolomite	Greenfield Dolomite	Tymochtee Dolomite	A_1 anhydrite	A_1 carbonate	A_2 anhydrite	A_2 carbonate	B unit	C unit	E unit	F unit	G unit	Salina Group	Bass Islands Dolomite	Devonian carbonates
		70	40B											40B		
		80	30B											30B		
		60	34B											34B		
*172	*150?	*90?B														
		99	55B											55B		
		62?B														
		*451												250B		
													(TD 200 ft)	64B		
										*56	32B			32B		
		212		66?B										66B		

APPENDIX B.–SAMPLE DESCRIPTIONS

Allen County
Shawnee Township
Section 11 ($NE\frac{1}{4}$)

Sohio #2 Vistron
Permit No. 71
Sample No. 2359
Elevation (KB) 854 feet

Depth (ft)	
	Samples start at 30 feet in SALINA GROUP
30 - 40	Overburden
40 - 60	Dolomite, light- and medium-brown, microcrystalline (in place?); overburden
60 - 70	Dolomite as above, overburden. Limestone, medium-brownish-gray, micrograined, dolomitic. TYMOCHTEE DOLOMITE(?) at 60 feet
70 - 85	Overburden
85 - 95	Overburden. Limestone, medium-brown, lithographic (very fine- to medium-grained fragments of dolomicrite)
95 - 110	Limestone, light- and medium-grayish-brown and medium-brown, lithographic. Overburden
110 - 125	Limestone as above. Limestone, light-gray to brownish-gray, micrograined, laminated
125 - 135	Limestone, medium-gray to brownish-gray, lithographic, probably argillaceous
135 - 145	Limestone, light-gray, slightly brownish, micrograined, slightly dolomitic; laminated in part
145 - 150	Dolomite, medium-brown, microcrystalline (recrystallized?); laminated with black partings. Limestone as above, trace. GREENFIELD DOLOMITE at 145 feet
150 - 155	Dolomite as above
155 - 165	Dolomite, light-brown, microcrystalline and very finely crystalline (recrystallized); sucrosic in part; pelletal in part
165 - 170	Dolomite as above, in part dark brown and mottled yellow
170 - 175	Misplaced sample (Lockport)
175 - 180	Dolomite as above
180 - 190	Dolomite as above, laminated with dark-brown partings
190 - 200	Dolomite, light-brown, yellowish-brown, light-brownish-gray, microcrystalline (recrystallized in part)
200 - 215	Dolomite, very light- and light-brown, pinkish-brown, yellowish-brown, very light-brownish-gray, microcrystalline to finely crystalline (recrystallized), fossiliferous or fragmental; sucrosic in part; excellent vuggy porosity. LOCKPORT GROUP at 200 feet (GR)
215 - 250	Dolomite as above, light yellowish brown, very light brownish gray; porosity as above
250 - 255	Dolomite as above, very light and light grayish brown in part (microcrystalline). Chert, very light-gray; trace. GOAT ISLAND DOLOMITE at 255 feet (GR)
255 - 275	Dolomite, very light- and light-brown, grayish-brown, microcrystalline and very finely crystalline (recrystallized); sucrosic in part. Chert, very light-gray; heavy trace. Cavings
275 - 285	Dolomite, very light- to medium-gray, microcrystalline to medium-crystalline; poor pinpoint porosity. Cavings. GASPORT DOLOMITE at 272 feet (GR)
285 - 295	Dolomite as above, sucrosic in part; excellent vuggy porosity
295 - 300	Cavings
300 - 305	Dolomite, light-gray, greenish-gray, microcrystalline and very finely crystalline; slightly argillaceous in part. Cavings. ROCHESTER FORMATION at 298 feet (GR)
305 - 310	Dolomite as above, fossiliferous or fragmental, slightly pyritic, slightly glauconitic. Cavings
310 - 330	Dolomite as above. Dolomite, very light-gray to brownish-gray, microcrystalline to medium-crystalline (recrystallized); fair vuggy porosity
330 - 350	Dolomite as above, very light gray to brownish gray

350 - 355	Dolomite as above. Dolomite, light- and medium-gray, very finely crystalline, slightly glauconitic. ORDOVICIAN at 350 feet (GR)

Crawford County
Liberty Township
Section 15 ($SW\frac{1}{4}$)

Vandeveer #1 Brause
Permit No. 12
Sample No. 1496
Elevation (KB) 1030 feet

Depth (ft)	
	SILURIAN at 430 feet; SALINA GROUP undifferentiated
430 - 440	Dolomite, light- and medium-brown, microcrystalline (recrystallized? in large part)
440 - 450	Dolomite, light- and medium-brown, microcrystalline, laminated
450 - 460	Dolomite, light-brown, light-gray, microcrystalline, brecciated (some fragments consisting of chert); anhydritic in part; black shaly partings
460 - 470	Dolomite, light-brown, microcrystalline (recrystallized)
470 - 480	Dolomite as above. Dolomite, light-gray, brownish-gray, microcrystalline; partings as above
480 - 490	Dolomite, light-brown, gray, brownish-gray, microcrystalline
490 - 530	Dolomite, light-brown to grayish-brown, microcrystalline; black partings
530 - 570	Dolomite, light-brown, light- to medium-grayish-brown, microcrystalline, anhydritic (brown and white anhydrite); partings as above
570 - 580	Dolomite, light- to dark-brown, light-gray, microcrystalline, anhydritic; 85%. Shale, dark-green, 10%. Anhydrite, 50%. C unit(?) at 510 feet (GRN) E unit not recognized in samples; does not have characteristic response on GRN
580 - 590	Dolomite as above, 90%. Shale as above, 10%. Anhydrite, trace
590 - 600	Shale as above, 70%. Dolomite, light-brown to grayish-brown, microcrystalline; 30%. Anhydrite, trace
600 - 620	Dolomite, light-brown, microcrystalline, anhydritic (brown and white anhydrite). Shale as above, trace. B unit at 589 feet (GRN)
620 - 630	Dolomite as above
630 - 640	Dolomite, very light- to medium-brown, microcrystalline, very anhydritic; pelletal and oolitic in part (mud-supported)
640 - 650	Anhydrite, dolomitic
650 - 660	Dolomite, very light-brown, microcrystalline, very anhydritic; grading into anhydrite
660 - 670	Dolomite, very light-brown, light-grayish-brown, microcrystalline, anhydritic; poor pinpoint porosity
670 - 680	Dolomite, very light-brown, microcrystalline, slightly anhydritic. Gypsum, trace
680 - 700	Dolomite, light- and medium-brown, microcrystalline, laminated. (Greenfield lithology?)
700 - 710	Dolomite as above, poor pinpoint porosity
710 - 730	Dolomite, light-brown, microcrystalline and very finely crystalline (recrystallized); sucrosic in part; poor pinpoint and vuggy porosity. Nonrepresentative Salina
730 - 740	Dolomite as above. Dolomite, very light-brownish-gray, microcrystalline (recrystallized?)
740 - 750	Dolomite as in samples from 710 feet to 730 feet. Nonrepresentative Salina
750 - 760	Dolomite as above, medium brown; sparry in part
760 - 780	Dolomite as above, light brown; very light brownish gray in part. Nonrepresentative Salina. Shale, medium-green; trace
780 - 830	Dolomite, very light-brown to brownish-gray, microcrystalline to medium-crystalline (recrystallized); poor pinpoint porosity. LOCKPORT GROUP(?) or nonrepresentative Salina at 785 feet (GRN)
830 - 910	Dolomite, white to very light-gray, microcrystalline to medium-crystalline (recrystallized)
910 - 940	Dolomite as above, very light

brown to brownish gray

940 - 950 Dolomite as above. Dolomite, light-brown, microcrystalline and very finely crystalline (recrystallized); sucrosic in part

950 - 960 Dolomite, light- to medium-brown (heavy trace very light gray), microcrystalline to finely crystalline (recrystallized). Non-representative Salina

960 - 1000 Dolomite, light-brown, microcrystalline and very finely crystalline (recrystallized). Chert, very light-brownish-gray; trace

1000 - 1090 Dolomite, white, very light-gray, microcrystalline and very finely crystalline (recrystallized). Dolomite as above, trace

1090 - 1100 Dolomite, very light-gray, brownish-gray, microcrystalline and very finely crystalline (recrystallized). Chert, very light-gray, very light-gray and brown, white; heavy trace. GOAT ISLAND DOLOMITE at 1078 feet (GRN)

1100 - 1110 Dolomite, very light-brown, microcrystalline (recrystallized). Chert, very light-gray; trace

1110 - 1120 Dolomite, very light- to medium-gray, microcrystalline to coarsely crystalline. GASPORT DOLOMITE at 1100 feet (GRN)

1120 - 1130 Dolomite, light- to medium-gray, greenish-gray, light-brown, predominantly microcrystalline, slightly pyritic; argillaceous in large part. Shale, light- and medium-green; trace. ROCHESTER FORMATION at 1112 feet (GRN)

1130 - 1140 Dolomite, very light- and light-brown, mottled-pink, light-green, microcrystalline to coarsely crystalline, slightly pyritic. Shale as above, trace. DAYTON FORMATION at 1122 feet (GRN)

1140 - 1150 Dolomite as above. Dolomite, medium- to dark-gray, microcrystalline to finely crystalline (recrystallized). Shale as above, trace

1150 - 1160 Dolomite, very light-brown, mottled-light- and medium-gray, microcrystalline to coarsely crystalline, slightly pyritic. Dolomite as above, trace

1160 - 1170 Dolomite, mottled-light-brown, light- and medium-gray, microcrystalline, fragmental or fossiliferous. CABOT HEAD FORMATION at 1158 feet (GRN)

1170 - 1180 Dolomite as above, very light and light brown in part; 70%. Shale, medium-green; 30%

1180 - 1190 Shale as above, 60%. Dolomite, light-brown, light-greenish-gray to gray, microcrystalline to coarsely crystalline (recrystallized)

1190 - 1200 Shale, medium-greenish-gray; 90%. Dolomite as above, 10%

1200 - 1210 Dolomite, very light- and light-brown, gray, microcrystalline to coarsely crystalline, fossiliferous (bryozoan, crinoids), slightly pyritic. Shale as above, 20%

1210 - 1220 Dolomite as above, light brown

1220 - 1240 Dolomite, very light-brown, very light- to light-gray, microcrystalline to finely crystalline (recrystallized). Shale, medium-grayish-green, dolomitic; trace

1240 - 1260 Dolomite as above, slightly hematitic and glauconitic; limestone in part; argillaceous and silty in part. Shale as above, trace. Chert, white; trace. BRASSFIELD FORMATION at 1240 feet (GRN)

1260 - 1270 Dolomite and limestone, very light- and light-brown to gray, microcrystalline to coarsely crystalline (recrystallized); 90%. Shale as above, 10%. Chert, very light-brown, gray; heavy trace

1270 - 1280 Shale, medium-gray, greenish-gray, green, red; 50%. Dolomite and limestone as above, argillaceous in part; 50%. ORDOVICIAN at 1267 feet (GRN)

Crawford County
Vernon Township
Section 5 (SW$\frac{1}{4}$)

Mt. Carmel Drilling
#1 Strohm-Snyder
Permit No. 40
Sample No. 1444
Elevation (KB) 1092 feet

Depth (ft)

790 - 810 Siltstone, light- and medium-gray,

	argillaceous; grading into shale. Dolomite, light- and medium-brown, microcrystalline and very finely crystalline (recrystallized). Dolomite, very light-brown, microcrystalline. Shale, medium- and dark-gray, laminated; heavy trace. SILURIAN SALINA GROUP (F unit?) at 791 feet (GRN)
810 - 830	Dolomite, very light-yellowish-gray, microcrystalline
830 - 840	Dolomite, light-brown, microcrystalline (recrystallized), slightly sparry. Cavings
840 - 860	Dolomite, light-brown, microcrystalline. Dolomite, light-gray, microcrystalline, argillaceous. Shale, light-green, waxy, slightly pyritic; trace. E unit at 832 feet (GRN)
860 - 870	No samples
870 - 880	Dolomite as above, light brown. Dolomite, light-gray, microcrystalline, slightly argillaceous. Shale as above, trace
880 - 920	Dolomite, light-brown, microcrystalline (recrystallized). Dolomite as above, light gray; trace
920 - 930	Dolomite, light-brown, light-gray, microcrystalline; a few very dark-brown partings
930 - 940	Dolomite, light-brown, microcrystalline (recrystallized in part). Dolomite, light- and medium-gray, microcrystalline, slightly argillaceous. C unit at 930 feet (GRN)
940 - 950	Dolomite, light-brown, microcrystalline; slightly grayish in part. Dolomite, medium-brown to grayish-brown, microcrystalline, slightly argillaceous
950 - 980	Dolomite, light-brown, microcrystalline; 80%. Shale, medium- and dark-greenish-gray; 20%
980 - 990	Dolomite, light- and medium-brown, microcrystalline, 60%. Dolomite, light- to dark-gray, greenish-gray, microcrystalline, argillaceous; 40%
990 - 1010	Dolomite as above, light brown; 90%. Dolomite as above, gray and greenish gray; 10%
1010 - 1020	Dolomite as above, light brown; anhydritic in part; 60%. Dolomite as above, gray, greenish gray; grading into shale; 40%; Anhydrite, trace. B unit at 992 feet (GRN)
1020 - 1070	Dolomite, very light- and light-brown, slightly grayish, microcrystalline. Anhydrite, trace
1070 - 1100	Dolomite, very light-brown, slightly grayish, microcrystalline, slightly anhydritic; a few dark-brown shaly partings
1100 - 1110	Dolomite, light- and medium-brown, microcrystalline (recrystallized in part), laminated, slightly anhydritic; poor pinpoint porosity; a few partings as above
1110 - 1120	Dolomite as above, in part mottled medium gray
1120 - 1130	Dolomite, light- to dark-brown, mottled-medium-gray, microcrystalline and very finely crystalline (recrystallized); poor pinpoint porosity
1130 - 1140	Dolomite as above, poor vuggy porosity (vugs filled with gypsum). Dolomite, laminated light- and very dark-gray, microcrystalline (recrystallized?)
1140 - 1170	Dolomite, very light- to medium-brown, microcrystalline (recrystallized)
1170 - 1200	Dolomite as above, microcrystalline to finely crystalline (recrystallized)
1200 - 1210	Dolomite, white to very light-yellowish-brown, microcrystalline and very finely crystalline (recrystallized); good intercrystalline porosity. Dolomite, light-brown, microcrystalline; sucrosic in part; fair pinpoint porosity. Top of white dolomite LOCKPORT DOLOMITE(?) at 1178 feet (GRN)
1210 - 1230	Dolomite as above, white to very light yellowish brown. Dolomite, very light- and light-brown, microcrystalline to finely crystalline (recrystallized); trace
1230 - 1260	Dolomite, light-brown, micro-

	crystalline to medium-crystalline (recrystallized); sucrosic in part; poor to fair intercrystalline porosity
1260 - 1280	Dolomite, light-brown, microcrystalline to finely crystalline
1280 - 1310	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline (recrystallized)
1310 - 1370	Dolomite, white and very light-gray, microcrystalline to finely crystalline (recrystallized); very fine sample. Top of white dolomite at 1300 feet (GRN)
1370 - 1380	Dolomite as above. Dolomite, light-yellowish-gray, microcrystalline to finely crystalline (recrystallized); heavy trace
1380 - 1400	Dolomite, white to very light-gray, light-yellowish-gray, microcrystalline to finely crystalline (recrystallized)
1400 - 1420	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline (recrystallized)
1420 - 1450	Dolomite as above, very slightly glauconitic; light brown in part (chertless Goat Island Formation?)
1450 - 1470	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline (recrystallized), slightly pyritic. Dolomite, medium-brownish-gray to greenish-gray, microcrystalline, argillaceous. Dolomite as above, brown; trace. ROCHESTER FORMATION at 1452 feet (GRN)
1470 - 1480	Dolomite, light-brown, microcrystalline, slightly glauconitic, slightly pyritic. Shale, medium-green; trace. DAYTON FORMATION at 1464 feet (GRN)
1480 - 1490	Dolomite as above, light brown and very light gray in part. Shale, light- and medium-green, greenish-gray; trace
1490 - 1500	Dolomite, very light- to medium-gray, very light- and light-brown, microcrystalline to coarsely crystalline, fossiliferous; coarse grained in part; 90%. Shale, light-green; 10%. CABOT HEAD FORMATION at 1488 feet (GRN)
1500 - 1520	Shale, light-green, Dolomite, light-brown, microcrystalline; trace
1520 - 1530	Shale as above, in part reddish brown. Dolomite as above
1530 - 1540	Shale as above, 90%. Dolomite as above, hematitic in part; 10%
1540 - 1550	Shale, medium-gray, reddish-brown; 50%. Dolomite, very light- and light-brown to brownish-gray, recrystallized, crinoidal; 50%
1550 - 1560	Dolomite as above, hematitic in part; 70%. Shale as above, 30%
1560 - 1570	Dolomite as above, slightly argillaceous and silty in part. Shale, medium-gray, green; heavy trace
1570 - 1580	Dolomite as above, 90%. Shale, light- and medium-green, medium-gray, red; 10%
1580 - 1590	Dolomite, light- and medium-gray, very light-brown, very finely crystalline to coarsely crystalline (recrystallized), slightly glauconitic; hematitic in part. Chert, cream-colored; trace. Shale, medium-green, gray; trace. BRASSFIELD FORMATION at 1583 feet (GRN)
1590 - 1620	Dolomite as above. Chert as above, fossiliferous; heavy trace. Shale as above, trace
1620 -	Shale, red, light-green. Limestone, light-gray, very finely crystalline; trace. ORDOVICIAN at 1614 feet (GRN)

Defiance County
Washington Township
Section 32

Maumee Valley Oil and Gas #1 Boland
Permit No. 20
Sample No. 961
Elevation (GL) 715 feet

Depth (ft)	
266 - 276	Dolomite, very light- to light-brown and grayish-brown, sublithographic. Dolomite, very light-gray and light-brown, sublithographic and microcrystalline; trace. Sandstone, white, fine- to

		medium-grained; trace. Shale, medium-gray to light-grayish-green; trace. SILURIAN (SALINA GROUP undifferentiated?) at 266 feet
276 -	286	Dolomite as above, very light grayish brown
286 -	296	Dolomite, light- and medium-brown, mottled-gray, microcrystalline, laminated; dark-brown partings. Chert, recrystallized; trace
296 -	307	Dolomite, light-brown, microcrystalline
307 -	329	Dolomite, very light- and light-brown, light- and medium-gray to greenish-gray, microcrystalline, slightly sandy (fine- and medium-grained sand), argillaceous; silty in part; grading into shale. C unit at 307 feet
329 -	339	Dolomite, very light-grayish-brown to light-brown, microcrystalline; a few dark-brown partings. B unit at 329 feet
339 -	349	Dolomite, very light- to medium-brown, microcrystalline. Anhydrite, white; trace
349 -	359	Dolomite, very light-gray, very light- to medium-brown, microcrystalline, slightly anhydritic; poor vuggy porosity (crystal molds)
359 -	365	Dolomite, medium-brown, microcrystalline. Dolomite, very light-brown, microcrystalline; trace
365 -	380	Dolomite, light-brownish-gray, light- and medium-brown, microcrystalline, slightly sparry; sucrosic in part; poor vuggy porosity (crystal molds)
380 -	395	Dolomite, light- and medium-brown to grayish-brown, microcrystalline
395 -	405	Dolomite, white to light-gray, microcrystalline and very finely crystalline. Nonrepresentative Salina
405 -	435	Dolomite, very light- to medium-brown, white, very light-gray, microcrystalline and very finely crystalline; poor vuggy porosity
435 -	469	Dolomite as above, very light to medium brown
469 -	480	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline; slightly grayish in part; poor vuggy porosity. Nonrepresentative Salina
480 -	510	Dolomite as above, light and medium brown, medium brownish gray
510 -	531	Dolomite, light-brown, microcrystalline and very finely crystalline, sparry; sucrosic in part; fair vuggy porosity
531 -	557	Dolomite as above, nonsparry; poor pinpoint and vuggy porosity
557 -	580	Dolomite, very light- and light-brown, microcrystalline to medium-crystalline. Dolomite, very light- to medium-gray, microcrystalline; sparry in small part; poor pinpoint to vuggy porosity. LOCKPORT DOLOMITE at 557 feet
580 -	660	Dolomite, very light-gray to brownish-gray, microcrystalline to very coarsely crystalline; probably crinoidal
660 -	745	Dolomite as above, light gray in part, sucrosic in part
745 -	775	Dolomite, white and very light-gray, microcrystalline to medium-crystalline
775 -	855	Dolomite, very light- and light-gray, microcrystalline to medium-crystalline. Dolomite rhombs, trace
855 -	900	Dolomite, light-gray, microcrystalline to coarsely crystalline, fossiliferous or fragmental; sucrosic in part; poor vuggy porosity
900 -	910	Dolomite as above, light gray, slightly pyritic. Dolomite, very light- and light-brown, microcrystalline and very finely crystalline; crinoidal in part; mottled light greenish gray with clay in part. Base LOCKPORT DOLOMITE at 902 feet
910 -	920	Dolomite, very light- and light-brown, microcrystalline to medium-crystalline, slightly cherty; in small part mottled very light greenish gray as above; crinoidal in part
920 -	930	Dolomite, very light-gray, brown,

	microcrystalline to finely crystalline; poor vuggy porosity
930 - 945	Dolomite as above, white in part microcrystalline to coarsely crystalline; very fine sample
945 - 985	Dolomite, white to very light-brown, microcrystalline to coarsely crystalline; poor vuggy porosity
985 - 995	Dolomite, very light- and light-brown, microcrystalline to coarsely crystalline; crinoidal in part. Dolomite, very light- to dark-gray, microcrystalline, slightly pyritic; heavy trace. ORDOVICIAN at 995 feet

Erie County
Groton Township
Lot 10, 2nd Qtr.

Sentinel Enterprises
#1 Miller
Permit No. 2
Sample No. 774
Elevation (T) 726 feet

Depth (ft)	
185 - 218	Sandstone, light-brownish-gray, very fine- and fine-grained, dolomitic; grading into dolomite
218 - 233	No samples
233 - 244	Dolomite, light-brown and grayish-brown, microcrystalline (dolomicrite and dolosiltite); poor vuggy porosity in part. SILURIAN (BASS ISLANDS DOLOMITE) at 233 feet
244 - 254	Dolomite as above, laminated. Dolomite, light-gray, microcrystalline. Chert, white; trace
254 - 264	Anhydrite and gypsum, 70%. Dolomite as above, 30%. SALINA GROUP (G unit) at 257 feet
264 - 290	Dolomite, light- and medium-gray, microcrystalline, argillaceous; very slightly greenish in part; 90%. Gypsum and anhydrite, 10%
290 - 306	Dolomite as above. Gypsum and anhydrite, heavy trace
306 - 321	Dolomite, light-brown, light- and medium-brownish-gray to greenish-gray, microcrystalline, argillaceous, anhydritic; 85%. Anhydrite, 15%. Gypsum, trace
321 - 336	Dolomite as above, pelletal in part (brown dolomite); 95%. Anhydrite, 5%
336 - 363	Dolomite as above, predominantly light brown; 95%. Anhydrite, 5%
363 - 384	Dolomite, very light- and light-brown and grayish-brown, microcrystalline. Anhydrite, trace
384 - 394	Dolomite as above, anhydritic in part
394 - 408	Dolomite, medium- and dark-gray to brownish-gray, microcrystalline, very argillaceous; 70%. Dolomite as above, 30%. Anhydrite, trace. E unit(?) at 400 feet
408 - 422	Dolomite, very light- and light-brown, microcrystalline. Dolomite, light- and medium-gray, microcrystalline, argillaceous; trace. Anhydrite, trace
422 - 436	Dolomite, light-brown, microcrystalline; gypsum-filled vugs; 90%. Dolomite, light- to dark-gray, microcrystalline, argillaceous; 10%
436 - 451	Dolomite, very light- and light-brown, microcrystalline; anhydritic and gypsiferous in small part
451 - 463	Dolomite as above. Anhydrite, heavy trace
463 - 475	Dolomite and anhydrite as above. Chert, light-gray; trace
475 - 484	Dolomite, light-brown, medium- and dark-gray, microcrystalline, laminated; argillaceous in part; anhydritic in part. Anhydrite, heavy trace
484 - 495	Dolomite as above, 95%. Anhydrite, 5%
495 - 505	Dolomite, light-gray, light- and medium-brown to grayish-brown, microcrystalline; 60%. Dolomite, light- and medium-greenish-gray, microcrystalline, very argillaceous, silty; 40%. Anhydrite, trace. C unit at 500 feet
505 - 519	Dolomite as above, greenish gray; 80%. Dolomite, very light- and light-brown, microcrystalline; 20%. Anhydrite, heavy trace
519 - 537	Dolomite as above, greenish

		gray; 50%. Dolomite as above, brown; medium brown in part; 50%. Anhydrite, trace
537 -	544	Dolomite as above, greenish gray; brownish gray in part; 70%. Dolomite as above, brown; 30%. Anhydrite, trace
544 -	560	Dolomite, light-brown, microcrystalline, anhydritic; laminated in part; 70%. Dolomite as above, greenish gray; 30%. Shale, black; trace
560 -	573	Dolomite, medium-greenish-gray, microcrystalline, very argillaceous, 60%. Dolomite, light-brown and grayish-brown, microcrystalline; 40%. B unit at 573 feet
573 -	586	Dolomite, light-brown, grayish-brown, microcrystalline; anhydritic in part (brown anhydrite)
586 -	607	Dolomite as above. Dolomite, medium-greenish-gray, argillaceous; trace
607 -	617	Dolomite, light- and medium-brown, microcrystalline; 70%. Anhydrite, brown; 30%
617 -	626	Anhydrite, 70%. Dolomite, light-brownish-gray, microcrystalline; 30%
626 -	636	Dolomite, light-brownish-gray, gray, microcrystalline; 80%. Anhydrite, 20%
636 -	650	Anhydrite, 50%. Dolomite as above, 50%. Dolomite, light-greenish-gray, argillaceous; trace
650 -	675	Anhydrite, 70%. Dolomite as above, very light and light brown; 30%
675 -	687	Dolomite, very light- and light-brown, grayish-brown, microcrystalline; 70%. Anhydrite, 30%
687 -	698	Dolomite, light- to dark-brown, microcrystalline; grayish in part; 95%. Anhydrite, 5%
698 -	720	Dolomite, light-brown, grayish-brown; very slightly anhydritic in part
720 -	731	Dolomite as above. Dolomite, light-brown, light-brownish-gray, very finely crystalline, pelletal, oil-stained; with fair pinpoint and intercrystalline porosity
731 -	743	Dolomite, light-brownish-gray, very light- and light-brown, microcrystalline and very finely crystalline
743 -	753	Dolomite, light-brownish-gray to grayish-brown, microcrystalline. Anhydrite, trace. Shale, black; trace
753 -	762	Dolomite as above, predominantly light brown
762 -	778	Dolomite, very light-brown and yellowish-brown, microcrystalline and very finely sucrosic. Anhydrite, trace
778 -	783	Dolomite, very light-yellowish-brown to light-brown, microcrystalline and very finely crystalline. Anhydrite, trace
783 -	788	Dolomite as above, light and medium grayish brown in part. Anhydrite, trace
788 -	793	Dolomite, medium-grayish-brown, microcrystalline
793 -	798	Anhydrite, 60%. Dolomite as above, 40%
798 -	803	Dolomite, medium-brown, microcrystalline; 90%. Anhydrite, 10%
803 -	808	Dolomite as above. Anhydrite, heavy trace
808 -	813	Dolomite, very light- and light-brown, medium-grayish-brown, microcrystalline. Anhydrite, trace
813 -	819	Dolomite, light- and medium-brown, microcrystalline
819 -	829	Dolomite, light-gray, light- and medium-brown, microcrystalline; 70%. Anhydrite, 30%. Gypsum, trace
829 -	839	Anhydrite, 60%. Dolomite as above, 40%
839 -	848	Dolomite as above, 60%. Anhydrite, 40%. Chert, very light-brown; trace
848 -	854	Dolomite, light- and medium-brown, microcrystalline. Gypsum and anhydrite, heavy trace
854 -	910	Dolomite as above
910 -	935	Dolomite as above, predominantly light brown; very finely crystalline and laminated in part; siliceous in part. Chert, light-brown; heavy trace to trace
935 -	946	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline; sili-

	ceous in part. Chert, white; trace
946 - 956	Dolomite as above. Chert, white, very light-brownish-gray; heavy trace
956 - 966	Dolomite as above. Dolomite, very light- and light-gray, microcrystalline and very finely crystalline. Chert as above, heavy trace
966 - 994	Dolomite, very light-gray, microcrystalline to finely crystalline; finely sucrosic in part. Dolomite as above, brown; minor to 976 feet. Gypsum, trace
994 - 1043	Dolomite as above, very light to medium gray. Gypsum, heavy trace to trace from 1014 to 1054 feet
1043 - 1054	Dolomite, light- and medium-brown to grayish-brown and greenish-gray, microcrystalline, argillaceous to very argillaceous, pyritic, fossiliferous. Dolomite as above, minor. ROCHESTER FORMATION at 1046 feet
1054 - 1062	Dolomite, very light-yellowish-brown, brown, yellowish-gray, microcrystalline, slightly glauconitic, pyritic. Dolomite, medium-gray, microcrystalline, heavy trace. Shale, dark-brown, slightly glauconitic; pyrite laminations; trace. DAYTON FORMATION at 1054 feet
1062 - 1070	Dolomite, medium- and dark-gray to brownish-gray, microcrystalline, probably bioclastic, pyritic. Shale, light-green; trace. CABOT HEAD FORMATION at 1070 feet
1070 - 1083	No samples (probably clay shale)
1083 - 1121	Shale, light- and medium-green to grayish-green, poorly indurated
1121 - 1150	Shale as above. Dolomite, very light- and light-brown and grayish-brown, bioclastic, slightly pyritic. Shale, dark-brownish-red; trace. BRASSFIELD FORMATION(?) (top out of place)
1150 - 1159	Dolomite as above. Shale as above, green; trace
1159 - 1168	Dolomite and shale as above. Dolomite, slightly glauconitic and ferruginous
1168 - 1178	Dolomite, very light- and light-brown and gray to brownish-gray, bioclastic, fossiliferous (brachiopods). Shale, medium-grayish-green; trace
1178 - 1211	Dolomite as above, predominantly very light brown; siliceous in part. Chert, very light-brown to brownish-gray; trace
1211 - 1223	Dolomite and chert as above. Dolomite, light- and medium-greenish-gray, very fine-grained, fossiliferous, argillaceous, silty. Shale, medium-green, red; heavy trace. ORDOVICIAN at 1222 feet
1223 - 1234	Shale, red; minor light green
	Samples below 1234 feet not examined

Erie County
Huron Township
Lot 32 (Huron Village)

Nickel Plate Development Co. #1 N. Y., Chicago & St. Louis Railroad
Permit No. 5
Sample No. 695
Elevation (GL) 580 feet

Described from crushed core chips

Depth (ft)	
415 - 425	Dolomite, very light- and light-brown, microcrystalline, sandy to very sandy (very fine- to coarse-grained sand). Chert as above, white; with dolomite crystals; sandy in part; 30%
425 - 430	Dolomite as above, light brown in part. Dolomite, light-gray, microcrystalline, nonsandy; trace. Chert, white, fossiliferous; 10%. SILURIAN (BASS ISLANDS DOLOMITE) at 430 feet
430 - 435	Dolomite as above, light gray, microcrystalline; very sandy; grading into sandstone. Sandstone, trace
435 - 440	Dolomite, light-brown, light-gray, microcrystalline; poor vuggy porosity. Dolomite as above, trace
440 - 465	Dolomite, light-brown, microcrystalline; very poor vuggy

	to pinpoint porosity
465 - 470	Dolomite, light-gray, light-brown, microcrystalline; poor to fair pinpoint and vuggy porosity (dissolved gypsum crystals)
470 - 480	Dolomite, very light- and light-brown, microcrystalline; poor porosity as above
480 - 485	Dolomite, light- and medium-brown, light- to medium-gray, microcrystalline; shaly partings
485 - 490	Dolomite, light- and medium-brown, microcrystalline
490 - 495	Dolomite, light- to dark-gray, very light- to dark-brown, black, microcrystalline, laminated, anhydritic (brown anhydrite)
495 - 500	Dolomite as above. Gypsum, 5%. Anhydrite (crystalline), in gypsum; heavy trace. SALINA GROUP (G unit) at 500 feet
500 - 505	Gypsum, 60%. Dolomite, light- and medium-brown, microcrystalline, clayey; 40%. Anhydrite (crystalline), in gypsum; trace
505 - 510	Dolomite, light- and medium-brown, microcrystalline, anhydritic; grading into anhydrite. Gypsum, heavy trace
510 - 515	Anhydrite. Gypsum, trace
515 - 520	Dolomite, medium-brown, slightly grayish, microcrystalline, anhydritic; grading into anhydrite
520 - 525	Dolomite, medium-gray, microcrystalline, very argillaceous. Anhydrite and gypsum, heavy trace
525 - 530	Dolomite, light- and medium-brown, slightly grayish, microcrystalline. Dolomite, dark-brown, medium-gray, mottled, microcrystalline, argillaceous. Anhydrite, partly altered to gypsum, 30%
530 - 535	Shale, medium- and dark-greenish-gray, slightly dolomitic. Dolomite, light-brown to grayish-brown, microcrystalline, gypsiferous; poor pinpoint porosity along bedding planes (dissolved gypsum)
535 - 540	Shale as above, grading into medium-brownish-gray to greenish-gray dolomite, 80%. Gypsum and anhydrite, 20%
540 - 545	Shale and dolomite as above, 90%. Anhydrite and gypsum, 10%
545 - 550	Shale and dolomite as above, 60%. Gypsum and anhydrite, 40%
550 - 555	Dolomite, medium-gray to brownish-gray, microcrystalline, very argillaceous. Dolomite, medium-brown, microcrystalline, very anhydritic; grading into anhydrite. Gypsum and anhydrite, trace
555 - 560	Shale, medium-brownish-gray to greenish-gray, dolomitic; 60%. Anhydrite, in large part altered to gypsum; 40%
560 - 565	Dolomite, medium- and dark-brownish-gray, microcrystalline, argillaceous. Dolomite, medium-brown, microcrystalline, anhydritic. Anhydrite, 20%. Gypsum, trace. F unit at 563 feet
565 - 570	Anhydrite, medium-brownish-gray, microcrystalline, argillaceous; impure with dolomite
570 - 575	Anhydrite, medium-brown, microcrystalline; partly altered to gypsum; impure with dolomite
575 - 580	Anhydrite as above. Dolomite, trace
580 - 585	Anhydrite as in sample from 570 feet to 575 feet
585 - 590	Dolomite, very light- and light-brown, microcrystalline, anhydritic (brown anhydrite crystals); interbedded with gypsum partially to completely dissolved, leaving porous dolomite. Anhydrite, 20%. Gypsum, 10%
590 - 595	Anhydrite, impure with dolomite
595 - 600	Dolomite, medium- and dark-brown, microcrystalline, anhydritic. Anhydrite, 15%. Gypsum, 15%
600 - 605	Dolomite, light- and medium-brown, microcrystalline, pelletal (grain-supported), gypsiferous. Dolomite, medium-brownish-gray, microcrystalline, argillaceous, anhydritic. Anhydrite, 10%
605 - 610	Dolomite, light- and medium-brown, microcrystalline,

	anhydritic (brown anhydrite crystals). Shale, dark-gray, dolomitic; 10%
610 - 615	Anhydrite, impure with pelletal dolomite
615 - 630	Anhydrite, medium-brown to brownish-gray, microcrystalline; argillaceous in part; impure with dolomite
630 - 635	Dolomite, light- and medium-brown, microcrystalline, anhydritic (brown anhydrite crystals and white anhydrite); pelletal in part. Anhydrite, 30%
635 - 640	Dolomite, very light- to medium-brown, microcrystalline, anhydritic (brown anhydrite crystals). Dolomite, dark-brown, microcrystalline
640 - 645	Dolomite, medium- and dark-brown, microcrystalline; very anhydritic in part
645 - 650	Dolomite as above. Anhydrite, 50%
650 - 655	Anhydrite, 70%. Dolomite, medium-gray, slightly greenish, dark-brown, argillaceous to very argillaceous; 30%. E unit at 653 feet
655 - 660	Anhydrite, impure with dolomite; 50%. Dolomite, medium-gray to greenish-gray, microcrystalline, very argillaceous; 50%
660 - 665	Dolomite, light- and medium-brown, microcrystalline, anhydritic. Anhydrite, 20%
665 - 670	No samples
670 - 675	Dolomite, very light- and light-brown, microcrystalline, anhydritic (brown anhydrite crystals)
675 - 685	Dolomite, light-brown, light-grayish-brown, microcrystalline; carbonaceous partings; anhydritic in part
685 - 690	Dolomite as above. Anhydrite, 20%
690 - 700	Dolomite, light-brown, microcrystalline, anhydritic; carbonaceous laminations
700 - 710	Anhydrite, light-brown, microcrystalline; impure with dolomite
710 - 720	Dolomite, light-brown, microcrystalline, anhydritic (brown anhydrite crystals); carbonaceous partings
720 - 725	Dolomite, light- to dark-brown, microcrystalline; grayish in part. Dolomite, dark-gray, microcrystalline, very argillaceous
725 - 730	Dolomite as above, brown. Anhydrite, 20%
730 - 735	Dolomite, light-brown, microcrystalline, anhydritic (brown anhydrite crystals). Dolomite, dark-brownish-gray, microcrystalline, argillaceous
735 - 740	Dolomite, very light- and light-brown, microcrystalline, very anhydritic (brown and white anhydrite). Anhydrite, 10%. Argillaceous dolomite as above, trace
740 - 745	Anhydrite, 50%. Dolomite, light-brown, dark-brownish-gray, argillaceous, microcrystalline, 50%
745 - 750	Shale, light- and medium-greenish-gray, dolomitic, silty. Dolomite, light-brownish-gray, microcrystalline, argillaceous; heavy trace. Anhydrite, trace. C unit at 745 feet
750 - 755	Shale as above. Anhydrite, trace
755 - 760	Shale as above. Anhydrite, pink in part; 5%. Dolomite, very light-brown, microcrystalline; trace
760 - 765	Dolomite, light-brown to grayish-brown, microcrystalline. Dolomite, medium- and dark-brown, very anhydritic
765 - 770	Shale, medium-gray to greenish-gray, silty, dolomitic. Anhydrite, impure with dolomite; trace
770 - 775	Shale as above. Anhydrite, pink in part; 15%
775 - 780	Shale as above. Dolomite, light- and medium-brown, slightly grayish, microcrystalline, anhydritic; heavy trace
780 - 785	Shale as above. Dolomite as above, 50%
785 - 790	Shale as above
790 - 795	Anhydrite, impure with brown dolomite; 60% (Theta bed). Shale as above, grading into light- and medium-brownish-gray dolomite; 40%
795 - 800	Anhydrite, impure with brown

	dolomite
800 - 805	Shale as above. Dolomite, light-brown, microcrystalline, very anhydritic (brown anhydrite); 40%
805 - 810	Shale as above. Dolomite, light- and medium-brown, microcrystalline; grayish in part; anhydritic in part; 40%
810 - 815	Shale, medium-greenish-gray. Anhydrite, pink in part; 10%
815 - 820	Dolomite, light- and medium-gray to brownish-gray, microcrystalline, argillaceous to very argillaceous. Anhydrite, impure with brown dolomite; 5%
820 - 830	Anhydrite, impure with dolomite. B unit at 820 feet
830 - 835	Dolomite, light-brown, microcrystalline; brown anhydrite crystals; 90%. Shale, medium-greenish-gray; 10%
835 - 845	Anhydrite, impure
845 - 850	Anhydrite, impure; 50%. Dolomite, light-brown, microcrystalline; 50%
850 - 855	Dolomite as above
855 - 860	Dolomite as above, grayish brown in part; 90%. Shale, dark-gray; 10%. Anhydrite, impure; trace
860 - 865	Anhydrite, impure; 50%. Dolomite, light-brown, microcrystalline, anhydritic (brown anhydrite crystals); 50%
865 - 875	Anhydrite, impure
875 - 880	Anhydrite, impure with dolomite
880 - 885	Dolomite, light- and medium-brownish-gray to dark-brown, microcrystalline; argillaceous in part; 60%. Anhydrite, impure; 40%
885 - 890	Anhydrite, impure with dolomite
890 - 895	Dolomite, light- and medium-brown, microcrystalline; brown anhydrite crystals, 50%. Anhydrite, 25%. Shale, medium-greenish-gray; 25%
895 - 905	Anhydrite, light-brown, microcrystalline; impure with dolomite
905 - 910	Dolomite as above, laminated in small part with dark-grayish-brown dolomite. Anhydrite, heavy trace
910 - 915	Anhydrite
915 - 920	Anhydrite, 50%. Dolomite as above, 50%
920 - 930	Dolomite, medium-brown, microcrystalline; black carbonaceous partings. A_2 carbonate at 920 feet
930 - 935	Dolomite, very light- to medium-brown, microcrystalline; carbonaceous partings
935 - 940	Dolomite, medium- and dark-brown, microcrystalline; poor pinpoint porosity; patch of sparry dolomite
940 - 950	Dolomite, medium- and dark-grayish-brown, microcrystalline; laminated with carbonaceous partings. Sparry dolomite, trace from 945 feet to 950 feet
950 - 955	Dolomite, light-brown, microcrystalline; a few black anhydrite crystals
955 - 960	Dolomite as above, grayish in part. Anhydrite, 15%
960 - 965	Anhydrite, impure with dolomite
965 - 970	Dolomite, light- and medium-brown, microcrystalline; a few carbonaceous partings
970 - 975	Dolomite as above, slightly grayish
975 - 980	Dolomite, medium-brown, light- and medium-grayish-brown, microcrystalline. Sparry dolomite, trace
980 - 990	Dolomite as above; grayish-brown dolomite laminated with dark-gray shaly dolomite to 985 feet
990 - 995	Dolomite, light-brown, slightly grayish, microcrystalline. Shale, medium-greenish-gray to dark-gray; 10%
995 - 1000	Anhydrite, dolomitic
1000 - 1015	Anhydrite. Shale, black; heavy trace to 1005 feet. A_2 anhydrite at 995 feet
1015 - 1020	Anhydrite, 60%. Dolomite, light-brown, microcrystalline; 40%
1020 - 1025	Anhydrite, 80%. Dolomite as above, 20%
1025 - 1030	Anhydrite, impure with dolomite
1030 - 1040	Dolomite as in sample from 950 feet to 955 feet. A_1 carbonate

	at 1030 feet
1040 - 1055	Anhydrite, impure with dolomite
1055 - 1065	Dolomite, dark-brown, microcrystalline, oil-stained; black shaly partings from 1060 feet to 1065 feet; 70%. Anhydrite as above, 30%
1065 - 1070	Dolomite, medium-brown, microcrystalline, anhydritic (brown anhydrite crystals)
1070 - 1075	Dolomite, medium-brown, microcrystalline, slightly anhydritic; carbonaceous partings
1075 - 1080	Anhydrite, impure with dolomite
1080 - 1110	Anhydrite. A_1 anhydrite at 1080 feet
1110 - 1115	Dolomite, medium-brown, microcrystalline, slightly oil-stained; patches of sparry dolomite. LOCKPORT GROUP at 1110 feet
1115 - 1135	Dolomite, very light- to medium-brown, microcrystalline and very finely crystalline, laminated; carbonaceous partings; oil stained from 1125 feet to 1135 feet
1135 - 1140	Dolomite, medium-brown, microcrystalline to finely crystalline; oil stained in part; grayish brown in part; carbonaceous partings
1140 - 1150	Dolomite as above, light and medium brown
1150 - 1155	Dolomite, light-brown, microcrystalline; poor pinpoint porosity
1155 - 1160	Dolomite as in samples from 1140 feet to 1150 feet
1160 - 1170	Dolomite, light- and medium-brown, microcrystalline; slightly grayish in part; slightly siliceous in part
1170 - 1175	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; very poor vuggy porosity. Anhydrite, trace. Shale, light-green; trace
1175 - 1180	Dolomite as above, light brown
1180 - 1190	Dolomite, light-gray, very light- and light-brown, microcrystalline and very finely crystalline; poor pinpoint and vuggy porosity
1190 - 1195	Dolomite, light-yellowish-gray, very finely crystalline; 70% (chert facies). Chert, white, fossiliferous; 30%
1195 - 1200	Dolomite, light-gray, light-yellowish-gray, microcrystalline to finely crystalline; poor pinpoint to vuggy porosity
1200 - 1205	Dolomite as above, light gray
1205 - 1215	Dolomite, very light- and light-gray, recrystallized, bioclastic; fair vuggy porosity
1215 - 1220	Dolomite as above, predominantly microcrystalline. Anhydrite, trace
1220 - 1225	Misplaced sample
1225 - 1235	Dolomite, very light- and light-gray, microcrystalline (recrystallized)
1235 - 1240	Dolomite, very light- to dark-brown, microcrystalline and finely crystalline, bioclastic; poor vuggy porosity; few shaly partings. GASPORT DOLOMITE at 1235 feet
1240 - 1250	Dolomite as above. Anhydrite, trace to 1245 feet
1250 - 1280	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline; excellent vuggy porosity. Gypsum, trace (as vug-filler). Shale, light-gray (out of place), to 1255 feet
1280 - 1285	Dolomite, very light- to medium-gray, predominantly microcrystalline, slightly pyritic; poor vuggy porosity
1285 - 1290	Dolomite, light-greenish-gray, medium-brownish-gray, microcrystalline, silty, argillaceous, slightly pyritic. ROCHESTER FORMATION at 1285 feet
1290 - 1295	Dolomite as above, grading into shale
1295 - 1300	Dolomite and shale as above. Dolomite, light- and medium-gray, microcrystalline to finely crystalline; heavy trace
1300 - 1305	Shale, medium-brownish-gray to brown, dolomitic; 60%. Dolomite, light-brown, microcrystalline; 40%
1305 - 1310	Dolomite, light-brown, slightly yellowish, microcrystalline and finely crystalline, recrystallized. DAYTON

	FORMATION at 1305 feet
1310 - 1315	Dolomite as above. Dolomite, dark-grayish-brown, very finely crystalline. Shale, light-gray; trace
1315 - 1320	Shale, medium-green. CABOT HEAD FORMATION at 1315 feet
1320 - 1325	Shale, medium-green, red
1325 - 1350	Shale, medium-green. Sandstone, light-greenish-gray, fine-grained; trace to 1335 feet
	TD 1350 feet in Cabot Head Formation

Erie County
Perkins Township

Fenix & Scisson #1
NASA test well
Sample No. 2342
Elevation (GL) 648 feet

Depth (ft)	
280 - 290	Dolomite, light-gray, brown, microcrystalline (dolosiltite); fair pinpoint porosity (in crystal molds); 50%. Dolomite, very light- and light-brown, very finely crystalline, very sandy (very fine-grained sand); grading into sandstone; 40%. Sandstone, light-brownish-gray, very fine-grained, dolomitic; 10%. Chert, white, light-brown; trace. SILURIAN (BASS ISLANDS DOLOMITE) at 285 feet
290 - 310	Dolomite, light-gray, light- and medium-brown, microcrystalline (dolomicrite and dolosiltite). Sandy dolomite and sandstone as above, heavy trace
310 - 320	Dolomite, light- and medium-brown, microcrystalline (dolosiltite), anhydritic; good intercrystalline porosity in part; very gypsiferous in part. SALINA GROUP (G unit) at 312 feet (GRN)
320 - 330	Shale, medium-gray, very slightly greenish, dolomitic, very silty; grading into dolomite; anhydritic in part. Anhydrite, heavy trace
330 - 350	Shale as above, grading into dolomite. Anhydrite, trace
350 - 360	Dolomite as above, very anhydritic; medium grayish brown in part; 90%. Anhydrite, 10%. Dolomite cavings
360 - 370	Dolomite as above, grading into silty shale
370 - 380	Dolomite and shale as above, 95%. Anhydrite, 5%. Dolomite cavings. F unit at 379 feet (GRN)
380 - 390	Anhydrite, 40%. Dolomite and shale as above, 30%. Dolomite, light-brown, microcrystalline (dolomicrite); light-brown crystalline anhydrite as inclusions; 30%
390 - 400	Gray dolomite and shale as above, 35%. Brown dolomite as above, anhydritic; 35%. Anhydrite, 30%
400 - 410	Anhydrite, 70%. Dolomite, light- and medium-brown, microcrystalline (dolomicrite), very anhydritic; 30%
410 - 420	Dolomite, medium-gray, anhydritic, very argillaceous; grading into shale; 40%. Anhydrite, 30%. Dolomite as above, 30%
420 - 430	Dolomite and anhydrite as above, mostly cavings. Gypsum, trace
430 - 440	Dolomite, light-brown, microcrystalline (dolomicrite); brown anhydrite crystals; 95%. Anhydrite, 5%
440 - 450	Dolomite as above, medium brown and grayish brown in part. Anhydrite, heavy trace. Dolomite, medium-gray, very argillaceous; grading into shale; heavy trace
450 - 460	Dolomite and shale as above, 80%. Anhydrite, 20%. E unit at 452 feet (GRN)
460 - 470	Gray dolomite and shale as above, 80%. Anhydrite, 10%. Dolomite, light-brown, microcrystalline (dolomicrite), 10%
470 - 480	Gray dolomite and shale as above, 50%. Brown dolomite as above, 45%. Anhydrite, 5%
480 - 490	Dolomite, light-brown, grayish-brown, microcrystalline

		(dolomicrite and dolosiltite), slightly anhydritic (brown and white anhydrite)
490 -	500	Dolomite as above, 70%. Dolomite, medium-gray, very argillaceous; grading into shale; 30%
500 -	510	Dolomite as above. Anhydrite, heavy trace
510 -	520	Dolomite, light-brown, microcrystalline (dolomicrite and dolosiltite), anhydritic (brown anhydrite). Anhydrite, white; heavy trace
520 -	530	Dolomite as above. Anhydrite, trace
530 -	540	Dolomite as above, grayish in part. Anhydrite, heavy trace
540 -	550	Shale, medium- and dark-gray and brownish-gray; grading into dolomite; 60%. Dolomite as above, 30%. Anhydrite, 10%
550 -	560	Brown dolomite as above, 45%. Shale, medium-greenish-gray, silty; in part very dolomitic; grading into dolomite; 45%. Anhydrite, 10%. D unit at 544 feet (GRN). C unit at 555 feet (GRN)
560 -	580	Shale and argillaceous dolomite as above, 70%. Siltstone, light-grayish-brown, dolomitic; 30%.
580 -	590	Dolomite, light- and medium-gray to greenish-gray, microcrystalline (dolosiltite), very argillaceous, silty; 50%. Dolomite, light-brown to grayish-brown, microcrystalline (dolosiltite); very silty in part; 50%
590 -	600	Gray dolomite as above, 85%. Dolomite, light-brown, microcrystalline (dolomicrite and dolosiltite), 10%. Anhydrite, 5%
		Core description, 600 to 1300 feet; core starts in B unit
600'	603'	Anhydrite, white and brown, light-brown, microcrystalline; with swirls of dolomite; predominantly dolomite in lowest one foot (5-inch core loss between 600 and 601 feet)
603'	604'	Dolomite, light-brown, lithographic; brown anhydrite
604'	605'	crystals Dolomite, mottled-medium-gray and brown, argillaceous, 3". Shale, dark-gray to greenish-gray, 1" (8-inch core loss)
605'	605' 7"	Anhydrite, with white and brown dolomite
605' 7"	611' 7"	Shale, dark-gray to greenish-gray; a few blebs of anhydrite (4-inch core loss)
611' 7"	613' 6"	Anhydrite, bedded and nodular; 50%. Dolomite, light-brown, microcrystalline; 50%
613' 6"	614'	Shale, brown, thinly laminated. Dolomite. Anhydrite
614'	614' 6"	Core loss
614' 6"	617' 3"	Shale, light-green, dolomitic; blebs of white anhydrite
617' 3"	618'	Dolomite, light-brown, microcrystalline; laminated with gray shale and very minor anhydrite
618'	618' 7"	Core loss
618' 7"	620'	Shale, dark-brownish-gray; very minor amount of interbedded anhydrite
620'	620' 6"	Anhydrite, light-grayish-brown; nodules of dolomite; shale partings
620' 6"	621'	Core loss
621'	622' 3"	Anhydrite, with a few thin dolomite laminations; interbedded in lowest 4 inches with dark-brown to grayish-brown shale
622' 3"	625'	Shale, light- and medium-gray, greenish-gray, and brownish-gray, microcrystalline; laminated with light-gray dolomite; dolomite predominant in lowest foot. Anhydrite.
625'	625' 7"	Dolomite, light-brown, microcrystalline, bioturbaceous-looking
625' 7"	635'	Anhydrite, light-brown, microcrystalline; minor amount of interbedded dolomite
635'	636' 10"	Dolomite, light- and medium-brown; lithographic in part; may be stromatolitic; with anhydrite
636' 10"	637' 5"	Core loss
637' 5"	638' 11"	Dolomite, light-brown and gray, microcrystalline, argillaceous; slickenside

		fracture at 637' 10"
638' 11"	640' 5"	Shale, medium- and dark-greenish-gray; a few paper-thin anhydrite laminations
640' 5"	640' 11"	Core loss
640' 11"	641' 6"	Shale as above, medium brown, microcrystalline; minor amount of interbedded dolomite
641' 6"	642' 6"	Dolomite, light-brown; lithographic in part
642' 6"	643' 6"	Anhydrite, with minor amount of dolomite as above
643' 6"	647' 1"	Dolomite, light-brown; lithographic in part, laminated in part; 3" of anhydrite between 646' and 647' feet
647' 1"	647' 8"	Core loss
647' 8"	651'	Dolomite as above, with very minor amount of anhydrite
651'	659' 7"	Dolomite, light- and medium-brown; lithographic in part; with brown anhydrite crystals
659' 7"	660' 3"	Shale, dark-brown
660' 3"	662' 9"	Dolomite, light-brown; lithographic in part; numerous shale partings
662' 9"	663' 5"	Core loss
663' 5"	664' 2"	Dolomite as above
664' 2"	664' 9"	Shale, medium-gray to greenish-gray
664' 9"	666' 5"	Dolomite, light-brown, lithographic; with brown anhydrite crystals
666' 5"	666' 10"	Core loss
666' 10"	667' 4"	Dolomite as above
667' 4"	676' 8"	Anhydrite, with minor amount of interbedded dolomite
676' 8"	677' 1"	Core loss
677' 1"	681'	Anhydrite as above. Dolomite, medium-gray, argillaceous; from 677' 4" to 678'
681'	683' 7"	Dolomite, medium-gray, very argillaceous; possibly grading into shale
683' 7"	683' 11"	Core loss
683' 11"	684' 4"	Dolomite and shale as above
684' 4"	686' 9"	Anhydrite, with lithographic light-brown dolomite
686' 9"	687' 3"	Core loss
687' 3"	688' 6"	Shale, medium-gray, dolomitic
688' 6"	688' 10"	Core loss
688' 10"	689'	Shale as above
689'	693' 6"	Anhydrite, light- and medium-brown; with minor amount of dolomite
693' 6"	694' 3"	Core loss
694' 3"	695' 10"	Anhydrite as above
695' 10"	699'	Shale, dark-gray; slickenside fracture at 696' 10"
699'	699' 5"	Core loss
699' 5"	702'	Anhydrite, with dolomite from 701' to 701' 6"
702'	704'	Dolomite, light-brown, lithographic; with minor amount of interbedded anhydrite
704'	710' 5"	Anhydrite, with minor amount of dolomite
710' 5"	710' 11"	Dolomite, medium-gray, argillaceous
710' 11"	711' 4"	Anhydrite
711' 4"	711' 5"	Dolomite, light-brown, anhydritic
711' 5"	711' 10"	Core loss
711' 10"	713' 8"	Dolomite as above, with brown anhydrite crystals
713' 8"	721'	Anhydrite
721'	728' 9"	Anhydrite, medium-brown, mottled-gray, microcrystalline, bioturbaceous-looking; interbedded with dolomite
728' 9"	729' 11"	Anhydrite
729' 11"	733' 8"	Dolomite, medium-brown, microcrystalline, anhydritic
733' 8"	734' 3"	Core loss
734' 3"	739' 9"	Dolomite as above, laminated with gray dolomite
739' 9"	743'	Anhydrite, with minor amount of laminated dolomite
743'	745' 2"	Dolomite, medium-gray and brown, microcrystalline, laminated
745' 2"	745' 8"	Core loss
745' 8"	749' 4"	Dolomite, light- and medium-brown, microcrystalline, slightly anhydritic; some vuggy porosity due to dissolution of evaporite minerals
749' 4"	750' 8"	Core loss
750' 8"	773'	Dolomite, light-gray and medium-brown, microcrystalline, slightly anhydritic, laminated; some porosity as above (4-inch core loss from 754' 4" to 754' 8"; 8-inch core loss from 759'

		to 759' 8")
773'	775'	Anhydrite
775'	808' 6"	Dolomite, light- and medium-gray and brown, microcrystalline and very finely crystalline, anhydritic; mudstone in part; very finely laminated in part; argillaceous in part
808' 6"	808' 10"	Shale, dark-gray (log marker); bedding inclined 15°; continuing in upper part of underlying anhydrite
808' 10"	812' 3"	Anhydrite
812' 3"	815' 3"	Dolomite, medium-gray and brown, microcrystalline, anhydritic
815' 3"	829'	Anhydrite
829'	832' 5"	Dolomite, light- and medium-brown, microcrystalline, mudstone; with nodular anhydrite
832' 5"	834'	Anhydrite, light-brown, lithographic; with minor amount of dolomite
834'	843' 10"	Dolomite, light- and medium-brown, microcrystalline; some vuggy porosity
843' 10"	851' 7"	Anhydrite, light- and medium-brown, microcrystalline; oil stained at 844' 10"; with equal amount of interbedded dolomite
851' 7"	859' 6"	Anhydrite, light- and medium-brownish-gray, microcrystalline, mudstone; with minor amount of dolomite
859' 6"	864' 7"	Dolomite, light- and medium-brown, microcrystalline; oil stained throughout
864' 7"	866'	Anhydrite, with very minor amount of dolomite
866'	879'	Dolomite, light- and medium-brown, microcrystalline; grayish in part; oil stained from 866' to 869' 9"
879'	910' 7"	Anhydrite, with minor amount of dolomite
910' 7"	1012'	Dolomite, medium-brown, microcrystalline and very finely crystalline, porous; oil stained from 914' to 925'; porous from 944' to 946'; becoming very light brown to grayish brown at about 982'; porosity aligned along bedding planes. LOCKPORT DOLOMITE at 910' 7"
1012'	1102' 10"	Dolomite as above, light and medium gray, porous (vuggy porosity)
1102' 10"	1105' 4"	Dolomite, light- and medium-grayish-green, very argillaceous; grading into shale. ROCHESTER FORMATION at 1102' 10"
1105' 4"	1111' 4"	Shale, medium-gray to greenish-gray, slightly fossiliferous; thin dolomite interbeds
1111' 4"	1117'	Dolomite, light-brown, microcrystalline, argillaceous(?). DAYTON FORMATION at 1111' 4"
1117'	1117' 3"	Dolomite as above, glauconitic; light-greenish-gray shale partings
1117' 3"	1119'	Shale, light-green
1119'	1123'	Dolomite, dark-gray, very finely crystalline
1123'	1130' 6"	Shale, light-green; dolomitic in upper part; grading into red shale below. CABOT HEAD FORMATION at 1123'
1130' 6"	1133' 6"	Shale, red; grading into shale below
1133' 6"	1159'	Shale, medium-green
1159'	1175'	Shale, medium-green, with medium-crystalline light-brown dolomite from 1159' to 1160'
1175'	1211'	Shale, medium-gray; with a few interbeds of dolomite
1211'	1229'	Dolomite or limestone, light- and medium-brownish-gray, very finely to medium-crystalline, fossiliferous; hematitic in uppermost 2'; interbedded with medium-gray to greenish-gray shale. BRASSFIELD FORMATION at 1211'
1229'	1264'	Limestone or dolomite, finely and medium-crystalline, fossiliferous; with interbedded shale
1264'	1265'	Shale as above, predominant. Limestone or dolomite as above
1265'	1271'	Shale, medium-grayish-green, silty, fossiliferous; few interbeds of dolomite or limestone
1271'	1300'	Shale as above, grading into

red shale at 1271' 3"; becoming interbedded red and grayish-green shale. ORDOVICIAN at 1271' 3"

Fulton County
Chesterfield Township
Section 31

McClure Oil Co.
#1 Keefer
Permit No. 13
Sample No. 804
Elevation (KB) 732 feet

Depth (ft)	
730 - 740	Dolomite, light-gray, microcrystalline, sandy; grading into fine- to medium-grained sandstone. Dolomite, light-grayish-brown, microcrystalline, slightly sandy. Sand, fine-grained, heavy trace. Gypsum, sandy in part; trace. SYLVANIA SANDSTONE(?) at 735 feet
740 - 746	Sand as above. Sandstone and dolomite as above, minor. Shale, dark-greenish-gray, sandy, waxy; trace
746 - 756	Sand as above, 80%. Dolomite, light-brownish-gray to light-brown, microcrystalline; 20%. SILURIAN (undifferentiated SALINA GROUP) at 754 feet (GRN)
756 - 768	Dolomite, light-brown, microcrystalline and very finely crystalline, pelletal (mud-supported); fair pinpoint porosity. Gypsum, trace
768 - 778	Dolomite, light-brown, microcrystalline. Dolomite, light-gray to greenish-gray, microcrystalline, argillaceous to very argillaceous
778 - 787	Dolomite as above, brown; grayish in part. Dolomite, light- to dark-gray to greenish-gray, microcrystalline, argillaceous to very argillaceous; grading into shale
787 - 797	Dolomite, light-yellowish-brown to light-brown, microcrystalline. Dolomite, very light-gray to greenish-gray, microcrystalline, argillaceous, silty. Gypsum, trace (in brown dolomite)
797 - 802	Dolomite as above, brown
802 - 809	Dolomite, light-brown, microcrystalline; grayish in part. Dolomite, medium- and dark-gray to brownish-gray, microcrystalline, argillaceous to very argillaceous
809 - 815	Dolomite, light- and medium-brown, slightly grayish, microcrystalline. Chert, light-gray and white, banded; trace. Sulfur, trace
815 - 821	Dolomite, white to medium-brown, microcrystalline; silicified in part
821 - 830	No samples
830 - 841	Dolomite, light-brown, microcrystalline. Dolomite, light-gray, slightly greenish, microcrystalline, argillaceous to very argillaceous, slightly silty. E unit at 830 feet (GRN)
841 - 868	Dolomite, light- and medium-brown, grayish-brown, microcrystalline; pelletal in part. Dolomite, dark-brown, microcrystalline. Argillaceous dolomite as above, light and medium gray
868 - 884	Dolomite, light- and medium-brown, microcrystalline, pelletal (grain-supported); very finely sucrosic in part; poor pinpoint to vuggy porosity
884 - 898	Dolomite, light-yellowish-brown, light-grayish-brown, microcrystalline. Dolomite, light- and medium-gray, microcrystalline, argillaceous to very argillaceous
898 - 912	Dolomite, light- and medium-brown, slightly grayish, microcrystalline. Dolomite, medium-brownish-gray, microcrystalline, argillaceous. Chert, light-brown; trace. C unit at 908 feet (GRN)
912 - 925	Dolomite and chert as above. Shale, dark-gray
925 - 940	Dolomite, medium-brown, mottled-grayish-brown, microcrystalline; poor pinpoint porosity. Dolomite, light- and medium-gray, greenish-gray, microcrystalline, silty, argillaceous, sandy (very fine- to medium-grained sand); grading into shale. Gypsum, trace
940 - 979	Dolomite, light- and medium-brown, microcrystalline.

	Argillaceous dolomite as above. B unit at 972 feet (GRN)
979 - 1000	Dolomite, light-brown to yellowish-brown, microcrystalline. Argillaceous dolomite as above, heavy trace to 989 feet
1000 - 1037	Dolomite, light- and medium-brown, grayish, microcrystalline; carbonaceous partings
1037 - 1060	Dolomite, medium-brown, microcrystalline, laminated
1060 - 1071	Dolomite, light-gray, light-brown, microcrystalline
1071 - 1080	Dolomite, medium-brown, microcrystalline
1080 - 1088	Dolomite, light- and medium-brown to grayish-brown, microcrystalline; a few black shaly partings
1088 - 1108	Dolomite as above, grayish brown to brownish gray; a few partings as above. TYMOCHTEE DOLOMITE at 1088 feet
1108 - 1114	Dolomite as above. Dolomite, light- and medium-brown, microcrystalline
1114 - 1133	Dolomite as above, light and medium brown; poor pinpoint porosity; a few to a moderate number of dark-brown to black partings
1133 - 1147	Dolomite as above, in part very finely crystalline
1147 - 1168	Dolomite, light- and medium-brownish-gray to grayish-brown, microcrystalline. Dolomite, dark-gray, microcrystalline, very argillaceous
1168 - 1179	Dolomite, very light- to medium-brown, microcrystalline, laminated; poor pinpoint porosity. Dolomite and partings as above. GREENFIELD DOLOMITE at 1170 feet
1179 - 1189	Dolomite as above, very light to medium brown. Dolomite, medium- and very dark-brown, microcrystalline
1189 - 1199	Dolomite, very light- to medium-brown, microcrystalline and very finely crystalline, laminated, probably stromatolitic; fine- and medium-grained in part; patches and laminations of sparry dolomite
1199 - 1211	Dolomite as above, very light gray in part; finely crystalline and sucrosic in part. Dolomite, light-gray to greenish-gray, microcrystalline; trace
1211 - 1223	Dolomite, very light-grayish-brown and light-brown, microcrystalline and very finely crystalline
1223 - 1233	Dolomite, very light- and light-gray, brown, brownish-gray, microcrystalline and very finely crystalline; sucrosic in part; fair pinpoint to vuggy porosity. LOCKPORT DOLOMITE at 1232 feet (GRN)
1233 - 1257	Dolomite, very light-gray, brown, microcrystalline to finely crystalline; sucrosic in part; fair to good vuggy porosity
1257 - 1277	Dolomite, very light- and light-gray, brown, coarsely crystalline, bioclastic or fossiliferous
1277 - 1382	Dolomite as above, very light gray, microcrystalline to coarsely crystalline
1382 - 1415	Dolomite as above, very light to medium gray
1415 - 1424	Dolomite, very light- to dark-gray, microcrystalline to coarsely crystalline, pyritic. Dolomite, light-greenish-gray, microcrystalline, argillaceous; trace
1424 - 1437	Dolomite, mottled-light- and medium-brown, very light-brown, microcrystalline to coarsely crystalline, granular-looking, cherty, bioclastic or fossiliferous, slightly argillaceous. ROCHESTER FORMATION at 1427 feet (GRN)
1437 - 1446	Dolomite, light- and medium-gray, light-brown and grayish-brown, microcrystalline, bioclastic or fossiliferous, argillaceous, siliceous and very cherty; grading into chert. Dolomite as above, trace
1446 - 1457	Dolomite, mottled-light- and medium-brown, light-gray, microcrystalline to coarsely crystalline, bioclastic or fossiliferous, cherty. Chert, white, light-gray; trace. Dolomite as above, argillaceous; trace
1457 - 1469	Dolomite as above, mottled. Chert, cream, white; heavy trace
1469 - 1480	Dolomite, very light-gray, finely crystalline to coarsely crys-

talline (Brassfield lithology; sample out of place?)

1480 - 1490 Dolomite, light- and medium-brown, microcrystalline to finely crystalline; 95%. Chert, very light-brown, fossiliferous, 5%. BRASSFIELD FORMATION at 1482 feet (GRN)

1490 - 1501 Dolomite as above, predominantly white, very light and light brown. Chert, white, light-gray; trace

1501 - 1511 Dolomite as in samples from 1469 to 1480 feet

1511 - 1523 Dolomite as above. Dolomite, medium-gray, biocalcarenite; trace. Dolomite, medium-greenish-gray, argillaceous; trace. ORDOVICIAN at 1528 feet (GRN)

Fulton County
Swan Creek Township
Section 22

Ohio Oil Co. #1 Munn et al.
Permit No. 12
Sample No. 713
Elevation (GL) 680 feet

Depth (ft)

362 - 370 Dolomite, light-gray to grayish-brown, microcrystalline; fine to coarse grained in part; sandy to very sandy. Sand, medium-grained, rounded; heavy trace. Gypsum, trace. SYLVANIA SANDSTONE(?) at 368 feet

370 - 380 Dolomite, very light-gray to light-brown, sublithographic to microcrystalline. SILURIAN (undifferentiated SALINA GROUP) at 370 feet

380 - 395 Dolomite, very light-yellowish-brown to light-brown, microcrystalline. Gypsum, trace

395 - 400 Dolomite, very light- and light-brown, light-gray, very light-brownish-gray, microcrystalline; pelletal in small part. Gypsum, trace

400 - 443 Dolomite, very light-yellowish-gray, microcrystalline. Dolomite, light- and medium-gray, microcrystalline, argillaceous; pyritic to 414 feet. (E) unit at 405 feet

443 - 473 Dolomite, light- and medium-brown, microcrystalline, pelletal (medium-grained, grain-supported); poor pinpoint porosity. Gypsum, trace from 450 to 473 feet

473 - 498 Dolomite, light- to dark-brown, microcrystalline; poor pinpoint porosity; 80%. Shale, black, dark-gray, dolomitic; grading into dolomite; 20%

498 - 507 Dolomite as above, brown. Dolomite, light-gray, microcrystalline, argillaceous, silty, micaceous. C unit at 498 feet

507 - 524 Dolomite as above, brown, poor pinpoint porosity. Dolomite as above, argillaceous; grading into siltstone

524 - 533 Dolomite as above, argillaceous, silty. Dolomite, light- to dark-brown, microcrystalline, very anhydritic (includes nodular anhydrite; some nodules with gypsum along outer margins and anhydrite in center)

533 - 553 Dolomite, light- and medium-brown, microcrystalline, slightly anhydritic; grayish in part. Dolomite as above, argillaceous, silty

553 - 564 Dolomite as above, brown; impure with anhydrite

564 - 574 Dolomite, light- and medium-brown, microcrystalline, cherty, slightly anhydritic and gypsiferous; 90%. Shale, medium-green, black, dolomitic; 10%

574 - 583 Dolomite as above, anhydritic; 90%. Shale as above, 10%

583 - 607 Dolomite as above, anhydritic to very anhydritic. B unit at 583 feet

607 - 634 Dolomite, light- to dark-brown, microcrystalline. Gypsum and anhydrite, trace. Shale, black; trace

634 - 640 Dolomite as above, very anhydritic

640 - 675 Dolomite as above, anhydritic

675 - 688 Dolomite as above, very anhydritic

688 - 698 Dolomite as above, anhydritic

698 - 709 Dolomite, light- and medium-brown, microcrystalline; sucrosic in part; poor pinpoint porosity; few patches of sparry dolomite

709 - 724 Dolomite as above. Gypsum, trace. Very fine sample

724 - 734	Dolomite, very light-brown to light-grayish-brown, microcrystalline
734 - 770	Dolomite as above, medium grayish brown in part; a few black shaly partings
770 - 780	Dolomite, medium-grayish-brown, microcrystalline; black, dark-brown partings. TYMOCHTEE DOLOMITE at 770 feet
780 - 789	Dolomite as above, dark grayish brown; partings as above
789 - 811	Dolomite, medium- and dark-brown, slightly grayish, microcrystalline; partings as above
811 - 831	Dolomite, very light- to medium-brown, slightly grayish, microcrystalline
831 - 860	Dolomite, medium-grayish-brown to dark-gray, microcrystalline, slightly pyritic; partings as above. Gypsum, trace from 846 to 860 feet
860 - 870	Dolomite as above, dark brown in part. Dolomite, very light-brown, very light-brownish-gray, microcrystalline and very finely crystalline; laminated with gypsum; vugs filled with gypsum; fair pinpoint porosity in light-colored dolomite. GREENFIELD DOLOMITE at 865 feet
870 - 886	Dolomite, light- to dark-brown, microcrystalline; very finely sucrosic in part; poor pinpoint porosity; vugs filled with gypsum (to 879 feet)
886 - 904	Dolomite, light- to dark-brown, microcrystalline; poor pinpoint porosity
904 - 912	Dolomite, very light-brownish-gray, light-gray, light-brown, microcrystalline, laminated
912 - 920	Dolomite as above. Sparry dolomite, trace
920 - 939	Dolomite, light-brown, microcrystalline to medium-crystalline; fine to coarse grained in part, sucrosic in part; poor vuggy porosity
939 - 948	Dolomite as above. Chert, white, light-gray, fossiliferous(?); heavy trace. Sulfur, trace
948 - 957	Dolomite, very light-brownish-gray to light-brown, microcrystalline and very finely crystalline
957 - 976	Dolomite, very light-gray, brown (minor amount medium and dark gray), microcrystalline and very finely crystalline; excellent vuggy porosity. LOCKPORT DOLOMITE at 957 feet
976 - 1054	Dolomite as above, very light gray, microcrystalline to coarsely crystalline
1054 - 1070	Dolomite as above, light and medium gray
1070 - 1087	Dolomite as above, light to dark gray, slightly pyritic. Dolomite, light-greenish-gray, microcrystalline, argillaceous; trace. ROCHESTER FORMATION at 1080 feet
1087 - 1096	Dolomite, very light- to medium-gray, brown, microcrystalline to coarsely crystalline, cherty, pyritic, slightly argillaceous
1096 - 1127	Dolomite as above. Dolomite, light-brown, slightly grayish, microcrystalline; silty looking to 1119 feet
1127 - 1145	Dolomite, very light- and light-brown, microcrystalline to coarsely crystalline, slightly pyritic
1145 - 1155	Dolomite, white, very light- and light-brown, microcrystalline to coarsely crystalline; sucrosic in part
1155 - 1165	Dolomite as above, white
1165 - 1170	Dolomite, mottled-medium-brown, gray, finely and medium-crystalline, granular-looking; argillaceous in part. Dolomite as above, trace. BRASSFIELD FORMATION at 1147 feet. ORDOVICIAN at 1167 feet

Ohio Oil geologist's tops:

A_2 dolomite	780 feet
A_1 dolomite	848 feet
Brown "Niagaran"	893 feet
White "Niagaran"	920 feet
"Clinton Cataract"	1087 feet
Cincinnatian	1167 feet

Hancock County
Liberty Township
Section 28 (NW$\frac{1}{4}$)

Ashland #1 Cramer
Permit No. 150
Sample No. 1650
Elevation (KB) 793 feet

Depth (ft)

Bedrock at 10 feet in undifferentiated SALINA GROUP

0 - 10	Overburden
10 - 40	Dolomite, light- and medium-brown, microcrystalline
40 - 70	Dolomite, very light- to medium-brown, microcrystalline
70 - 90	Dolomite, light- and medium-grayish-brown, microcrystalline; black partings. TYMOCHTEE DOLOMITE at 70 feet
90 - 100	Dolomite, medium-brown to grayish-brown, microcrystalline; black and very dark-brown partings
100 - 120	No samples
120 - 130	Dolomite, medium- to dark-gray, microcrystalline, very argillaceous; grading into shale
130 - 150	Dolomite as above. Dolomite, medium-grayish-brown, microcrystalline. Dolomite, light-brown, microcrystalline
150 - 160	Dolomite as above. Dolomite, medium-brown, microcrystalline; trace. GREENFIELD DOLOMITE at 160 feet
160 - 180	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; fair vuggy porosity in part. Cavings
180 - 190	Dolomite as above. Dolomite, very light-gray, microcrystalline and very finely crystalline; LOCKPORT DOLOMITE at 190 feet (GRN)
190 - 290	Dolomite as above, very light gray; excellent vuggy porosity. Cavings
290 - 320	Dolomite as above, very light and light gray
320 - 350	Dolomite as above, in part medium and dark gray; in part slightly argillaceous; in part slightly pyritic. ROCHESTER FORMATION(?) at 310 feet (GRN)
350 - 370	Dolomite, very light-brown, very light- and light-gray, microcrystalline to coarsely crystalline
370 - 390	Dolomite as above, mottled pink and yellow in part. Dolomite, light-greenish-gray, microcrystalline, argillaceous; trace
390 - 410	Dolomite, mottled-light-gray, light-brown, recrystallized, probably coarse-grained; yellowish and pinkish in part. Chert, very light-gray; trace from 400 to 410 feet
410 - 430	Dolomite as above, slightly glauconitic. Dolomite, light- and medium-greenish-gray, micrograined, argillaceous
430 - 440	Dolomite as above. Shale, light-green; heavy trace. ORDOVICIAN(?) at 442 feet (GRN)
	Samples from 440 to 450 feet include red shale.

Hardin County
Cessna Township
Section 26 ($NE\frac{1}{4}$)

Teeters #1 Stephens
Permit No. 108
Sample No. 2099
Elevation (DF) 984 feet

Depth (ft)	
	Bedrock at 94 feet (driller's log) in TYMOCHTEE DOLOMITE
0 - 100	No samples
100 - 108	Dolomite, light-brown, microcrystalline; minor amount dark brown
108 - 122	Dolomite, light- and medium-gray to brownish-gray and grayish-brown, microcrystalline, laminated; dark-gray shaly partings. Dolomite as above, trace to 116 feet
122 - 129	Dolomite as above. Dolomite, dark-brown, microcrystalline, laminated; fine grained(?) in part. Limestone (secondary), light-gray, very finely crystalline; sucrosic in part; poor vuggy porosity. GREENFIELD DOLOMITE at 125 feet
129 - 133	Dolomite, very light-brown, microcrystalline; in part lined with dogtooth crystals of calcite. Limestone as above, trace
133 - 139	Dolomite, light- to dark-brown, microcrystalline and very finely crystalline; carbonaceous partings
139 - 156	Dolomite as above. Dolomite, very light-brown, microcrystalline and very finely crystalline
156 - 163	Dolomite, very light- and light-brown, light-gray, microcrystalline and very finely crystalline; sucrosic in part; very calcitic in part

163 -	180	Dolomite as above. Dolomite, dark-brown, microcrystalline. LOCKPORT GROUP at 173 feet (GRN)
180 -	211	Dolomite and limestone (secondary), very light- and light-gray, brown, microcrystalline and very finely crystalline; sucrosic in part; poor pinpoint to vuggy porosity
211 -	218	Dolomite, very light-gray, microcrystalline to finely crystalline
218 -	225	Dolomite, very light- and light-gray, microcrystalline to medium-crystalline; poor vuggy porosity. Very fine samples
225 -	232	Dolomite, very light- and light-gray, brown, microcrystalline to finely crystalline; poor pinpoint to vuggy porosity. Chert, white, light-gray; heavy trace. GOAT ISLAND DOLOMITE at 220 feet (GRN)
232 -	248	Dolomite as above, predominantly very light and light brown; 95%. Chert as above, 5%
248 -	255	Dolomite as above. Dolomite, very light- to medium-gray, microcrystalline to finely crystalline. Chert as above, trace. GASPORT DOLOMITE at 250 feet (GRN)
255 -	272	Dolomite, very light- to medium-gray, microcrystalline to finely crystalline; minor amount very light brown; poor vuggy porosity
272 -	277	Dolomite as above, slightly argillaceous; in part dark gray. ROCHESTER FORMATION at 270 feet (GRN)
277 -	283	Dolomite, very light- to dark-gray, microcrystalline and very finely crystalline; slightly greenish in part; slightly argillaceous in part
283 -	290	Dolomite, predominantly very light and light gray to brownish gray, microcrystalline and very finely crystalline, very slightly glauconitic. DAYTON FORMATION at 292 feet (GRN)
290 -	297	Dolomite, very light-brownish-gray, very light- and light-brown, microcrystalline, slightly glauconitic
297 -	305	Dolomite, mottled-light- and medium-gray, brown, microcrystalline to finely crystalline, fossiliferous (bryozoans, brachiopods), fragmental, slightly pyritic, slightly argillaceous
305 -	320	Dolomite as above, very slightly glauconitic and cherty
320 -	327	Dolomite, very light-brown, microcrystalline to medium-crystalline, slightly cherty, probably fragmental
327 -	345	Dolomite as above, light gray; brown in part. Dolomite, light-greenish-gray, microcrystalline, argillaceous; trace
345 -	353	Dolomite, very light- and light-brown, light-gray, microcrystalline to medium-crystalline, slightly glauconitic
353 -	360	Dolomite as above. Dolomite, light-brownish-gray, very fine- and fine-grained, slightly glauconitic, silty. Chert, white; trace
360 -	368	Dolomite as above, predominantly silty
		Sample gap to 1022 feet
		ORDOVICIAN at 373 feet (GRN)

Henry County
Freedom Township
Section 23

Lesh Drilling Co. #1
Badenhop
Permit No. 20
Sample No. 907
Elevation (KB) 718 feet

Depth (ft)		
455 -	460	Dolomite, light- and medium-brown, microcrystalline, slightly pyritic; sandy in part. Sandstone, white, light-gray, mottled-green (with clay), very fine- to medium-grained; heavy trace. Shale, light- and medium-green, waxy; trace. Chert, white, pelletal; trace. SILURIAN (undifferentiated SALINA GROUP) at 460 feet (GRN)
460 -	465	Dolomite, very light-grayish-brown to light-brown, microcrystalline. Selenite, trace. Pisoliths, trace
465 -	475	Dolomite as above, thinly laminated with dark-brown shaly dolomite
475 -	480	Dolomite, light-brown, micro-

		crystalline; minor amount light to medium gray
480 -	485	Dolomite as above, dark-brown shaly partings
485 -	490	Shale, dark-gray, dolomitic; 70%. Dolomite, light- and medium-brown, microcrystalline; 30%. E unit at 481 feet (GRN)
490 -	500	Dolomite as above, light and medium gray to brownish gray; argillaceous in part; in part replacement of original anhydrite(?) nodules; 70%. Shale as above, 30%
500 -	530	Dolomite, light-gray, microcrystalline, slightly argillaceous, slightly pyritic. Dolomite, very light- and light-brown, microcrystalline; very slightly anhydritic to 505 feet
530 -	540	Dolomite, light-brown, microcrystalline; recrystallized and very finely sucrosic in part; poor pinpoint porosity. Anhydrite, trace. Chert, white, oolitic; trace
540 -	545	Dolomite as above, medium and dark brown in part; porosity as above. Chert, dark-brown; trace
545 -	560	Dolomite, light- to dark-brown, microcrystalline; poor pinpoint to vuggy porosity. Dolomite, light-gray, microcrystalline, argillaceous
560 -	580	Dolomite, light-brown, microcrystalline; siliceous in part. Dolomite, light- to dark-gray, microcrystalline, argillaceous; minor to trace. C unit at 579 feet (GRN)
580 -	585	Dolomite, light- and medium-brown, light-gray, microcrystalline; argillaceous in part. Shale, light-green; trace
585 -	615	Dolomite, light- and medium-gray, greenish-gray, medium-grayish-brown and brown, microcrystalline, argillaceous to very argillaceous, slightly sandy (very fine-grained sand). Gypsum (nodule), trace from 595 to 600 feet
615 -	630	Dolomite, light- and medium-gray, microcrystalline, argillaceous to very argillaceous; grading into shale. Dolomite, light- and medium-brown, microcrystalline, laminated
630 -	635	Dolomite, light- and medium-brown, light- and medium-gray, microcrystalline, laminated; argillaceous in part
635 -	640	Dolomite as above, 80%. Shale, light- and medium-greenish-gray, dolomitic; 20%
640 -	650	Dolomite as above, 90%. Shale as above, 10%. Base of C unit at 644 feet (GRN)
650 -	675	Dolomite, light-brownish-gray to gray, light- and medium-brown, microcrystalline; gypsum lath (one)
675 -	685	Dolomite, light-brown, microcrystalline
685 -	700	Dolomite, light- and medium-brown, microcrystalline; slightly pyritic; dark-brown laminations
700 -	725	Dolomite, light- and medium-brown, microcrystalline; poor pinpoint porosity (solution of evaporite mineral crystals)
725 -	740	Dolomite, medium-brown, microcrystalline and very finely crystalline
740 -	745	Dolomite, medium-brown, very finely crystalline; sucrosic in part; poor to fair pinpoint to vuggy porosity
745 -	755	Dolomite as above, light brown, microcrystalline
755 -	780	Dolomite as in samples from 725 feet to 740 feet
780 -	790	Dolomite, light-grayish-brown to brown, microcrystalline; 95%. Dolomite as above, 5%. TYMOCHTEE DOLOMITE(?) (not representative) at 780 feet
790 -	820	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; grayish in part; poor pinpoint porosity in part; a few to a moderate number of dark-brown shaly partings
820 -	830	Dolomite, medium- and dark-brown, microcrystalline
830 -	840	Dolomite as above, dark-brown shaly partings
840 -	845	Dolomite as above; sucrosic in part; poor to fair pinpoint to

vuggy porosity

845 - 850 Dolomite, light-grayish-brown to dark-brown, microcrystalline and very finely (minor) crystalline; very finely sucrosic in part; poor pinpoint porosity; dark-brown shaly partings

850 - 860 Dolomite as above, light grayish brown to brown; partings as above

860 - 870 Dolomite as above, light grayish brown to medium brown; partings as above

870 - 875 Dolomite, medium- to dark-gray, microcrystalline, very argillaceous; grading into shale; 60%. Dolomite, medium-brown, microcrystalline and very finely crystalline and sucrosic; dark-brown carbonaceous partings; 40%. GREENFIELD DOLOMITE at 870 feet (GRN)

875 - 900 Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; sucrosic in part; wavy laminations; poor pinpoint porosity

900 - 905 Dolomite, very light-gray, light- and medium-brown, very finely crystalline, laminated and banded

905 - 910 Dolomite, very light-gray, very light- and light-brown, microcrystalline

910 - 915 Dolomite, very light- and light-gray, brown, microcrystalline and very finely crystalline; poor vuggy porosity. LOCKPORT DOLOMITE(?) at 911 feet (GRN)

915 - 925 Dolomite, very light-brownish-gray to light-gray, very finely and finely crystalline; good vuggy porosity

925 - 955 Dolomite as above, microcrystalline to finely crystalline; sucrosic in part; excellent vuggy porosity

955 - 1060 Dolomite, white to very light-gray, microcrystalline to finely crystalline, sucrosic; excellent intercrystalline and vuggy porosity

1060 - 1090 Dolomite, very light- to medium-gray, microcrystalline to coarsely crystalline. Base LOCKPORT DOLOMITE at 1086 feet (GRN)

1090 - 1095 Dolomite as above. Shale, medium-greenish-gray, dolomitic; trace

1095 - 1105 Dolomite as above (cavings?). Dolomite, very light-brown, microcrystalline and very finely crystalline; heavy trace

1105 - 1115 Cavings. Dolomite, light-brown, microcrystalline and very finely crystalline. Dolomite, medium-gray to brownish-gray, microcrystalline, argillaceous; trace

1115 - 1120 Dolomite, very light-brownish-gray to light-brown, microcrystalline to coarsely crystalline; 85%. Dolomite as above, argillaceous; 15%. Chert, white, brown; heavy trace

1120 - 1130 Dolomite as above, very light brownish gray to light brown. Dolomite, argillaceous as above; heavy trace to trace. Chert, white; trace

1130 - 1145 Dolomite, light-brown, mottled-light-gray, microcrystalline to coarsely crystalline, cherty. Dolomite, light-brownish-gray to gray and greenish-gray, micrograined, argillaceous; heavy trace. BRASSFIELD FORMATION(?) at 1141 feet (GRN)

1145 - 1150 Dolomite, very light-grayish-brown to light-brown, microcrystalline to coarsely crystalline, cherty; fair vuggy porosity

1150 - 1160 Dolomite as above, porosity as above; 95%. Chert, white; vuggy porosity; 5%

1160 - 1165 Dolomite, very light-gray, very light-brownish-gray to light-brown, microcrystalline to coarsely crystalline

1165 - 1175 Dolomite, white, finely crystalline and medium-crystalline; excellent vuggy porosity

1175 - 1180 Dolomite as above, light gray in part

1180 - 1185 Dolomite, very light- and light-brownish-gray, microcrystalline to medium-crystalline. Dolomite, light-greenish-gray,

very finely crystalline (grained?), argillaceous, pyritic. Shale, light-green; trace

1185 - 1190 Dolomite as above, brownish gray. Greenish-gray dolomite and shale as above, trace

1190 - 1200 Dolomite, light- to dark-gray, very finely crystalline and finely crystalline, bioclastic. ORDOVICIAN(?) at 1192 feet (GRN)

Huron County
Bronson Township
Lot 32, 4th Qtr.

Kin-Ark Oil #1 Lawrence et al. unit
Permit No. 58
Sample No. 1942
Elevation (KB) 833 feet

Depth (ft)

640 - 650 Sandstone, light-brown and grayish-brown to brownish-gray, very fine- to medium-grained, dolomitic; grading into dolomite. Dolomite, medium-brown, microcrystalline (dolosiltite)

650 - 660 No sample

660 - 680 Dolomite, light- and medium-brownish-gray, light- and medium-brown, microcrystalline, laminated, anhydritic to very anhydritic; vuggy porosity (due to dissolution of evaporites); 80%. Shale, light- and medium-gray to greenish-gray, very dolomitic; grading into silty dolomite; 20%. Gypsum, trace. SILURIAN (SALINA GROUP, G unit) at 653 feet (GRN)

680 - 720 Dolomite, light- and medium-gray, microcrystalline, silty, argillaceous. Dolomite as above, light to dark brown. Anhydrite, 20%. Shale, light-green; trace. Gypsum, trace

720 - 740 Dolomite, medium-brown, microcrystalline, anhydritic. Dolomite, light- and medium-gray, microcrystalline, silty, argillaceous. Anhydrite, trace. F unit at 726 feet (GRN)

740 - 760 Dolomite, light- and medium-gray, brownish-gray, greenish-gray, microcrystalline, argillaceous, silty, anhydritic. Dolomite, light-brown, microcrystalline, anhydritic. Anhydrite, heavy trace

760 - 780 Dolomite and anhydrite as above. Shale, black; heavy trace

780 - 800 Dolomite, light- and medium-brown, microcrystalline, anhydritic. Anhydrite, trace

800 - 840 Dolomite as above, very light to medium brown. Dolomite, light- and medium-gray, grayish-brown, microcrystalline, argillaceous, silty, laminated, anhydritic; pyritic in part; grading into shale. Anhydrite, 20%. E unit at 799 feet (GRN)

840 - 880 Dolomite as above, predominantly light and medium brown. Anhydrite, trace

880 - 900 Dolomite as above. Anhydrite, heavy trace

900 - 920 Dolomite, light- and medium-brown, brownish-gray, microcrystalline, anhydritic; 90%. Shale, medium-green, dolomitic; a few floating sand grains (fine-grained, rounded); 10%. Anhydrite, trace. C unit at 895 feet (GRN)

920 - 940 Dolomite as above, 90%. Shale as above, 10%

940 - 980 Shale, medium-gray and greenish-gray, dolomitic; 50%. Dolomite, very light- and light-brown, microcrystalline, very anhydritic; 45%. Siltstone, light- and medium-brownish gray, dolomitic; 5%. Anhydrite, heavy trace; trace from 960 to 980 feet

980 - 1000 Anhydrite, 50%. Dolomite, light- and medium-brown and gray, microcrystalline; 50%. Shale, medium-green; trace. B unit at 982 feet (GRN)

1000 - 1020 Anhydrite, 70%. Dolomite as above, 30%

1020 - 1040 Anhydrite. Shale, medium-green; heavy trace. Mud sample

1040 - 1060 Anhydrite, 60%. Dolomite, very light- and light-brown, microcrystalline; pelletal(?) in part; 40%

1060 - 1080 Dolomite, very light- and light-

	brown, microcrystalline, laminated, anhydritic; 70%. Anhydrite, 30%
1080 - 1100	Dolomite, light-brown, light- and medium-grayish-brown, microcrystalline, anhydritic; laminated with dark-gray shale; 90%. Anhydrite, 10%. A_2 carbonate at 1072 feet (GRN)
1100 - 1180	Dolomite, light-brown and grayish-brown, microcrystalline, anhydritic; laminated with gray dolomite. Anhydrite, trace. Shale, black; trace. A_2 anhydrite at 1158 feet (GRN). A_1 carbonate at 1168 feet (GRN)
1180 - 1200	Dolomite, light-brown to grayish-brown, microcrystalline, slightly anhydritic
1200 - 1240	Dolomite as above. Anhydrite, trace. A_1 anhydrite at 1213 feet (GRN)
1240 - 1260	Anhydrite, 60%. Dolomite, medium-brown; 40%. Chert, light-brown; trace
1260 - 1300	Dolomite as above, light- and medium brown. LOCKPORT GROUP at 1240 feet (GRN)
1300 - 1360	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline, fossiliferous. Chert, light-gray, light- and medium-brown; heavy trace
1360 - 1400	Dolomite as above. Dolomite, very light-gray, microcrystalline to finely crystalline, very slightly glauconitic. Chert, white and light- and medium-brown, fossiliferous; heavy trace
1400 - 1420	Dolomite, medium- and dark-gray, very finely to medium-crystalline, fossiliferous, slightly pyritic; 80%. Dolomite, light- and medium-brownish-gray, slightly greenish, very fine-grained, pyritic, argillaceous to very argillaceous; 20%. GASPORT DOLOMITE at 1390 feet (GRN). ROCHESTER FORMATION at 1422 feet (GRN)
1420 - 1440	Dolomite as above. Dolomite, very light-yellowish-brown, microcrystalline to finely crystalline; heavy trace. DAYTON FORMATION at 1434 feet (GRN)
1440 - 1460	Shale, light- and medium-grayish-green. Dolomite, very light-yellowish-brown to brown, microcrystalline; trace. CABOT HEAD FORMATION at 1450 feet (GRN)
1460 - 1480	Shale as above. Dolomite as above, light gray, microcrystalline to medium crystalline, fossiliferous; trace
1480 - 1500	Shale, dark-reddish-brown (predominantly) and medium-grayish-green. Dolomite as above, trace
1500 - 1520	Shale, dark-reddish-brown and medium-gray to greenish-gray; 80%. Dolomite as above, mottled yellow; 20%. Chert, very light-gray; trace
1520 - 1540	No sample
1540 - 1560	Dolomite, very light- and light-brown, light- and medium-brownish-gray, very finely to medium-crystalline, glauconitic, bioclastic; 70%. Shale, medium-gray and greenish-gray; 30%. Chert, very light-brown; trace. BRASSFIELD FORMATION at 1557 feet (GRN)
1560 - 1580	Dolomite, light-greenish-gray, very light-brown, very finely and finely crystalline, silty, argillaceous; 70%. Shale, light-green and red; 30%. ORDOVICIAN at 1586 feet (GRN)

Lucas County
Adams Township
Section 8

Disalle #1 Disalle
Permit No. 34
Sample No. 864
Elevation (GL) 619 feet

Depth (ft)	
	Bedrock in undifferentiated SALINA GROUP
0 - 90	Overburden
90 - 100	Dolomite, light-brown, microcrystalline; laminated in part
100 - 125	Dolomite, very light- and light-brown, microcrystalline, laminated; pyrite replacement of halite or anhydrite crystals
125 - 130	Dolomite, light-brown to grayish-brown, microcrystalline, faintly laminated
130 - 140	Dolomite, light-brown to brownish-gray, microcrystalline; poor

pinpoint to vuggy porosity.

		Dolomite, light- and medium-brown, microcrystalline; poor to fair pinpoint to vuggy porosity. Top of biostromal dolomite
140	152	Dolomite, very light-gray, light-yellowish-brown and pinkish-brown, microcrystalline and very finely crystalline, biostromal or biohermal; fair vuggy porosity
152	158	Dolomite as above, yellowish brown and pinkish brown; laminated in part. Calcite crystals, heavy trace
158	164	Dolomite, light- and medium-brown, microcrystalline to finely crystalline, laminated; original vuggy porosity in large part obliterated by sparry dolomite
164	182	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline, fossiliferous (crinoidal); porosity obliterated as above
182	212	Dolomite, light- and medium-brown, mottled-light-gray, microcrystalline and very finely crystalline, probably fossiliferous. Sparry dolomite, heavy trace
212	224	Dolomite as above, fossiliferous (coralline; colonial coral)
224	236	Dolomite, very light-brown, microcrystalline and very finely crystalline; fair pinpoint porosity
236	248	Dolomite as above, 70%. Dolomite, light- and medium-gray, mottled-brown, microcrystalline and very finely crystalline; 30%
248	260	Dolomite, light-gray, light-brown, microcrystalline to finely crystalline
260	266	Dolomite as above, very light gray, light brown
266	290	Dolomite, light-gray, light- and medium-brown, microcrystalline to finely crystalline; sucrosic in part
290	296	Dolomite, very light- to light-brownish-gray, microcrystalline. SALINA lithology
296	300	Dolomite, very light-brown, microcrystalline to finely crystalline
300	314	Dolomite, very light-brown, finely crystalline
314	320	Dolomite, light- to medium-brown (trace of light-gray), microcrystalline (predominantly) and very finely and finely crystalline
320	326	Dolomite, medium-brown, microcrystalline. Chert, white, light-gray; heavy trace
326	332	Dolomite as above, 90%. Chert, white, brown, gray; 10%
332	338	Dolomite, light- and medium-brown, microcrystalline. Chert, white; trace
338	344	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline. Chert, white, gray, brown; heavy trace. Sphalerite, trace
344	356	Dolomite as above. Chert, white; heavy trace to 350 feet
356	374	Dolomite, very light- and light-gray, very light-brown, microcrystalline to medium-crystalline; poor vuggy porosity. LOCKPORT DOLOMITE at 360 feet
374	422	Dolomite, very light-gray, microcrystalline and very finely crystalline; excellent vuggy porosity
422	494	Dolomite as above, microcrystalline to coarsely crystalline
494	524	Dolomite, white, very light-brown (cream-colored), microcrystalline to very coarsely crystalline, crinoidal
524	536	Dolomite as above, white
536	542	Dolomite, white, light-gray, microcrystalline to coarsely crystalline, fossiliferous or bioclastic; fair vuggy porosity
542	548	Dolomite as above, light and medium gray
548	556	Dolomite, white, very light-brown, light-gray, microcrystalline to finely crystalline, pyritic. Dolomite, light-brown, micrograined, argillaceous; trace. Base of LOCKPORT DOLOMITE at 554 feet
556	587	Dolomite, light- and medium-gray, mottled-green, microcrystalline, fossiliferous (bryozoan), pyritic; 50%. Shale, light-green; 40%. Dolomite, very

	light-brown, microcrystalline; 10%
587 - 602	Shale, light-green, fossiliferous (bryozoan); 50%. Dolomite, light-brown, light- and medium-gray, finely crystalline (dolomitized fine- and medium-grained calcarenite), pyritic; 50%
602 - 624	Dolomite, light- and medium-brown, finely crystalline (calcarenite as above)
624 - 640	Dolomite as above, medium brown, brachiopod bearing
640 - 645	Dolomite as above(?), light brown. Very fine sample
645 - 655	Dolomite, very light- and light-gray, finely crystalline, glauconitic, slightly pyritic, bioclastic(?). Very fine sample
655 - 660	Dolomite, light- and medium-brown, microcrystalline to medium-crystalline
660 - 670	Dolomite as above, light brown
670 - 700	No samples
700 - 710	Dolomite, mottled-light- and medium-gray, light-brown, fossiliferous. Dolomite, light-greenish-gray, micrograined, fossiliferous, argillaceous. ORDOVICIAN at 690 feet (from driller's log)
	Samples below 710 feet not examined
	QUEENSTON SHALE at 770 feet

Lucas County
Harding Township
Section 9 ($SE\frac{1}{4}$)

Liberty Petroleum #1
Ketring unit
Permit No. 60
Sample No. 2811
Elevation (DF) 675 feet

Depth (ft)	
398 - 413	Dolomite, very light-brown, microcrystalline. Dolomite, light-gray, microcrystalline, argillaceous to very argillaceous. Shale, light-gray to greenish-gray; trace. Sandstone, white, fine- and medium-grained, dolomitic; trace. SILURIAN (undifferentiated SALINA GROUP) at 398 feet
413 - 428	No samples
428 - 439	Dolomite as above
439 - 454	Dolomite, light-brown, microcrystalline; minor amount light gray
454 - 471	Dolomite as above. Dolomite, medium-gray to greenish-gray, microcrystalline, very argillaceous; trace. E unit at 444 feet (GR)
471 - 489	Dolomite as above. Chert, medium-brown, mottled-white; trace. Quartz, recrystallized; trace
489 - 520	Dolomite, light-brown, microcrystalline. Cavings
520 - 588	Samples out of place. C unit at 561 feet (GR)
588 - 597	Dolomite, light- to very dark-brown, microcrystalline, anhydritic to very anhydritic (nodular and laminated anhydrite); 60%. Dolomite, medium-gray, slightly greenish, microcrystalline, silty, argillaceous; grading into shale; 40%. Anhydrite, trace
597 - 605	Dolomite, light- and medium-brown, microcrystalline, anhydritic to very anhydritic. Dolomite as above, very argillaceous; trace. B unit at 604 feet (GR)
605 - 627	Dolomite, light- and medium-brown, microcrystalline, anhydritic
627 - 654	Dolomite as above. Shale, light-greenish-gray, silty; trace
654 - 661	Dolomite as above, pelletal (grain-supported). Shale, light- and medium-greenish-gray; heavy trace
661 - 724	Dolomite, light- and medium-brown, microcrystalline, slightly anhydritic; pelletal as above; fair pinpoint porosity due to solution of pellets. Shale as above, heavy trace. Anhydrite, trace
724 - 762	Dolomite, light-brown, slightly grayish, microcrystalline. Base of B unit(?) at 724 feet
762 - 796	Dolomite, light- to medium-brown to grayish-brown, microcrystalline. TYMOCHTEE DOLOMITE at 762 feet
796 - 822	Dolomite, medium-grayish-brown, microcrystalline
822 - 859	Dolomite as above. Shale, black; trace
859 - 865	Dolomite as above; dark-gray shaly partings
865 - 903	Dolomite, medium- and dark-brown, microcrystalline. GREENFIELD DOLOMITE at 865 feet

903 - 923	Dolomite as above, light to dark brown
923 - 931	Dolomite, very light- and light-brown, slightly grayish, microcrystalline
931 - 955	Dolomite, very light- and light-brown, microcrystalline. Sparry calcite, trace
955 - 1010	Dolomite, very light-gray, microcrystalline and very finely crystalline. Very fine sample. LOCKPORT DOLOMITE at 963 feet (GR)
1010 - 1129	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline
1129 - 1138	Dolomite as above, light brown in part. Dolomite, light- and medium-gray, microcrystalline, slightly argillaceous, slightly pyritic. Base of LOCKPORT DOLOMITE(?) at 1133 feet (GR)
1138 - 1143	Dolomite, very light-brown, microcrystalline, very slightly glauconitic; crinoidal in part. Dolomite, very light- to medium-gray, light-brownish-gray, microcrystalline; bioclastic in part; pyritic in part; argillaceous in part. Shale, light- to medium-gray; trace
1143 - 1150	Dolomite, very light- to medium-gray, mottled, light-brown, microcrystalline to coarsely crystalline, bioclastic
1150 - 1156	Dolomite as above. Shale, medium-gray; trace. Chert, light- and medium-gray; trace
1156 - 1168	Dolomite, light-brown to brownish-gray, micrograined, slightly argillaceous. Chert, clear, light-brown; heavy trace
1168 - 1173	Dolomite as above, crinoidal in part. Dolomite, very light-gray and very light-brownish-gray, coarsely crystalline, bioclastic. Chert, white, very light-brown; trace. BRASSFIELD FORMATION at 1178 feet (GR)
1173 - 1180	Dolomite as above, very light gray and brownish gray
1180 - 1209	Dolomite as above, light brown in part
1209 - 1222	Dolomite, very light-gray to brownish-gray, coarsely crystalline; minor amount light gray
1222 - 1232	Dolomite as above. Shale, reddish-brown, light-green, dolomitic; 5%. ORDOVICIAN at 1220 feet (GR)

Paulding County
Paulding Township
Section 24

Water well, City of Paulding
Sample No. 425
Elevation (GL) 727 feet

Depth (ft)	
	Bedrock in undifferentiated SALINA GROUP
0 - 70	Overburden
70 - 85	Dolomite, light-gray, very light- and light-brown, microcrystalline
85 - 90	Dolomite, very light- and light-brown, microcrystalline
90 - 95	Dolomite, very light-brown, medium-brownish-gray to grayish-brown, microcrystalline; dark-gray to brown partings. Anhydrite, trace
95 - 105	Dolomite, very light-brown to yellowish-brown, microcrystalline; poor vuggy porosity (crystal molds)
105 - 110	Dolomite as in samples from 70 feet to 85 feet
110 - 115	Dolomite, very light-brown to yellowish-brown, very light-greenish-gray, microcrystalline
115 - 120	Dolomite, very light-yellowish-gray, microcrystalline; poor vuggy porosity (crystal molds). Nonrepresentative Salina(?)
120 - 125	Dolomite, very light- and light-brown, gray, microcrystalline; sucrosic in part; poor vuggy and pinpoint porosity. Nonrepresentative Salina
125 - 130	Dolomite as above, very light to medium brown
130 - 145	Dolomite, very light- to medium-brown, very light-brownish-gray, microcrystalline, sucrosic in part; poor pinpoint and vuggy porosity. Nonrepresentative Salina
145 - 160	Dolomite, very light-brown to grayish-brown, light-brown, microcrystalline; poor pinpoint porosity. Nonrepresentative Salina
160 - 170	Dolomite, very light- and light-brown, grayish-brown, mi-

		crocrystalline to finely crystalline; probably granular in large part; poor intercrystalline porosity. Nonrepresentative Salina
170 -	175	Dolomite, very light-yellowish-brown to light-brown, microcrystalline. Nonrepresentative Salina
175 -	195	Dolomite as above, sucrosic in part; poor pinpoint to vuggy porosity
195 -	220	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline; sucrosic in part; poor pinpoint to vuggy porosity. Nonrepresentative Salina
220 -	240	Dolomite as above, medium brown to grayish brown in part (to 225 feet)
240 -	245	Dolomite, very light-yellowish-brown to medium-brown, microcrystalline. Nonrepresentative Salina
245 -	250	Dolomite as above, very finely crystalline in part
250 -	280	Dolomite, light- and medium-brown to grayish-brown, microcrystalline; a few dark-gray to brown partings
280 -	285	Dolomite, very light- to medium-brown, medium-grayish-brown (light-brown dolomite mottled green in part), microcrystalline; argillaceous in part; a few partings as above
285 -	290	Dolomite, light- and medium-brown to grayish-brown, microcrystalline; a moderate number of dark-brown partings
290 -	295	Dolomite as above, predominantly medium brown, microcrystalline and very finely crystalline
295 -	300	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; sucrosic in part; stained with dead oil; poor pinpoint and vuggy porosity. Shale, medium- and dark-brown; trace
300 -	310	Dolomite, very light- and light-brown, light-yellowish-brown, microcrystalline
310 -	325	Dolomite, light- and medium-grayish-brown, microcrystalline; a few dark-brown partings. TYMOCHTEE DOLOMITE(?) at 310 feet
325 -	335	Dolomite, light- and medium-gray, slightly brownish, microcrystalline; argillaceous to very argillaceous in part
335 -	345	Dolomite as above, grayish brown and brownish gray
345 -	350	Dolomite as above, grading into shale. Dolomite, light- and medium-brown, microcrystalline
350 -	360	Dolomite, light-brown, microcrystalline and very finely crystalline; poor pinpoint porosity; gypsum blades (up to 0.1 mm) on chips to 355 feet. GREENFIELD DOLOMITE at 345 feet
360 -	365	Dolomite, light- to dark-brown, microcrystalline; dark-brown partings
365 -	370	Dolomite as above. Dolomite, very light-yellowish-brown, microcrystalline and very finely crystalline; poor pinpoint porosity
370 -	375	Dolomite, light-yellowish-brown to dark-brown, microcrystalline and very finely crystalline; probably granular in part; sucrosic in part; poor to fair vuggy porosity. Nonrepresentative Salina
375 -	385	Dolomite as above, predominantly very light yellowish brown, microcrystalline. Nonrepresentative Salina
385 -	405	Dolomite, very light-yellowish-gray to yellowish-brown, microcrystalline and very finely crystalline; sucrosic in part; fair vuggy porosity. Nonrepresentative Salina
405 -	410	Dolomite, light-brown, grayish-brown, microcrystalline
410 -	420	Dolomite, very light- and light-gray to brownish-gray, mi-

		crocrystalline and very finely crystalline; sucrosic in part; fair vuggy porosity. LOCKPORT DOLOMITE at 410 feet
420 -	435	Dolomite as above, very light brown in part
435 -	445	Dolomite, very light-gray to brown, microcrystalline to medium-crystalline; sucrosic in part
445 -	485	Dolomite as above, very light gray to white; excellent vuggy and intercrystalline porosity
485 -	500	Dolomite as above, very light and light gray, microcrystalline to coarsely crystalline
500 -	540	Dolomite as above, very light gray to white
540 -	590	Dolomite as above, very light and light gray
590 -	595	Dolomite, very light- to dark-gray, predominantly microcrystalline, slightly pyritic, fossiliferous; slightly argillaceous in part. Base of LOCKPORT at 595 feet
595 -	600	Dolomite, very light-gray, light-brown, microcrystalline to medium-crystalline, fossiliferous (crinoids). Dolomite, very light- and light-greenish-gray, very fine- and fine-grained, argillaceous. Chert, white, light-brown; trace
600 -	610	Dolomite as above, light brown, microcrystalline to medium crystalline. Dolomite, light-gray, very fine- and fine-grained, argillaceous; trace to 605 feet
610 -	615	Dolomite, very light- and light-brown, microcrystalline to finely crystalline; poor pinpoint to vuggy porosity. Chert, white, light-gray, very light-brown, heavy trace
615 -	620	Dolomite and chert as above. Hematitic dolomite, trace
620 -	625	Dolomite, microcrystalline to coarsely crystalline, pelletal; stained red with hematite. Chert, stained red; heavy trace. TD 625 feet in BRASSFIELD FORMATION(?)

Putnam County
Liberty Township
Section 29 ($SW\frac{1}{4}$)

Ohio Oil #1 Barlage
Permit No. 31
Sample No. 156
Elevation (GL) 740 feet

Depth (ft)		
		Samples start in undifferentiated SALINA GROUP
0 -	55	Overburden
55 -	78	Dolomite, very light- and light-brown, minor light gray to brownish gray, microcrystalline. Chert, white, very light-brown; trace from 59 to 78 feet
78 -	87	Dolomite, very light- and light-brown, light- and medium-gray, brownish-gray, microcrystalline; laminated in part. Chert as above, trace
87 -	93	Dolomite, light-brown, microcrystalline. Dolomite, light-greenish-gray, very argillaceous, silty, sandy (very fine-grained sand); grading into shale. C unit at 87 feet
93 -	98	Argillaceous dolomite and shale as above, light and medium gray in part; 60%. Dolomite, light- and medium-brown, microcrystalline, pelletal; oolitic in part; 40%
98 -	115	Dolomite, very light-brown, light-grayish-brown, microcrystalline; laminated in part; mottled very light green with clay in small part. Argillaceous dolomite and shale as above, heavy trace
115 -	155	Dolomite, light-brown, microcrystalline, laminated. Dolomite, medium- and dark-gray, microcrystalline, very argillaceous; trace
155 -	211	Dolomite, light-brown to yellowish-brown, microcrystalline; a few dark-brown partings. Shale, dark-gray; trace
211 -	223	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline. Shale cavings
223 -	228	Dolomite, very light-brown, microcrystalline. Dolomite as above, trace. Shale cavings
228 -	277	Dolomite, very light- to medium-

	brown, microcrystalline and very finely crystalline; poor pinpoint porosity
277 - 310	Dolomite, light- and medium-brown, slightly grayish, microcrystalline
310 - 316	Dolomite, light- to medium-grayish-brown, brownish-gray, microcrystalline; argillaceous in part. TYMOCHTEE DOLOMITE at 310 feet
316 - 322	Dolomite, medium-brown, microcrystalline. Dolomite as above, trace
322 - 340	Dolomite as in samples from 310 to 316 feet
340 - 359	Dolomite, medium-brown, slightly grayish, microcrystalline; dark-brown partings
359 - 366	Dolomite as above, medium brownish gray in part
366 - 379	Dolomite, medium-gray, microcrystalline, argillaceous to very argillaceous
379 - 397	Dolomite, light- to dark-brown, microcrystalline, stylolitic; carbonaceous partings. GREENFIELD DOLOMITE at 379 feet
397 - 417	Dolomite, very light- to medium-brown, grayish-brown, microcrystalline, laminated (stromatolitic?), slightly sparry; poor pinpoint to vuggy porosity
417 - 423	Dolomite, light-yellowish-brown, microcrystalline
423 - 430	Dolomite, very light-brown, yellowish-brown, very light-gray, microcrystalline and very finely crystalline; poor vuggy porosity. LOCKPORT DOLOMITE at 430 feet
430 - 442	Dolomite, predominantly very light- and light-gray, microcrystalline to finely crystalline; sucrosic in part; fair vuggy porosity
442 - 498	Dolomite as above, very light to light gray, fragmental or fossiliferous
498 - 539	Dolomite as above, very light and light brownish gray, gray; mottled light green with clay in part to 505 feet
539 - 555	Dolomite, very light-brownish-gray to medium-gray, microcrystalline to coarsely crystalline; argillaceous in part, slightly pyritic in part. Dolomite, very light-greenish-gray, microcrystalline; trace. Base of LOCKPORT DOLOMITE(?) at 545 feet
555 - 562	Dolomite, very light-brownish-gray, light-gray, microcrystalline to coarsely crystalline; very slightly glauconitic in part; very slightly argillaceous in part
562 - 574	Dolomite as above, predominantly very finely and finely crystalline
574 - 614	Dolomite, very light-gray, brown, microcrystalline to coarsely crystalline; poor to fair vuggy porosity. BRASSFIELD FORMATION(?) at 574 feet
614 - 621	Dolomite as above. Dolomite, medium- and dark-gray, microcrystalline to finely crystalline, slightly pyritic; very argillaceous in part. ORDOVICIAN(?) at 618 feet

Richland County
Blooming Grove Township
Section 28 (NE$\frac{1}{4}$)

Southern Triangle
#1 Barnd
Permit No. 286
Sample No. 1230
Elevation (KB)
1136 feet

Depth (ft)	
	SILURIAN (BASS ISLANDS DOLOMITE) at 1245 feet (GRN)
1250 - 1260	Dolomite, medium-brown, microcrystalline, laminated; cherty in part. Sandstone, very light-brown, very fine- and fine-grained, dolomitic; heavy trace. Chert, very light-gray; a few black shaly partings; trace
1260 - 1270	Dolomite, sandstone, and chert as above. Anhydrite, trace
1270 - 1280	Anhydrite, impure. G unit at 1260 feet (GRN)
1280 - 1300	Dolomite, light- and medium-brown, light-brownish-gray, light-gray, greenish-gray, microcrystalline, anhydritic; very argillaceous in part; grading into shale; 90%. Anhydrite, 10%
1300 - 1310	Dolomite as above, 80%. Anhy-

	drite, 20%
1310 - 1320	Dolomite as above, 90%. Anhydrite, 10%. Gypsum, trace
1320 - 1330	Dolomite, light- and medium-brown, microcrystalline, anhydritic. Shale, dark-brown; trace. F unit at 1312 feet (GRN)
1330 - 1350	Dolomite as above. Dolomite, light- and medium-gray, brownish-gray, greenish-gray, microcrystalline, argillaceous; grading into shale
1350 - 1370	Dolomite as above. Chert, white; trace to 1360 feet
1370 - 1380	Anhydrite, impure. Dolomite, light-gray, medium-greenish-gray, microcrystalline, argillaceous; grading into shale; heavy trace
1380 - 1400	Dolomite, light- and medium-brown, microcrystalline; slightly anhydritic
1400 - 1410	Limestone, white, very light- to medium-brown, lithographic, coarse-grained in part; probably fossiliferous; sparry in part
1410 - 1420	Dolomite, light- to medium-greenish-gray, microcrystalline, very argillaceous, anhydritic. Dolomite, light-brown, microcrystalline; trace. E unit at 1402 feet (GRN)
1420 - 1430	Dolomite, light- and medium-brown, microcrystalline; lithographic in part. Anhydrite, heavy trace. Dolomite as above, trace
1430 - 1450	Dolomite as above, anhydritic
1450 - 1460	Dolomite, light- and medium-brown, light-grayish-brown, microcrystalline (lithographic in part)
1460 - 1490	Dolomite as above, anhydritic
1490 - 1500	Dolomite as above, very slightly anhydritic
1500 - 1530	Dolomite, medium-gray, greenish-gray, microcrystalline, very argillaceous; grading into shale; 80%. Dolomite as above, 20%. Sand, medium-grained, rounded; trace. Anhydrite, trace. C unit at 1483 feet (GRN)
1530 - 1570	Dolomite as above, argillaceous; 70%. Dolomite as above, brown; 30%. Anhydrite, trace
1570 - 1580	No sample
1580 - 1590	Shale, dark-grayish-green, brown; 60%. Dolomite, light-brown, medium-grayish-brown, microcrystalline (lithographic in part); 40%
1590 - 1600	Shale as above, 50%. Dolomite as above, 50%
1600 - 1610	Anhydrite, impure. B unit at 1586 feet (GRN)
1610 - 1640	Dolomite, very light-brown, microcrystalline (lithographic), very anhydritic; 80%. Shale, medium-green, dark-brown; 20%
1640 - 1650	Anhydrite, impure; 80%. Shale as above, 20%
1650 - 1680	Dolomite, very light- and light-brown, microcrystalline (lithographic in large part), anhydritic; 70%. Dolomite, medium-gray, greenish-gray, very argillaceous; 30%
1680 - 1750	Dolomite, light- and medium-brown, grayish-brown, microcrystalline, laminated. Anhydrite, a few dark-brown partings; trace. A_2 carbonate at 1666 feet (GRN)
1750 - 1760	Dolomite, very light- to light-brown, microcrystalline, 85%. Anhydrite, 15%. A_2 anhydrite at 1752 feet (GRN)
1760 - 1770	Anhydrite, impure
1770 - 1780	Anhydrite, 70%. Dolomite, light- to medium-gray, brownish-gray, brown, microcrystalline; argillaceous in part; 30%
1780 - 1790	Dolomite as in samples from 1750 feet to 1760 feet. A_1 carbonate at 1769 feet (GRN)
1790 - 1800	Dolomite as above, very anhydritic
1800 - 1820	Dolomite as above, anhydritic. Dolomite, very dark-brown, microcrystalline
1820 - 1830	Dolomite as above, 50%. Anhydrite, 50%. A_1 anhydrite at 1824 feet (GRN)
1830 - 1840	Dolomite as above, 70%. Anhydrite, 30%
1840 - 1850	Anhydrite, 60%. Dolomite as above, 40%
1850 - 1860	Limestone, very light- to medium-brown, micrograined, fossiliferous (brachiopods, ostracods?). Shale, red, dark-gray, brown; heavy trace. LOCKPORT GROUP at 1833 feet (GRN)

1860 - 1870	Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; laminated in part. Limestone as above, dark brown; heavy trace
1870 - 1890	Dolomite as above, probably fossiliferous
1890 - 1910	Dolomite, very light-yellowish-brown to medium-brown, light-gray, microcrystalline, probably fossiliferous; equivalent of chert-bearing dolomite in Butler Township
1910 - 1920	Dolomite as above, very light yellowish brown, very light and light brown, gray. Chert, white; trace
1920 - 1930	Dolomite, very light-brown to grayish-brown, microcrystalline. Chert, white, very light-gray; heavy trace
1930 - 1960	Dolomite, very light- and light-gray, microcrystalline to finely crystalline, very slightly glauconitic; fair intercrystalline and vuggy porosity. Chert, cream-colored; trace
1960 - 1970	Dolomite as above, very light brown in part
1970 - 1990	Dolomite, very light-brown, microcrystalline, very slightly glauconitic. Chert, cream-colored, very light-gray. GOAT ISLAND DOLOMITE at 1961 feet (GRN)
1990 - 2000	No sample
2000 - 2010	Dolomite, very light- and light-gray, brown, microcrystalline to coarsely crystalline; fossiliferous(?) in part. Shale, light-green, dark-grayish-brown; trace. ROCHESTER FORMATION at 1993 feet (GRN)
2010 - 2020	Dolomite as above. Shale as above, brown; trace
2020 - 2040	Limestone and dolomite, very light- and light-gray, brown, light-greenish-gray, pink, micrograined to coarse-grained (microcrystalline to coarsely crystalline); glauconitic in part. Shale, light-green; trace. DAYTON FORMATION at 2011 feet (GRN)
2040 - 2050	Limestone, white, very light- to dark-gray, mottled-pink (hematitic), yellow, micrograined to medium-grained, fossiliferous. Shale, light-green, medium-greenish-gray, red; heavy trace. Sandstone, medium-greenish-gray, very fine-grained; trace
2050 - 2060	Sandstone, light- to medium-greenish-gray to gray, very fine-grained, dolomitic, silty; grading into siltstone; 70%. Limestone as above, 30%. Shale, light-greenish-gray; trace
2060 - 2070	Limestone as above, 60%. Sandstone and siltstone as above, 40%. Shale, heavy trace
2070 - 2080	Limestone as above, 70%. Shale, light-green, 30%. Sandstone and siltstone as above, heavy trace. CABOT HEAD FORMATION at 2053 feet (GRN)
2080 - 2100	Shale, light-green, reddish-brown; 80%. Limestone and dolomite, very light-gray, light-brown, red, micrograined to coarse-grained, microcrystalline; mottled yellow in part; hematitic in small part; 20%
2100 - 2120	Shale as above, 60%. Limestone, white, very light-gray, very light- and light-brown, dark-gray, red, granular, slightly glauconitic; 40%
2120 - 2140	Limestone as above, 60%. Shale as above, 40%
2140 - 2170	Limestone as above, 50%. Siltstone or very fine-grained sandstone, light- to medium-greenish-gray; 30%. Shale as above, 20%. BRASSFIELD FORMATION at 2150 feet (GRN)
2170 - 2190	Limestone as above, 90%. Shale, light- to medium-green, silty in part; 10%
2190 - 2200	Limestone and shale as above. Shale, in part red. ORDOVICIAN at 2179 feet (GRN)

Richland County
Sharon Township
Section 24 ($NW\frac{1}{4}$)

Reliance #1 Gwirtz
Permit No. 285
Sample No. 1252
Elevation (DF) 1121 feet

Depth (ft)

DELAWARE LIMESTONE at 791 feet (GRN)

	COLUMBUS LIMESTONE at 836 feet (GRN)
	Coral zone 885 to 903 feet
	Basal sandy zone 930(?) to 950 feet
	SILURIAN (SALINA GROUP, F unit) at 950 feet (GRN)
954 - 975	Dolomite, very light- and light-brown, microcrystalline. Dolomite, medium-gray, microcrystalline, argillaceous
975 - 982	Dolomite as above, medium gray. Dolomite, very light- to medium-brown, microcrystalline, slightly anhydritic (brown anhydrite)
982 - 997	Dolomite as above. Anhydrite, trace. Chert, very light-brown; trace
997 - 1037	Dolomite as above, light and medium brown. Anhydrite, heavy trace
1037 - 1084	Dolomite, light-brown, microcrystalline, slightly pelletal (mud-supported). Dolomite, medium-brownish-gray, microcrystalline, argillaceous; heavy trace. Anhydrite, trace. E unit at 1023 feet (GRN)
1084 - 1101	Dolomite as above, light brown. Anhydrite, heavy trace
1101 - 1118	Anhydrite, impure
1118 - 1128	Anhydrite, 50%. Dolomite, light- and medium-brown, microcrystalline; 50%
1128 - 1138	Dolomite as above, grayish in part; 70%. Anhydrite, 30%
1138 - 1178	Dolomite, light- and medium-brownish-gray, grayish-brown, medium- and dark-gray, microcrystalline, argillaceous; gray dolomite grading into shale. Anhydrite, heavy trace. C unit at 1115 feet (GRN)
1178 - 1207	Dolomite and anhydrite as above. Dolomite, silty; light grayish green in part (samples not reliably labelled)
1207 - 1240	Anhydrite, 60%. Dolomite, light-brown, microcrystalline; 40%. B unit at 1182 feet (GRN)
1240 - 1275	Anhydrite, 80%. Dolomite, light-brown, grayish-brown, microcrystalline, 20%. Shale, light-green; heavy trace
1275 - 1377	Dolomite, very light- to medium-brown, grayish-brown, microcrystalline
1377 - 1400	Dolomite, white, very light-brown, microcrystalline and very finely crystalline. Lens of Lockport lithology, probably about 15 feet thick, top at 1368 feet (GRN). Dolomite, light- and medium-brown, gray, microcrystalline; argillaceous in part; heavy trace
1400 - 1417	Dolomite, very light-brown, microcrystalline
1417 - 1434	Dolomite, very light- to medium-brown, microcrystalline
1434 - 1453	Rusty samples
1453 - 1470	Dolomite, light- and medium-brown, light-brownish-gray, microcrystalline
1470 - 1487	Dolomite, very light- and light-brown, very light-gray, microcrystalline. LOCKPORT GROUP(?) at 1484 feet (GRN)
1487 - 1527	Dolomite, very light- and light-gray, microcrystalline to finely crystalline
1527 - 1547	Dolomite, very light- to medium-gray, microcrystalline to finely crystalline; brownish in part; fair intercrystalline porosity
1547 - 1607	Dolomite as above, very light and light gray
1607 - 1615	Dolomite, very light-brownish-gray, microcrystalline, very slightly glauconitic. Chert, light-brownish-gray, gray; heavy trace. GOAT ISLAND DOLOMITE at 1608 feet (GRN)
1615 - 1632	Dolomite, very light- and light-brown, very light- to medium-gray, microcrystalline to coarsely crystalline; fossiliferous or fragmental in part. GASPORT DOLOMITE at 1625 feet (GRN)
1632 - 1645	Dolomite as above. Shale, medium-brownish-gray, dolomitic; trace. ROCHESTER FORMATION at 1630 feet (GRN)
1645 - 1657	Dolomite, very light- and light-brown, microcrystalline, glauconitic. DAYTON FORMATION at 1643 feet (GRN)

1657 - 1670	Dolomite, medium-gray, slightly brownish, microcrystalline, granular-looking. Shale, light-green; trace. CABOT HEAD FORMATION(?) at 1670 feet (GRN)
1670 - 1696	Shale, medium-greenish-gray
	Samples below 1696 feet not examined
	BRASSFIELD FORMATION at 1768 feet (GRN)
	ORDOVICIAN at 1793 feet (GRN)

Seneca County
Scipio Township
Section 13 (SW$\frac{1}{4}$)

Ohio Oil #1 Bishop
Permit No. 25
Sample No. 104
Elevation (T) 908 feet

Depth (ft)	
	Top of SILURIAN SALINA GROUP (F unit?) at 179 feet
	Samples above 177 feet not examined
177 - 185	Dolomite, very light- and light-brown, brownish-gray, microcrystalline, anhydritic, brecciated; 70%. Sandstone, very light-brown, gray, very fine- and fine-grained; dolomitic in part; 30%
185 - 192	Dolomite, very light- and light-brown, microcrystalline, brecciated; minor amount light gray; poor pinpoint porosity
192 - 204	Dolomite as above, nonbrecciated
204 - 225	Dolomite as above. Chert, very light-brown; trace to 220 feet
225 - 235	Dolomite, light-brown, microcrystalline. Dolomite, light-gray, microcrystalline, slightly argillaceous, silty. Chert, white; trace to 230 feet
235 - 241	Dolomite, light-brown, brownish-gray, microcrystalline, brecciated, slightly anhydritic. Dolomite, light- and medium-gray, microcrystalline, argillaceous. Chert, colorless, recrystallized; trace
241 - 247	Dolomite, light-brown, light-gray, microcrystalline, slightly anhydritic; poor pinpoint porosity
247 - 257	Dolomite as above; light-gray dolomite silty, slightly argillaceous; poor vuggy porosity (no permeability). Chert, medium- and dark-brown; recrystallized in part
257 - 260	Dolomite, light-brown, brownish-gray, gray, microcrystalline; argillaceous in part (gray dolomite); poor vuggy porosity. Chert, white; trace. E unit(?) at 257 feet
260 - 267	Dolomite, very light- and light-brown, microcrystalline; excellent pinpoint porosity in part. Selenite, trace. Dolomite, light-gray, microcrystalline, argillaceous, waxy; trace. Chert, recrystallized; trace
267 - 282	Dolomite as above. Chert as above, heavy trace. Chert, very light-gray, light-brown; heavy trace from 273 to 282 feet
282 - 295	Dolomite, very light- and light-brown, light-brownish-gray, microcrystalline. Chert, very light-gray, light-brown; recrystallized in part; heavy trace
295 - 301	Dolomite, very light-yellowish-brown to light-brown, microcrystalline, anhydritic (brown anhydrite crystals); poor pinpoint to vuggy porosity. Dolomite, light- and medium-gray, microcrystalline, argillaceous. Chert as above, trace
301 - 306	Dolomite, very light- and light-brown, microcrystalline, very anhydritic (white and brown anhydrite)
306 - 313	Dolomite, light- and medium-brown, brownish-gray, gray, microcrystalline, anhydritic; argillaceous in part
313 - 319	Dolomite, very light- and light-brown, microcrystalline, very anhydritic (brown anhydrite crystals)
319 - 324	Dolomite, medium-grayish-brown to dark-gray, microcrystalline; argillaceous in large part. C unit at 319 feet
324 - 331	Dolomite, light- and medium-brown, gray, greenish-gray, brownish-gray, microcrystalline, very anhydritic, silty and slightly sandy (very fine-grained sand); argillaceous in part. Chert, light-brown; trace

331 -	342	Dolomite, very light-grayish-brown to light-brown, microcrystalline. Dolomite, light- and medium-gray, microcrystalline, argillaceous, silty. Anhydrite, heavy trace to trace
342 -	350	Dolomite as above, very anhydritic. Anhydrite, 10%
350 -	357	Dolomite, light- and medium-brown, microcrystalline, very anhydritic; minor amount light and medium gray to greenish gray; argillaceous and silty in part; 90%. Anhydrite, 10%
357 -	364	Dolomite, very light- to medium-brown, light-brownish-gray, microcrystalline, slightly anhydritic (brown anhydrite); laminated in part. Selenite, trace
364 -	382	Dolomite, light- and medium-brown, grayish-brown, microcrystalline, slightly anhydritic; 90%. Shale, light- and medium-greenish-gray, dolomitic; 10%. Anhydrite, heavy trace
382 -	400	Dolomite, very light-grayish-brown to light-brown, microcrystalline, very anhydritic. B unit at 382 feet. Base of B unit not determined
400 -	429	Dolomite, light-brown, medium- to dark-brownish-gray, microcrystalline; argillaceous in part. Anhydrite, heavy trace to trace
429 -	432	Dolomite, light- to dark-brown, microcrystalline; 80%. Anhydrite, 20%
432 -	439	Dolomite, light- and medium-greenish-gray, microcrystalline, very argillaceous; grading into shale; 50%. Anhydrite, 50%
439 -	446	Anhydrite, 70%. Dolomite, light- to dark-brown, microcrystalline, 30%
446 -	455	Anhydrite, 50%. Dolomite as above, 50%
455 -	464	Dolomite as above, 80%. Anhydrite, 20%
464 -	472	Dolomite as above, 70%. Anhydrite, 30%
472 -	490	Dolomite as above, anhydritic (brown and white anhydrite)
490 -	515	Dolomite as above. Dolomite, dark-grayish-brown, microcrystalline, argillaceous; heavy trace
515 -	532	Dolomite, light-grayish-brown to brownish-gray and brown, microcrystalline and very finely crystalline; very finely sucrosic in part; pelletal(?) in part
532 -	539	Dolomite, very light- and light-gray to brownish-gray, microcrystalline, laminated. Dolomite as above, heavy trace
539 -	558	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline, anhydritic; minor amount light gray; fair pinpoint porosity. Nonrepresentative Salina
558 -	572	Dolomite, very light-brown, microcrystalline and very finely crystalline, sparry; fair pinpoint porosity. Nonrepresentative Salina
572 -	580	Dolomite, very light- and light-yellowish-brown, microcrystalline. Dolomite, light- and medium-gray, mottled-light-brown, light-greenish-gray, microcrystalline to medium-crystalline. Shale, light-greenish-gray, pyritic; heavy trace. LOCKPORT DOLOMITE(?) at 575 feet
580 -	585	Dolomite as above, gray. Shale as above, clayey; dirty sample
585 -	590	Dolomite, light- and medium-gray, very light-brownish-gray, microcrystalline to medium-crystalline. Shale, light-green; heavy trace
590 -	594	Dolomite as above. Shale as above, trace
594 -	604	Dolomite, very light-brown, light-grayish-brown, microcrystalline to medium-crystalline; sucrosic in part. Shale as above, trace
604 -	620	Dolomite as above, very light and light brown
620 -	647	Dolomite as above, granular looking
647 -	667	Dolomite, light-brown, microcrystalline and very finely crystalline, slightly sparry; a few carbonaceous partings; poor pinpoint and vuggy porosity

667 - 675 Dolomite, very light-brown, microcrystalline to medium-crystalline, granular-looking; minor amount very light to medium gray. Shale, light-green, waxy; trace

675 - 707 Dolomite as above, very light gray to brownish gray; sucrosic in part

707 - 818 Dolomite as above, very light gray; fair to excellent pinpoint, intercrystalline, and vuggy porosity to 813 feet

818 - 873 Dolomite as above, fair vuggy porosity (some vugs filled with gypsum)

873 - 880 Dolomite, very light- to dark-gray, light-greenish-gray, microcrystalline, pyritic; argillaceous in part. ROCHESTER FORMATION at 873 feet

880 - 885 Dolomite, very light-brown, microcrystalline, slightly sparry (fossiliferous?), slightly pyritic; minor amount light gray. Shale, light-green; trace. DAYTON FORMATION at 880 feet

885 - 890 Dolomite, very light-brown, microcrystalline. Dolomite, light- and medium-gray, microcrystalline; trace

890 - 895 Dolomite, very light- and light-brown, microcrystalline to coarsely crystalline, fossiliferous, very slightly glauconitic

895 - 900 Dolomite as above, brown. Dolomite, medium-gray, mottled-brownish, microcrystalline, probably granular. Shale, light-green; trace

900 - 930 Shale, light-green, poorly indurated. Dolomite, medium-green, mottled-brown, coarse-grained. Dirty sample. CABOT HEAD FORMATION at 900 feet

930 - 945 Shale, medium-green, fissile

945 - 958 Shale as above. Dolomite, light-brown, microcrystalline; heavy trace to trace

958 - 999 Dolomite, light- and medium-brown, microcrystalline to coarsely crystalline, crinoidal, brachiopod-bearing. Shale as above, heavy trace to trace

999 - 1018 Dolomite as above, very light brown, slightly glauconitic. Chert, white to cream-colored; trace from 1005 to 1018 feet

1018 - 1032 Dolomite, very light-brown, light-grayish-brown to greenish-brown, microcrystalline to coarsely crystalline; argillaceous and silty in part. Chert as above, trace

1032 - Shale, red; minor amount light green. Dolomite as above, trace. ORDOVICIAN at 1032 feet

Williams County
Center Township
Section 25

Tamp Oil Co. #1 Wineland
Permit No. 37
Sample No. 1429
Elevation (KB) 779 feet

Depth (ft)

460 - 470 Dolomite, very light-grayish-brown, sublithographic to microcrystalline. Shale, light-grayish-green. Sand, medium-grained, rounded; trace. SILURIAN (undifferentiated SALINA GROUP) at 468 feet (GRN)

470 - 490 Dolomite, very light-gray to brownish-gray, microcrystalline. Dolomite, light-brown, microcrystalline. Dolomite, light-gray, microcrystalline, sandy to very sandy. Shale, light-green; trace

490 - 500 Dolomite as above, very light gray. Dolomite, as above, light brown; selenite crystals

500 - 510 Dolomite, very light-grayish-brown, microcrystalline, slightly pyritic. Chert, light-gray; trace

510 - 530 Cavings

530 - 540 Dolomite, medium- and dark-gray, microcrystalline, pyritic, argillaceous; grading into shale

540 - 550 Dolomite as above, light grayish brown in part

550 - 560 Dolomite, light- to dark-gray, light-brown, grayish-brown, microcrystalline, laminated, slightly pyritic; argillaceous in part

560 - 570 Dolomite, light- and medium-

brown to grayish-brown, microcrystalline, pyritic; argillaceous in part

570 - 580 Dolomite, light- and medium-brown, microcrystalline; poor pinpoint porosity. Gypsum and anhydrite, trace

580 - 590 Dolomite as above, poor pinpoint to vuggy porosity. Dolomite, light- and medium-gray to grayish-brown, microcrystalline, anhydritic; trace

590 - 600 Dolomite, light-brownish-gray, light- and medium-brown, microcrystalline and very finely crystalline; sucrosic in part; pelletal in part; patches of sparry dolomite; poor to fair pinpoint porosity. Nonrepresentative Salina

600 - 620 Dolomite, light-brown, grayish-brown, microcrystalline, laminated; dark-gray shaly partings

620 - 640 Dolomite, very light-gray, brown, microcrystalline; poor vuggy porosity. Top of nonrepresentative Salina

640 - 650 Dolomite, medium- and dark-brown, mottled-light-yellowish-brown, microcrystalline, probably pelletal, faintly laminated; patches of sparry dolomite

650 - 660 Dolomite as above, very light gray in small part; poor pinpoint to vuggy porosity

660 - 670 Dolomite as in sample from 640 to 650 feet; excellent pinpoint to vuggy porosity (due to solution of anhydrite? crystals)

670 - 680 Dolomite, light- and medium-brown, microcrystalline and very finely crystalline; poor pinpoint porosity

680 - 690 Dolomite as above, poor to fair pinpoint and vuggy porosity; a moderate number of patches of sparry dolomite

690 - 700 Dolomite, light- and medium-brown, microcrystalline and very finely crystalline, pelletal; poor pinpoint porosity. Dolomite, very light-gray and brownish-gray, microcrystalline; a few patches of sparry dolomite

700 - 710 Dolomite, very light-brown to grayish-brown and yellowish-brown, microcrystalline to medium-crystalline, very sparry; poor to fair pinpoint to vuggy porosity

710 - 730 Dolomite, light-brown, microcrystalline and very finely crystalline; probably pelletal in part; poor pinpoint porosity

730 - 740 Dolomite, medium-gray, microcrystalline, argillaceous; poor vuggy porosity. Dolomite as above, trace (Tymochtee lens)

740 - 750 Dolomite, light- and medium-brown, microcrystalline to finely crystalline; poor vuggy porosity. Dolomite, light-gray, brownish-gray, microcrystalline; patches of sparry dolomite. Sphalerite, trace

750 - 760 Dolomite, light-yellowish-gray to light-brown, microcrystalline and very finely crystalline, sparry, fossiliferous (corals?); sucrosic in part; excellent vuggy porosity; laminated in part

760 - 770 Dolomite, light-brown, microcrystalline and very finely crystalline, very sparry; excellent vuggy porosity

770 - 780 Dolomite, light- and medium-brown, microcrystalline, very sparry; poor to fair pinpoint to vuggy porosity

780 - 800 Dolomite, light-brown, microcrystalline and very finely crystalline, very sparry, coralline (colonial corals); poor vuggy porosity

800 - 810 Dolomite, light-brown, microcrystalline and very finely crystalline, slightly sparry

810 - 820 Dolomite, very light-yellowish-gray, microcrystalline and very finely crystalline, very sparry; poor pinpoint to vuggy porosity

820 - 840 Dolomite as in sample from 800 to 810 feet; slightly grayish from 830 to 840 feet

840 - 850 Dolomite, very light-gray to light-yellowish-gray, microcrystalline. Dolomite as above

850 - 870 Dolomite, very light- and light-brown to grayish-brown, microcrystalline to coarsely

	crystalline
870 - 890	Dolomite, light-gray, very light- to medium-brown, microcrystalline to medium-crystalline, slightly sparry; sucrosic in part
890 - 910	Dolomite, light- and medium-gray, brownish-gray, microcrystalline and very finely crystalline. LOCKPORT DOLOMITE at 890 feet
910 - 970	Dolomite as above, light gray, brownish gray
970 - 975	Dolomite, very light-gray to brownish-gray, microcrystalline and very finely crystalline; sucrosic in part; fair vuggy porosity
975 - 1000	Dolomite as above, finely crystalline to coarsely crystalline in part; poor to fair vuggy porosity
1000 - 1015	Dolomite as above, very light and light gray to brownish gray
1015 - 1040	Dolomite as above, very light gray
1040 - 1045	Dolomite, very light-gray, microcrystalline to coarsely crystalline. Dolomite, light-yellowish-gray, microcrystalline to coarsely crystalline
1045 - 1055	Dolomite as above. Dolomite, light- and medium-brown, very finely crystalline, sparry
1055 - 1070	Dolomite, very light-gray, microcrystalline to coarsely crystalline
1070 - 1075	Dolomite, light-gray, microcrystalline
1075 - 1145	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline
1145 - 1165	Dolomite, very light- and light-gray, brown, light-greenish-gray, microcrystalline, slightly pyritic, slightly argillaceous. Dolomite, light-greenish-gray, microcrystalline, very argillaceous; trace. Base of LOCKPORT DOLOMITE(?) at 1137 feet (GRN)
1165 - 1170	Dolomite, light- and medium-brown, mottled-gray, microcrystalline
1170 - 1175	Dolomite as above, microcrystalline to medium crystalline; 60%. Chert, white, fossiliferous; 40%. Shale, dark-brown, dolomitic; trace
1175 - 1180	Dolomite, light-brown, microcrystalline to medium-crystalline; slightly argillaceous in part; 90%. Chert as above, 10%
1180 - 1185	Dolomite, light- and medium-brown, microcrystalline to medium-crystalline, probably granular or bioclastic
1185 - 1190	Dolomite as above, 95%. Chert, cream-colored; 5%. Shale, medium-gray, dark-brown, dolomitic; trace
1190 - 1195	Dolomite as above, 95%. Chert as above, 5%. Shale as above, heavy trace
1195 - 1210	Dolomite, very light-brownish-gray, microcrystalline to coarsely crystalline
1210 - 1215	Dolomite as above. Dolomite, very light- to light-greenish-gray, very fine-grained, very slightly argillaceous; trace. ORDOVICIAN at 1214 feet (GRN)

Wood County
Washington Township
Section 32 ($NE\frac{1}{4}$)

Continental #1 Euler
Permit No. 211
Sample No. 1043
Elevation (KB) 668 feet

Depth (ft)	
	Bedrock at 112 feet in SALINA GROUP (B unit?)
0 - 140	Overburden
140 - 150	Shale, light-green; 50%. Dolomite, light-brown, microcrystalline; sandy in part; may be overburden; 50%. Calcite, drusy; trace
150 - 170	Shale, light-green; 50%. Dolomite as above, very light brown in part, 50%. Calcite as above, heavy trace
170 - 180	Dolomite as above. Shale, light-green; heavy trace. Calcite as above, heavy trace
180 - 190	Dolomite, very light- to dark-brown, microcrystalline, gypsiferous; laminated in part; 95%. Shale, light-green; 5%. Gypsum, heavy trace
190 - 200	Dolomite, light- and medium-brown, microcrystalline; dark-brown partings. Shale as above, trace. Anhydrite, trace
200 - 210	Dolomite, light- and medium-brown, microcrystalline; su-

crosic in part; fair pinpoint to vuggy porosity. Gypsum, trace

210 - 230 Dolomite, light- and medium-brown, microcrystalline; grayish in part. TYMOCHTEE DOLOMITE(?) at 210 feet

230 - 240 Dolomite as above, light brown to grayish brown

240 - 250 Dolomite as above, medium grayish brown in part. Dolomite, light- and medium-brown, microcrystalline, laminated; sucrosic in part; dark-brown and black partings; shaly in part

250 - 260 Dolomite, medium-brownish-gray, microcrystalline. Gypsum, trace (nodular or laminated)

260 - 270 Dolomite as above, black shaly partings

270 - 290 Dolomite, light- and medium-brown to grayish-brown, microcrystalline; partings as above

290 - 330 Dolomite, light- and medium-grayish-brown to brownish-gray, microcrystalline; a few black shaly partings; a moderate number of partings from 290 to 330 feet

330 - 340 Dolomite and partings as above. Dolomite, medium- and dark-brown, microcrystalline. GREENFIELD DOLOMITE at 338 feet (GRN)

340 - 350 Dolomite, light- to dark-brown, microcrystalline

350 - 360 Dolomite, very light- and light-brown, microcrystalline and very finely crystalline

360 - 380 Dolomite as above, very light to medium brown; poor vuggy porosity

380 - 390 Dolomite, very light-grayish-brown to light-brown, microcrystalline and very finely crystalline. Dolomite, very light-gray, microcrystalline and very finely crystalline; argillaceous in part; trace

390 - 400 Dolomite as above, brown and gray

400 - 420 Dolomite, white, microcrystalline to medium-crystalline; excellent intercrystalline and vuggy porosity. LOCKPORT DOLOMITE at 401 feet (GRN)

420 - 530 Dolomite, white and very light-gray, predominantly microcrystalline; sucrosic in part; excellent vuggy porosity

530 - 540 Dolomite, white to light-gray, microcrystalline to coarsely crystalline, fossiliferous or fragmental; excellent vuggy porosity

540 - 550 Dolomite as above, light gray

550 - 560 Dolomite as above. Dolomite, medium- and dark-gray, very finely crystalline, slightly argillaceous; poor vuggy porosity. Dolomite, very light-greenish-gray, microcrystalline, very slightly argillaceous; trace. ROCHESTER FORMATION at 559 feet (GRN)

560 - 570 Dolomite, light- and medium-gray, microcrystalline and very finely crystalline, slightly pyritic; argillaceous in part. Dolomite, very light- and light-brown, microcrystalline to coarsely crystalline, pyritic; poor vuggy porosity. DAYTON FORMATION at 564 feet (GRN)

570 - 590 Dolomite as above, brown. Dolomite, very light- to medium-gray, microcrystalline to coarsely crystalline; mottled brown and green in part; argillaceous in part. Shale, light-green; trace to 580 feet. CABOT HEAD FORMATION at 570 feet (GRN)

590 - 600 Dolomite, very light- to medium-brown, very light- and light-gray, microcrystalline to coarsely crystalline, slightly argillaceous; pyritic in part

600 - 610 Dolomite as above, cherty in part. Chert, very light-gray to brown; trace

610 - 630 Dolomite, mottled-light- and medium-brown and gray, microcrystalline to coarsely crystalline, fragmental, slightly pyritic, slightly cherty, fossiliferous (crinoid, bryozoan), slightly argillaceous in part. Shale, medium-greenish-gray, dolomitic; heavy trace. BRASSFIELD FORMATION at 620 feet (GRN)

630 - 640 Dolomite, light-brown, micro-

	crystalline to coarsely crystalline, fossiliferous; poor vuggy porosity
640 - 650	Dolomite as above, mottled gray in part; medium brown in part; argillaceous in part
650 - 670	Dolomite, very light- and light-brown, microcrystalline to coarsely crystalline; fair intercrystalline and vuggy porosity. Chert, white; trace
670 - 680	Dolomite as above, trace. Dolomite, medium-brown, slightly grayish, very fine- and fine-grained, slightly argillaceous and glauconitic
680 - 690	Bad sample, includes red shale. ORDOVICIAN at 670 feet (GRN)

Wyandot County
Antrim Township
Section 28 (SE¼)

Ohio Oil #1 Chatlain
Sample No. 4
Elevation (GL) 910 feet

Depth (ft)	
	Bedrock in SALINA GROUP (B unit?)
0 - 54	No samples
54 - 85	Dolomite, light-brown, microcrystalline. Calcite, secondary (grapestone). Chert, very light- and light-brown; trace to 60 feet
85 - 120	Limestone, light-brown, micrograined. Calcite as above. Dolomite as above, trace
120 - 150	Limestone and calcite as above. Dolomite, light-gray to brownish-gray, microcrystalline, slightly argillaceous. Surface cavings
150 - 160	Limestone and calcite as above. Dolomite, very light-brown, microcrystalline
160 - 165	Dolomite, very light-brown, light-brownish-gray, microcrystalline. Calcite, secondary; heavy trace
165 - 180	Dolomite, light-yellowish-brown, light-brownish-gray, microcrystalline and very finely crystalline. Limestone (calcite?), light-brownish-gray; grapestone in part; heavy trace
180 - 185	Dolomite, light-yellowish-brown, light-brown to grayish-brown, microcrystalline. Limestone or calcite as above
185 - 190	Calcite, very light- to medium-brown; sucrosic in large part
190 - 195	Calcite as above, 60%. Dolomite, very light-yellowish-brown, microcrystalline; 40%
195 - 200	Dolomite, light-brown, microcrystalline and very finely crystalline; 70%. Calcite as above, 30%
200 - 205	Dolomite, very light-brown, microcrystalline, gypsiferous. Calcite as above, trace
205 - 225	Dolomite, very light- and light-brown, light- and medium-grayish-brown, microcrystalline. Shale, light-greenish-gray (cavings?), to 210 feet. Calcite as above, trace
225 - 235	Dolomite as above, microcrystalline and very finely crystalline
235 - 255	Dolomite, very light- and light-brown, microcrystalline; pelletal(?) in small part; becoming in part light grayish brown at 240 feet
255 - 285	Dolomite, light-grayish-brown, very light-brown, microcrystalline (probably equivalent to Tymochtee beds)
285 - 295	Dolomite, light-brown, light- and medium-grayish-brown, microcrystalline
295 - 325	Dolomite as above, predominantly light and medium grayish brown
325 - 330	Dolomite, light-brown, light- and medium-grayish-brown, microcrystalline; a few black shaly partings
330 - 335	Dolomite, light- and medium-brown, microcrystalline
335 - 340	Dolomite, very light- to medium-brown, microcrystalline; poor pinpoint porosity
340 - 345	Dolomite as above, in small part medium grayish brown
345 - 360	Dolomite, light-brown, light-grayish-brown, microcrystalline
360 - 365	Gypsum, 75%. Dolomite, medium-brownish-gray, microcrystalline, argillaceous; 25%
365 - 375	Dolomite, light- and medium-brown, medium-brownish-gray, microcrystalline; argillaceous in part; 60%. Gypsum, impure

	with dolomite, 40%
375 - 380	Dolomite, light-brown, light- and medium-grayish-brown, microcrystalline, gypsiferous; 90%. Gypsum, impure with dolomite, 10%
380 - 385	Dolomite, light- to dark-brown, microcrystalline, faintly laminated; very poor pinpoint porosity
385 - 390	Dolomite as above. Gypsum and anhydrite, trace
390 - 395	Dolomite, predominantly light-brown, microcrystalline and very finely crystalline; poor pinpoint porosity
395 - 400	Dolomite, light- and medium-brown, microcrystalline
400 - 405	Dolomite, light-brown, microcrystalline; slightly grayish in part; poor pinpoint and vuggy porosity (solution of gypsum crystals)
405 - 410	Dolomite, very light- and light-brown, microcrystalline and very finely crystalline; poor vuggy porosity; pores partially filled with gypsum
410 - 415	Dolomite, light-brown, light-grayish-brown, microcrystalline, 95%. Gypsum, impure with dolomite, 5%
415 - 420	Dolomite and gypsum as above. Dolomite in part very finely crystalline
420 - 430	Dolomite as above, 90%. Gypsum, 10%. Anhydrite, trace
430 - 434	Dolomite, light-brown, light-grayish-brown, microcrystalline
434 - 440	Dolomite, very light- and light-brown, light-gray, microcrystalline; poor pinpoint and vuggy porosity. LOCKPORT GROUP(?) at 434 feet
440 - 535	Dolomite as above, very light and light gray, fossiliferous or biofragmental
535 - 540	Dolomite, very light- and light-brown, microcrystalline. Chert, very light-brown, gray; heavy trace. Dolomite as above, trace. GOAT ISLAND DOLOMITE at 535 feet
540 - 545	Dolomite, light-gray, brownish-gray, microcrystalline to medium-crystalline; 90%. Dolomite as above, 10%. GASPORT DOLOMITE at 541 feet
545 - 550	Dolomite, very light- and light-gray, microcrystalline to coarsely crystalline
550 - 555	Dolomite as above, medium gray in part
555 - 565	Dolomite, light-brown, microcrystalline, slightly argillaceous. Dolomite as above, slightly pyritic; heavy trace to 560 feet. ROCHESTER FORMATION at 555 feet
565 - 575	Dolomite, very light- and light-brown, microcrystalline, very slightly glauconitic. DAYTON FORMATION(?) at 565 feet
575 - 580	Dolomite, very light- and light-brown, light-greenish-gray, microcrystalline and very finely crystalline, slightly glauconitic; poor pinpoint porosity
580 - 585	Dolomite as above, microcrystalline to coarsely crystalline, pyritic; pink in part
585 - 590	Dolomite as above. Dolomite, light- and medium-gray, microcrystalline, slightly argillaceous. Shale, medium-greenish-gray; trace. CABOT HEAD FORMATION(?) at 587 feet
590 - 600	Dolomite as above, pink, brown, gray, slightly fossiliferous (brachiopods). Shale, light-green, poorly indurated; trace
600 - 610	Shale, light-greenish-gray; 50%. Dolomite, light-brown, light-brownish-gray, microcrystalline(?), fossiliferous (bryozoan); mottled pink and greenish yellow in part; 50%
610 - 615	Dolomite, light-brownish-gray, grayish-brown, microcrystalline to coarsely crystalline, fossiliferous or fragmental; 90%. Shale as above, 10%
615 - 625	Dolomite, very light-brown to light-grayish-brown, light- and medium-gray, microcrystalline and very finely crystalline, fossiliferous (bryozoan), slightly pyritic
625 - 630	Shale, light-greenish-gray. Dolomite as above, trace
630 - 675	Dolomite as above, light brown. Shale, light-greenish-gray;

heavy trace to trace

675 - 680 Dolomite as above. Shale as above, heavy trace. Chert, very light-brown; heavy trace

680 - 695 Dolomite as above, cherty in part. Shale, light-greenish-gray; heavy trace to trace. Chert, very light-brown, medium-gray; trace

695 - 700 Shale, light-brown, dark-gray, microcrystalline; 90%. Shale, light-green, greenish-gray; 10%. Chert, very light-brown; trace

700 - 705 Dolomite as above, 60%. Shale, red, light-green; 40%. ORDOVICIAN at 703 feet

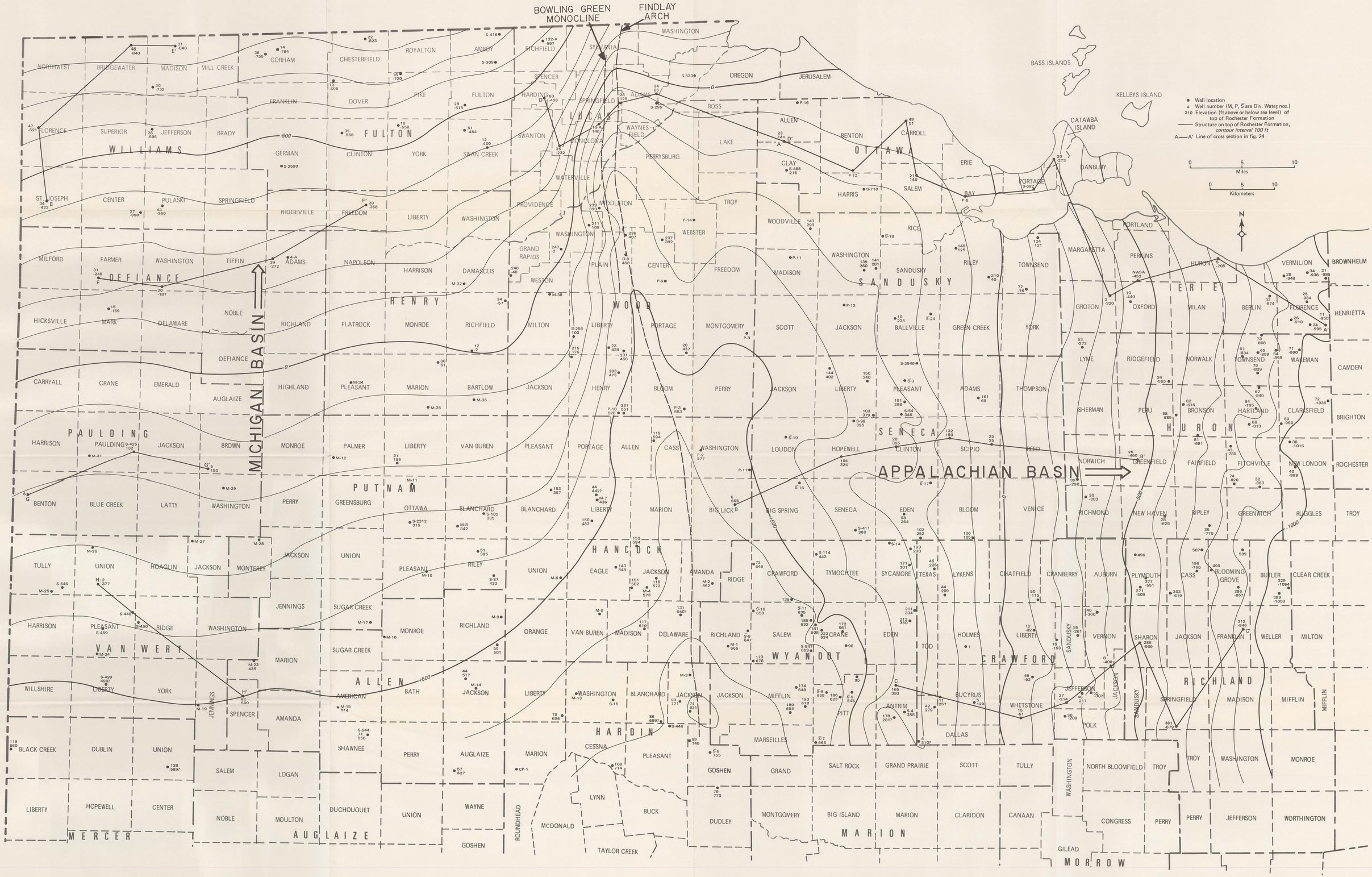

FIGURE 3. Locations of wells used in this study and structure on top of the Rochester Formation. Locations of cross sections of figure 24 shown also.