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STRUCTURAL EVOLUTION OF SOUTHEASTERN MICHIGAN --
MIDDLE ORDOVICIAN TO MIDDLE SILURIAN

presented by

Paul K. Mescher

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James H. Fisher
Major professor

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STRUCTURAL EVOLUTION OF SOUTHEASTERN MICHIGAN -- MIDDLE ORDOVICIAN TO MIDDLE SILURIAN

By

Paul K. Mescher

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ABSTRACT

STRUCTURAL EVOLUTION OF SOUTHEASTERN MICHIGAN —
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The structural history of southeastern Michigan has been previously tied in with wrench fault mechanics related to compressional forces accompanying the Appalachian Orogeny. For this study, the following lithostratigraphic units were studied: Middle Ordovician through Lower Silurian (complete), A-2 Carbonate (Middle Silurian), and Dundee formation (Middle Devonian).

Structural reversal is demonstrated along the Lucas-Monroe Monocline, suggesting that this feature is a true extension of the Bowling Green Fault. Faulting between two wells located on the northwest extension of this fault suggests that the forces responsible for the structural reversal progressed slowly along the fault. The Rovsek-Jorgensen #1 well appears to be a continuation of the failed Precambrian rift valley proposed by Hinze et al., (1969, 1975). Vertical offset in the Precambrian basement of the Northville Anticline has been estimated up to 1,000 feet by some authors. Therefore fault movements appear to be dominantly vertical in this area, caused by shearing along pre-existing lines of weakness in the Precambrian basement.

As the result of regional tectonics exerting shearing forces, the basement surface in Michigan probably has an irregular surface that plays a major role in forming the structures visible in subsurface mapping of southeastern Michigan.

DEDICATION

I would like to dedicate this study to my parents, Mr. and Mrs. Paul A. Mescher, for all the help and faith they have expressed to me throughout my career.

ACKNOWLEDGMENTS

The writer wishes to express his deep appreciation to Dr. James H. Fisher, chairman of the thesis committee, for his friendship, valuable suggestions and assistance and under whose guidance this study was undertaken.

Special thanks go to Dr. C. E. Prouty and Dr. James W. Trow, other members of the committee, for their most appreciated advice, suggestions, and constructive criticism of this manuscript.

Thanks also go to Dow Chemical Company of Midland, Michigan, for providing the financial assistantship that made it possible to complete this Master's program and provided valuable training for this thesis project.

The writer gratefully acknowledges Mr. Garland D. Ells and Mr. Ronald E. Elowski of the Michigan State Geological Survey for discussions and assistance in providing gamma ray logs, state records, and well samples necessary for this study. Many well logs were also provided by Dr. Fisher, Dow Chemical Co.,and by my father, Paul A. Mescher.

Finally, the writer wishes to express sincere gratitude to his parents for their encouragement during the course of these studies. A special thanks goes to my father, a petroleum geologist for over 30 years, for his unending patience and support.

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General

The Middle Ordovician carbonates of Michigan have long been a prolific hydrocarbon source, and their importance and potential as a petroleum reservoir has continued to grow throughout the years. Production from Albion-Scipio, Michigan's only class A field, comes from the Middle Ordovician Trenton and Black River formations. The Trenton-Black River is still considered by many geologists to be the most likely prospect for giant oil fields in the Michigan Basin (DeHaas, 1979).

The Albion-Scipio field consists of several narrow linear oil fields located on or along a possible deep seated, dolomitized strike-slip fault or fracture zone trending northwest across Hillsdale, Jackson, and Calhoun Counties (Ells, 1962). There are numerous similar, though smaller fields located in southeast Lower Michigan. These include the Sumpter, New Boston, Deerfield, Summerfield, Freedom, Medina, and Northville fields located in Washtenaw, Lenawee, Monroe and Wayne Counties. Total Petroleum has also made recent discoveries during 1979-1980 in Jackson County.

While it is assumed that production is from fault or fracture zones, test wells have yet to be drilled to the basement on either side of the proposed Albion-Scipio fault system. This would conclusively prove whether there is any vertical offset to this system. Merritt (1968) used a gravity study to conclude that vertical offset could be as much as several hundred feet.

The proposed basement faults are believed to be of Precambrian age (Fisher 1969 et. al). These old fault planes probably served as reactivation surfaces throughout geologic time and played an important role in the developmental history of the Michigan Basin. From regional studies by Ells (1969) and others, the southeast quadrant of Lower Michigan appears as a geologically complex and intriguing area. This new study attempts to shed further insight into the structural history of this area of the basin as well as outlining the potential for further petroleum exploration.

Purpose and Scope

Abundant subsurface data in the form of gamma ray logs, state drilling records, well samples, and a small number of well cores are available for the southeast quadrant of Lower Michigan. Well control is good in Jackson, Washtenaw and Lenawee Counties but tends to be quite sparse in eastern Wayne and Monroe Counties where the cities of Detroit and Monroe are located.

The main purpose of this study is to determine the times when these faults were reactivated and the magnitudes of their vertical and/or lateral displacement. Three structural contour and 13 isopach maps, as well as stratigraphic cross-sections are used to relate the stratigraphy and faulting events to the evolutionary development of the Michigan Basin from Middle Ordovician (Glenwood) through Early Silurian (Clinton) time (Figure 1). In addition, the Middle Silurian A-2 Carbonate and Middle Devonian Dundee formations are mapped to provide insight into later geologic changes in this area of the basin. These

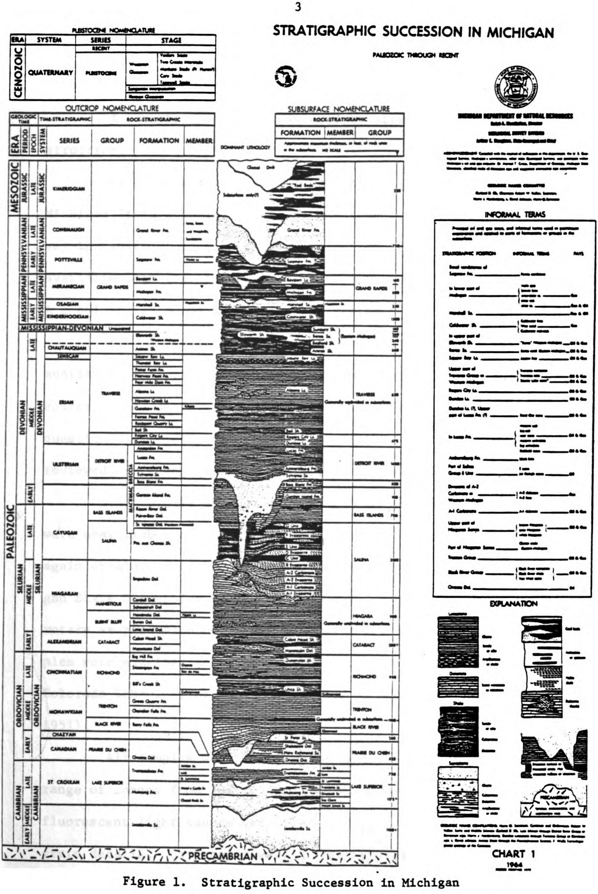

Figure 1. Stratigraphic Succession in Michigan

maps may be found in the pocket located in the back of the thesis.

Procedure -- Method of Study

A threefold approach was used to attain data for use in map construction.

(1) Gamma ray/neutron logs (primarily) were obtained from the Michigan State University Geology Department, the State Geological Survey in Lansing, and the private collection of Paul Mescher, Sr. All available logs reaching the Dundee through Lower Ordovician were used. A total of 114 mechanical logs were reviewed for this study.

(2) State drilling records were examined where there were no available gamma ray/neutron logs. These were obtained from the same sources as #1 above. Formation tops that were obviously incorrect or questionable were not used. A total of 203 state drilling records were reviewed, bringing the total number of well locations to 317.

(3) Samples were used to spot check areas where gamma ray logs were unavailable and state drilling records were in doubt. These were again obtained from the State Geological Survey in Lansing and the Michigan State University Geology Department. Most of the samples viewed were rotary samples although a few shallow wells had cable tool samples. Samples were examined using procedures outlined in the Quarterly of the Colorado School of Mines ("Examination of Well Cuttings," Vol. 46, No. 4, 1951).

All samples were examined using a binocular microscope with a range of lenses from 10x to 40x. An incandescent light source and a fluorescent light source were used to accurately determine colors and grain details. Carbonates were differentiated using a mixture of seven parts water to one part concentrated hydrochloric acid.

Only four sample sets were reviewed for this paper. The bulk of the data was obtained from methods two and three for use in correlating lithostratigraphic units.

Of great help in correlating gamma ray logs were the stratigraphic cross-sections prepared by R. T. Lilienthal (1978), a State Survey geologist. These cross-sections criss-cross the state and were thoroughly tested during the author's association with Dow Chemical Co. Of particular interest was the subdivision of the Late Ordovician Cincinnatian Series into five persistent lithostratigraphic units. Nurmi (1972) made a similar fivefold subdivision of the Cincinnatian Series. However, his classification also included the Utica Shale as a sixth unit. Other differences become obvious in Figure 2.

Lilienthal did not continue his Cincinnatian units into eastern Wayne County, but the author found no apparent problems in correlating unit tops in this area.

Location

The area of study consists of the southeast quadrant of the Southern Peninsula of Michigan (Figure 3). This includes about 40% of Jackson County, and Washtenaw, Wayne, Lenawee, and Monroe Counties in their entirety.

Reliability of Data

The main problems encountered in this study were poor well coverage in eastern Wayne and Monroe Counties and inaccuracies encountered in state drilling records. Many times these apparent errors were in very old entries recorded when Michigan's stratigraphic succession was not as well understood, or when only the driller was

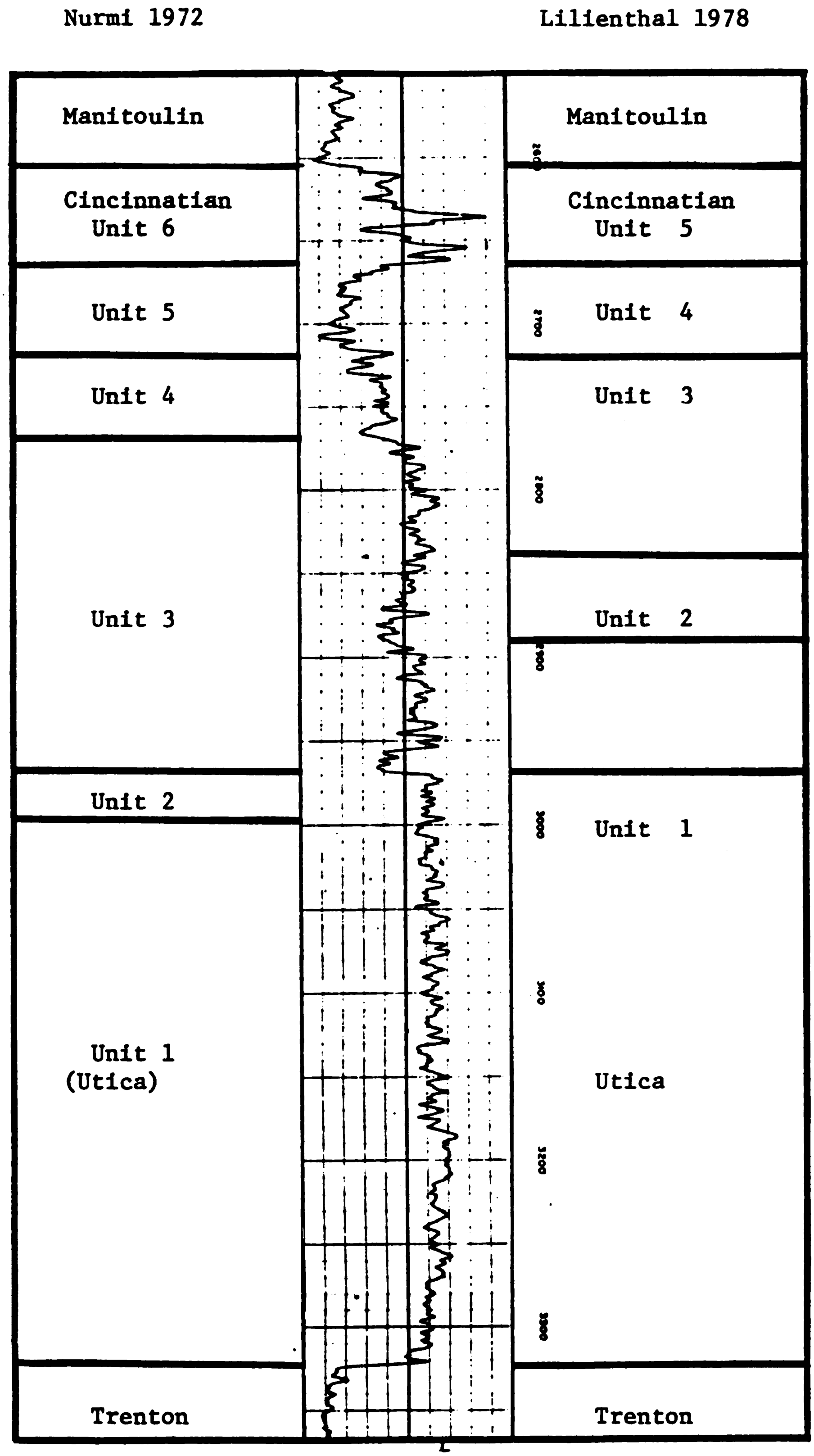

Figure 2.

A Representative Gamma Ray Well Log Section

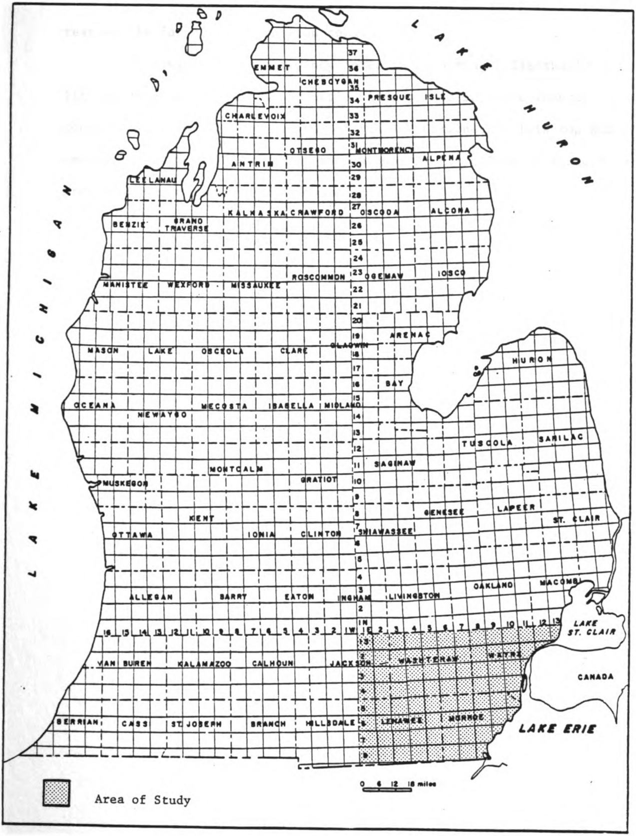

Figure 3. Location Map

responsible for noting formation tops.

The only major discrepancy noted in comparing Lilienthal's lithostratigraphic units to formation tops picked in state records could be seen in choosing the top of the A-2 Carbonate. This top was consistently picked five to ten feet higher in the column in state records than those chosen by Lilienthal.

PREVIOUS WORK WITHIN THE MICHIGAN BASIN

Merritt (1968) made a gravitational study of the Albion-Scipio field in an attempt to determine vertical offset in the Precambrian basement complex. Later, Hinze and Merritt (1969) conducted a gravitational study of the entire basement complex of the Lower Peninsula. Laaksonen (1971) examined the basement lithology of the Michigan Basin using well cuttings.

Cohee (1947, 1948) investigated the Cambrian and Ordovician of the Michigan Basin and adjoining areas using cable tool samples. Ells (1967) prepared a stratigraphic cross-section of the Cambrian and Ordovician formations based on gamma ray logs and similar lithologies for a limited number of wells. Catacosinos (1972, 1974) studied Cambrian lithostratigraphy using gamma ray logs, state records, and well cuttings. Syrjamaki (1977) studied the Lower Ordovician Prairie du Chien formation using gamma ray logs, state records, and the previous work of Cohee.

Ordovician studies have been carried out in adjacent areas by Gutstadt (1958) in Indiana, Sanford (1961) in southwestern Ontario, Buschbach (1965) in Illinois, and Stelzer (1966) in Ohio. The Trenton unconformity problem was examined in regional detail by Rooney (1966) and others.

Hussey (1950) examined Middle Ordovician rocks outcropping in the vicinity of Escanaba in Michigan's Upper Peninsula. Seyler (1974) made a structure and isopach study of Michigan's Middle Ordovician subsurface using gamma ray logs. Newhart (1976) studied the carbonate facies of the Trenton - Black River.

The Upper Ordovician Cincinnatian Series was studied by Nurmi (1972), as discussed earlier.

Much of the early work on the Lower Silurian was descriptive rather than interpretive, or consisted of a total group study. Cohee (1948) lumped the Manitoulin and Cabot Head formations into the Cataract Group due to their gradational contact and a lack of well control. Various studies looked at the Lower Silurian in limited areas of the Michigan Basin (Ehlers, 1962; Ehlers and Kesling, 1957; Shaver, 1974). Brigham (1971) did a structural study including the Silurian for southwestern Ontario and southeastern Michigan. Lower Silurian outcrops have been described on Manitoulin Island by Bolton (1968), in eastern Wisconsin by Shrock (1938), and in Indiana by Pinsak (1964). Potter (1975) conducted a Lower Silurian subsurface study based on gamma ray logs.

Many studies have been made of the Middle Silurian Niagaran Series due to petroleum occurrence in pinnacle reefs. The original subsurface terminology in Michigan was developed by Landes (1945). His division of the Salina into eight primary units (including the A-2 Carbonate) is the most widely used classification today. Evans (1950) modified this system slightly. Ells (1958, 1960, 1963, 1969) has correlated the various Silurian units in detail around the various Niagaran pinnacle reef oil fields and the Albion-Scipio field. Fisher et al (1969) has also done detailed correlation in the Michigan Basin. Fincham (1975) studied the Salina units in the subsurface using gamma ray logs.

Niagaran reef faunas have been studied in great detail by Cummings and Shrock (1928), Lowenstam (1950), Huh (1973), and many others. Shaw (1975) concluded that Niagaran reef thicknesses were directly related to structural trends in the underlying strata.

On a regional scale the works of Cohee (1948), Melhorn (1958), Ehlers and Kesling (1962), Sanford (1972), Mesollela (1974), and many others are extensive.

The Devonian as a whole has been isopached using gamma ray logs by Fisher (1969). Gardner (1974) also used gamma ray logs to make a regional stratigraphic and depositional environment study of the Middle Devonian in the Michigan Basin. Landes (1951) studied the Detroit River Group, and the possibility of a Middle Devonian unconformity was examined by Newcombe (1930). Bloomer (1969) described lithology and porosity in a Middle Devonian Dundee core. Other Dundee carbonate studies have been carried out by Tinklepaugh (1957), Jackson (1958), Dastanpour (1977), Hamrock (1978), Hyde (1979), and Ten Have (1979).

Several comprehensive Michigan Basin studies have also been of great interest. Ells (1969) wrote "The Architecture of the Michigan Basin," an excellent structural summary. This was complemented by Fisher's "Early Paleozoic History of the Michigan Basin." Fisher also presented a "Structural History of the Michigan Basin" at the 1979 meeting of the Michigan Basin Geological Society.

A most helpful recent state publication by Lilienthal (1978) illustrates the gamma ray curves used in preparing his cross-sections. This aided immeasurably in correlating the wells used in this study. The cross-sections cover virtually the entire Lower Peninsula of Michigan, and include Jurassic through Cambrian formations and Upper Precambrian, depending on the location and total depth of the well.

STRUCTURAL HISTORY OF THE MICHIGAN BASIN

The Michigan Basin is a roughly circular, symmetrical autogeosynclinal or intracratonic basin located in the Central Interior Platform of the United States. It includes the Southern Peninsula and the eastern part of the Northern Peninsula of Michigan, eastern Wisconsin, the northeast corner of Illinois, northern Indiana, northwest Ohio, and parts of Ontario bordering Lake Huron, Lake St. Clair, and the western end of Lake Erie (Figure 4). Surrounding the basin are numerous positive structures. These include the Algonquin Arch to the east (Ontario), the Findlay Arch to the southeast (northwest Ohio), the Kankakee Arch to the southwest (north Indiana), the Wisconsin Arch to the west (central Wisconsin), and the Canadian Shield to the north and northeast (Canada). The total areal extent of the basin has been estimated at 122,000 square miles (Cohee, 1965).

Through the years there has been considerable controversy over the age and roles these structures played in influencing the structural history of the Michigan Basin. Most writers have agreed that the Algonquin Arch was a positive feature during part of the Paleozoic. Sanford and Quillian (1958) used isopach maps to show that the transgressive overlap of Upper Cambrian units onto the arch indicates its presence in Upper Cambrian time at least. Sutterlin and Brigham (1967) proposed a Precambrian age for the arch due to the thinning of Upper Cambrian rocks over local Precambrian highs. They stated that the highs were erosional

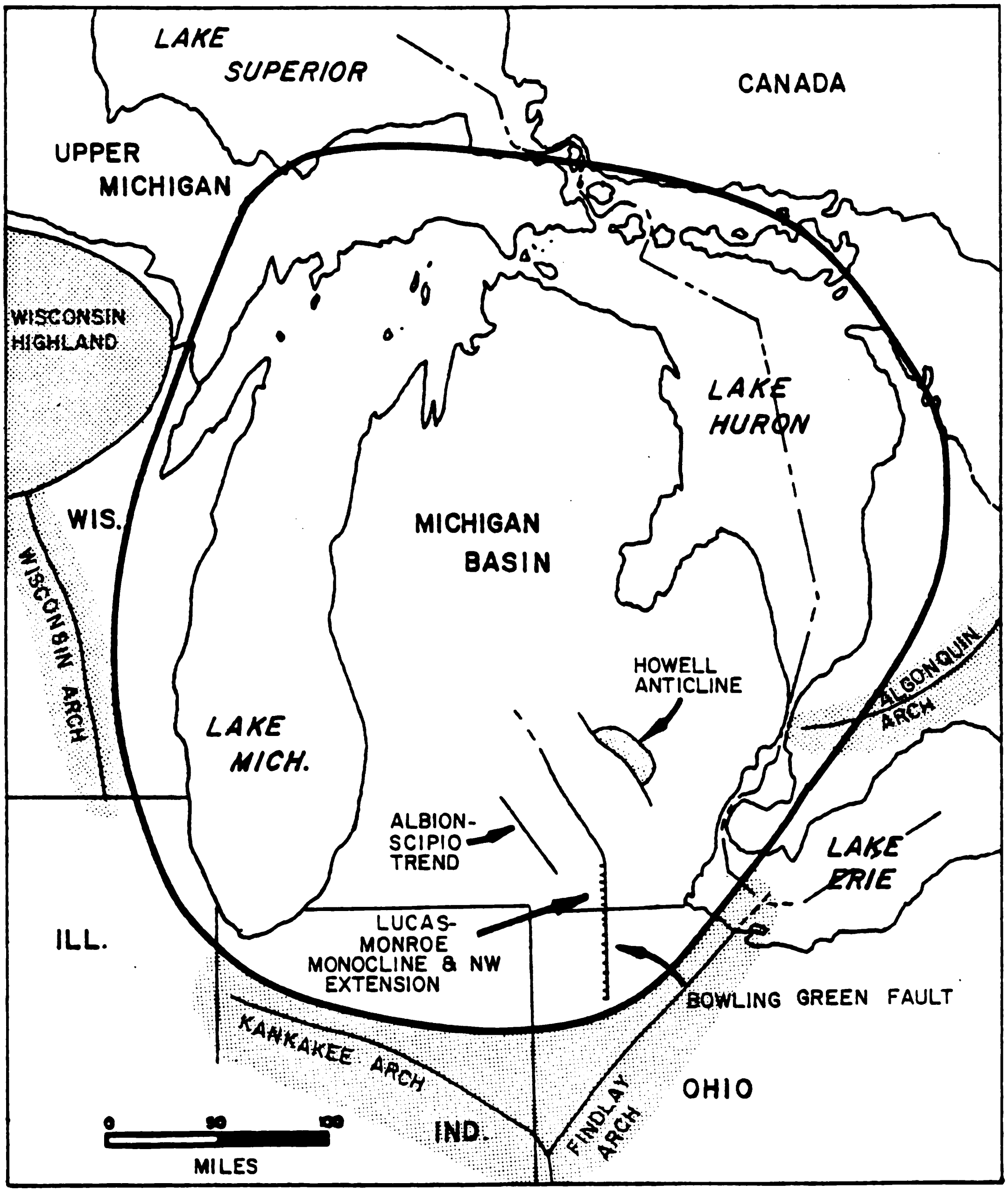

Figure 4.
Regional Structure Map of Michigan and Surrounding Area
[modified from Green (1957), Prouty (1974), and Fisher (1979)]

features present prior to deposition. Cohee (1947), Kay and Colbert (1965), and Brigham (1971) all believed that the absence of Lower Ordovician rock from southeastern Michigan and western Ontario was the result of intense erosion during Post-Knox unconformity time.

The Findlay Arch also has its own history. Pirtle (1932) believed the arch originated primarily during Cincinnatian time. Lockett (1947) tied the Algonquin and Findlay Arches together. Sanford (1961) used lithologic data and isopach mapping to show Lockett to be in error, stating that the Findlay Arch was not prominent until Upper Ordovician or Late Trenton time. Cohee (1948) inferred the presence of the arch in Upper Cambrian time due to the erosion of Upper Cambrian and Lower Ordovician formations in southeastern Michigan and northeastern Ohio, and the absence of Cambrian and Lower Ordovician rocks in Ontario. Woodward (1961) believed the Findlay Arch was present during the Lower Ordovician, while Janssens and Stieglitz (1974) postulated a Devonian age.

Lockett (1947) believed the Chatham Sag to be a breach in the older Algonquin - Findlay Arches due to the subsidence of the adjacent Michigan and Appalachian Basins. Green (1957) believed the Algonquin and Findlay Arches were a tectonically related continuation of the Cincinnati Arch. Sanford (1961) stated that there was no tectonic relationship to the arches. Instead, he thought the Chatham Sag was the result of a downthrown, faulted basement block.

Pirtle (1932) believed the Kankakee Arch had a Precambrian age and was a southwest extension of the Wisconsin Arch. Ekblaw (1938) believed this structure had a Lower or Middle Ordovician origin. This was later verified through the use of isopach mapping by Cohee (1945), and Swann (1951), who showed that the development of the Kankakee Arch did not occur until after Prairie du Chien time. Green (1957) related the structure in the Findlay, Kankakee, and Cincinnati Arch regions to basin subsidence rather than structural uplift between basins. He then proposed that the term Kankakee Arch be dropped due to a lack of evidence for true arching extending from Indiana to Illinois.

Pirtle (1932) believed that the Wisconsin Arch showed upward movement during the Precambrian. Workman (1935) and Snyder (1968) assigned a Pre-St. Peter age, and Workman stated that portions of the arch were eroded as low as the Franconia formation. Cohee (1947) considered the arch to have an Upper Cambrian or Lower Ordovician age based on dolomite-sand ratios and their occurrences in the Eau Clair, Trempealeau, and Prairie du Chien formations of Wisconsin and Michigan.

The origin of the Michigan Basin has been the subject of many debates since Douglas Houghton first studied the rocks of the Northern Peninsula in 1814. Pirtle (1932) studied fold trends in the Michigan Basin and concluded that these folds were controlled by trends of weakness in the Precambrian basement rocks. He suggested that the folds were due to vertical forces associated with horizontal compression that was most intense after Middle Mississippian time.

Newcombe (1933) also believed that Precambrian basement faults controlled the localization of en echelon folds present in the Michigan Basin. He felt that these structures reflected the result of shearing that developed in the basement complex during the Keweenawan Disturbance. The principal folding of the anticlinal trends was believed to have occurred during the Late Devonian, with subsequent movements during the Late Mississippian accentuating the structures.

Kirkham (1937) dismissed tangential and horizontal mountain-building forces from having a role in the origin of the Michigan Basin. He believed the shifting of large magma bodies from one area of the earth's crust to another created a "downwarping" rather than a true basin. During this movement the Precambrian surface became marked by faults, rifts, joint systems, and shear zones, creating lines of weakness along which vertical forces could act later. Step faults along these lines could then create subparallel anticlinal trends.

Lockett (1947) claimed that the dominant positive structures surrounding the Michigan Basin were the cores of Precambrian mountains. The principal "movements" of these structures during the Paleozoic were the result of basin subsidence. The weight of sediments derived from these mountains provided the subsidence mechanism. Continued sedimentation caused differential subsidence along lines of weakness in the Precambrian basement, particularly on the basinward sides of these lines. Lockett attributed the mid-basinal anticlinal trends to this subsidence rather than orogenic forces.

A regional Precambrian structure map is included here for future reference (Figure 5). It was constructed by splicing together maps by Brigham (1971) and Hinze et.al.(1975).

Kilbourne (1947) attributed the formation of the Howell Anticline to normal faulting in the basement rocks. Paris (1977) later tied the development of the Howell Anticline in with the compressional forces of the Appalachian Orogeny. Kilbourne gave a Coldwater age to this structure, while Paris ascribed a Late Salina age.

Cohee and Landes (1958) claimed that the Michigan Basin first expressed closure during Late Silurian time, with great downwarping

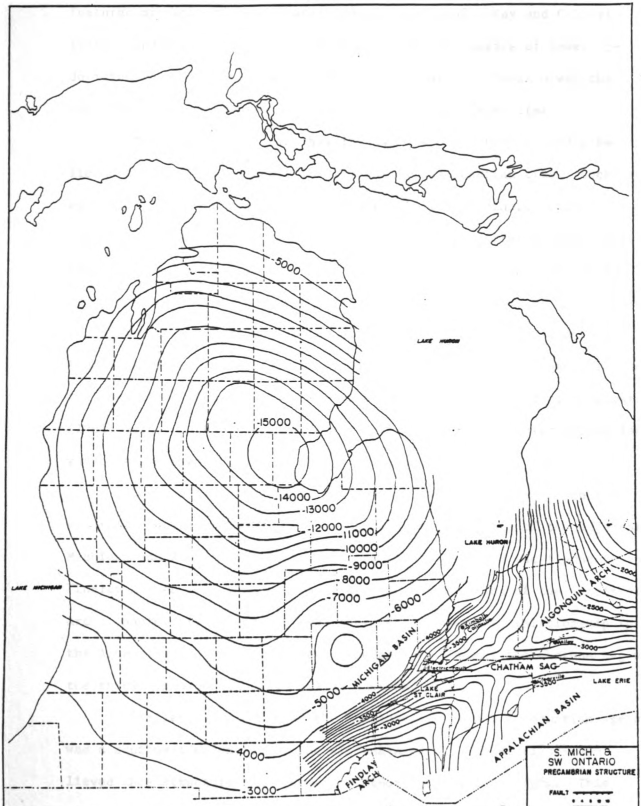

Figure 5. Regional Precambrian Structure Map
[modified from Brigham (1971) and Hinze et. al. (1975)]

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Fisher (1969) stated a Middle Ordovician origin for the present basin. This conclusion was later substantiated by Seyler (1974). Catacosinos (1972, 1974) and Prouty (1970) have suggested that an embryonic Michigan Basin could have existed during the Late Cambrian.

Ells (1962, 1969) and Prouty (1970) have summarized notable trends within the basin, including: (1) NW - SW folding with evident lateral faults; (2) fairly definite radial-like fold patterns; (3) persistent joint patterns at several rim locations (Figure 6). Prouty also concluded that the basic structural patterns of the basin, including basement lineations and bordering structures, were inherited from the Precambrian.

Moody (1973) attributed the brecciation and fracture-type porosity of the Albion-Scipio field to wrench faulting. Harding (1974) modeled strike-slip faulting in the laboratory and noted the similarity of his divergent wrench model to Trenton structure of the Albion-Scipio trend.

Prouty (1976) used LANDSAT imagery studies to conclude that lineaments gleaned from the studies are shear faults, that most basin folds are fault related, that the major faulting and folding occurred in pre-Marshall-Mississippian time, and that the shearing stresses are related to structural activity in the Appalachian region.

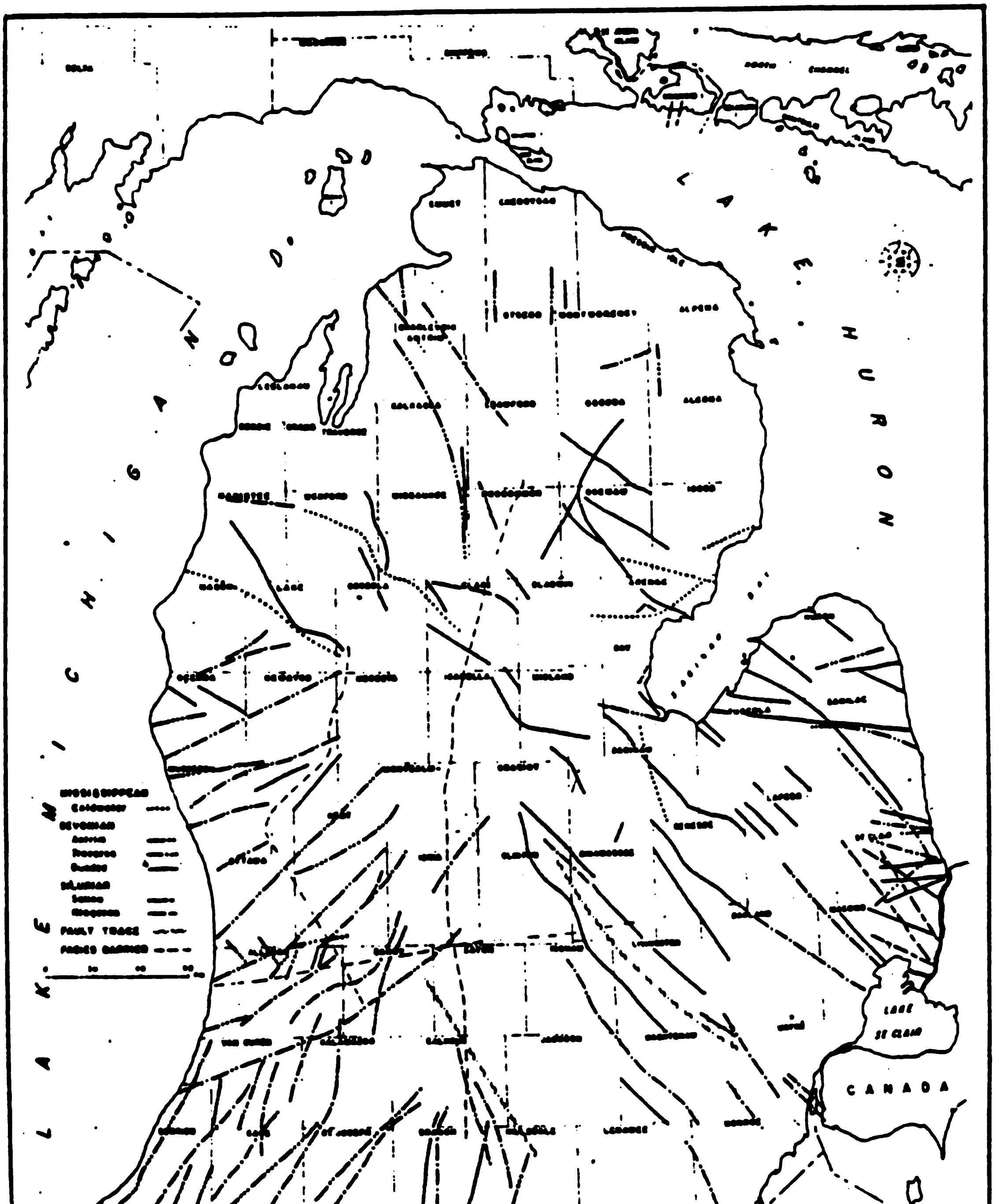


Figure 6. Major Structural Trends in the Michigan Basin (compiled by Prouty, 1971)

Hinze (1963) proposed yet another origin for the Michigan Basin. Using extensive gravimeter and magnetometer surveys of Michigan's Lower Peninsula (Figures 7 and 8), he suggested that the basin may have formed as the result of isostatic sinking in response to the added mass of Keweenawan basic lavas in the basement complex.

Haxbe, Turcotte, and Bird (1976 proposed a related thermal contraction mechanism for the evolution of the Michigan Basin. Their model involved mantle diapirs rising to about the Moho, heating the lower crustal rocks. The heating caused a transformation of the meta-stable gabbroic rocks to eclogite. When the mantle rocks began to cool by conduction, the basin isostatically subsided under the load of the eclogite.

Merritt (1968) conducted a gravitational study of the Albion-Scipio oil field and concluded that there was significant evidence for petroleum production to be tied-in with a basement fault or fault line scarp having around 800 feet of relief.

Hinze and Merritt (1969) noted that the magnetic map and the Bouguer gravity anomaly map closely parallel the northwesterly trends of the mid-basin anticlines. They attributed this close alignment of intrabasin structures and geophysical anomalies to lines of weakness in the basement complex that are associated with a rift zone filled with basalts. They noted that the dominant feature of the Bouguer gravity anomaly map is the Mid-Michigan anomaly or "high" that transects the Michigan Basin. Shaw (1971) conducted a mobile ground magnetometer survey of a portion of the Southern Peninsula of Michigan. The survey area ran east-west from Allegan County to St. Clair County. He concluded that the basement in this area was dominantly granitic, with the exception of the area of the Howell Anticline, which was interpreted as having a mafic

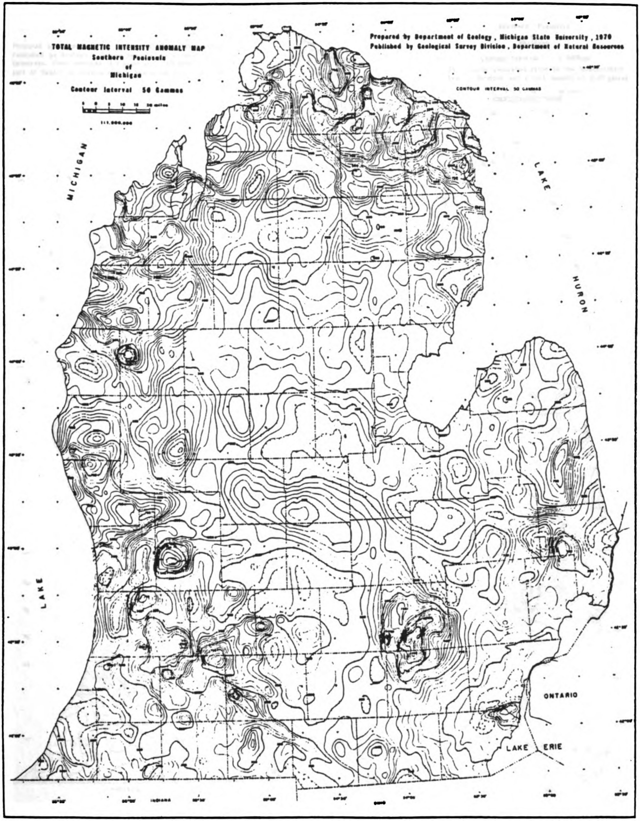


Figure 7. Aeromagnetic Map of the Southern Peninsula of Michigan (from Hinze, 1963)

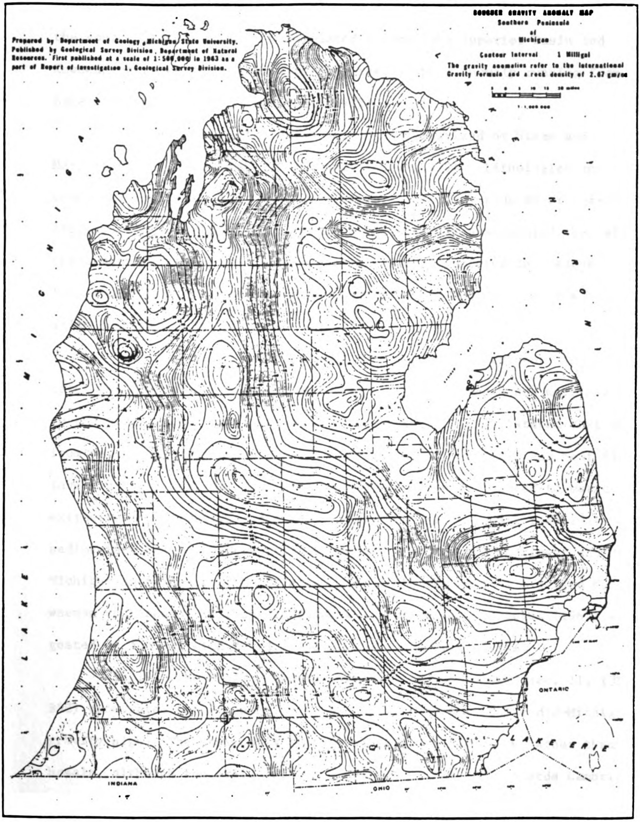


Figure 8. Bouguer Gravity Anomaly Map
(from Hinze, 1963)

composition. Oray et. al. (1973) used geophysical studies to show that the source of this anomaly was related to the Lake Superior Basin and Keweenawan rocks associated with the Mid-Continent anomaly running from Lake Superior to Kansas (Craddock, 1972).

Basement test lithologies have been summarized by Hinze and Merritt (1969), Laaksonen (1971), and Fisher (1979). Lithologies encountered include granite, granite gneiss, quartzite, redbeds or "granite wash," and diorite dikes. Hinze et. al. (1975) also stated that altered mafic volcanic rocks (greenstones) were encountered in Presque Isle County near the northern tip of the Southern Peninsula. True basalts have yet to be found.

Ocala and Neyer (1973) stated that geophysical evidence indicates the Precambrian basement has been disturbed beneath and marginal to the Mid-Michigan gravity anomaly. Hinze et. al. (1975) stated that data from outcrops, drill holes, and gravity, magnetic, seismic, and heat flow investigations indicate that this anomaly is directly related to mafic extrusive and intrusive rocks that "commonly are in horsts flanked by sedimentary basins." Thus it would appear that the Mid-Continent and Mid-Michigan anomalies and the Lake Superior Basin are part of a failed Keweenan continental rift system (Cambray, 1979 et. al.). Innes (1967) suggested an analogy with the East African Red Sea rift system.

In 1970 the Mobil - Messmore #1 (Livingston County, Sec. 11, T3N, R5E) penetrated the Precambrian within the boundaries of the Mid-Michigan gravity high. The basement material consisted of quartzite rather than basalt, although the state drilling record for this well records Cambrian quartzite with "some pebbles...(and) a boulder of extrusive rock (basalt?)" immediately above the Precambrian contact. Hinze et. al. (1975)

have interpreted the absence of basalt to the effects of the Grenville Orogeny, which is believed to have affected this area "and subsequently complicated and perhaps altered the basement geology so that the basalt, at least locally, is not present."

In 1975 the McClure-Sparks et. al. #1 well (Gratiot County, Sec. 8, T10N, R2W) also penetrated the Precambrian of the Mid-Michigan gravity high. Here drillers encountered "granite wash" (redbeds), diorite dikes, and possibly some basalt and slickensided material (State Drilling Record). A summary map showing the Mid-Michigan gravity high, basement tests, and Precambrian provinces may be seen in Figure 9.

Gregg (1979) studied one of the cores from the Sparks well. He stated that the granite wash consisted of interlaminated red siltstone and gray sandstone derived from a granitic source region. The sediments were probably deposited in a fluvial or deltaic deposit, possibly a flood plain.

Hinze et. al. (1975) summarized several basalt-trough models in their study, and Fisher (1979) has speculated that the Mid-Michigan gravity high represents a rift or graben, with the Sparks well showing the possibility of 5000+ feet of Precambrian (?) redbeds in its upper portion. A revised basalt-trough model is shown in Figure 10.

Fowler and Kuenzi (1978) suggest that the redbed sequences represent shallow marine turbidites deposited within the failed Keweenawan rift valley.

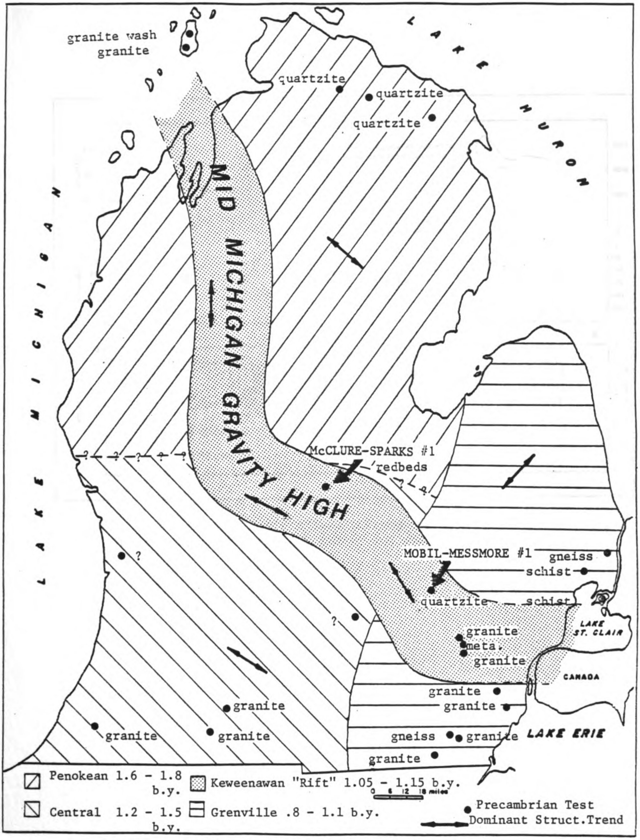


Figure 9. Precambrian Province - Lithology Map (modified from Hinze et al 1975 and Fisher 1979)

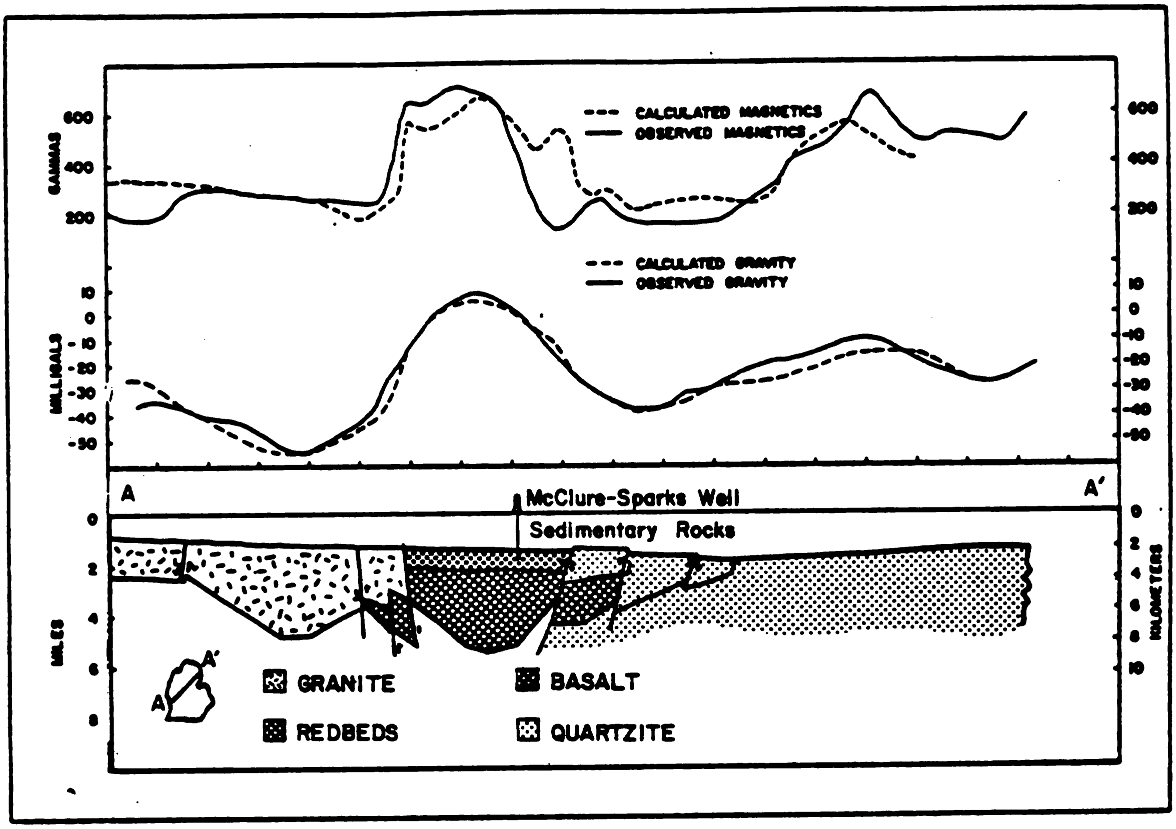


Figure 10. Revised Basalt-Trough Model
[modified from Hinze et. al. (1975) and Fisher (1979)]

REGIONAL STRATIGRAPHY

General

Group and formation names are based on the stratigraphic chart shown previously (Figure 1). Formation contacts were based on work done by the Michigan Basin Geological Society (Fisher, et.al, 1969). The Cincinnatian Series was subdivided using Lilienthal's stratigraphic cross-sections (1978).

Cambrian-Lower Ordovician

The Post-Knox Unconformity plays an important role in the later discussion of the Glenwood isopach. Syrjamaki (1977) summarized the literature on the Upper Cambrian-Lower Ordovician of Michigan in this manner:

1) The Post-Knox Unconformity occurred at the end of Prairie du Chien time. Thus, the Prairie du Chien, where present, has an erosional surface.

2) In Michigan, the Glenwood is transitional with the overlying Black River formation.

3) Where the Prairie du Chien is missing, erosion has occurred to the Trempealeau formation.

Several southeastern Michigan state drilling records list the presence of the St. Peter Sandstone between the Glenwood Shale and the Prairie du Chien Group. However, Horowitz (1961) and Balombin (1974) have shown the St. Peter to be limited to the western side of the state.

Catacosinos (1972, 1974) assigned this sandstone to the Jordan member of the Lake Superior Group and/or the Prairie du Chien Group.

It should be noted that the writer was most concerned with accurately picking the base of the Glenwood Shale rather than conclusively identifying the underlying strata. For an extensive review of the Lower Ordovician in Michigan, see Syrjamaki (1977).

Middle Ordovician

Syrjamaki (1977) has demonstrated that the Wisconsin Arch served as the source area for the Lower Ordovician New Richmond interval in the Michigan Basin. During Lower Chazy (Glenwood) time the source area appears to have shifted to the Appalachian borderland (Prouty, 1979, personal communication). Seyler (1974) states that the Glenwood apparently represents sediments derived from erosion of Upper Cambrian-Lower Ordovician formations and deposited by a transgressing Middle Ordovician sea.

Catacosinos (1974) described the Glenwood of the Michigan Basin as "an interbedded sequence of green shale, gray dolomite, thin sandstone, and limestone which everywhere lies unconformably on older rocks." In southern Michigan he categorizes the Glenwood as a thin green shale occasionally interbedded with thin sandstone beds.

The Glenwood "Extra Section" is an informal term coined by Catacosinos (1972). It supposedly refers to a basal limestone of the Black River formation that can be picked on gamma ray logs and used as a stratigraphic marker on the eastern side of the Michigan Basin. Syrjamaki (1977) stated that he was able to trace this marker on gamma ray logs north through Huron County and west through Lenawee, Hillsdale, and Branch Counties. However, he stated that outside of this area the curve loses definition due to increasing thickness and changing lithology of the Prairie du Chien, problems with the erosional contact of the Post-Knox Unconformity, and unsure boundaries of the St. Peter Sandstone.

For this study, "standard" picks of the top and base of the Glenwood were made using Lilienthal's cross-sections.

The Black River in the Michigan Basin generally consists of light brown to gray, fossiliferous, dense to crystalline limestone and dolomite. Cohee (1948) and others have demonstrated localized secondary dolomitization around apparent fault and fracture zones, and Newhart (1976) has shown that the unit as a whole becomes more dolomitic toward the Wisconsin Arch. Seyler (1974) states that a thin bed of very argillaceous limestone and shale occur at the base of the Trenton and top of the Glenwood.

Seyler (1974) used isopach mapping to show that during Black River time, the region was an embayment of the Middle Ordovician sea open to the southeast and thickening locally in the southern Lake Huron area. He characterized the Black River sea as shallow, with the area steadily subsiding, as shown by the thick carbonates and abundant fossils.

The Trenton in the Michigan Basin is lithologically similar to the Black River. It generally consists of light brown to gray, fossiliferous, crystalline limestone and dolomite. It is generally more fossiliferous and demonstrates similar, though more pronounced patterns of secondary dolomitization. Of particular interest is the "mushrooming" pattern of dolomitization and hydrocarbon migration below the impermeable Utica Shale. In 1946 Landes wrote his classic paper on the origin of secondary dolomitization, and tied in earlier theories for magnesium-rich waters ascending fracture systems to the Trenton limestone in the Lima-Indiana oil field of northern Ohio. These ascending waters created secondary (epigenetic) dolomite, often having sufficient secondary porosity for petroleum migration and entrapment beneath the Utica Shale "caprock." Newhart (1976) believed the driving force of this mechanism in the Trenton-Black River of Michigan to consist of water entering strata of the Wisconsin highlands, migrating down dip through fracture systems and finally ascending fracture zones and faults in the Michigan Basin. He did not specifically name the formation(s) that were most likely avenues for this fluid migration.

The regional Trenton structure map (Figure 11) is quite similar to the Precambrian structure map shown previously (Figure 5). However dips of the Trenton strata are not as great due to thicknesses of the Upper Cambrian and Middle Ordovician sections increasing basinward (Brigham, 1971). More structural features in southeastern Michigan are apparent due to increased well control.

Seyler (1974) used isopach mapping to demonstrate that closure of the Michigan Basin occurred during Trenton time. He characterized the Trenton sea as shallow, with the basin steadily subsiding as shown by the abundance of fossils and thick carbonates.

Upper Ordovician

Nurmi (1972) studied the Upper Ordovician of the Michigan Basin. He and Lilienthal (1978) divided the Upper Ordovician into units as shown previously in Figure 2. For convenience, Nurmi's units will be shown in parentheses.

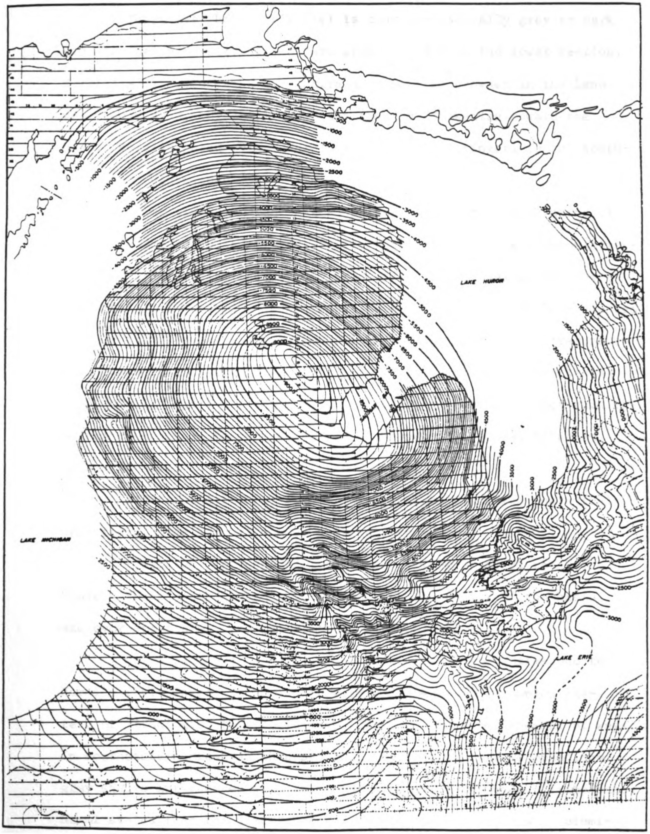


Figure 11. Regional Trenton Structure
(from Fisher, 1972)

The Utica Shale (Unit One) is characteristically gray to dark gray in the upper section and dark gray to black in the lower section. Nurmi (1972) states that the entire unit becomes browner in the Lenawee County area, but still shows the trend of darkening toward the base. He also noted thin interbedded limestone stringers in the southeastern Michigan counties.

Nurmi (1972) stated that anomalous thickening and thinning of this unit appear to be related to structures shown on the Trenton structure map. He also noted that the Utica Shale (Unit One) thinned over the Howell and Northville anticlines. The Albion-Scipio field evaluated by Ells (1962) shows an anomalous thickening of this unit. After personal communication with Ells (1972), Nurmi stated that the thickening was probably "due to tectonic activity along 'The Trend' rather than the solution-erosional feature described by Rooney (1966)" and later by DeHaas (1979).

From fossil studies Nurmi concluded that the Utica Shale (Unit One) represented a shallow near-shore environment.

(Unit Two) corresponds to the top 30 feet or so of the Utica Shale. Nurmi stated that it thinned toward the center of the basin and over structures, and was at times difficult to pick.

Units One, Two, and the lower portion of Three correspond to Nurmi's (Unit Three). He described this sequence as a complex pattern of lithologies that could have been subdivided in a number of ways. In southeastern Michigan this sequence consists of gray to greenish-gray shales interbedded with thin beds of gray, argillaceous limestones. Nurmi states that the limestones thicken to the north and are dolomitized in southwestern Michigan. The center of the basin is comprised predominantly of fossiliferous limestone with minor shale breaks, with shale content increasing toward the basin margins. He also noted that this sequence was thickest in southeastern Michigan and speculated that the shales in this area represented pro-delta terrigenous clastics of the westward prograding Appalachian delta complex. By studying the fossil assemblage Nurmi concluded this sequence represented a low intertidal through high subtidal environment.

The upper portion of Unit Three corresponds to Nurmi's (Unit Four). It is characterized as a massive, slightly argillaceous dark brown limestone that is thickest in the basin center. Bryozoans are the dominant fossil. Nurmi used bryozoan morphology to characterize the depositional environment as shallow neritic below mean wave base.

Unit Four (Unit Five) has been characterized by Nurmi as a sequence of interbedded carbonates and shales. The carbonates tend to be argillaceous in the center of the basin, and grade vertically and laterally into dolomites. Shales tend to be gray in the center of the basin, grading vertically and laterally into gypsiferous red and green shales. Nurmi (1972) noted an anomalous thinning of this unit in the northern St. Clair County - southern Ontario area and attributed this to erosion rather than non-deposition, from isopach mapping and a study of well cores.

Unit Five (Unit Six) in southern Michigan has been described by Nurmi as a red shale. The red color was attributed to hematite. Oolites were reported in Mason and Allegan Counties. Nurmi concluded that these facies represented a very shallow to intertidal depositional environment. This highly oxidized environment could also be responsible for the lack of fossil preservation (Nurmi, 1972). Nurmi found anomalous thickening and thinning in this unit closely corresponding to Unit Five, and also attributed this to erosion.

It is interesting to note how closely these two authors have correlated these units independently of each other.

Lower Silurian

The Lower Silurian Cataract Group is divided into the Manitoulin and Cabot Head formations. The "Clinton" of the Michigan Basin is a stratigraphic term carried over from the New York section and is commonly used in the petroleum industry. It makes up the basal unit of the Niagaran Series.

Potter (1975) studied the Lower Silurian in detail. He characterized the Manitoulin as a shallow water biostromal carbonate. It grades into the overlying Cabot Head Shale. Potter demonstrated a reciprocal thinning and thickening of these formations due to the nature of their depositional environments. The Manitoulin tends to thicken in shallow water areas and thin in deeper water, while the Cabot Head's clastic sediments tend to fill in lows and onlap onto higher areas.

Due to the gradational contact between formations the Cataract Group as a whole was mapped for this study.

Potter (1975) characterized the Clinton Group as a tan to gray dolomite, split to the southwest by a thin gray dolomitic shale. The Rochester Shale is part of the Clinton and is a good marker for the base of the Niagaran. The Clinton represents a shallow sea favorable for cherty carbonate deposition with thin shale interbeds. The Rochester represents clastic materials derived from an eastern source region, possibly entering through the Chatham Sag (Potter, 1975).

Middle Silurian (A-2 Carbonate)

Mesollela et. al. (1974) have described the Niagaran Group, including the A-2 Carbonate. It is characterized as a brown to gray carbonate that is highly laminated by algal mounds in some places. Brigham et. al. (1971) note that the A-2 Carbonate thins over Niagaran reef complexes and reef pinnacles.

Middle Devonian (Dundee Formation)

Bloomer (1969) described the Dundee as a buff to brown to gray finely crystalline limestone. He also noted a breccia zone in the upper Dundee and dolomitic trends in the central and western portions of the Michigan Basin.

In southeastern Michigan the Dundee lies immediately below the glacial drift in Monroe and southern Wayne Counties (Figure 12). Great variability in Dundee thicknesses encountered in state drilling records is due to difficulty in picking the Dundee-Detroit River contact.

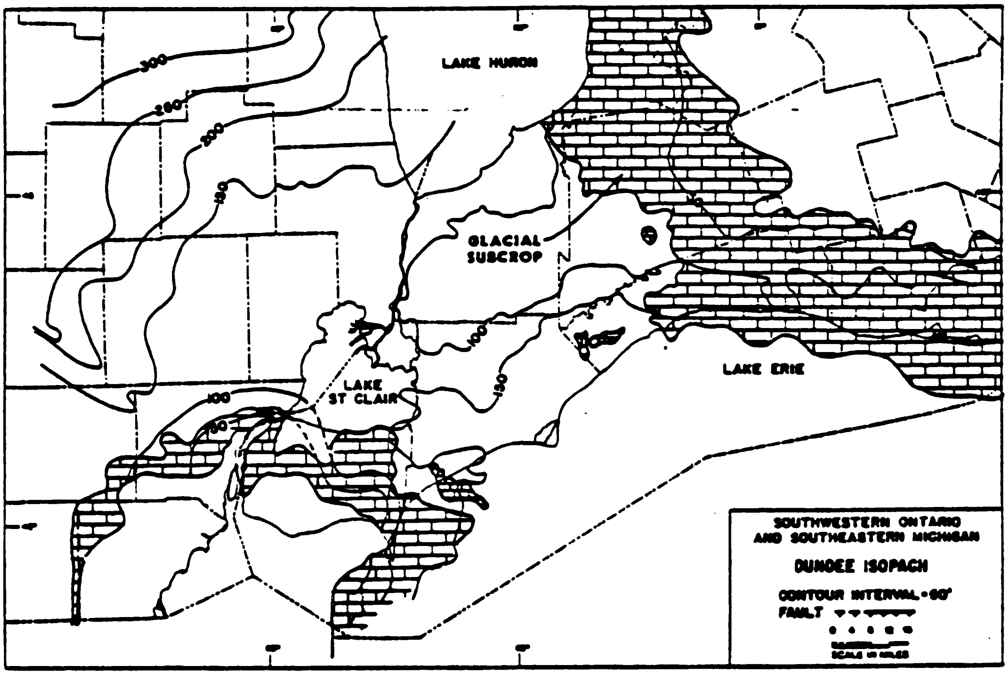


Figure 12. Dundee Isopach of Southeastern Michigan and Southwestern Ontario.(from Brigham, 1971)

MAP INTERPRETATION

General

Thirteen isopach maps and three structure contour maps were constructed during the course of this study. The complete sequence of Glenwood through Cataract Group and Clinton were isopached, plus the A-2 Carbonate and Dundee formation. The top of the Trenton, A-2 Carbonate, and Dundee formations served as datums for structure contour maps. The Middle Ordovician through Lower Silurian units are the main emphasis of this study, with the A-2 Carbonate serving as an "intermediate" depth formation and the Dundee serving as a "shallow" formation for structural mapping.

Maps of Michigan's southeast quadrant were constructed using a scale of one inch equals two miles. This allowed structural and stratigraphic features to be shown in great detail where there is good well control. Tops for the various units were picked, using Lilienthal (1978) as the major reference.

The major structural and stratigraphic features of the region and of this area of the basin have been recognized for many years and were described in previous sections. It is the point of this study to examine the specific stratigraphic and structural characters of the southeast quadrant and relate them directly to the stratigraphy, structure, and tectonics of the surrounding region.

Glenwood Isopach (Plate 1)

The Glenwood of this area ranges from five to 28 feet thick. It is thickest in southern Lenawee County. It thins slightly to the east in Monroe County and thins greatly to the north in Washtenaw and Wayne Counties.

As the Glenwood was deposited over the Post-Knox Unconformity surface, one would expect the thickness to reflect an irregular, eroded topography. This would explain the anomalous thickening and thinning that does not show up in any of the following maps with one notable exception. An area of thinning in 4S - 2E and 3E also appears in several other maps and will be analyzed later.

Thickening due to fault movement is not readily apparent in this map. This may in part be due to sparse well control, but evidence from later maps and cross-sections suggests that faults were not active during this time.

Black River Isopach (Plate 2)

The Black River formation of this area shows a regional thickness of 300 to 480 feet. An anomalously thick area of 535 feet may be seen in T2S, R7E and will be discussed later.

The formation is thinnest in Jackson County and western Washtenaw and Lenawee Counties. It thickens greatly to the northeast toward Lake Huron. There is no indication of the presence of the Findlay Arch during Black River time.

While it is impossible to state whether there was basin closure at this time due to the small area actually mapped, the Black River contours nonetheless suggest an open sea to the east.

Two areas of anomalous thinning may be seen in Monroe County. This type of thinning may be explained in two ways. It may represent erosion of a positive area, or it may be due to a lesser rate of subsidence of the area during deposition. Brown (1980, personal communication) states that the Trenton-Black River contact viewed in cores extracted by Total Petroleum Inc. "suggest" the possibility of an unconformity in southeastern Michigan. On the other hand, if the Precambrian basement is fractured and faulted as proposed by Fisher (1969) and others, the differential subsidence could be explained by basement blocks subsiding at varying rates.

The anomalously thick section centers around the Rovsek-Jorgensen #1 well (Sec. 26, T2S, R7E). Well control demonstrates that the thickening occurs very abruptly, suggesting a graben. This trend of anomalous, abrupt thickening shows up in numerous other isopach maps of the area. Figure 13 shows a north-south cross-section and Figure 14 shows an east-west cross-section across the "Washtenaw Graben." These cross-sections reveal anomalous thickening in the Black River, Trenton, and Cincinnatian Units 3 and 5. The Utica and Cincinnatian Units 1, 2, and 4 do not show this thickening. Thus it would appear that the periods of anomalous thickening represent periods of differential subsidence rather than steep dips off surrounding structures. The subsidence could be caused by basement blocks sinking at different rates.

Well control in the Trenton suggests that the graben trends NW - SE, parallel to Trenton production in the Northville field. The exact length of the graben cannot be determined from this same data, as there is not enough well control along its strike to determine end points.

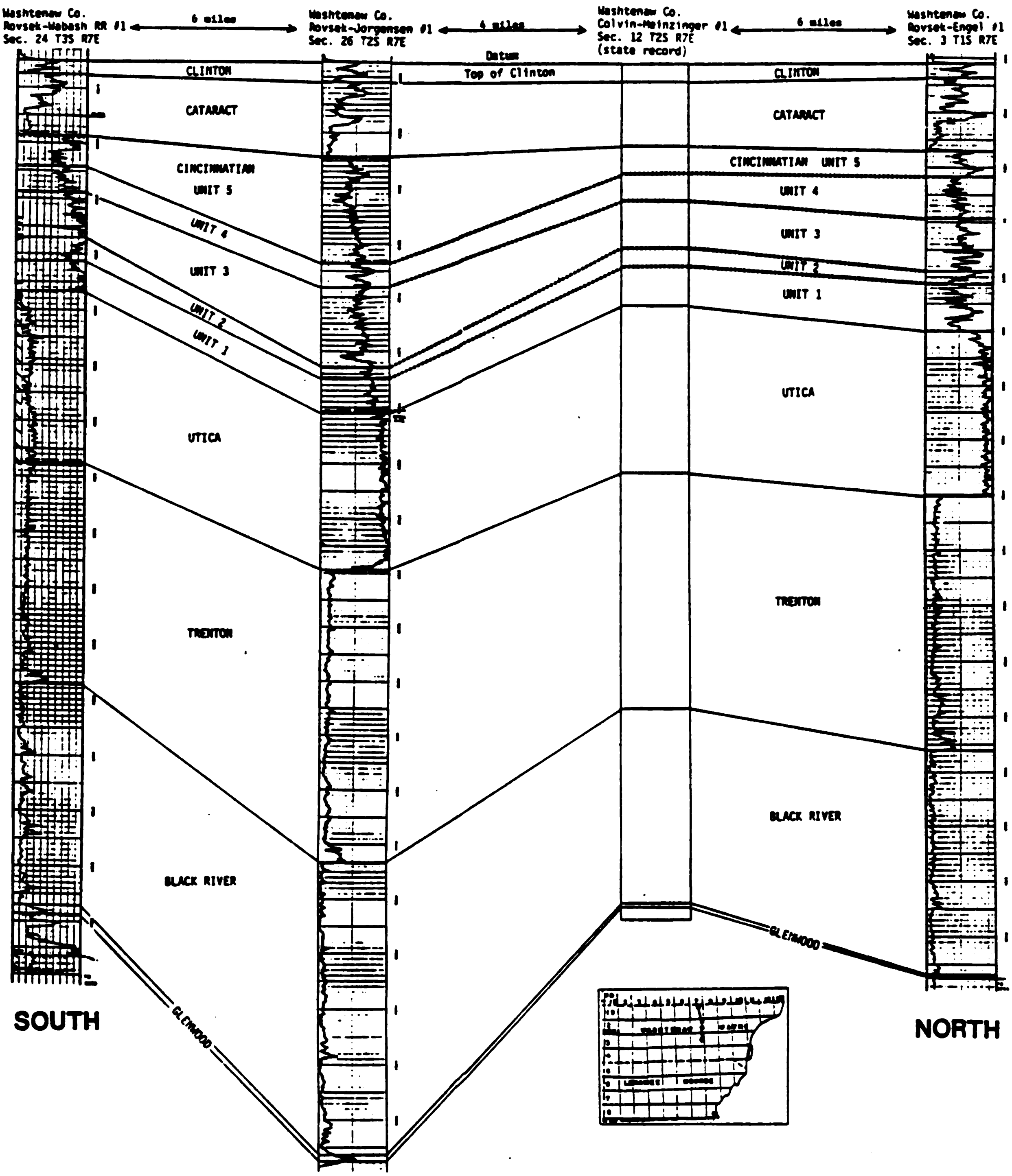


Figure 13. North-South Cross-section across "Washtenaw Graben."

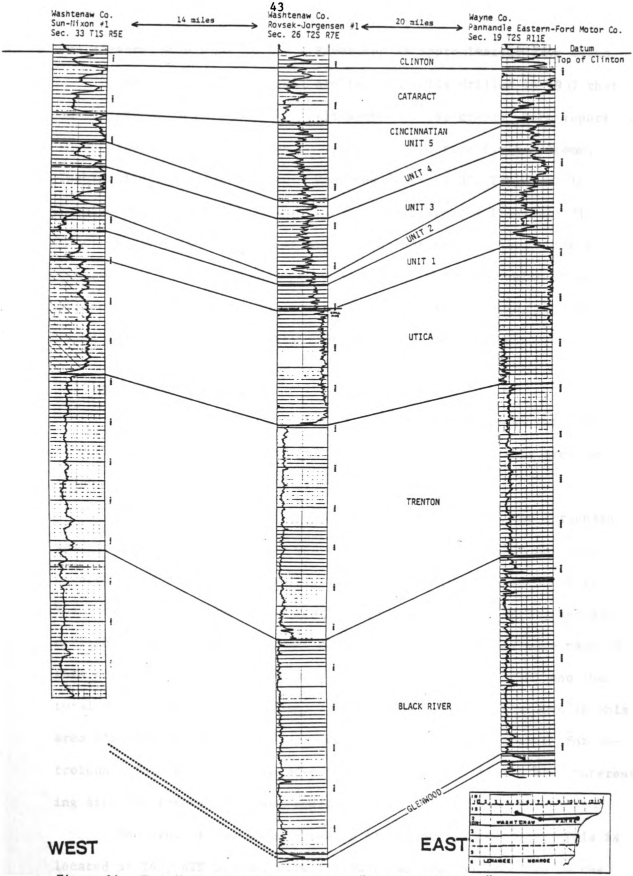


Figure 14. East-West Cross-section across "Washtenaw Graben."

Its measured width on the Black River map is approximately five miles.

Near the Jorgensen well are two old wells drilled in 1937 that may be useful in defining the fault system of the graben. Both report shows of oil and gas that may be related to fracture-fault systems. The Ypsilanti Development Co. - Voorhees #1 (Sec. 32, T2S, R7E) is located west of the Jorgensen well, and Darke Bros. - Truesdell #1 (Sec. 25, T2S, R8E) is located east of the Jorgensen well. While a single fault could have been proposed between these two wells, the writer believes that two faults running parallel to the Northville trend would more readily explain the strike of the graben.

Trenton Isopach (Plate 3)

The Trenton formation of this area shows a regional thickness of 270 to 440 feet. As a general rule the formation in this area is thinnest in the south and thickens northward.

Anomalous thickening of 535 feet occurs again in the Jorgensen well located in the Washtenaw Graben. Anomalous thickening may also be seen along the Northville trend and in T1S, R1E of Jackson County. The Jackson County area is currently being developed by Total, and was a "tight hole" during the summer of 1980. Two discoveries were made in this area - the Total - Faist et. al. #1 - 7 (Sec. 7, T1S, R1E) and the total - Faist et. al. #2 - 7 (Sec. 7, T1S, R1E). Isopach contours in this area also show great thickening, suggesting fault-related traps for petroleum. This would seem to make the Jorgensen well area a most interesting site for future petroleum exploration.

One area of anomalous thinning is evident on this map. This is located at T4S, R2E and 3E, directly above an area of thinning in the

Glenwood and below an area of thinning in the Cincinnatian Unit 5 Isopach. While Trenton erosion could be proposed as the cause of this (Rooney, 1966), the presence of "thins" in the same location in three unrelated maps would again appear to be related to differential subsidence of basement blocks.

The anomalous thickening and thinning along the Northville Trend appears in nearly all the remaining isopach maps, and will be discussed with the Trenton structure map interpretation.

Seyler (1979) demonstrated that basin closure occurred during Trenton time, with a depocenter in southern Lake Huron. With the exception of the Washtenaw Graben, there is no abrupt thickening off any structure. This pattern of gradual regional thickening lends support to Green's (1957) statement that the structural elements surrounding this area of the basin were stable with respect to basin subsidence, rather than rising.

<u>Utica Isopach</u> (Plate 4)

The Utica formation of this area shows a regional thickness of 200 to 410 feet. With few exceptions, the anomalous thickening and thinning of this unit appear directly related to structures that have been mapped using the Trenton top as the structural datum (Plate 14).

Anomalous thinning and thickening coincides with the Northville Trend of Washtenaw and Wayne Counties. However, the most spectacular thickening and thinning may be seen along the structural trend previously identified as the Lucas - Monroe Monocline and northwest extension.

The Lucas - Monroe Monocline runs north-south along the Lenawee and Monroe County borders. It is in direct alignment with the

Bowling Green fault systems shown by Green (1957). However, there has been much debate whether the Lucas - Monroe Monocline reflects an extension of the Bowling Green fault or is merely a flexure dipping steeply to the west.

The Utica Isopach map (Plate 4) shows the Utica thickening abruptly on the west side of the structure, particularly near the Michigan - Ohio border. This alone does not prove the existence of a fault, and could be explained by a monoclinal flexure. However, two areas of anomalous thinning along the northwest extension are not as easily explained by this method. This thinning is probably not due to erosion, as the Utica - Cincinnatian contact is considered conformable. The alternative explanation of this thinning would be a slower rate of subsidence of these areas during deposition, possibly related to varying rates of basement block subsidence.

The Washtenaw Graben area shows a normal, regional thickness at this time and indicates a period of quiescence. However, the Jackson County area of T1S - R1E again shows anomalous thickening that is probably related to fault movements.

Cincinnatian Series

Unit One Isopach (Plate 5). This map shows a regional thickness of 60 to 160 feet. Contours along the Northville Trend suggest slight movement at this time, although no anomalous thickening or thinning is present.

Anomalous thickening is present along the Lucas - Monroe Monocline. However, unlike Utica time when the thickening occurred abruptly to the west of this structure, the thickening now is seen abruptly to the east. This becomes very clear in an east-west cross-section across the area (Figure 15). It now becomes very difficult to account for these changes in sedimentation patterns using a flexure or monocline. An alternative explanation would seem to be needed.

The answer can probably be found in the Trenton structure map (Plate 14). This map reveals a strong offset in the contour lines along the Lenawee - Monroe County border, suggesting fault movement. The question then would seem to be whether this lateral offset in the contour lines is due to shearing and/or vertical offset.

It has already been shown that the greatest thickness in the Utica occurred on the west side of the Lucas - Monroe Fault. This thickening then diminished northward along the fault until a normal regional thickness can be seen in Washtenaw County. Figure 15 shows the Trenton - Black River has a normal regional thickness in this area. Therefore it would appear that the movement occurred in the underlying strata, probably in the Precambrian basement complex.

Figure 16 shows a diagrammatic structural cross-section across the Lucas - Monroe Fault. A small area of the Trenton structure map is shown below this diagram for reference. Note that offset in the contour lines can be explained partly by vertical fault movement in which the western side sinks and slopes southward toward Ohio. The apparent movement then becomes left-lateral. This can be easily demonstrated by marking parallel contour lines on a sheet of paper and making a cut perpendicular or nearly so to the contours. Then, holding the paper with your hands on each side of the cut or "fault," lower the left or "western" side of the paper while holding the right side steady. When viewed straight on, the contours will show a left-lateral offset.

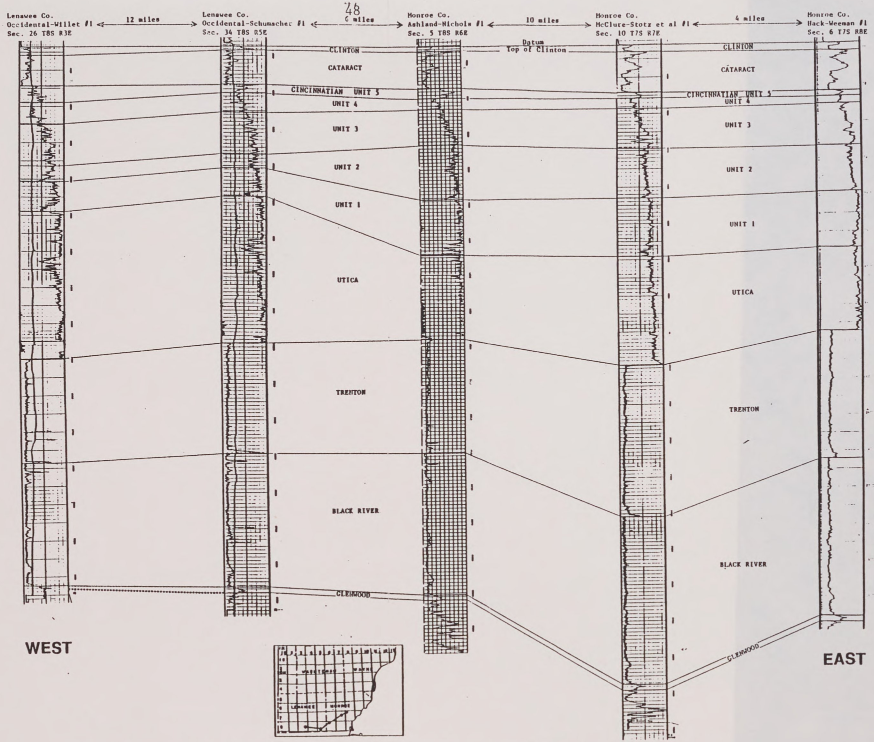
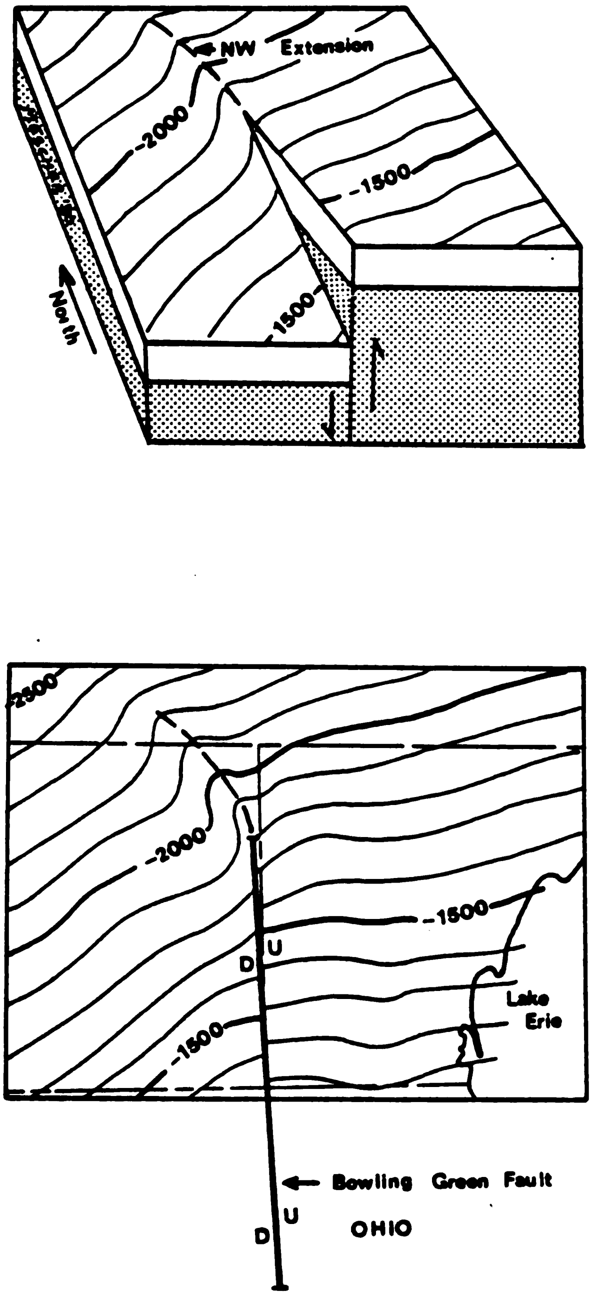


Figure 15. East-West Cross Section across Lucas - Monroe Monocline



Structural Cross-Section across Lucas-Monroe Fault (highly diagrammatic)

Trenton Fm.

Trenton Structure Map

Figure 16. Diagrammatic Structural Cross-section across Lucas - Monroe Fault

Figure 15 also demonstrates structural reversal, with great subsidence to the west of the fault during Utica deposition, and subsidence to the east of the fault during deposition of Cincinnatian Units One and Two. This is clearly illustrated in Figure 17, with the movement occurring in the Precambrian complex. (It should be noted that no wells have been drilled to the Precambrian in this area. Therefore vertical offset in the Precambrian has not been proven). Since greater total subsidence occurred on the west side of the fault, the western block is considered downthrown.

The Washtenaw Graben area again shows a normal regional thickness, again indicating quiescence here. The Jackson County area also shows a normal regional thickness.

Unit Two Isopach (Plate 6). This map shows a regional thickness of 50 to 150 feet and is nearly identical to the Unit One Isopach. Minor variations are found in the areas of Jackson County, the Washtenaw Graben, Northville, and southeastern Wayne County.

Anomalous thickening may be seen in the Jackson County and Washtenaw Graben areas, and probably represent fault-related subsidence as discussed previously. Anomalous thinning occurs over the Northville Anticline, and probably represents thinning due to non-deposition as a result of slower subsidence than the surrounding basin rather than erosion or uplift.

Unit Three Isopach (Plate 7). This map shows a regional thickness of 60 to 120 feet. Anomalous thickening occurs in the Jackson County and Washtenaw Graben areas in a fashion similar to the Unit Two Isopach. Anomalous thinning occurs over the Northville area, also as discussed in the Unit Two map. The outstanding feature of this map is the

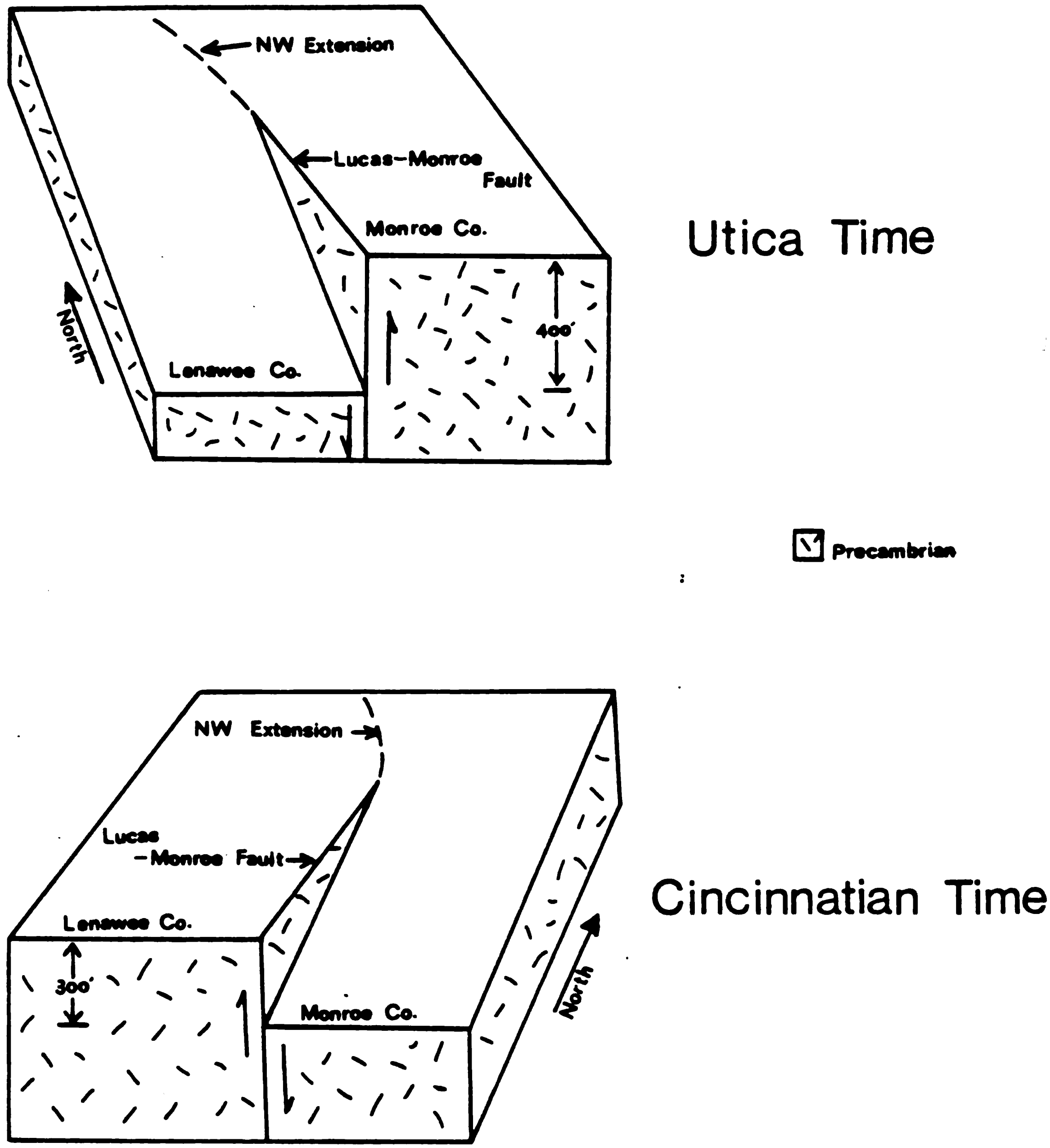


Figure 17. Structural Reversal across the Lucas - Monroe Fault

normal regional thickness displayed over the Lucas - Monroe Fault, indicating a period of quiescence for this feature.

Unit Four Isopach (Plate 8). This map shows a regional thickness of 60 to 90 feet. The Washtenaw Graben and Jackson County areas show a normal regional thickness, indicating quiescence in these areas. Contours over the Northville Trend apparently show some minor movement but no unusual thickening or thinning is evident. The trace of the Lucas - Monroe Fault and northwest extension are evident, with a minor increase in thickness of 20 feet on the east side of the fault indicating slight subsidence.

Unit Five Isopach (Plate 9). This map shows a regional thickness of 10 to 80 feet. It shows a regional thinning from west to east, or, more generally, from basin center to basin margin. This could possibly be attributed to the basin simply "filling up" with sediment toward the basin margin.

The area of the Washtenaw Graben is again anomalously thick, probably due to further vertical fault movements. The Jackson County area shows a normal thickness and represents quiescence in this area. The Northville Trend again shows some apparent minor movement, but no unusual thickening or thinning. The Lucas - Monroe Fault is not evident at this time and indicates quiescence. The northwest extension of the fault may have exerted slight control at this time, as the 50 and 60 foot contours in this area nose considerably over this feature.

One area shows slight anomalous thinning in T4S, R3E. The thinning is only about ten feet, but it is of interest because it is directly over areas of thinning in the Glenwood and Trenton, suggesting a basement block showing sporadic variation in subsidence rates compared to the rest of the basin.

Cataract Isopach (Plate 10).

The Cataract Isopach represents the combined Manitoulin Carbonate and overlying Cabot Head Shale. Potter (1975) demonstrated reciprocal thickening and thinning in these formations, so interpretation of the Cataract as a whole requires some degree of caution.

The map shows a regional thickness of 80 to 130 feet. Contours show thickening on the east side of the Lucas - Monroe Fault. This could possibly indicate subsidence of the eastern block. However, the thickening also corresponds roughly to the outline of the Ohio - Indiana Platform described by Potter (1975). He stated that this platform apparently represents an extension of the Cincinnatian and Findlay Arches that did not subside as fast as the surrounding basin. If so, this area would have been quite shallow and thus favor growth of carbonate producing organisms such as algae. This would allow the Manitoulin to build up thicker in this area, as Shaw (1975) demonstrated Niagaran reefs building up in shallow areas that were influenced by structure. Subdividing the Cataract into the Manitoulin and Cabot Head formations would be needed to prove this.

The Northville Anticline shows approximately 20 feet of thinning over this structure. The suspicion would be for the Manitoulin to thicken over the structure (shallow environment) while the Cabot Head thins, but this would again require studying these individual formations.

The Jackson County area shows a normal regional thickness. However, the Washtenaw Graben area shows a subtle thickening to the northwest toward Livingston County. This suggests a continuation of this structure into Livingston County, with the northwest end sinking slightly while the southeastern end remains relatively constant. This will be further developed in the conclusion of this thesis.

An area of anomalous thickening occurs in the Peake-Anglemeyre #1 well of Washtenaw County, Sec. 34, T4S, R4E. Approximately 2,000 feet southeast of this well is the Peake-Bohnenstiehl #1 well, located in the same section. When a structural cross-section was constructed (Figure 18), the result showed that the anomalous thickening and structural offset could be explained by placing a near vertical fault between these wells. The Pre-Clinton formations of the Anglemeyre well show similar, though more subtle increases in thickness. Fisher (1980, personal communication) suggests that this period of normal faulting probably represents a growth fault. However, during Clinton time the faulting shows a reversal. This may tie in with the structural reversal shown previously across the Lucas - Monroe Fault, suggesting a change in direction of the widespread regional forces that caused shearing movement along the pre-existing planes of weakness in the Precambrian basement. It is interesting to note that these wells fall directly on the northwest extension of the Lucas - Monroe Fault.

<u>Clinton Isopach</u> (Plate 11).

The regional thickness of the Clinton varies from 10 to 30 feet. It thins slightly in the general area of the Ohio - Indiana Platform, and the 15 foot contour line along the Lucas - Monroe Fault and northwest extension shows slight movement during this time.

As the Clinton contains considerable carbonate, the buildup in the Northville area may be due to a favorable shallow environment for

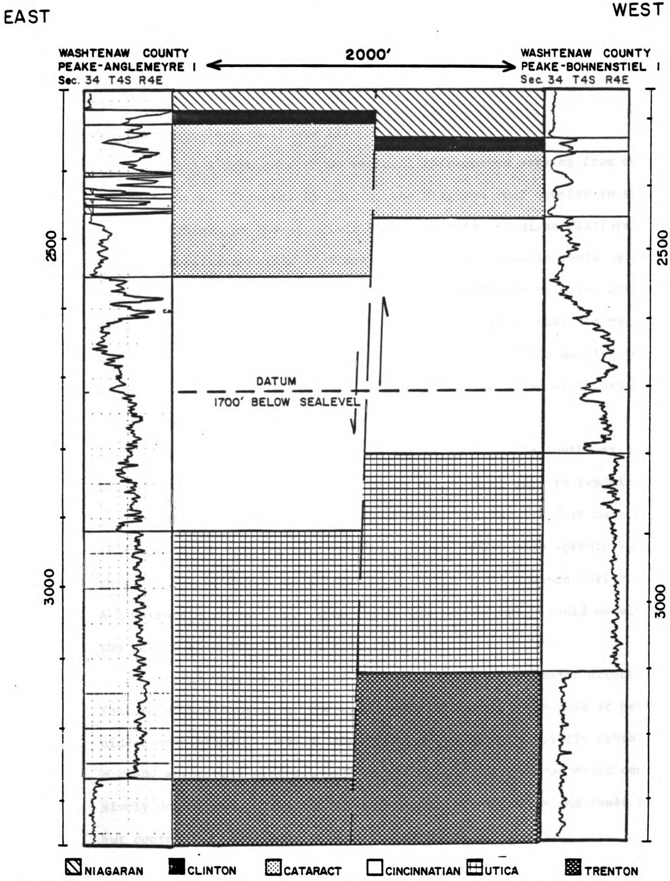


Figure 18. Structural Cross-Section Between Two Nearby Washtenaw Co. Wells

carbonate producing organisms. A sample study would be a useful tool for explaining thickness variation and possible facies changes in the Clinton.

A-2 Carbonate Isopach (Plate 12)

The A-2 Carbonate shows regional thicknesses varying from 60 to 170 feet thick. It makes up part of the Niagaran reef complex in southeastern Michigan on the St. Clair Platform (Ohio - Indiana Platform). The reef complex consists of a massive reef, and pinnacle reefs as shown by Autra (1977). He further stated that A-2 Carbonate thinning occurred over massive and pinnacle reefs. Thus it would appear that the regional southern thinning in this area is directly related to the massive reef of the St. Clair Platform, while sporadic isolated areas of thinning occur over pinnacles.

An anomalously thick section may be seen on the southwest side of the Northville production trend. There are several ways to explain this.

Mesolella et. al. (1974) have shown that the A-2 Carbonate thickens in front of the massive reef complex. Autra (1977) also speculates that this could have been a downthrown area due to fault movement prior to A-2 Carbonate deposition. Thus the anomalous thickness could merely be the result of channel way filling.

It is interesting to note on this map that the major structural feature of previous maps, the Lucas - Monroe Fault, is masked or perhaps hidden completely. However, the Northville Anticline finally exhibits a clear structural picture, with the southwest side of the fault conclusively downthrown. Previous maps suggested an anticline and fault trace, but contouring still left much to the imagination.

Dundee Isopach (Plate 13)

The Dundee varies in thickness from 0 to 100 feet. Truncation occurs in Monroe County due to Pleistocene glaciation. It is interesting to note how closely the truncation along the Lenawee - Monroe County border follows the Lucas - Monroe Fault. The upthrown eastern side was planed off by glacial activity, while the downthrown western side retains much of its regional thickness. Thickness appears to have been greatest in southern Michigan over the St. Clair Platform.

The Northville Anticline and fault are not as well defined on this map as on the A-2 Carbonate. This is probably due to a combination relative quiescence during this time and poor well control, as many state records seem to indicate difficulty in picking the top of the underlying Detroit River Group.

Trenton Structure Map (Plate 14)

The Trenton structure map clearly defines the strike of the Lucas - Monroe Fault and northwest extension as discussed earlier. Contours along the strike of the fault show considerable left-lateral offset that can be explained through vertical fault movement related to basement shearing. Contours along the northwest extension appear to reflect several narrow aligned anticlines. This becomes more apparent in the Utica Isopach, which appears to show a direct relationship to the Trenton structure map.

The Northville Anticline is sometimes referred to as a southern extension of the Howell Anticline. However, the Northville Anticline is apparently but one of a series of narrow aligned anticlinal structures that make up the Howell Anticline system (Ells, 1962). A close-up of the Northville system is shown in Figure 19. Gas is produced from relatively high on structure, while oil is generally produced in structural lows. Isopach mapping reveals the southwest side to be downthrown, indicating a fault with vertical displacement up to 1,000 feet (Newcombe, 1933). The structure of this anticlinal system is reflected in all the isopach maps constructed for this study.

The anticlinal structures have two apparent explanations that may be inter-related. The structures probably reflect differentially subsiding basement blocks as the result of basement shearing. If so, the resultant fracturing and brecciation along fault and structure planes could serve as pathways for fluid migration. These fluids could then cause dissolution and dolomitization as pointed out by Landes (1946) and others, creating collapse around the blocks and producing anticlinal structures. However, it is unlikely that such dissolution could create features of the magnitude displayed in all the maps constructed for this study (Fisher, 1980, personal communication).

<u>A-2 Carbonate Structure Map</u> (Plate 15).

The A-2 Carbonate map shows a close similarity to the Trenton structure map. However, the Northville and Lucas - Monroe Fault are not as sharply defined due to the thicknesses of the underlying sediments.

<u>Dundee Structure Map</u> (Plate 16).

The Dundee structure map shows strong similarities to the preceding structure maps. The Lucas - Monroe Fault is clearly defined by Dundee erosion, with the Dundee of the upthrown east side having been planed off by glaciation as discussed earlier. The Northville and northwest extension are considerably masked by thicknesses of underlying sediments. This is particularly true of the Salina units, when the

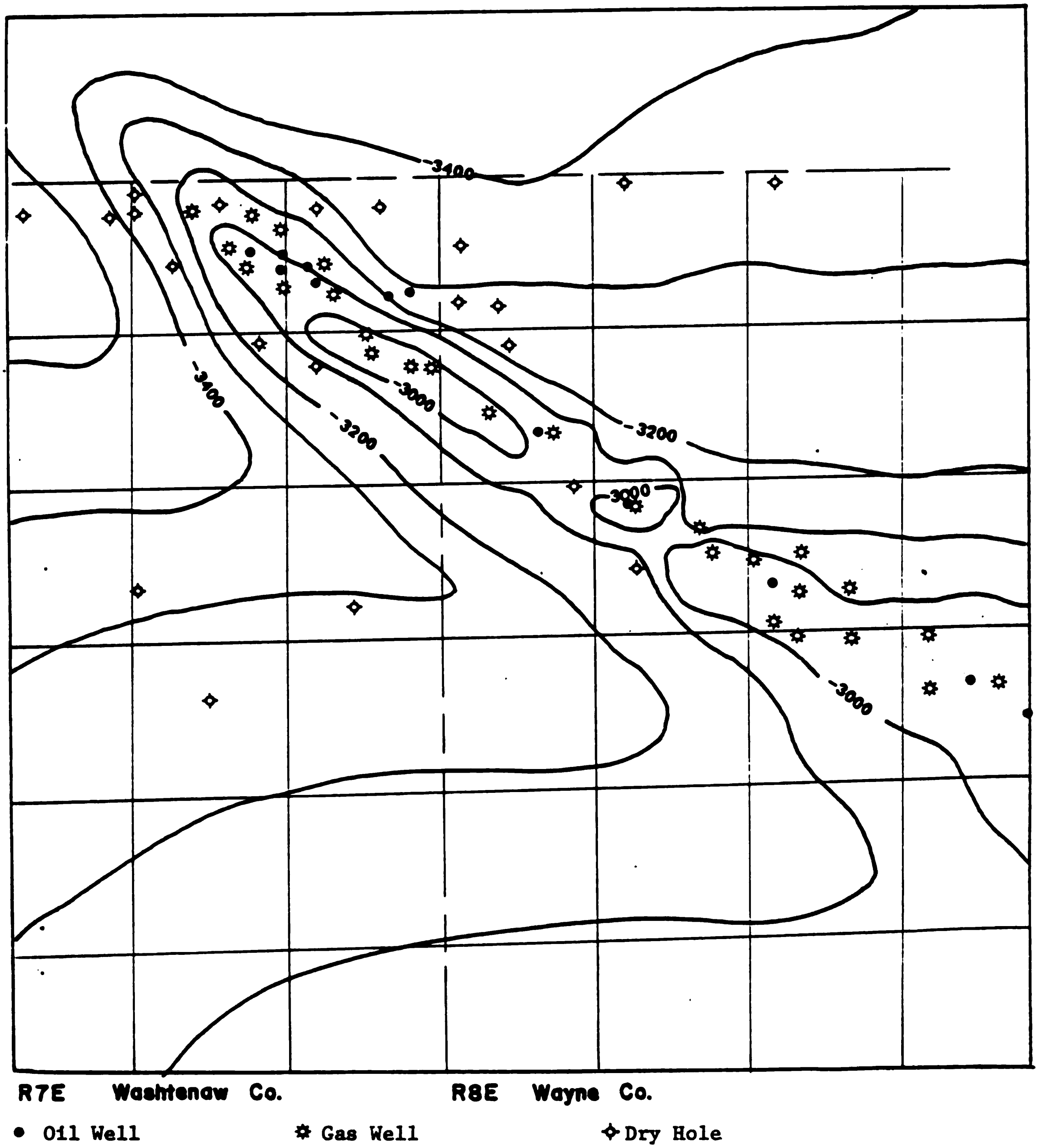


Figure 19. Aligned Anticlinal Structures in the Northville System

major sinking of the Michigan Basin occurred (Fisher, 1969).

PETROLEUM OCCURRENCE

It appears that the most likely places for petroleum production in this area of the Michigan Basin would be: (1) porous erosional remnants underlying impermeable seals; (2) wedge outs along the basin margin; (3) wedge outs around Silurian reef structures, and (4) porosity traps associated with faulted structures.

Cases one and two are related to truncated Cambrian and Lower Ordovician formations and the Post-Knox Unconformity, as pointed out by Syrjamaki (1977). The Glenwood could serve as an impermeable caprock. A Trenton unconformity has been suggested by Rooney (1966) and others, with the Utica Shale serving as an effective caprock. However, Newhart (1976) and others have suggested that patterns of dolomitization and hydrocarbon accumulation are more closely related to faulting and fracturing in the Trenton - Black River.

Case three has been described by Autra (1977) and many others.

Case four is considered to be the key to future Trenton - Black River discoveries, as shown in the Albion-Scipio and Northville fields. There are numerous apparently faulted areas in this area of the basin that remain unexplored or apparently forgotten.

The Deerfield, Summerfield, and Macon Creek fields lie directly along the trace of the Lucas - Monroe Fault and northwest extension. Few of these wells have penetrated deeper than the top of the Trenton, yet current exploration in these areas appears to be at a standstill.

Total Petroleum has made several discoveries in Jackson County, T1S, R1E and T1S, R1W during 1079-80. This area was kept "tight" by the company for as long as possible with Total employees showing "restrained" optimism for future development. The deep sections shown by the Rovsek - Jorgensen #1 well of Washtenaw County display remarkable similarity to the Jackson areas in the isopach maps, suggesting similar fault related petroleum traps in Washtenaw County.

SUMMARY AND CONCLUSIONS

Brigham (1971) and Hinze et. al. (1975) have constructed structure maps of the Precambrian surface. It is granted that these maps have sparse well control in most areas. Nonetheless, the maps were constructed with most data based on gravity and magnetic surveys. The resulting regional Precambrian structure map (Figure 5) bears a striking resemblance to the regional Trenton structure map (Figure 11) constructed by Fisher (1972). The Trenton isopach and remaining post-Trenton maps all showed an apparent direct relationship to the structures shown in the Trenton structure map. Syrjamaki (1977) constructed regional structure contour maps on the Middle Ordovician Glenwood member, Lower Ordovician Prairie du Chien Group, and Late Cambrian Trempealeau formation, and these maps again mirrored the Precambrian and Trenton structure maps. Thus it would appear that Precambrian basement structure has played a major role in shaping the developmental history of the Michigan Basin.

Fisher (1969), Hinze and Merritt (1969), Prouty (1970), and many others have concluded that the Precambrian basement is highly faulted. These faults apparently extend up through the overlying sediments as growth faults, as shown in the Peake-Anglemeyre #1 well (Figure 18). The faults probably formed during the Precambrian as the result of the Penokean Orogeny and Keweenawan Disturbance (Hinze et. al., 1975). Hinze et. al. (1969, 1975) have proposed that a rift zone was created during the Keweenawan Disturbance. This aborted rift zone is then visible as the "Mid-Michigan Gravity High" seen in the Bouguer gravity anomaly map (Figure 8).

The McClure - Sparks #1 and Mobil - Messmore #1 were deep tests drilled within the area of the mid-Michigan gravity high. No basalt was encountered as would be predicted. However, extra thick sections were encountered in the McClure - Sparks well where approximately 5,000 feet of probably Precambriar redbeds (Fisher, 1979) were encountered that could have been derived from erosion of a granite source region (Gregg, 1979) and deposited in the failed rift valley.

The Rovsek - Jorgensen #1 well was also drilled into the mid-Michigan gravity high (Figure 20). This well stopped in the Prairie du Chien. However, unusually thick sections were also encountered in this well. The Cataract Isopach (Plate 10) suggests subsidence was apparently slowing in the Jorgensen well during the Early Silurian. Thus the "Washtenaw Graben" that is visible in the isopach maps of this study appears to be an extension of the proposed rift zone. The Jorgensen well probably represents an area nearing the end of the failed rift valley.

Thus it appears that the deep sections of the Rovsek - Jorgensen well and the structural reversal of the Lucas - Monroe Fault present strong evidence for vertical fault movement within the basin. The Pre-Clinton growth faulting and later reverse faulting of the Peake-Anglemeyre well suggests that the forces responsible for creating the structural reversal of the Lucas - Monroe Fault progressed slowly up the fault, reaching the Anglemeyre well by Clinton time. The reversal itself is probably due to a shift in direction of the regional forces that created basement shearing along the pre-existing planes of weakness in the Precambrian basement.

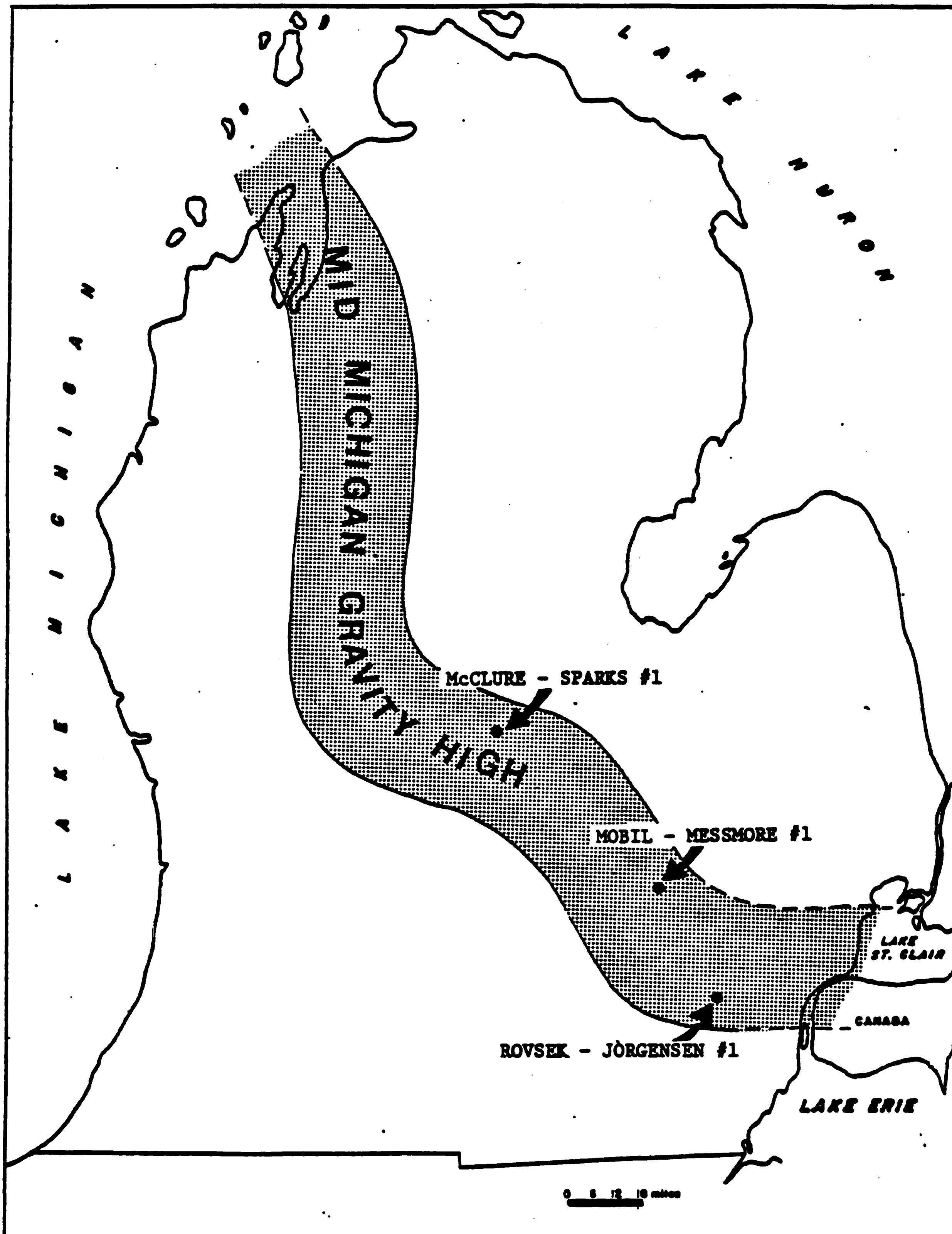


Figure 20. Location of Rovsek - Jorgensen Well

Paris (1977) and other workers have directly related Appalachian tectonics to the evolution of the Michigan Basin. He concluded that the development of the Howell Anticline and other fault-related folds was due to compressional forces affecting lines of weakness in the Precambrian basement.

However, this raises the question of whether the Michigan Basin is a true tectonic basin. It is centrally located on the continent quite a distance from any folded mountains. If one examines a western tectonic basin, such as the Denver Basin, the basin structures are found around the basin margin rather than in the center of the basin.

It would appear that the Michigan Basin has been affected by more generalized regional forces, perhaps from as far away as the Ouachita and Appalachian regions (Fisher, 1980, personal communication). These areas contributed forces that were transmitted through the Precambrian basement and played a major role in shaping the evolution of the Michigan Basin. Eardley (1962) states that the Ouachita system may be a westward extension of the Appalachian system. The main thrusting in the Ouachita region occurred during the Late Pennsylvanian or Permian. The Appalachian region was subjected to three major orogenic events: The Taconic Orogeny (Late Ordovician), Acadian Orogeny (Middle or Late Devonian), and Appalachian Orogeny (Pennsylvanian). Forces from these areas have undoubtedly played a role in shaping the evolution of the Michigan Basin. However, to pin down the exact source and direction of tectonic forces that affected the Michigan Basin would appear to be a difficult task.

As a result of regional tectonics, the Precambrian basement of the Michigan Basin probably has an irregular surface due to shearing activity. Some blocks move up or down in relation to one another, while others may have a dominant lateral component. This in turn plays a major role in forming the structures that are visible in subsurface mapping (Figure 21).

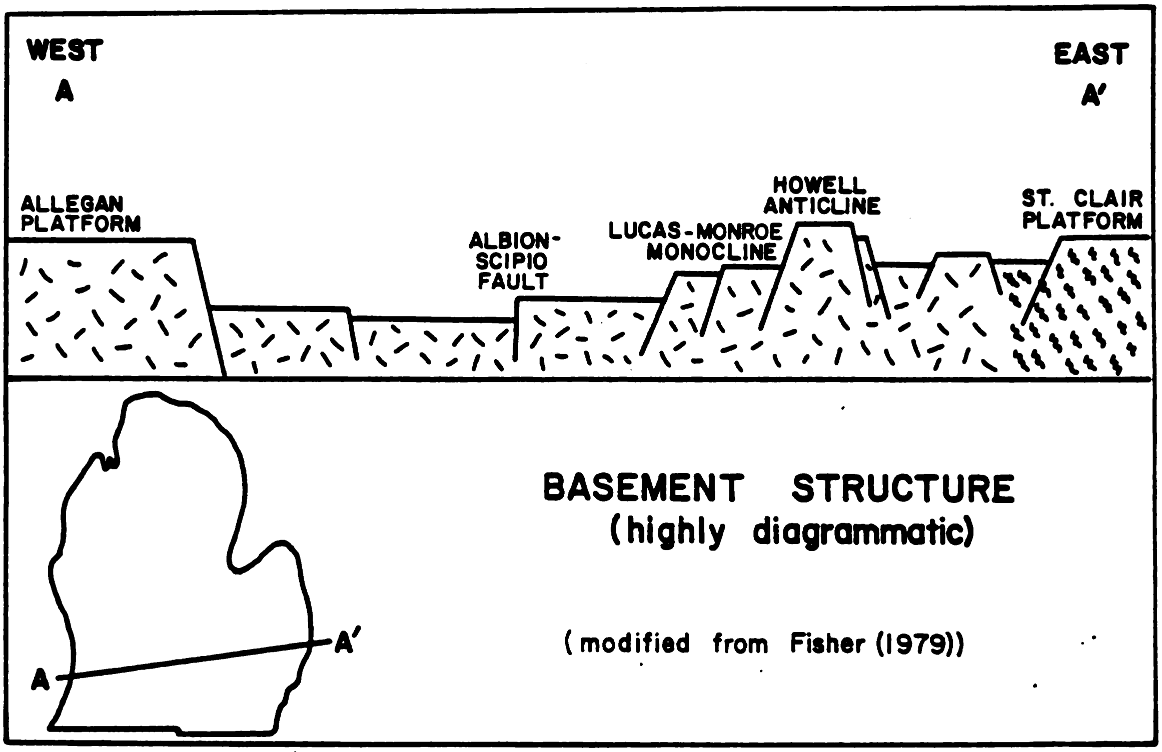

WEST
A
EAST
A'
ALLEGAN PLATFORM
ALBION-SCIPIO FAULT
LUCAS-MONROE MONOCLINE
HOWELL ANTICLINE
ST. CLAIR PLATFORM
BASEMENT STRUCTURE
(highly diagrammatic)
(modified from Fisher (1979))
A
A'

Figure 21.

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APPENDIX

TABLE I.

CATALOG OF WELLS USED IN THE

SOUTHEAST QUADRANT OF MICHIGAN'S LOWER PENINSULA

Wells are arranged alphabetically by county. Data was gathered from state drilling records (SDR), gamma ray logs (GRL), and samples (SMPL). Formation tops were determined by a study of the data. Information includes Principal Operator, Farm Name, Permit #, Location, Elevation, and Total Depth.

Formation Abbreviations

DND	Dundee	CIN4	Cincinnatian Unit 4
DTR	Detroit River	CIN3	Cincinnatian Unit 3
A2C	A-2 Carbonate	CIN2	Cincinnatian Unit 2
A2E	A-2 Evaporite	CIN1	Cincinnatian Unit 1
A1C	A-1 Carbonate	UTC	Utica
NGR	Niagaran	TRN	Trenton
CLN	Clinton	BLR	Black River
CAT	Cataract (Cabot Head and Manitoulin Fms.)	GLW	Glenwood
		PDC	Prairie du Chien
CIN5	Cincinnatian Unit 5	TRM	Trempealeau

<u>Jackson County</u>

Operator: Total	DND 2255	CIN5 4152	TRN 4993
Farm: Faist et al #1-7	DTR 2320	CIN4 4222	BLR 5212
PN: 32714	A2C 3465	CIN3 4273	GLW 5572
Sec. 7, T1S, R1E	A2E 3566	CIN2 4432	PDC 5585
SW-NE-NW	CLN 4018	CIN1 4536	
El. 957 - TD 5653 (GRL)	CAT 4032	UTC 4602	

Operator: Total	DND 2257	CIN5 4135	TRN 4928
Farm: Faist et al #2 -7	DTR 2328	CIN4 4205	BLR 5189
PN: (not listed)	A2C 3502	CIN3 4257	GLW 5543
Sec. 7, T1S, R1E	A2E 3580	CIN2 4408	PDC 5556
SW-SE-NW	CLN 4001	CIN1 4464	
El. 957 - TD 5601 (GRL)	CAT 4023	UTC 4532	

Jackson County (continued)

Operator: Total	DND 2229	CIN5 4130	TRN 4806
Farm: Hankerd #1-17	DTR 2316	CIN4 4216	BLR 5161
PN: 33028	A2C 3524	CIN3 4266	GLW 5520
Sec. 17, T1S, R1E	NGR 3596	CIN2 4380	PDC 5532
NE-NE-SE	CLN 3991	CIN1 4445	
El. 975 - TD 5590 (GRL)	CAT 4011	UTC 4515	

Operator: Neyer &Miller	DND 2132	CIN5 3976	TRN 4660
Farm: Dixon #1	DTR 2218	CIN4 4064	BLR 4994
PN: 21992	A2C 3381	CIN3 4114	
Sec. 26, T1S, R1E	NGR 3451	CIN2 4222	
NE-NW-SE	CLN 3852	CIN1 4296	
El. 923 - TD 5385 (GRL)	CAT 3866	UTC 4368	

Operator: Hammer Oil	DND 1793	CIN5 3370	TRN 4073
Farm: Boone #1	DTR 1890	CIN4 3478	BLR 4411
PN: 21898	A2C 2736	CIN3 3504	GLW 4760
Sec. 26, T3S, R1E	NGR 2809	CIN2 3614	PDC 4770
NW-NW-NE	CLN 3256	CIN1 3688	
El. 959 - TD 4903 (GRL)	CAT 3266	UTC 3760	

Operator: Mobil	DND 1934		
Farm: Clark #1	DTR 2030		
PN: 29944	A2C 2913		
Sec. 4, T3S, R2E	NGR 2980		
SE-NE-SE			
El. 1032 - TD 3511 (GRL)			

Opr: American Hydrocarbons	DND 1776	CIN5 3400	TRN 4106
Farm: Culbert #1			BLR 4455
PN: 23399	A2C 2740		GLW 4812
Sec. 22, T3S, R2E			PDC 4814
C-SW-SW	CLN 3282		
El. 962 - TD 4953 (SDR)			

Operator: Reed	DND 1715	CIN5 3180	TRN 3887
Farm: Reed #1			BLR 4240
PN: 21982			
Sec. 7, T4S, R1E			PDC 4561
SE-SW-SE	CLN 3068		
El. 987 - TD 4566 (SDR)			

Operator: Cowen	DND 1748	CIN5 3229	TRN 3945
Farm: Wellhoff #1			BLR 4271
PN: 28305	A2C 2581		GLW 4615
Sec. 10, T4S, R1E	A2E 2644		PDC 4624
C-SE-NE	CLN 3122		
El. 996 - TD 4651 (SDR)		UTC 3621	

Jackson County (continued)

Operator: Cowen	DND 1733	CIN5 3228	TRN 3934
Farm: DeLand Comm. #1			BLR 4261
PN: 28460	A2C 2560		GLW 4602
Sec. 10, T4S, R1E			
NE-SW-NE	CLN 3116		
El. 989 - TD 4675 (SDR)		UTC 3616	

Operator: Carter	DND 1773	CIN 3280	TRN 3977
Farm: Randall #1			
PN: 22066	A2C 2588		
Sec. 11, T4S, R1E			
NW-NE-NW	CLN 3143		
El. 1006 - TD 4693 (SDR)		UTC 3475	

Operator: Gordon	DND 1715		TRN 3949
Farm: Dermyre et al #1			
PN: 28848	A2C 2560		
Sec. 11, T4S, R1E			PDC 4628
NW-NW-SW			
El. 1011 - TD 4637 (SDR)	CAT 3128	UTC 3615	

Operator: Cowen	DND 1755		TRN 3952
Farm: Wellhoff #1-A			BLR 4287
PN: 28492	A2C 2612		GLW 4626
Sec. 11, T4S, R1E			PDC 4630
NW-SW-NW	CLN 3136		
El. 1011 - TD 4718 (SDR)		UTC 3636	

Operator: Bayley Prod.	DND 1719	CIN5 3227	TRN 3928
Farm: Hess #1	DTR 1800	CIN4 3310	BLR 4255
PN: 28705	A2C 2542	CIN3 3350	GLW 4614
Sec. 8, T4S, R2E	A2E 2616	CIN2 3462	PDC 4617
NW-NW-SW	CLN 3104	CIN1 3537	
El. 987 - TD 4671 (GRL)	CAT 3116	UTC 3609	

Operator: Otterbine	DND 1705	CIN5 3212	TRN 3908
Farm: Baylis #1			BLR 4257
PN: 22017	A2C 2582		GLW 4602
Sec. 9, T4S, R2E			PDC 4607
SE-SE-NE	CLN 3093		
El. 964 - TD 4685 (SDR)		UTC 3591	

Operator: Taggart	DND 1695	CIN5 3195	TRN 3884
Farm: Watkins Farms #1			
PN: 19444			GLW 4570
Sec. 13, T4S, R2E			PDC 4576
SE-SW-SE	CLN 3065		
El. 1012 - TD 4700 (SDR)			

Jackson County (continued)

Operator: Ohio Oil	DND 1700	CIN5 3196	TRN 3891
Farm: Watkins Farms #1	DTR 1790	CIN4 3266	BLR 4250
PN: 23656	A2C 2576	CIN3 3310	GLW 4592
Sec. 24, T4S, R2E	A2E 2644	CIN2 3425	PDC 4597
SW-SW-NE	CLN 3069	CIN1 3500	
El. 1051 - TD 4650 (GRL)	CAT 3078	UTC 3571	

Lenawee County

Operator: McClure	DND 1666	CIN5 2984	TRN 3702
Farm: Antczk & Sawyer #1	DTR 1756	CIN4 3066	BLR 4050
PN: 22010	A2C 2399	CIN3 3126	GLW 4350
Sec. 18, T5S, R1E	A1C 2480	CIN2 3244	PDC 4363
SW-NW-NE	CLN 2884	CIN1 3294	
El. 1092 - TD 4427 (GRL)	CAT 2894	UTC 3366	

Operator: Bell & Gault	DND 1604	CIN5 2929	TRN 3652
Farm: Wheaton #1			
PN: 22781	A2C 2317		GLW 4316
Sec. 21, T5S, R1E			PDC 4321
SE-SE-NW	CLN 2828		
El. 1091 - TD 4420 (SDR)			

Operator: Bell & Gault	DND 1538	CIN5 2832	TRN 3552
Farm: Kisner #1	DTR 1623	CIN4 2926	BLR 3892
PN: 22044	A2C 2258	CIN3 2992	
Sec. 33, T5S, R1E	A1C 2316	CIN2 3083	
NW-SW-NE	CLN 2726	CIN1 3132	
El. 1080 - TD 4165 (GRL)	CAT 2737	UTC 3208	

Operator: Farmers Oil	DND 1555	CIN5 2964	TRN 3680
Farm: Myers Estate #1		CIN4 3045	BLR 4039
PN: 23277	A2C 2355	CIN3 3102	GLW 4355
Sec. 5, T5S, R2E		CIN2 3224	PDC 4370
SW-NE-SW	CLN 2854	CIN1 3267	
El. 1006 - TD 4406 (GRL)	CAT 2865	UTC 3343	

Operator: St. Louis Pipe	DND 1412		TRN 3540
Farm: Dibble #1			
PN: 3452			
Sec. 16, T5S,R3E			
SW-NW-SW	CLN 2715		
El. 968 - TD 3645 (SDR)	CAT 2723		

Lenawee County (continued)

Operator: Reef Petrol.		CIN5 2641	TRN 3340
Farm: Valkenburg #1-25	DTR 1394		BLR 3704
PN: 31972	A2C 2013		GLW 4052
Sec. 25, T5S, R3E			PDC 4067
SE-SE-NE	CLN 2527		
El. 890 - TD 4124 (SDR)		UTC 3000	
Operator: Cambridge Oil	DND 818	CIN5 2436	TRN 3103
Farm: Service #1	DTR 913	CIN4 2526	BLR 3464
PN: 28868	A2C 1842	CIN3 2590	GLW 3804
Sec. 2, T5S, R4E	NGR 1916	CIN2 2691	PDC 3818
C-SW-SE	CLN 2323	CIN1 2734	
El. 895 - TD 4000 (GRL)	CAT 2334	UTC 2817	
Operator: Voorhees	DND 1115		TRN 3269
Farm: Gove #1			
PN: 7598			
Sec. 8, T5S, R4E			
NE-SW-SW			
El. 834 - TD 4060 (SDR)			
Operator: McClure	DND 932	CIN5 2456	TRN 3149
Farm: Allen #1	DTR 1049	CIN4 2520	BLR 3532
PN: 22886	A2C 1859	CIN3 2575	GLW3909
Sec. 14, T5S, R4E	NGR 1931	CIN2 2690	PDC 3928
NE-NW-SW	CLN 2342	CIN1 2735	
El. 872 - TD 4046 (GRL)	CAT 2354	UTC 2814	
Operator: Good &Good	DND 344	CIN5 2067	TRN 2707
Farm: DeLodder #GG-1	DTR 463	CIN4 2115	BLR 3091
PN:24304	A2C 1495	CIN3 2161	GLW 3464
Sec. 3, T5S, R5E	A1C 1540	CIN2 2265	PDC 3478
SE-SE-SW	CLN 1935	CIN1 2304	
El. 760 - TD 3555 (GRL)	CAT 1953	UTC 2381	
Operator: Gulf	DND 386	CIN5 1793	TRN 2650
Farm: Gordon #1-9	DTR 496	CIN4 2046	BLR 3032
PN: 31792	A2C 1433	CIN3 2096	GLW 3424
Sec. 9, T5S, R5E	A1C 1482	CIN2 2203	PDC 3440
SE-SE	CLN 1877	CIN1 2240	
El. 777 - TD 3800 (GRL)	CAT 1894	UTC 2322	
Operator: Michigan Oil	DND 110	CIN5 1880	TRN 2545
Farm: Craig #1	DTR 212		
PN: 19333	A2C 1290		
Sec. 13, T5S, R5E			
NW-SE-SE	CLN 1751		
El. 710 - TD 2683 (SDR)	CAT 1766		

Lenawee County (continued)

Operator: Gulf	DND 250	CIN5 1956	TRN 2620
Farm: Gilmore #1 - 15	DTR 360	CIN4 2010	BLR 3001
PN: 31919	A2C 1400	CIN3 2060	GLW 3393
Sec. 15, T5S, R5E	A1C 1450	CIN2 2168	PDC 3411
SE-SW-NW	CLN 1842	CIN1 2209	
El. 760 - TD 3798 (GRL)	CAT 1856	UTC 2298	
Operator: McClure	DND 583	CIN5 2156	TRN 2820
Farm: Earhart #1	DTR 669		BLR 3190
PN: 22517	A2C 1580		GLW 3583
Sec. 17, T5S, R5E			
NE-NE-SW	CLN 2040		
El. 798 - TD 3645 (GRL)			
Operator: McClure	DND 163	CIN5 1851	TRN 2517
Farm: Preston #1	DTR 270	CIN4 1904	BLR 2878
PN: 22834	A2C 1294	CIN3 1960	GLW 3261
Sec. 23, T5S, R5E	A1C 1344	CIN2 2060	PDC 3278
SE-NW-SE	CLN 1734	CIN1 2105	
El. 721 - TD 3305 (GRL)	CAT 1748	UTC 2181	
Operator: McClure	DND 180	CIN5 1880	TRN 2496
Farm: Smitka #1	DTR 287	CIN4 1934	
PN: 23315	A2C 1312	CIN3 1990	
Sec. 23, T5S, R5E	A1C 1360	CIN2 2089	
SE-SE-SW	CLN 1751	CIN1 2136	
El. 711 - TD 2685 (GRL)	CAT 1762	UTC 2208	
Operator: Socony Oil	DND 110	CIN5 1755	TRN 2418
Farm: Russell #1			
PN: 3600			
Sec. 25, T5S, R5E			
C-S-S	CLN 1645		
El. 699 - TD 2576 (SDR)			
Operator: Good &Good	DND 184	CIN5 1857	TRN 2525
Farm: Preston #2	DTR 290	CIN4 1910	BLR 2898
PN: 24645	A2C 1306	CIN3 1960	GLW 3293
Sec. 25, T5S, R5E	A1C 1350	CIN2 2080	PDC 3306
SE-NW-SW	CLN 1740	CIN1 2124	
El. 710 - TD 3400 (GRL)	CAT 1754	UTC 2196	
Operator: Bernardt Oil	DND 160	CIN5 1876	TRN 2567
Farm: Steele #1	DTR 270		BLR 2898
PN: 25641	A2C 1297		
Sec. 26, T5S, R5E			
NE-NW-NE	CLN 1755		
El. 710 - TD 3032 (SDR)			

Lenawee County (continued)

Operator: Socony Oil	DND 110	CIN5 1910	TRN 2445
Farm: Downing Estate #1			
PN: 3353			
Sec. 36, T5S, R5E			
NE-NE-SW			
El. 698 - TD 3437 (SDR)			

Operator: Socony Oil	DND 106	CIN5 1889	TRN 2445
Farm: McCarbery #1			
PN: 2759			
Sec. 36, T5S, R5E			
NW-NE-NW			
El. 694 - TD 2552 (SDR)			

Operator: Trolz	DND 1272	CIN5 2520	TRN 3257
Farm: Hawkins et al #1	DTR 1367	CIN4 2593	BLR 3576
PN: 23838	A2C 1957	CIN3 2653	GLW 3886
Sec. 20, T6S, R1E	NGR 2036	CIN2 2770	PDC 3902
SE-NW-SE	CLN 2414	CIN1 2820	
El. 979 - TD 3962 (GRL)	CAT 2427	UTC 2900	

Operator: Anderson Oil	DND 1320	CIN5 2640	TRN 3367
Farm: Brooks et al #1	DTR 1408	CIN4 2714	BLR 3706
PN: 28168	A2C 2053	CIN3 2780	GLW 4024
Sec. 4, T6S, R2E	NGR 2140	CIN2 2882	PDC 4042
NE-SW-SW	CLN 2531	CIN1 2940	
El. 1010 - TD 4076 (GRL)	CAT 2545	UTC 3014	

Operator: Lawton	DND 986	CIN5 2274	TRN 3002
Farm: Drewyer	DTR 1072	CIN4 2345	BLR 3334
PN: 23751	A2C 1695	CIN3 2405	GLW 3660
Sec. 25, T6S, R2E	NGR 1776	CIN2 2518	PDC 3680
NE-SE-NE	CLN 2166	CIN1 2562	
El. 864 - TD 3752 (GRL)	CAT 2182	UTC 2636	

Operator: Occidental Pet.	DND 1125	CIN5 2392	TRN 3115
Farm: Rupert et ux #1	DTR 1216	CIN4 2456	BLR 3440
PN: 28529	A2C 1832	CIN3 2520	GLW 3757
Sec. 29, T6S, R2E	NGR 1910	CIN2 2631	PDC 3775
SW-SE-NE	CLN 2287	CIN1 2677	
El. 930 - TD 3852 (GRL)	CAT 2303	UTC 2750	

Operator: McClure	DND 1103	CIN5 2394	TRN 3113
Farm: Francourer #1			BLR 3451
PN: 22112	A2C 1815		GLW 3793
Sec. 18, T6S, R3E			PDC 3814
NW-NE-SW	CLN 2282		
El. 888 - TD 3900 (SDR)			

Lenawee County (continued)

Operator: Bell & Gault	DND 1089	CIN5 2385	TRN 3105
Farm: Burnett et al #1	DTR 1170		BLR 3417
PN: 21637	A2C 1845		
Sec. 22, T6S, R3E			
NW-SE-NE	CLN 2278		
El. 849 - TD 3605 (SDR)			

Operator: California Co.	DND 1030	CIN5 2307	TRN 3037
Farm: Mohr #1	DTR 1110	CIN4 2376	BLR 3368
PN: 24515	A2C 1746	CIN3 2441	GLW 3702
Sec. 30, T6S, R3E	NGR 1823	CIN2 2551	PDC 3716
C-SE-NW	CLN 2201	CIN1 2595	
El. 872 - TD 3764 (GRL)	CAT 2216	UTC 2676	

Operator: Marathon	DND 1045	CIN5 2327	TRN 3062
Farm: Mohr et al #1	DTR 1124		BLR 3394
PN: 24749	A2C 1730		GLW 3727
Sec. 30, T6S, R3E			PDC 3741
C-SW-NE	CLN 2213		
El. 853 - TD 3795 (GRL)		UTC 2696	

Operator: McCulloch Oil	DND 1016	CIN5 2286	TRN 3013
Farm: Barrow et ux #1-30	DTR 1092	CIN4 2356	BLR 3344
PN: 28803	A2C 1716	CIN3 2418	GLW 3677
Sec. 30, T6S, R3E	NGR 1790	CIN2 2530	
C-NE-SW	CLN 2180	CIN1 2572	
El. 854 - TD 3704 (GRL)	CAT 2196	UTC 2646	

Operator: Bell & Gault	DND 824	CIN5 2222	TRN 2918
Farm: Brenke #1	DTR 926		BLR 3256
PN: 35807	A2C 1660		GLW 3660
Sec. 2, T6S, R4E	A1C 1790		PDC 3670
SW-SW-SW	CLN 2110		
El. 792 - TD 3752 (SDR)			

Operator: Morriss	DND 87	CIN5 1870	TRN 2406
Farm: Downing #1			
PN: 19191			
Sec. 1, T6S, R5E			
NW-NW-SE	CLN 1637		
El. 684 - TD 2492 (SDR)			

Operator: Morriss	DND 107	CIN5 1839	TRN 2421
Farm: Downing #2	DTR 198		
PN 19375			
Sec. 1, T6S, R5E			
NE-NE-SW			
El. 683 - TD 2492 (SDR)	CAT 1737		

Lenawee County (continued)

Operator: Morriss	DND 107		TRN 2647
Farm: Downing #3	DTR 177		
PN: 19376			
Sec. 1, T6S, R5E			
SE-NW-SE	CLN 1720		
El. 680 - TD 2491 (SDR)			
Operator: Mutch		CIN5 1683	TRN 2353
Farm: Downing #1-A			
PN: 22865			
Sec. 1, T6S, R5E			
SW-SE-NE	CLN 1568		
El. 681 - TD 3025 (SDR)			
Operator: Borton	DND 520	CIN5 2075	TRN 2635
Farm: Borton #2	DTR 595		
PN: 130			
Sec. 5, T6S, R5E			
SE-SE	CLN 1660		
El. 715 - TD 2830 (SDR)	CAT 1965		
Operator: Withrow,Rogers	DND 325		TRN 2468
Farm: Ross #1	DTR 385		
PN: 3342			
Sec. 23, T6S, R5E			
SE-NE-NE	CLN 1670		
El. 683 - TD 2593 (SDR)	CAT 1780		
Operator: Hall	DND 45	CIN5 1779	TRN 2355
Farm: LaVoy #1			
PN: 7634			
Sec. 25, T6S, R5E			
SE-NE-NW	CLN 1528		
El. 678 - TD 2492 (SDR)	CAT 1673		
Operator: Mich. Pacific Oil	DND --	CIN5 1666	TRN 2250
Farm: Busey #1	DTR 66		
PN: 3793			
Sec. 25, T6S, R5E			
NE-SE-SE	CLN 1450		
El. 677 - TD 2505	CAT 1627		
Operator: Bub Oil	DND 432	CIN5 1793	TRN 2500
Farm: Garno et al #1	DTR 503		GLW 3227
PN: 26538	A2C 1198		PDC 3239
Sec. 32, T6S, R5E			
SW-SE-SE	CLN 1688		
El. 684 - TD 3240 (SDR)		UTC 2132	

Lenawee County (continued)

Operator: W.K.Devel. Co.			TRN 2490
Farm: Weisinger #1			
PN: None listed			
Sec. 33, T6S, R5E			
NE-NE			
El. 710 - TD 2670 (SDR)			

Operator: Kernodle	DND 60	CIN5 1527	TRN 2116
Farm: Trimmins Heirs #1			
PN: 8319			
Sec. 36, T6S, R5E			
NE-SE-NE	CLN 1330		
El. 676 - TD 2216 (SDR)			

Operator: Neal	DND 1202	CIN5 2497	TRN 3115
Farm: Dunigan #1			
PN: 9800			
Sec. 7. T7S, R1E			
NE-NW-NE			
El. 956 - TD 3175 (SDR)	CAT 2398		

Operator: Good & Good	DND 1029	CIN5 2184	TRN 2942
Farm: Borck			
PN: 25052			GLW 3550
Sec. 28, T7S; R1E			PDC 3568
SE-SW-NE			
El. 912 - TD 3650 (SDR)			

Operator: Pannell	DND 1038	CIN5 2160	TRN 2929
Farm: Weber #1	DTR 1138	CIN4 2240	BLR 3210
PN: 22716	A2C 1582	CIN3 2294	GLW 3520
Sec. 29, T7S, R1E	NGR 1658	CIN2 2410	PDC 3538
SW-SW-SW	CLN 2063	CIN1 2461	
El. 912 - TD 3630 (GRL)	CAT 2077	UTC 2539	

Operator: Miller	DND 978	CIN5 2102	TRN 2865
Farm: Fike #1	DTR 1082	CIN4 2174	BLR 3139
PN: 26309	A2C 1574	CIN3 2232	GLW 3452
Sec. 33, T7S, R1E	A1C 1630	CIN2 2342	PDC 3472
SW-SE-NW	CLN 2000	CIN1 2390	
El. 882 - TD 3520 (GRL)	CAT 2016	UTC 2463	

Operator: Good & Good	DND 876	CIN5 2022	TRN 2781
Farm: Siegfried #1	DTR 976	CIN4 2088	BLR 3063
PN: 23723	A2C 1504	CIN3 2147	GLW 3376
Sec. 34, T7S, R1E	A1C 1568	CIN2 2259	PDC 3396
NW-NE-SW	CLN 1926	CIN1 2309	
El. 816 - TD 3420 (GRL)	CAT 1942	UTC 2384	

Lenawee County (continued)

Operator: Hammer Oil	DND 903	CIN5 2057	TRN 2811
Farm: Wellnitz #1	DTR 1010	CIN4 2120	BLR 3101
PN: 21822	A2C 1509	CIN3 2181	GLW 3412
Sec. 36, T7S, R1E	NGR 1575	CIN2 2290	PDC 3433
NW-SE-NW	CLN 1958	CIN1 2339	
El. 855 - TD 3526 (GRL)	CAT 1976	UTC 2416	

Operator: Occidental	DND 914	CIN5 2144	TRN 2881
Farm: Seeburger #1	DTR 1020	CIN4 2208	BLR 3198
PN: 28533	A2C 1609	CIN3 2272	GLW 3526
Sec. 12, T7S, R2E	A1C 1666	CIN2 2382	PDC 3548
NW-SW-NE	CLN 2040	CIN1 2428	
El. 827 - TD 3575 (GRL)	CAT 2052	UTC 2504	

Operator: Ashland Oil	DND 932	CIN5 2138	TRN 2891
Farm: Much #1	DTR 1040	CIN4 2202	BLR 3200
PN: 26411	A2C 1631	CIN3 2266	GLW 3526
Sec. 13, T7S, R2E	A1C 1686	CIN2 2378	PDC 3548
SW-SE-SE	CLN 2033	CIN1 2424	
El. 840 - TD 3800 (GRL)	CAT 2044	UTC 2504	

Operator: Amer.Hydrocarbons	DND 828	CIN5 2006	TRN 2752
Farm: Emerson #1	DTR 922	CIN4 2060	BLR 3060
PN: 23737	A2C 1450	CIN3 2122	GLW 3340
Sec. 27, T7S, R2E	A1C 1492	CIN2 2236	PDC 3356
NW-NE-SE	CLN 1904	CIN1 2278	
El. 840 - TD 3468 (GRL)	CAT 1914	UTC 2356	

Operator: A.P.A. Oil	DND 710	CIN5 1952	TRN 2697
Farm: Gemple #1	DTR 773		BLW 2997
PN: 23087	A2C 1429		GLW 3362
Sec. 25, T7S, R3E			PDC 3372
SE-SW-SW	CLN 1846		
El. 753 - TD 3427 (SDR)			

Operator: Horizon Oil	DND 846	CIN5 2031	TRN 2777
Farm: Meech & Griffith #1	DTR 943	CIN4 2086	BLR 3080
PN: 26876	A2C 1531	CIN3 2150	GLW 3410
Sec. 30, T7S, R3E	A1C 1595	CIN2 2268	PDC 3424
SW-SE-NW	CLN 1928	CIN1 2303	
El. 799 - TD 3685 (GRL)	CAT 1938	UTC 2380	

Operator: Powell			TRN 2234
Farm: Iott #1			
PN: 8254			
Sec. 1, T7S, R5E			
SE			
El. 677 - TD 2304 (SDR)	CAT 1435		

Lenawee County (continued)

Operator: LaDu Oil	DND 320	CIN5 1790	TRN 2373
Farm: Long #2			
PN: 983			
Sec. 2, T7S, R5E			
SW-NE-NE			
El. 708 - TD 3328 (SDR)	CAT 1660		
Operator: Bub Oil	DND 436	CIN5 1800	TRN 2485
Farm: Vanhaerents #1			BLR 2801
PN: 23979			GLW 3211
Sec. 4, T7S, R5E			PDC 3221
NW-SW-NW	CLN 1679		
El. 683 - TD 3246 (SDR)			
Operator: Bub Oil	DND 439	CIN5 1778	TRN 2488
Farm: Seidel #1	DTR 515		BLR 2798
PN: 23667	A2C 1239		GLW 3206
Sec. 5, T7S, R5E			PDC 3214
SE-NE-NE	CLN 1674		
El. 683 - TD 3251 (SDR)		UTC 2118	
Operator: Bertson	DND 55		TRN 1985
Farm: Heath #1			
PN: 7870			
Sec. 13, T7S, R5E			
SE-SE-SE			
El. 682 - TD 2091 (SDR)			
Operator: M.V.O.C. Inc.		CIN5 1592	TRN 2297
Farm: Yape #1			
PN: 24554			
Sec. 14, T7S, R5E			
SE-SE-SE	CLN 1474		
El. 681 - TD 3112 (SDR)			
Operator: Bernhardt Oil	DND --	CIN5 1282	TRN 2007
Farm: Gerber #1			
PN: 24541	A2C 701		
Sec. 24, T7S, R5E			
SE-SE-SE	CLN 1145		
El.690 - TD 2087 (SDR)			
Operator: M.V.O.C. Inc.	DND 121	CIN5 1505	TRN 2208
Farm: Hoffman #1	DTR 188		
PN: 24362	A2C 942		
Sec. 24, T7S, R5E			
SW-SW-SE	CLN 1370		
El. 691 - TD 2476 (SDR)			

Lenawee County (continued)

Operator: Bernhardt Oil	DND --	CIN5 1274	TRN 1993
Farm: Gerber Estate #1	DTR 44		BLR 2290
PN: 25016	A2C 728		GLW 2691
Sec. 25, T7S, T5E			PDC 2711
NE-NE-NE	CLN 1156		
El. 687 - TD 2901 (SDR)			

Operator: LeBlanc	DND --		
Farm: Fick #1	DTR 65	CIN5 2060	TRN 2309
PN: 8204			
Sec. 26, T7S, R5E			GLW 3055
S-SW-SE			PDC 3075
El. 688 - TD 3128 (SDR)			

Operator: Bauer Bros.	DND 932	CIN5 2045	TRN 2801
Farm: Beal #1	DTR 991		BLR 3075
PN: 24336	A2C 1495		
Sec. 3, T8S, R1E			
NE-SW-SW	CLN 1941		
El. 873 - TD 3448 (GRL)		UTC 2402	

Operator: Good & Good	DND 917	CIN5 2054	TRN 2810
Farm: Beal GG-1	DTR 1016	CIN4 2118	BLR 3082
PN: 23276	A2C 1536	CIN3 2174	GLW 3396
Sec. 3, T8S, R1E	A1C 1594	CIN2 2288	PDC 3416
NE-NW-SW	CLN 1950	CIN1 2336	
El. 874 - TD 3487 (GRL)	CAT 1968	UTC 2414	

Operator: Bauer Bros.		CIN5 2050	TRN 2806
Farm: Moore #1			BLR 3082
PN: 24491			GLW 3403
Sec. 3, T8S, R1E			
NW-NE-SW			
El. 875 - TD 3446 (GRL)			

Operator: Sun Oil	DND 930	CIN5 2078	TRN 2835
Farm: Cisco #1	DTR 1035	CIN4 2142	BLR 3110
PN: 23891	A2C 1564	CIN3 2200	GLW 3426
Sec. 4, T8S, R1E	A1C 1617	CIN2 2313	PDC 3446
NE-SE-NE	CLN 1976	CIN1 2364	
El. 887 - TD 3603 (GRL)	CAT 1990	UTC 2442	

Operator: The MOCO	DND 926	CIN5 2012	TRN 2762
Farm: Walter #1	DTR 1026	CIN4 2077	BLR 3028
PN: 23652	A2C 1488	CIN3 2130	GLW 3334
Sec.18, T8S, R1E	A1C 1544	CIN2 2243	PDC 3353
SW-SE-NW	CLN 1903	CIN1 2290	
El.872 - TD 3488 (GRL)	CAT 1917	UTC 2368	

Lenawee County (continued)

Operator: Hackett	DND 736	CIN5 1821	TRN 2576
Farm: Lipe #4-1			BLR 2844
PN: 24882	A2C 1302		GLW 3175
Sec. 25, T8S, R1E			PDC 3191
NW-NW-NE	CLN 1706		
El. 810 - TD 3238 (SDR)		UTC 2176	

Operator: Buck & Basin	DND 814	CIN5 1885	TRN 2648
Farm: Ferris Comm. #1	DTR 913	CIN4 1950	BLR 2920
PN: 21916	A2C 1394	CIN3 2005	GLW 3241
Sec. 27,T8S, R1E	A1C 1450	CIN2 2125	PDC 3262
NW-NW-NW	CLN 1792	CIN1 2166	
El. 831 - TD 3352 (GRL)	CAT 1811	UTC 2240	

Operator: Neyer	DND 821	CIN5 1893	TRN 2655
Farm: Brasher #1	DTR 925	CIN4 1957	BLR 2940
PN: 24905	A2C 1408	CIN3 2006	GLW 3237
Sec. 28, T8S, R1E	A1C 1468	CIN2 2120	PDC 3257
NE-NW-NW	CLN 1786	CIN1 2171	
El. 832 - TD 3306 (GRL)	CAT 1800	UTC 2248	

Operator: MOCO	DND 832	CIN5 1900	TRN 2653
Farm: Flint Comm. #1	DTR 942	CIN4 1958	BLR 2933
PN: 25931	A2C 1422	CIN3 2010	GLW 3224
Sec.31, T8S, R1E	A1C 1474	CIN2 2123	PDC 3244
NW-NE-NW	CLN 1792	CIN1 2170	
El. 839 - TD 3306 (GRL)	CAT 1811	UTC 2246	

Operator: Howard	DND 735	CIN5 1837	TRN 2593
Farm: Snyder #1	DTR 843	CIN4 1896	BLR 2874
PN: 23718	A2C 1370	CIN3 1953	GLW 3193
Sec. 20, T8S, R2E	A1C 1431	CIN2 2068	PDC 3215
NW-SE-NW	CLN 1743	CIN1 2110	
El. 790 - TD 3284 (GRL)	CAT 1764	UTC 2194	

Operator: Basin Oil	DND 703	CIN5 1864	TRN 2593
Farm: Snedicor et al #1			BLR 2875
PN: 23527	A2C 1314		GLW 3230
Sec. 17, T8S, R3E			PDC 3258
SE-NE-SE	CLN 1732		
El. 749 - TD 3281 (SDR)			

Operator: Occidental	DND 602	CIN5 1743	TRN 2496
Farm: Willet et ux #1	DTR 702	CIN4 1788	BLR 2784
PN 28531	A2C 1260	CIN3 1847	GLW 3124
Sec. 26, T8S, R3E	A1C 1330	CIN2 1962	
NW-SE-SE	CLN 1636	CIN1 2007	
El. 746 - TD 3147 (GRL)	CAT 1660	UTC 2089	

Lenawee County (continued)

Operator: Neptune Oil	DND 606	CIN5 1753	TRN 2492
Farm: Raymond #1			BLR 2767
PN: 23618	A2C 1230		GLW 3111
Sec. 27, T8S, R3E			PDC 3130
SE - SE-SE	CLN 1638		
El. 748 - TD 3191 (SDR)		UTC 2084	

Operator: Sun Oil	DND 574		
Farm: Jacob et al	DTR 678		
PN: (not listed)			
Sec. 7, T8S, R4E			
C-S			
El. 711 - TD 1004 (GRL)			

Operator: Buck & Basin	DND 570	CIN5 1753	TRN 2508
Farm: McClenathen et ux #1	DTR 657	CIN4 1798	BLR 2808
PN: 16693	A2C 1260	CIN3 1866	GLW 3147
Sec.18, T8S, R4E	A1C 1326	CIN2 1980	PDC 3174
NE-NE-NW	CLN 1638	CIN1 2018	
El. 717 - TD 3217 (GRL)	CAT 1656	UTC 2104	

Operator: D.O.H.I. Oil	DND 215		
Farm: Farrow #1			
PN: 1167			
Sec. 13, T8S, R5E			
SE-NE	CLN 1467		
El. 696 - TD 1477 (SDR)			

Operator: Ogden Oil	DND 315		TRN 2217
Farm: Fachett #1			
PN: (none listed)			
Sec. 28, T8S, R5			
N - SW	CLN 1400		
El. 700 - TD 2325 (SDR)			

Operator: Eckert	DND 310	CIN5 1479	TRN 2198
Farm: Taylor #1			BLR 2540
PN: 10448			GLW 2900
Sec. 32, T8S, R5E			PDC 2920
SE-NE-SW	CLN 1373		
El. 715 - TD 3902 (SDR)			

Operator: Occidental		CIN5 1474	TRN 2187
Farm: Schumacher et al #1		CIN4 1502	BLR 2491
PN: 28543	A2C 966	CIN3 1554	GLW 2862
Sec. 34, T8S, R5E	A1C 1040	CIN2 1664	PDC 2879
NE-SE-SW	CLN 1372	CIN1 1705	
El. 713 - TD 2930 (GRL)	CAT 1388	UTC 1784	

Lenawee County (continued)

Operator: Houseknecht Oil	DND 652	CIN5 1700	TRN 2460
Farm: Gillen #1	DTR 746	CIN4 1756	BLR 2726
PN: 23863	A2C 1243	CIN3 1816	GLW 3038
Sec. 12, T9S, R1E	A1C 1305	CIN2 1928	PDC 3052
NE-NE-NW	CLN 1606	CIN1 1970	
El. 766 - TD 3139 (GRL)	CAT 1626	UTC 2048	

Operator: Neptune Oil	DND 597	CIN5 1718	TRN 2472
Farm: Raymond Estate #1	DTR 694	CIN4 1762	BLR 2755
PN: 23295	A2C 1250	CIN3 1826	GLW 3094
Sec. 3, T9S, R3E	A1C 1304	CIN2 1940	PDC 3109
NW-NE-NE	CLN 1622	CIN1 1980	
El. 752 - TD 3200 (GRL)	CAT 1645	UTC 2060	

Monroe County

Operator: Basin Oil	DND 99	CIN5 1819	TRN 2452
Farm: Kanitz et ux #1	DTR 153	CIN4 1850	BLR 2829
PN: 22092	A2C 1203	CIN3 1896	GLW 3251
Sec. 13, T5S, R6E	A1C 1254	CIN2 2014	TRM 3260
SE-SE-SE	CLN 1689	CIN1 2071	
El. 677 - TD 3343 (GRL)	CAT 1712	UTC 2126	

Operator: Bell & Marks	DND 171	CIN5 1855	TRN 2488
Farm: Lennard #1	DTR 266	CIN4 1895	BLR 2868
PN: 23659	A2C 1288	CIN3 1942	GLW 3274
Sec.15, T5S, R6E	A1C 1345	CIN2 2056	TRM 3290
SE-SE-NE	CLN 1726	CIN1 2108	
El. 682 - TD 3313 (GRL)	CAT 1749	UTC 2166	

Operator: Huffmaster	DND 126	CIN5 1910	TRN 2512
Farm: Bordine #1			
PN: 3368			
Sec.16, T5S, R6E			
NW-SE-NW	CLN 1798		
El. 701 - TD 2660 (SDR)			

Operator: Olmstead	DND --	CIN5 1707	TRN 2325
Farm: Frink #1	DTR 68		
PN: 3667			
Sec. 25, T5S, R6E			
SW-SE-NE	CLN 1610		
El. 672 - TD 2800 (SDR)	CAT 1641	UTC 2075	

Operator: Dayton	DND --
Farm: Fasking #1	DTR 68
PN: 1097	
Sec. 30,T5S, R6E	
NE-NE	
El. 692 - TD 3398 (SDR)	

Monroe County (continued)

Operator: Bell & Marks	DND 60	CIN5 1903	TRN 2511
Farm: Heath #1	DTR 132		BLW 2896
PN: 23531	A2C 1330		GLW 3366
Sec. 4, T5S, R7E			TRM 3378
SE-SE-NE	CLN 1777		
El. 658 - TD 3398 (SDR)			

Operator: Dow Chemical Co.	DND --	CIN5 1889	TRN 2462
Farm: Grassley #1	DTR 100		BLR 2845
PN: 17767			
Sec. 7, T5S, R7E			TRM 3285
SE-SE-NW	CLN 1708		
El. 680 - TD 3325 (SDR)	CAT 1836		

Operator: Humble Oil	DND 77	CIN5 1884	TRN 2499
Farm: McCrea Comm. #1	DTR 189		BLR 2858
PN: 25606	A2C 1320		
Sec. 9,T5S, R7E			
C-NW-NW	CLN 1767		
El. 689 - TD 3255 (SDR)	CAT 1787	UTC 2186	

Operator: Collin	DND --	CIN5 1885	TRN 2480
Farm: Denhard #1	DTR 64		
PN: 19419			
Sec. 10,T5S, R7E			
NW-NE-NW	CLN 1753		
El. 667 - TD 2811 (SDR)	CAT 1775		

Operator: Humble Oil	DND 130	CIN5 1829	TRN 2441
Farm: Oger #1	DTR 228	CIN4 1844	BLR 2803
PN: 24405	A2C 1230	CIN3 1890	GLW 3206
Sec. 15, T5S, R7E	A1C 1296	CIN2 2006	TRM 3226
C-SE-SE	CLN 1703	CIN1 2068	
El. 676 - TD 3260 (GRL)	CAT 1723	UTC 2126	

Operator: Simpson	DND 56	CIN5 1798	TRN 2420
Farm: Jennings GG #1	DTR 120	CIN4 1820	BLR 2771
PN: 23532	A2C 1194	CIN3 1863	GLW 3164
Sec. 22, T5S, R7E	A1C 1258	CIN2 1979	TRM 3184
NW-SE-NW	CLN 1674	CIN1 2036	
El. 663 - TD 3280 (GRL)	CAT 1697	UTC 2098	

Operator: McClure & Mask	DND --	CIN5 1799	TRN 2420
Farm: Jennings #1	DTR 57		BLR 2771
PN: 19227			GLW 3200
Sec. 22, T5S, R7E			TRM 3220
SE-NW-NW	CLN 1686		
El. 665 - TD 2728 (GRL)	CAT 1708		

Monroe County (continued)

Operator: None listed			TRN 2430
Farm: Leminard			
PN: None listed			
Sec. 16, T5S, R10E			
NW-NE			
El. 580 - TD 2430 (SDR)			
Operator: Sturman	DND --	CIN5 1375	TRN 2000
Farm: Chapman #1			BLR 2381
PN: 11221			GLW 2846
Sec. 29, T5S, R10E			TRM 2865
NE-NE-NW	CLN 1261		
El. 597 - TD 2377 (SDR)	CAT 1277		
Operator: Cilley			TRN 2227
Farm: Huntley #1			
PN: 549			
Sec. 15, T6S, R6E			
W-NW			
El. 695 - TD 2100 (SDR)			
Operator: Morriss	DND 70		TRN 2243
Farm: Lidster #1			
PN: 980			GLW 2953
Sec. 18, T6S, R6E			TRM 2965
NW-NW			
El. 707 - TD 3160 (SDR)			
Operator: Morriss	DND 77	CIN5 1560	TRN 2148
Farm: Reau #1			
PN: 957			
Sec. 18, T6S, R6E			
SE-SW			
El. 707 - TD 2262 (SDR)			
Operator: Morriss	DND 70	CIN5 1555	TRN 2125
Farm: LaPointe & Dusseau #1			
PN: 835			
Sec. 19, T6S, R6E			
NE-NE-NW			
El. 709 - TD 2253(SDR)	CAT 1440		
Operator: Basin Oil	DND --	CIN5 1530	TRN 2118
Farm: Dusseau & LaPointe #2	DTR 83		
PN: 6798			
Sec. 19, T6S, R6E			
SE-SE-NW			
El. 676 - TD 2191 (SDR)	CAT 1434		

Monroe County (continued)

Operator: A.V. Oil Farm: Roe #2 PN 3637 Sec. 19, T6S, R6E SE-SE-SW El. 676 - TD 2078 (SDR)	DND 64 CLN 1275	CIN5 1404	TRN 2058
Operator: McPheron Farm: Roe #1 PN: 2952 Sec. 19, T6S, R6E SE-SE-SW El. 681 - TD 2110 (SDR)	DND -- DTR 60 CAT 1380	CIN5 1470	TRN 2061
Operator: McPheron Farm: Roe #6 PN: 7364 Sec. 19, T6S, R6E NW-NE-SW El. 676 - TD 2160 (SDR)	DND -- DTR 80 CLN 1295	CIN5 1416	TRN 2096
Operator: McPheron Farm: Gaertner #3 PN: 6767 Sec. 19, T6S, R6E NW-SW-SE El. 677 - TD 3137 (SDR)	DND 70 CLN 1290	CIN5 1470	TRN 2072
Operator: Clapsaddle et al Farm: Reaume #1 PN: 7301 Sec. 20, T6S, R6E El. 675 - TD 2460 (SDR)	DND 71 CAT 1473	CIN5 1572	TRN 2118
Operator: None listed Farm: Dundee Well PN: None listed Sec. 25, T6S, R6E NE-NE El. 680 - TD 2277 (SDR)	DND 38 DTR 103	CIN5 1563	TRN 2133
Operator: Jetter Drilling Farm: Morrison #1 PN: 7836 Sec. 26, T6S, R6E NW-NW-SE El. 677 - TD 2233 (SDR)	DND 42 CAT 1442	CIN5 1525	TR 2110

Monroe County (continued)

Operator: McPheron			TRN 2073
Farm: Spahr #1			
PN: 7716			
Sec. 29, T6S, R6E			
NW-NW-NW	CLN 1292		
El. 675 - TD 2172 (SDR)			

Operator: Rowe	DND --		TRN 2099
Farm: Judit #1			
PN: 12833			
Sec. 29, T6S, R6E			
NW-NE-SW			
El. 676 - TD 2510 (SDR)			

Operator: Shiffman	DND 67	CIN5 1598	TRN 2039
Farm: Bragg #1			
PN: 7538			
Sec. 29, T6S, R6E			
SW-SW-SW			
El. 680 - TD 2147 (SDR)			

Operator: Shiffman			TRN 2024
Farm: Bragg #2			
PN: 8847			
Sec. 29, T6S, R6E			
NW-SW-SW			
El. 675 - TD 2125 (SDR)			

Operator: Simon	DND 64	CIN5 1455	TRN 2042
Farm: Rowe #1			
PN: 7190			
Sec. 30, T6S, R6E			
NE-SE-SE			
El. 678 - TD 2124 (SDR)	CAT 1352		

Operator: Dever	DND 62	CIN5 1371	TRN 2060
Farm: Lauer #1	DTR 129	CIN4 1418	
PN: 23850	A2C 837	CIN3 1467	
Sec. 30, T6S, R6E	A1C 888	CIN2 1580	
NE-NW-NW	CLN 1257	CIN1 1701	
El. 678 - TD 2160 (GRL)	CAT 1270	UTC 1848	

Operator: Good & Good	DND --	CIN5 1353	TRN 2043
Farm: Roe #1		CIN4 1398	BLR 2393
PN: 22879	A2C 796	CIN3 1445	
Sec. 30, T6S, R6E	A1C 844	CIN2 1559	
NE-NE-SW	CLN 1235	CIN1 1680	
El. 678 - TD 2437 (GRL)	CAT 1248	UTC 1829	

<u>Monroe County</u> (continued)

Operator: A.V. Oil	DND --	CIN5 1455	TRN 2045
Farm: Vandercook #1	DTR 56		
PN: 2688			
Sec. 30, T6S, R6E			
NE-SE-NE			
El. 680 - TD 2184 (SDR)		UTC 1850	
Operator: Berston	DND --	CIN5 1472	TRN 2055
Farm: Mueller #1	DTR 80		
PN: 12115			
Sec. 30, T6S, R6E			
SE-NW-NW			
El. 676 - TD 2104 (SDR)	CAT 1376		
Operator: McPheron	DND --	CIN5 1503	TRN 2068
Farm: Montry #5	DTR 85		
PN: 9257			
Sec. 30, T6S, R6E			
NW-SE-SW			
El. 677 - TD 2311 (SDR)	CAT 1355		
Operator: Vanco Oil	DND --	CIN5 1466	TRN 2052
Farm: Montry #2			
PN: 7393			
Sec. 30, T6S, R6E			
SW-SE-SW	CLN 1256		
El. 678 - TD 2184 (SDR)	CAT 1376		
Operator: Fisher-McCall Oil	DND --	CIN5 1535	TRN 1535
Farm: Brunt #1	DTR 60		
PN: 7105			
Sec. 30, T6S, R6E			
NE-SW-SW			
El. 679 -TD 2137 (SDR)			
Operator: Good & Good	DND 105		TRN 2064
Farm: Halberstadt #1			
PN: 7201			
Sec. 31, T6S, R6E			
SW-NE-NW	CLN 1070		
El. 678 - TD 2265 (SDR)		UTC 1838	
Operator: McPheron	DND 90	CIN5 1362	TRN 2040
Farm: Duval #1			
PN: 6965			
Sec. 31, T6S, R6E			
SW-NE-SW	CLN 1070		
El. 675 - TD 2110 (SDR)			

Monroe County (continued)

Operator: Powell &Gilbreath DND 56 CIN5 1483 TRN 2034
Farm: Cain #1
PN: 7211
Sec. 31, T6S, R6E
NW-NE-SW CLN 1238
El. 678 - TD 2150 (SDR) CAT 1394

Operator: Good & Good DND 60 CIN5 1472 TRN 2054
Farm: Montry #4
PN: 8569
Sec. 31, T6S, R6E
NW-NE-NW
El. 676 - TD 2144 (SDR) CAT 1365

Operator: Duffey CIN5 1542 TRN 2184
Farm: Russell Estate #1
PN: 8730
Sec. 5, T6S, R7E
SW-SW-SW CLN 1381
El. 648 - TD 2286 (SDR) UTC 1987

Operator: Dow Chemical
Farm: Kopka #1 DTR 43 CIN5 1558 TRN 2233
PN: 19263
Sec. 7, T6S, R7E
NW-NW-SW
El. 667 - TD 2360 (SDR) UTC 2156

Operator: None listed TRN 2150
Farm: Norgard
PN: None listed
Sec. 8, T6S, R7E
NW-NW
El. 660 - TD 2150 (SDR)

Operator: Bell &Gault TRN 2037
Farm: Brossia #1
PN: 26755
Sec. 13, T6S, R7E
SE CLN 1258
El. 633 - TD 2116 (SDR)

Operator: Morriss TRN 1985
Farm: Elconin #1
PN: 11180
Sec. 1, T6S, R9E
NE-SW-SW
El. 590 - TD 1925 (SDR)

Monroe County (continued)

Operator: Morriss	DND --		TRN 1895
Farm: Compau #1	DTR --		BLR 2287
PN: 13867			GLW 2745
Sec. 12, T6S, R9E			TRM 2763
SW-SW-NE	CLN 1135		
El. 592 - TD 2910 (SDR)	CAT 1155	UTC 1725	
Operator: Harvey	DND --	CIN5 1377	TRN 2033
Farm: Brackett #1			
PN: 7471			
Sec. 4, T7S, R6E	CLN 1230		
NW-NE-NW	CAT 1244		
El. 673 - TD 2270 (SDR)			
Operator: McDonald			TRN 2007
Farm: McCarty #1			
PN: 7519			
Sec, 6, T7S, R6E			
NE-NE-NE	CLN 1200		
El. 677 - TD 2105 (SDR)			
Operator: Berell Oil		CIN5 1760	TRN 1985
Farm: Yape #1			
PN: 7424			
Sec. 7, T7S, R6E			
SW-SE-NW			
El. 680 - TD 2295 (SDR)			
Operator: Ferguson& Garrison		CIN5 1272	TRN 1963
Farm: Shimp #1			BLR 2300
PN: 25494	A2C 666		GLW 2698
Sec. 16, T7S, R6E			TRM 2720
S-SE-SE	CLN 1150		
El. 686 - TD 3671 (SDR)	CAT 1162		
Operator: Brailey Oil	DND --		TRN 1957
Farm: Ault #1	DTR --		
PN: 6610			
Sec. 17, T7S, R6E			
NW SW NW	CLN 1240		
El. 678 - TD 2850 (SDR)	CAT 1255	UTC 1810	
Operator: Rowe	DND --		TRN 1931
Farm: Bieber #1	DTR--		
PN: 15091			
Sec. 18, T7S, R6E			
SW-NW-SW	CLN 1225		
El. 680 - TD 2016(SDR)	CAT 1236	UTC 1710	

Monroe County (continued)

Operator: Meredith & Merrill	DND --	CIN5 1358	TRN 1947
Farm: Bieber #1			
PN: 19620			
Sec. 18, T7S, R6E			
NE-NW-SW			
El. 684 - TD 2437 (SDR)	CAT 1265	UTC 1750	

Operator: Bernhardt Oil	DND --	CIN5 1226	TRN 1944
Farm: Allen #2	DTR 35		BLR 2237
PN: 25378	A2C 663		GLW 2650
Sec. 19, T7S, R6E			TRM 2670
SW-SW-SW	CLN 1110		
El. 688 - TD 2763 (SDR)		UTC 1701	

Operator: Bernhardt Oil	DND --	CIN5 1163	TRN 1881
Farm: Allen #1	DTR 24		BLR 2205
PN: 21076			
Sec. 30, T7S, R6E			
NE-NE-NW	CLN 1051		
El. 687 - TD 2400 (SDR)			

Operator: Bernhardt Oil	DND --	CIN5 1192	TRN 1910
Farm: Kain #1	DTR 28		
PN: 20803			
Sec. 30, T7S, R6E			
NE-NW-NW	CLN 1078		
El. 689 - TD 2382 (GRL)			

Operator: Dow Chemical Co.	DND --	CIN5 1140	TRN 1844
Farm: Steuwe et ux #1	DTR --		BLR 2131
PN: 19563			
Sec. 34, T7S, R6E			
NW-NW-SW	CLN 1020		
El. 679 - TD 2199 (SDR)	CAT 1037	UTC 1637	

Operator: Parsons Bros	DND --	CIN5 1317	TRN 1976
Farm: Newcomb #1			
PN: 19574			
Sec. 4, T7S, R7E			
NW-NE-NE	CLN 1190		
El. 649 - TD 2179 (SDR)	CAT 1208		

Operator: Parsons Bros.	DND --	CIN5 1335	TRN 2002
Farm: Howard #1	DTR 14		
PN: 19823			
Sec. 4, T7S, R7E			
NW-SW-NW	CLN 1213		
El. 659- TD 2124 (SDR)	CAT 1230		

Monroe County (continued)

Operator: Grand Oil		CIN5 1460	TRN 2009
Farm: Waltz #1			BLR 2335
PN: 22475	A2C 767		
Sec. 4,T7S, R7E			
NW-NW-SE	CLN 1343		
El. 654 - TD 2443 (SDR)			

Operator: Grand Oil	DND --	CIN5 1275	TRN 1938
Farm: Bastian #1			
PN: 22220			
Sec. 9, T7S, R7E			
NW-NE-NE	CLN 1153		
El. 649 - TD 2350 (SDR)			

Operator: McClure	DND --	CIN5 1247	TRN 1992
Farm: Stotz-Williams #1		CIN4 1257	BLR 2409
PN: 25062	A2C 624	CIN3 1286	GLW 2877
Sec. 10, T7S, R7E		CIN2 1396	TRM 2890
SW-SW-NE	CLN 1112	CIN1 1530	
El. 650 - TD 2989 (GRL)	CAT 1130	UTC 1691	

Operator: Basin Oil	DND --	CIN5 1170	TRN 1831
Farm: Metz Comm. #1		CIN4 1186	BLR 2182
PN: 23024	A2C 610	CIN3 1226	GLW 2610
Sec. 12, T7S, R7E		CIN2 1336	TRM 2627
SE-NE-SE	CLN 1037	CIN1 1450	
El. 627 - TD 2659 (GRL)	CAT 1053	UTC 1610	

Operator: Beck	DND --	CIN5 1348	TRN 1948
Farm: Sancrant #1	DTR 38		
PN: 7702			
Sec. 19, T7S, R7E			
NW-SW-NW	CLN 1207		
El. 669 - TD 5495 (SDR)	CAT 1225		

Operator: Strasburg Oil	DND --	CIN5 1300	TRN 1884
Farm: Hansberger #1	DTR --		
PN: None listed			
Sec. 5, T7S, R8E			
NW-NW			
El. 625 - TD 1989 (SDR)			

Operator: Hack Drilling	DND --	CIN5 1218	TRN 1870
Farm: Weeman #1	DTR --	CIN4 1228	BLR 2222
PN: 23356	A2C 566	CIN3 1248	GLW 2654
Sec. 6, T7S, R8E	A1C 644	CIN2 1364	TRM 2668
NW-SE-SE	CLN 1086	CIN1 1490	
El. 641 - TD 2711 (GRL)	CAT 1103	UTC 1642	

Monroe County (continued)

Operator: Parsons Bros.		CIN5 1268	TRN 1829
Farm: Weeman #1			BLR 2166
PN: 19573			
Sec. 7, T7S, R8E			
SW-SE-NW			
El. 630 - TD 2313 (SDR)			

Operator: Midwest Explor.	DND --		TRN 1793
Farm: Inklovich #1	DTR --		
PN: 28581			
Sec. 9, T7S, R8E			
SE-NE-SW	CLN 1200		
El. 623 - TD 2549 (SDR)			

Operator: None listed	DND --	CIN5 1150	TRN 1735
Farm: Moore Well	DTR --		
PN: None listed			
Sec. ?, T7S, R9E			
Not listed			
El. 585 - TD 1750 (SDR)	CAT 1060		

Operator: Ashland Oil	DND --	CIN5 1072	TRN 1780
Farm: Nichols #1	DTR --	CIN4 1100	BLR 2103
PN: 26224	A2C 543	CIN3 1130	GLW 2504
Sec. 5, T8S, R6E	A1C 619	CIN2 1230	TRM 2520
C-SE-SE	CLN 953	CIN1 1385	
El. 693 - TD 2777 (GRL)	CAT 967	UTC 1544	

Operator: Bernhardt Oil	DND --	CIN5 1186	TRN 1917
Farm: Creque #1	DTR 45		BLR 2216
PN: 21345			
Sec. 6, T8S, R6E			
SE-SW-SE	CLN 1063		
El. 692 - TD 2424 (SDR)			

Operator: Bauer	DND --	CIN5 1040	TRN 1741
Farm: Berry #1	DTR --		BLR 2036
PN: 21731			GLW 2504
Sec.16, T8S, R6E			TRM 2522
NW-SW-SE	CLN 915		
El. 684 - TD 2321 (SDR)			

Operator: Bauer	DND --	CIN5 1007	TRN 1724
Farm: Madalinski #1	DTR --		BLR 2021
PN: 22423			GLW 2478
Sec. 17, T8S, R6E			TRM 2489
SW-SW-SE	CLN 907		
El. 680 - TD 2516 (SDR)			

Monroe County (continued)

Operator: Bauer	DND --	CIN5 1035	TRN 1750
Farm: Schaedler #1	DTR --		BLR 2055
PN: 23307			
Sec. 17, T8S, R6E			
SE-SW-SW	CLN 915		
El. 674 - TD 2076 (SDR)			

Operator: Smoots	DND 145	CIN5 1435	TRN 2146
Farm: Rittner #1	DTR 218		BLR 2458
PN: 22788	A2C 865		
Sec. 18, T8S, R6E			
SE-SE-NW	CLN 1318		
El. 697 - TD 2505 (SDR)			

Operator: Bauer Bros.	DND --	CIN5 1115	TRN 1738
Farm: Hillebrand #1	DTR --		BLR 2037
PN: 24155			
Sec. 20, T8S, R6E			
SE-SW-NW	CLN 1015		
El. 683 - TD 2500 (SDR)			

Operator: Sun Oil	DND --		TRN 1711
Farm: Clampitt #1	DTR --		BLR 2011
PN: 5031			GLW 2471
Sec. 28, T8S, R6E			TRM 2487
NW-NW-NW	CLN 997		
El. 690 - TD 2513 (SDR)			

Operator: Great Lakes Drlg.	DND 22	CIN5 1294	TRN 2034
Farm: Fisher #1	DTR 80		
PN: 22645	A2C 771		
Sec. 31, T8S, R6E			
SE-SE-NW	CLN 1181		
El. 695 - TD 2233 (SDR)		UTC 1827	

Operator: Great Lakes Drlg.	DND --	CIN5 1070	TRN 1809
Farm: Fisher #1	DTR --	CIN4 1103	BLR 2133
PN: 23373	A2C 550	CIN3 1138	GLW 2523
Sec. 31, T8S,R6E	A1C 630	CIN2 1243	TRM 2542
SE-SE-NE	CLN 961	CIN1 1396	
El. 696 - TD 2579 (GRL)	CAT 977	UTC 1556	

Operator: Norton &Tuttle	DND --	CIN5 1039	TRN 1711
Farm: Schultz #1	DTR --		BLR 2017
PN: 22117			GLW 2477
Sec. 1, T8S, R7E			TRM 2500
SE-SW-SW	CLN 908		
El. 636 - TD 2531 (SDR)		UTC 1607	

Monroe County (continued)

Operator: Dow Chemical	DND --	CIN5 1060	TRN 1733
Farm: Yarger #1	DTR --		BLR 2005
PN: 19773			
Sec. 2, T8S, R7E			
SE-SW-SW	CLN 905		
El. 642 - TD 2054 (SDR)	CAT 931	UTC 1620	

Operator: Amer.Hydrocarbons	DND --	CIN5 1108	TRN 1813
Farm: McBride #1	DTR --		BLR 2128
PN: 22737	A2C 495		
Sec. 8, T8S, R7E			
E-SW-NW	CLN 973		
El. 668 - TD 2601 (SDR)			

Operator: Hess & Roy	DND --	CIN5 1060	TRN 1757
Farm: Brunt #1	DTR --		
PN: 381			
Sec. 9, T8S, R7E			
NE-NE			
El. 642 - TD 2164 (SDR)		UTC 1500	

Operator: Erie Oil	DND --	CIN5 1000	TRN 1690
Farm: Temperance	DTR --		
PN: None listed			
Sec. 31, T8S R7E			
SE			
El. 645 - TD 1755 (SDR)	CAT 870		

Operator: None listed			TRN 1598
Farm: Bedford-Erie #2			
PN: None listed			
Sec. 36, T8S, R7E			
E-NW			
El. 595 - TD 1658 (SDR)			

Operator: Kruidenier	DND --	CIN5 916	TRN 1544
Farm: Potter et al #1	DTR --		
PN: 15183			
Sec. 22, T8S, R8E			
NE-NW-NW	CLN 738		
El. 577 - TD 1830 (SDR)	CAT 755		

Washtenaw County

Operator: Albers	DND 1522	CIN5 3671	TRN 4338
Farm: Kaiser #1			BLR 4691
PN: 25698	A2C 2880		
Sec. 6, T1S, R3E			
SE-NE-NW	CLN 3495		
El. 969 - TD 4784 (SDR)			

Operator: Albers	DND 1527	CIN5 3646	TRN 4300
Farm: Hannawald #1	DTR 1640	CIN4 3719	BLR 4744
PN: 28620	A2C 2862	CIN3 3779	
Sec. 6, T1S, R3E	A2E 2942	CIN2 3906	
NE-SW-SW	CLN 3295	CIN1 3949	
El. 960. TD 5020 (GRL)	CAT 3307	UTC 4022	

Operator: Ohio Oil	DND 1494	CIN5 3560	TRN 4220
Farm: Cooper #1	DTR 1606	CIN4 3633	BLR 4637
PN: 19384	A2C 2833	CIN3 3744	GLW 5044
Sec. 7, T1S, R3E	A2E 2918	CIN2 3825	PDC 5054
SW-SW-SE	CLN 3407	CIN1 3870	
El. 938 - TD 5154 (GRL)	CAT 3426	UTC 3936	

Operator: Dannemiller	DND 1723	CIN5 3879	TRN 4660
Farm: Prentice #1			
PN: 25057	A2C 3085		
Sec. 18, T1S, R3E			
C-SW-NW	CLN 3704		
El. 939 - TD 4846 (SDR)		UTC 4379	

Operator: Simpson & Gulf	DND 1540	CIN5 3598	TRN 4270
Farm: Wagner #1	DTR 1630	CIN4 3682	BLR 4704
PN: 24161	A2C 2873	CIN3 3739	GLW 5087
Sec. 22, T1S, R3E	A2E 2945	CIN2 3863	PDC 5097
SW-SW-NW	CLN 3454	CIN1 3910	
El. 961 - TD 5159 (GRL)	CAT 3474	UTC 3979	

Operator: Hunt	DND 1448		
Farm: Weber et al #1-26	DTR 1567		
PN: 32581	A2C 2804		
Sec. 26, T1S, R4E	CLN 3373		
SE-SW-SW			
El. 917 - TD 3401 (SDR)			

Operator: Hunt	DND 1397		
Farm: Gooding-Douthat #1-24			
PN: 32683	A2C 2988		
Sec. 24, T1S, R5E			
NW-SW-SE			
El. 938 - TD 3584 (SDR)			

Washtenaw County (continued)

Operator: Cities Service	DND 1470		
Farm: Brassow	DTR 1567		
PN: 29964	A2C 2933		
Sec. 28, T1S, T5E			
NE-NE-SW			
El. 959 - TD 3460 (GRL)			

Operator: Sun	DND 1558	CIN5 3536	TRN 4185
Farm: Nixon #1	DTR 1650	CIN4 3606	BLR 4624
PN: 19371		CIN3 3666	
Sec. 33, T1S, R5E		CIN2 3781	
SW-SW-NW	CLN 3386	CIN1 3824	
El. 952 - TD 4998 (GRL)	CAT 3406	UTC 3896	

Operator: Hunt	DND 1344		
Farm: Whitmore Lake Devel. Goff #1-8	DTR 1482		
PN: 32734	A2C 3074		
Sec. 8, T1S,R6E			
SW-NE-NE			
El. 922 - TD 3630 (SDR)			

Operator: Hunt	DND 1173		
Farm: Vose et al #1-26	DTR 1316		
PN: 32704	A2C 2934		
Sec. 26, T1S, R6E			
SE-NW-SE			
El. 979 - TD 3480 (SDR)			

Operator: Taggart	DND 707	CIN5 3636	TRN 4247
Farm: LeMaster #1			
PN: 18796			
Sec. 1, T1S, R7E			
NW-SE-SE			
El. 962 - TD 4397 (SDR)	CAT 3528		

Operator: Taggart	DND 695	CIN5 3630	TRN 4235
Farm: LeMaster #5			
PN: 19039			
Sec. 1, T1S, R7E			
NE-SW-SE			
El. 954 - TD 4468 (SDR)	CAT 3510	UTC 3950	

Operator: Consumers Power	DND 735	CIN5 3667	TRN 4274
Farm: Sprenger et al #1			
PN: 21142	A2C 2998		
Sec. 1, T1S, R7E			
SW-SW-NW	CLN 3515		
El. 986 - TD 4701 (SDR)	CAT 3557		

Washtenaw County (continued)

Operator: Consumers Power	DND 728	CIN5 3558	TRN 4105
Farm: Buers #1			
PN: 19240	A2C 2910		
Sec. 1, T1S, R7E			
NE-NW-SW	CLN 3430		
El. 977 - TD 4519 (SDR)	CAT 3462		

Operator: Consumers Power	DND 1562	CIN5 3676	TRN 4274
Farm: Sprenger et al #1	DTR 1685	CIN4 3716	
PN: 19088	A2C 3010	CIN3 3787	
Sec. 1, T1S, R7E	A2E 3170	CIN2 3884	
SE-SW-NW	CLN 3516	CIN1 3908	
El. 988 - TD 4478 (GRL)		UTC 3988	

Operator: Albers		CIN 5 3750	TRN 4362
Farm: Merritt #1			BLR 4769
PN: 19010	A2C 3055		
Sec. 1, T1S, R7E	A2E 3231		
SE-NW-NW			
El. 982 - TD 4881 (SDR)	CAT 3630		

Operator: Taggart	DND 825	CIN5 3443	TRN 4040
Farm: Rider			BLR 4485
PN: 19089			
Sec. 2, T1S, R7E			
NW-SE-SE			
El. 974 - TD 4549 (SDR)	CAT 3320		

Operator: Consumers Power	DND 1456	CIN5 3536	TRN 4085
Farm: Cons. Power #105	DTR 1576	CIN4 3579	
PN: 18949	A2C 2897	CIN3 3626	
Sec. 2, T1S, R7E	A2E 3058	CIN2 3730	
SE-SE-NE	CLN 3380	CIN1 3750	
El. 984 - TD 4551 (GRL)	CAT 3416	UTC 3814	

Operator: Rovsek	DND 1049	CIN5 3739	TRN 4347
Farm: Bulman #1			BLR 4806
PN: 25759	A2C 3052		GLW 5252
Sec. 2, T1S, R7E			TRM 5258
NE-NW-SW	CLN 3581		
El. 996 - TD 5377 (SDR)		UTC 4054	

Operator: Consumers Power	DND 745	CIN5 3495	TRN 4038
Farm: Dolan #1			BLR 4474
PN: 19064	A2C 2830		
Sec. 2, T1S, R7E			
NE-NE-SE	CLN 3312		
El. 983 - TD 4508 (SDR)	CAT 3367		

Washtenaw County (continued)

Operator: Consumers Power	DND 849	CIN5 3525	TRN 4116
Farm: Fitzgerald #2			
PN: 24318	A2C 2750		
Sec. 2, T1S, R7E			
NE-SE-NW	CLN 3374		
El. 1013 - TD 4430 (SDR)		UTC 3828	

Operator: Rovsek	DND 1038	CIN5 3768	TRN 4402
Farm: Engel #1-A	DTR 1131	CIN4 3816	BLR 4860
PN: 23743	A2C 3061	CIN3 3892	GLW 5270
Sec. 3,T1S, R7E	A2E 3254	CIN2 3992	PDC 5275
NW-NW-SE	CLN 3610	CIN1 4012	
El. 1040 - TD 5317 (GRL)	CAT 3640	UTC 4100	

Operator: Flemming	DND 1126	CIN5 3811	TRN 4424
Farm: Taylor #1			BLR 4875
PN: 19342			
Sec. 3, T1S, R7E			
SE-NW-NE			
El. 1007 - TD 5200 (SDR)	CAT 3695	CIN5 3825	TRN 4436

Operator: Zellman	DND 1236		
Farm: Baumgardner #1			
PN: 19499			
Sec. 8, T1S, R7E			
NW-SE-NW	CLN 3665		
El. 945 - TD 4706 (SDR)			

Operator: Albers	DND 1059	CIN5 3732	TRN 4340
Farm: Isac			
PN: 19820	A2C 3020		
Sec. 11, T1S, R7E			
NW-NE-NW	CLN 3570		
El. 953 - TD 4752 (SDR)	CAT 3601		

Operator: Collin	DND 839	CIN5 3463	TRN 4078
Farm: Brummel et al #1			BLR 4528
PN 19254	A2C 2811		
Sec. 12, T1S, R7E			
SE-NW-SE			
El. 937 - TD 4284 (SDR)	CAT 3350		

Operator: Consumers Power	DND 668	CIN5 3300	TRN 3892
Farm: Haray et al #1			BLR 4300
PN: 18841			
Sec. 12, T1S, R7E			
W-NW-NE			
El. 940 - TD 4445 (SDR)	CAT 3196		

Washtenaw County (contined)

Operator: Consumers Power		CIN5 3345	TRN 3922
Farm: Butler et al #2			
PN: 19166	A2C 2648		
Sec. 12, T1S, R7E			
NE-SE-NE			
El. 939 - TD 4564 (SDR)			
Operator: McClure	DND 1007	CIN5 3564	TRN 4168
Farm: Noble #1	DTR 1130		
PN: 19121	A2C 2883		
Sec. 13, T1S, R7E	A2E 3092		
SW-SE-SW	CLN 3408		
El. 875 - TD 4684 (SDR)	CAT 3434		
Operator: Union Drlg.	DND 1143	CIN5 3710	TRN 4318
Farm: Voss Comm. #1			
PN: 10141			
Sec. 16, T1S, R7E			
SW-NW-NE	CLN 3553		
El. 915 - TD 6410 (SDR)	CAT 3580		
Operator: West	DND 1024		TRN 4153
Farm: Rogers #1	DTR 1162		
PN: 18929	A2C 2288		
Sec. 23, T1S, R7E			
SE-SE-NW	CLN 3396		
El. 883 - TD 4559 (SDR)			
Operator: Chamness	DND 1009	CIN5 3520	TRN 4117
Farm: Troy Comm. #1			
Sec. 27, T 1S, R7E			
NE-SE-NE	CLN 3354		
El. 886 - TD 6094 (SDR)	CAT 3382		
Operator: Johnson & Pew	DND 1364	CIN5 3344	TRN 4020
Farm: Mohrlock-Shears Com.	DTR 1480	CIN4 3423	BLR 4430
#1		CIN3 3476	
PN: 19751	A2C 2663	CIN2 3604	
Sec. 14, T2S, R3E	A2E 2753	CIN1 3654	
NW-NW-SW	CLN 3214	UTC 3728	
El. 993 - TD 4659 (GRL)	CAT 3232		
Operator: Peake	DND 1272	CIN5 3227	TRN 3898
Farm: Goers #1	DTR 1390	CIN4 3303	BLR 4319
PN: 24396	A2C 2538	CIN3 3360	GLW 4698
Sec. 25, T2S, R3E	A2E 2618	CIN2 3478	PDC 4710
NW-SW-NE	CLN 3091	CIN1 3530	
El. 939 - TD 4758 (GRL)	CAT 3112	UTC 3596	

<u>Washtenaw County</u> (continued)

Operator: DeGenther	DND 1237	CIN5 3164	TRN 3814
Farm: Wenk #1			BLR 4236
PN: 19891			GLW 4615
Sec. 33, T2S, R4E			PDC 4625
SE-SW-SW	CLN 3020		
El. 918 - TD 4758 (SDR)	CAT 3051		
Operator: Worsley	DND 1045	CIN5 3067	TRN 3712
Farm: Miller &Holtz #1			
PN: 19202			
Sec. 28, T2S, R5E			
NE-SW-NW			
El. 890 - TD 4215 (SDR)	CAT 2960		
Operator: Colvin & Assoc.	DND 808	CIN5 3205	TRN 3798
Farm: Meinzinger #1	DTR 930		BLR 4235
PN: 11341			GLW 4689
Sec.12, T2S, R7E			PDC 4696
SE-NE-NW	CLN 3057		
El. 818 - TD 5692 (SDR)	CAT 3090		
Operator: Rovsek	DND 644	CIN5 3045	TRN 3793
Farm: Jorgensen #1	DTR 749	CIN4 3234	BLR 4332
PN: 25714	A2C 2367	CIN3 3280	GLW 4867
Sec. 26, T2S, R7E	A2E 2544	CIN2 3427	PDC 4874
NE-NW-NE	CLN 2873	CIN1 3447	
El. 782 - TD 5002 (GRL)	CAT 2908	UTC 3510	
Operator: Ypsilanti Dev.Co.	DND 714	CIN5 2956	TRN 3540
Farm: Voorhees #1			
PN: 3828			
Sec. 32, T2S, R7E			
NE-NE-SE			
El. 788 - TD 3822 (SDR)	CAT 2816		
Operator: Lima	DND 714	CIN5 2956	TRN 3540
Farm: Voorhees #1			
PN: 3828			
Sec. 32, T2S, R7E			
NE-NE-SE			
El. 788 - TD 2786 (SDR)	CAT 2816		
Operator: Sun	DND 1322	CIN5 3192	
Farm: Horning #1	DTR 1430		
PN: 18701.	A2C 2590		
Sec. 1, T3S, R3E	A2E 2685		
NE-NE-NE	CLN 3057		
El. 924 - TD 3256 (GRL)	CAT 3084		

<u>Washtenaw County</u> (continued)

Operator: Petro-Min	DND 1844	CIN5 3460	TRN 4152
Farm: Whitaker et al #1			BLR 4528
PN: 28911	A2C 2734		GLW 4897
Sec. 20, T3S R3E			PDC 4908
NE-SE-NE	CAT 3320		
El. 995 - TD 5275 (SDR)		UTC 3842	
Operator: NY Petro-Min	DND 1812	CIN5 3428	TRN 4121
Farm: Widmayer #1-A			BLR 4515
PN: 28990	A2C 2702		GLW 4857
Sec. 21, T1S, R3E			PDC 4861
W-SE-SE			
El. 980 - TD 5241 (GRL)		UTC 3808	
Operator: Bell & Gault	DND 1759	CIN5 3432	TRN 4127
Farm: Widmayer #1			BLR 4504
PN: 28655	A2C 2732		GLW 4862
Sec. 21, T3S, R3E			PDC 4867
C-SE-SE	CLN 3293		
El. 978 - TD 5206 (GRL)		UTC 3815	
Operator: Mio-McClure	DND 1238	CIN5 3112	TRN 3785
Farm: Eisemann #1	DTR 1390	CIN4 3187	BLR 4207
PN: 21903	A2C 2460	CIN3 3240	
Sec. 6, T3S, R4E	A1C 2521	CIN2 3354	
C-NW-SE	CLN 2974	CIN1 3406	
El. 967 - TD4392 (GRL)	CAT 2998	UTC 3474	
Operator: The Moco	DND 1252	CIN5 3130	TRN 3802
Farm: Kuhl #1	DTR 1370		
PN: 21309	A2C 2490		
Sec. 8, T3S, R4E	A1C 2551		
SW-SW-SE	CLN 3003		
El. 945 - TD 4271 (GRL)	CAT 3025	UTC 3496	
Operator: Rovsek	DND 1213	CIN5 3087	TRN 3762
Farm: Grau #1	DTR 1334	CIN4 3158	BLR 4178
PN: 27472	A2C 2433	CIN3 3217	GLW 4555
Sec. 8, T3S, R4E	A1C 2496	CIN2 3328	PDC 4563
SW-SE-NE	CLN 2953	CIN1 3379	
El. 957 - TD 4628 (GRL)	CAT 2977	UTC 3450	
Operator: Majeske	DND 1218	CIN5 3119	TRN 3765
Farm: Niehaus et ux #1			
PN: 28782			
Sec. 8, T3S, R4E			
SW-NE-SW	CLN 2993		
El. 948 - TD 3977 (SDR)			

Washtenaw County (continued)

Operator: Sun	DND 1272	CIN5 3185	TRN 3860
Farm: Haab-Grau-Buss #1	DTR 1406	CIN4 3253	
PN: 19608	A2C 2525	CIN3 3303	
Sec. 8, T3S, R4E	A1C 2628	CIN2 3428	
SW-NW-SW	CLN 3056	CIN1 3485	
El. 942 - TD 4155 (GRL)	CAT 3079	UTC 3554	
Operator: Sun	DND 1206	CIN5 3009	TRN 3669
Farm: Meyer #1	DTR 1328	CIN4 3082	BLR 4082
PN: 25607	A2C 2341	CIN3 3136	GLW 4457
Sec. 16, T3S, R4E	A1C 2393	CIN2 3242	PDC 4465
NW-SE-SE	CLN 2877	CIN1 3294	
El. 974 - TD 4524 (GRL)	CAT 2897	UTC 3368	
Operator: Majeske	DND 1524	CIN5 3315	TRN 4001
Farm: DuRussel #1	DTR 1646	CIN4 3390	
PN: 28534	A2C 2765	CIN3 3458	
Sec. 17, T3S, R4E	NGR 2822	CIN2 3517	
SW-NW-NW	CLN 3237	CIN1 3616	
El. 935 - TD 4500(GRL)	CAT 3259	UTC 3694	
Operator: Majeske	DND 1730	CIN5 3443	TRN 4128
Farm: DuRussel #2			BLR 4530
PN: 28596			
Sec. 18, T3S, R4E			
SE-SE-SW	CLN 3308		
El. 947 - TD 4682 (SDR)			
Operator: Majeske	DND 1689		TRN 4118
Farm: DuRussel #3			BLR 4538
PN: 28726			
Sec. 18, T3S, R4E			
NE-NW-SE	CLN 3288		
El. 931 - TD 4655 (SDR)			
Operator: Sun	DND 1252	CIN5 2991	TRN 3642
Farm: Hoener #1	DTR 1364	CIN4 3048	BLR 4052
PN: 27099	A2C 2334	CIN3 3111	GLW 4429
Sec. 21, T3S, R4E	A1C 2384	CIN2 3216	TRM 4444
NE-SW-SE	CLN 2864	CIN1 3267	
El. 1002 - TD 4502 (GRL)	CAT 2884	UTC 3339	
Opr:Washtenaw Co.Rd.Comm.	DND 1120		
Farm: WCRC #2			
PN: Brine	A2C 2300		
Sec. 23, T3S, R4E			
NW-NE-SW	CLN 2768		
El. 971 - TD 2772 (SDR)			

Washtenaw County (continued)

Operator: Texaco	DND 740		
Farm: Kuebler #1	DTR 857		
PN: 27649	A2C 1911		
Sec. 28, T3S, R5E	A1C 1963		
SE-NW-SW	CLN 2454		
El. 896 - TD 2503 (GRL)	CAT 2468		

Operator: Rovsek	DND 357	CIN5 2486	TRN 3076
Farm: Wabash RR #1	DTR 464	CIN4 2540	BLR 3472
PN: 25482	A2C 1796	CIN3 2588	GLW 3876
Sec. 24, T3S, R7E	A1C 1864	CIN2 2682	TRM 3887
SE SE NW	CLN 2350	CIN1 2714	
El. 694 - TD 3973 (GRL)	CAT 2376	UTC 2771	

Operator: Bayley Products	DND 1702	CIN5 3227	TRN 3928
Farm: Hess #1	DTR 1800	CIN4 3310	BLR 4256
PN: 28705	A2C 2542	CIN3 3350	GLW 4614
Sec. 8. T4S, R3E	A1C 2617	CIN2 3462	PDC 4618
NW NW SW	CLN 3104	CIN1 3537	
El. 975 - TD 4663 (GRL)	CAT 3126	UTC 3609	

Operator: Trolz	DND 1638	CIN5 3150	TRN 3846
Farm: Trolz	DTR 1772	CIN4 3200	BLR 4209
PN: 25950	A2C 2560	CIN3 3289	GLW 4558
Sec. 20, T4S, R3E	A1C 2620	CIN2 3408	PDC 4570
NW-SE-SW	CLN 3029	CIN1 3448	
El. 1025 - TD 4640 (GRL)	CAT 3040	UTC 3522	

Operator: Michigan Oil	DND 1181	CIN5 2810	TRN 3475
Farm: Gierbach			
PN: 21249	A2C 2180		
Sec. 21, T4S, R4E			
NW-NW-NW	CLN 2698		
El. 854 - TD 3637 (SDR)			

Operator: Besko	DND 837	CIN5 2476	TRN 3160
Farm: Allen #1-A	DTR 975	CIN4 2533	BLR 3536
PN: 26204	A2C 1878	CIN3 2595	GLW 3889
Sec. 27, T4S, R4E	A1C 1938	CIN2 2710	TRM 3902
SW-SW-NW	CLN 2360	CIN1 2758	
El. 864 - TD 4039 (GRL)	CAT 2374	UTC 2832	

Operator: Taggart	DND 1170	CIN5 2845	TRN 3397
Farm: Curtis #1	DTR 1265		
PN: 18777			
Sec. 28, T4S, R4E			
C-SW-SW	CLN 2710		
El. 859 - TD 3806 (SDR)			

Washtenaw County (continued)

Operator: Peake	DND 932	CIN5 2607	TRN 3322
Farm: Anglemeyre #1	DTR 1080	CIN4 2667	BLR 3770
PN: 22349	A2C 1956	CIN3 2724	
Sec. 34, T4S, R4E	A1C 2006	CIN2 2840	
NE-NW-NW	CLN 2362	CIN1 2890	
El. 918 - TD 3939 (GRL)	CAT 2413	UTC 2969	
Operator: Peake & Harvey	DND 896	CIN5 2444	TRN 3100
Farm: Bohnenstiehl #1	DTR 1020	CIN4 2504	BLR 3491
PN: 23380	A2C 1846	CIN3 2574	GLW 3862
Sec. 34, T4S, R4E	A1C 1902	CIN2 2664	PDC 3878
SW-NW-NE	CLN 2330	CIN1 2710	
El. 919 - TD 3951 (GRL)	CAT 2354	UTC 2786	
Operator: Sun	DND 650	CIN5 2401	TRN 3046
Farm: Filsinger #1	DTR 822		
PN: 19074			
Sec.10,T4S, R5E			
NE-NE-SW	CLN 2268		
El. 859 - TD 3435 (GRL)	CAT 2300		
Operator: Good & Good	DND 533	CIN5 2301	TRN 2945
Farm: Marion GG-1	DTR 670	CIN4 2360	BLR 3351
PN: 23921	A2C 1670	CIN3 2412	GLW 3756
Sec. 14, T4S, R5E	A2E 1729	CIN2 2514	PDC 3764
NW-NW-SE	CLN 2175	CIN1 2561	
El. 795 - TD 3861 (GRL)	CAT 2199	UTC 2635	
Operator: Good & Good	DND 578	CIN5 2325	TRN 2970
Farm: Schowacko GG-1	DTR 727	CIN4 2384	BLR 3375
PN: 24714	A2C 1727	CIN3 2440	GLW 3775
Sec. 16, T4S, R5E	A1C 1768	CIN2 2546	PDC 3784
NE-NE-NW	CLN 2200	CIN1 2590	
El. 864 - TD 3856 (GRL)	CAT 2226	UTC 2663	
Operator: Leonard	DND 620	CIN5 2334	TRN 2985
Farm: Schwocho #1	DTR 760	CIN4 2390	BLR 3394
PN: 26856	A2C 1723	CIN3 2442	GLW 3788
Sec. 17, T4S, R5E	A1C 1782	CIN2 2551	PDC 3802
SE-SE-SE	CLN 2206	CIN1 2595	
El. 862 - TD 3934 (GRL)	CAT 2230	UTC 2672	
Operator: McClure	DND 690	CIN5 2358	TRN 2969
Farm: Lindsley #1	DTR 802		
PN: 19778			
Sec. 32, T4S, R5E			
NW-SE-NW			
El. 875 - TD 3475 (SDR)			

Washtenaw County (continued)

Operator: Basin	DND 375	CIN5 2132	TRN 2757
Farm: Wanty #1	DTR 480	CIN4 2176	BLR 3154
PN: 22292	A2C 1474	CIN3 2226	GLW 3520
Sec. 28, T4S, R6E	A1C 1539	CIN2 2350	PDC 3533
NE-NE-SE	CLN 2006	CIN1 2370	
El. 721 - TD 3637 (GRL)	CAT 2026	UTC 2444	

Operator: Violette	DND --	CIN5 1945	TRN 2545
Farm: Sanderson #1	DTR 70		
PN:930			
Sec. 26, T4S, R7E			
N-S-SW			
El. 674 - TD 2680 (SDR)	CAT 1845		

Wayne County

Operator: Hayes	DND 603		
Farm: Hayes #1	DTR 743		
PN: 26569	A2C 2798		
Sec. 2, T1S, R8E	A2E 2946		
SW-NE-SW	CLN 3308		
El. 806 - TD 3325 (SDR)			

Operator: Collin	DND 725	CIN5 3666	TRN 4303
Farm: Whipple	DTR 800		
PN: 18966	A2C 3020		
Sec. 4, T1S, R8E			
NE-NE-NW	CLN 3542		
El. 951 - TD 4695 (SDR)	CAT 3575	UTC 3940	

Operator: McClure	DND 728	CIN5 3711	TRN 4300
Farm: Howell et al #1	DTR 880		
PN: 18982	A2C 3015		
Sec. 5, T1S, R8E			
NE-NE-NW	CLN 3540		
El. 964 - TD 4772 (SDR)		UTC 3865	

Operator: Sun Oil	DND 700	CIN5 3617	TRN 4225
Farm: Maybury Sanatorium#1	DTR 854	CIN4 3658	
PN: 19348	A2C 2986	CIN3 3753	
Sec. 6, T1S, R8E	A2E 3148	CIN2 3813	
SE-SE-SW	CLN 3462	CIN1 3837	
El. 950 - TD 4720 (GRL)	CAT 3501	UTC 3925	

Operator: Taggart	DND 735	CIN5 3694	TRN 4299
Farm: Dickinson et al #1			
PN: 18995			
Sec. 6, T1S, R8E			
NE-NW-SW	CLN 3542		
El. 963 - TD 4678 (SDR)	CAT 3585		

Wayne County (continued)

Operator: Consumers Power	DND 648	CIN5 3264	TRN 3866
Farm: Terrill et ux #1	DTR 778	CIN4 3308	BLR 4312
PN: 19201	A2C 2620	CIN3 3390	
Sec. 7, T1S, R8E	A2E 2799	CIN2 3456	
SW-NE-SW	CLN 3116	CIN1 3478	
El. 919 - TD 4491 (GRL)	CAT 3165	UTC 3571	
Operator: Union	DND 650	CIN5 3525	TRN 4137
Farm: Angell	DTR 780		
PN: 18897			
Sec. 7, T1S, R8E			
SE-NE-NW	CLN 3370		
El. 921 - TD 4521 (SDR)	CAT 3410		
Operator: Consumers Power	DND 594		TRN 3975
Farm: Thomson #1			
PN: 19241	A2C 2725		
Sec. 8,T1S,R8E			
SW-SW-SW	CLN 3234		
El. 862 - TD 4142 (SDR)			
Operator: Woodson	DND 624	CIN5 3456	TRN 4075
Farm: Lucier #1			BLR 4519
PN: 19665	A2C 2788		
Sec. 9,T1S, R8E	A2E 2970		
SW-SW-SW	CLN 3309		
El. 860 - TD 4590 (SDR)	CAT 3344		
Operator: Consumers Power	DND 645	CIN5 3318	TRN 3868
Farm: Wayne Co. #1			BLR 4293
PN: 19421	A2C 2692		
Sec. 16, T1S, R8E	A2E 2858		
NE-SW-SW			
El. 889 - TD 4439 (SDR)	CAT 3215	UTC 3564	
Operator: Consumers Power	DND 606	CIN5 3295	TRN 3825
Farm: Wayne Co. #2			
PN: 19915	A2C 2630		
Sec.16, T1S, R8E			
SE-SE-SW	CLN 3129		
El. 865 - TD 4380 (SDR)	CAT 3170		
Operator: Consumers Power	DND 593	CIN5 3358	TRN 3955
Farm: Wayne Co. #3	DTR 775		
PN: 20157	A2C 2701		
Sec.16,T1S, R8E	A2E 2868		
SW-SE-SE	CLN 3201		
El. 860 - TD 4287 (SDR)	CAT 3244	UTC 3632	

Wayne County (continued)

Operator: Consumers Power	DND 616	CIN5 3256	TRN 3857
Farm: Det.Hse of Correction#1	DTR750		BLR 4285
PN: 19362	A2C 2604		
Sec. 17,T1S, R8E			
NE-SW-NW	CLN 3116		
El. 847 - TD 4349 (SDR)		UTC 3570	

Operator: Consumers Power	DND 708	CIN5 3320	TRN 3946
Farm:Det.Hse of Cor. #2	DTR 840		
PN: 19432	A2C 2668		
Sec.17, T1S, R8E			
SW-NE-SW	CLN 3178		
El. 838 - TD 4465 (SDR)	CAT 3215	UTC 3650	

Operator: Consumers Power	DND 664	CIN5 3255	TRN 3550
Farm: Det. Hse. of Cor. #3	DTR 797		BLR 4282
PN: 19496	A2C 2665		GLW 4774
Sec. 17, T1S, R8E	A2E 2840		PDC 4782
SW-NE-SE	CLN 3120		
El. 900 - TD 5483 (SDR)	CAT 3160	UTC 3550	

Operator: Consumers Power	DND 594	CIN5 3264	TRN 3867
Farm: Det. Hse. of Cor. #4	DTR 728		
PN: 19730	A2C 2639		
Sec. 17, T1S,R8E			
NW-SE-NW			
El. 841 - TD 4498 (SDR)	CAT 3168	UTC 3580	

Operator: Taggart	DND 660	CIN5 3289	TRN 3885
Farm: George et al #1	DTR 815		BLR 4339
PN: 19329	A2C 2614		GLW 4822
Sec. 18, T1S, R8E	A2E 2800		PDC 4829
SW-NE-NE	CLN 3126		
El. 861 - TD 5130 (SDR)	CAT 3158	UTC 3591	

Operator: Consumers Power	DND 661	CIN5 3234	TRN 3832
Farm: Forbes #1	DTR 789		BLR 4267
PN: 19541	A2C 2589		
Sec. 21, T1S, R8E			
NE-NW-NW	CLN 3080		
El. 879 -TD 4429 (SDR)	CAT 3122	UTC 3565	

Operator: Consumers Power	DND 594	CIN5 3197	TRN 3762
Farm: Millard et al #1			BLR 4210
PN: 19578	A2C 2552		
Sec. 21, T1S, R8E	A2E 2727		
SW-NE-NE	CLN 3039		
El. 854 - TD 4337 (SDR)	CAT 3085	UTC 3457	

Wayne County (continued)

Operator: Consumers Power	DND 597	CIN5 3176	TRN 3774
Farm: CPCO Elvidge #1	DTR 707	CIN4 3206	
PN: 18946	A2C 2533	CIN3 3290	
Sec. 22, T1S, R8E	A2E 2708	CIN2 3364	
NW-NE-SW	CLN 3034	CIN1 3392	
El. 781 - TD 3806 (GRL)	CAT 3066	UTC 3475	

Operator: Consumers Power	DND 605	CIN5 3176	TRN 3774
Farm: Elvidge #1	DTR 717		BLR 4212
PN: 18946	A2C 2522		
Sec. 22, T1S, R8E	A2E 2714		
NW-NE-SW	CLN 3035		
El. 809 - TD 4363 (SDR)	CAT 3072	UTC 3434	

Operator: Consumers Power	DND 575	CIN5 3278	TRN 3841
Farm: Webber #1			BLR 4244
PN: 19936	A2C 2615		
Sec. 22, T1S, R8E			
C-NW-			
El. 826 - TD 4285 (SDR)	CAT 3175	UTC 3570	

Operator: Consumers Power	DND 542	CIN5 3227	TRN 3813
Farm: Raetzal Comm. #1			BLR 4186
PN: 19907	A2C 2581		
Sec. 22, T1S, R8E	CLN 3093		
N-N-SE	CAT 3115		
El. 787 - TD 4240 (SDR)			

Operator: Consumers Power	DND 574	CIN5 3210	TRN 3771
Farm: CPCO #208	DTR 680	CIN4 3230	BLR 4179
PN: 25538	A2C 2562	CIN3 3316	
Sec. 22, T1S, R8E	A2E 2740	CIN2 3372	
NW-NW-SE	CLN 3064	CIN1 3390	
El. 800 - TD 4210 (GRL)	CAT 3098	UTC 3480	

Operator: Peake	DND 475	CIN5 3132	TRN 3729
Farm: Wayne Co. #1	DTR 607		BLR 4156
PN: 21682	A2C 2484		
Sec. 23, T1S, R8E	A2E 2646		
SW-NW-SE	CLN 2982		
El. 713 - TD 4506 (SDR)	CAT 3005		

Operator: Albers	DND 544	CIN5 3176	TRN 3717
Farm: C&O RR #2	DTR 675		BLR 4128
PN: 20794	A2C 2530		
Sec. 23, T1S, R8E			
SW-NW-SW	CLN 3016		
El. 770 - TD 4257 (SDR)	CAT 3050		

Wayne County (continued)

Operator: Consumers Power	DND 508	CIN5 3099	TRN 3702
Farm: Burroughs Corp.#4	DTR 641		BLR 4146
PN: 26024	A2C 2482		
Sec. 24, T1S, R8E	A2E 2636		
SE-SE-SW	CLN 2960		
El. 729 - TD 4305 (SDR)		UTC 3408	

Operator: Peake	DND 530	CIN5 3066	TRN 3656
Farm: Zittel #1	DTR 631	CIN4 3095	BLR 4096
PN: 22978	A2C 2437	CIN3 3182	
Sec. 25, T1S, R8E	A2E 2618	CIN2 3253	
SW-SW-NE	CLN 2927	CIN1 3279	
El. 717 - TD 4369 (GRL)	CAT 2957	UTC 3365	

Operator: Peake	DND 498	CIN5 3024	TRN 3620
Farm: Wayne Co.Rd.Com.#4	DTR 613	CIN4 3054	BLR 4064
PN: 23638	A2C 1196	CIN3 3156	
Sec. 25, T1S, R8E	A2E 1362	CIN2 3234	
NW-SE-SE	CLN 2886	CIN1 3256	
El. 690 -TD 4118 (GRL)	CAT 2915	UTC 3322	

Operator: Peake	DND 467	CIN5 3028	TRN 3624
Farm: Wayne Co.Rd.Com.#2	DTR 590	CIN4 3061	BLR 4030
PN: 22341	A2C 2395	CIN3 3149	
Sec. 26, T1S, R8E	A2E 2566	CIN2 3218	
NW-NE-NE	CLN 2887	CIN1 3244	
El. 683 - TD 4123 (GRL)	CAT 2920	UTC 3330	

Operator: Consumers Power	DND 484	CIN5 3006	TRN 3597
Farm: Holman #1	DTR 604	CIN4 3028	BLR 4036
PN: 26016	A2C 2393	CIN3 3110	
Sec. 30,T1S, R9E	A2E 2570	CIN2 3183	
SW-SW-SW	CLN 2864	CIN1 3215	
El. 706 - TD 4187 (GRL)	CAT 2895	UTC 3296	

Operator: Peake	DND 426	CIN5 2940	TRN 3525
Farm: Wayne Co.Rd.Com.#3	DTR 546	CIN4 2959	BLR 3940
PN: 23362	A2C 2310	CIN3 3041	
Sec. 32, T1S, R9E	A2E 2483	CIN2 3111	
NW-NW-NW	CLN 2797	CIN1 3131	
El. 654 - TD 3986 (GRL)	CAT 2827	UTC 3228	

Operator: Spidel	DND 868	CIN5 3150	TRN 3758
Farm: Spicer #1			
PN: 19634	A2C 2532		
Sec. 6, T2S, R8E			
SW-NW-SW			
El. 795 - TD 4115(SDR)			

Wayne County (continued)

Operator: Petrolia	DND 736	CIN 5 3134	TRN 3723
Farm: Fowler			
PN: 19379	A2C 2495		
Sec. 7, T2S, R8E	A2E 2673		
NW-SE-NW	CLN 3002		
El. 791 - TD 4252 (SDR)	CAT 3015		

Operator: Darke Bros.	DND 220	CIN5 2660	TRN 3240
Farm: Truesdell #1			
PN: 3813			
Sec.25, T2S, R8E			
SW-SW-SW	CLN 2520		
El. 658 - TD 3600 (SDR)	CAT 2540		

Operator: None listed	DND 125	CIN5 2490	TRN 3065
Farm: Ford #1	DTR 215		
PN: None listed			
Sec. 22, T2S, T10E			TRM 3940
NE-NW-SE			
El. 612 - TD 3960 (SDR)	CAT 2355		

Operator: Panhandle Eastern	DND --	CIN5 2413	TRN 2990
Farm: Fomoco #1	DTR 195	CIN4 2422	BLR 3400
PN: 25560	A2C 1780	CIN3 2473	GLW 3866
Sec. 19, T2S, T11E	A2E 1932	CIN2 2546	TRM 3882
W-SE	CLN 2261	CIN1 2590	
El. 588 - TD 3917 (GRL)	CAT 2294	UTC 2695	

Operator: Leatherman			TRN 2830
Farm: Scheffler			
PN: 3265			
Sec. 26, T3S, R8E			
SE-SW-NE			
El. 667 - TD 2960 (SDR)			

Operator: Lancy & Churchill		CIN5 2000	TRN 2500
Farm: Ecorse Twp. #1			
PN: None			
Sec. 34, T3S, R11E			
W			
El. 593 - TD 2610 (SDR)			

Operator: Bonanza Oil	DND --	CIN5 1960	TRN 2483
Farm: DeRoy #1			
PN: 5830			
Sec. 22, T4S, R8E			
S-SW-SE			
El. 642 - TD 2560 (SDR)	CAT 1808		

<u>Wayne County</u> (continued)

Operator: Uhl	DND --	CIN5 1887	TRN 2425
Farm: Kuehl #1	DTR 65		
PN: 19214			
Sec. 26, T4S, R8E			
NW-NW-SW	CLN 1715		
El. 637 - TD 2827 (SDR)	CAT 1734		

Opr: Pontchartrain Petrol.	DND --	CIN5 1810	TRN 2440
Farm: Boynton #1			
PN: 3701			
Sec. 27, T4S, R8E			
NW-SE-NE			
El. 640 - TD 2566 (SDR)			

Operator: McClure	DND --	CIN5 1961	TRN 2550
Farm: Fritsch et al #1	DTR 87		
PN: 19260			
Sec. 1, T4S, R9E			
NE-NE-SE	CLN 1827		
El. 621 - TD 2885 (SDR)	CAT 1838		

Operator: Voorhees	DND --	CIN5 2090	TRN 2640
Farm: Poet #1			
PN: 10211			
Sec. 6, T4S, R9E			
NE-SW-SW			
El. 642 - TD 2955 (SDR)			

Operator: Sun	DND --	CIN5 1975	TRN 2564
Farm: Haener et al #1	DTR 79		
PN: 11746	A2C 1330		
Sec. 9, T4S, R9E			
NE-SW-SW	CLN 1848		
El. 632 - TD 2942 (SDR)	CAT 1865		

Operator: Colvin Assoc.	DND --	CIN5 1875	TRN 2445
Farm: Theisen #1			BLR 2860
PN: 10430			GLW 3300
Sec. 16, T4S, R9E			
NE-SE-SE			
El. 625 - TD 4028 (SDR)	CAT 1715	UTC 2280	

Operator: MacCallum	DND 76	CIN5 1980	TRN 2515
Farm: Gumtow #1	DTR 135		
PN: 10877			
Sec. 17, T4S, R9E			
C-SW-NW	CLN 1810		
El. 633 - TD 2610 (SDR)		UTC 2345	

Wayne County (continued)

Operator: Acme	DND --	CIN5 1890	TRN 2564
Farm: Dolbozq #1			
PN: 10099			
Sec. 18, T4S, R9E			
NW-NE-NE			
El. 635 - TD 2800 (SDR)	CAT 1850		
Operator: Voorhees	DND --	CIN5 1880	TRN 2526
Farm: Otter #1			
PN: 9546			
Sec. 18, T4S, R9E			
NE-SW-NE			
El. 637 - TD 2733 (SDR)			
Operator: Marathon	DND --	CIN5 1752	TRN 2361
Farm: Marathon #1	DTR 47	CIN4 1774	BLR 2758
PN: BD #146	A2C 1155	CIN3 1814	GLW 3193
Sec. 22, T4S, R10E	A2E 1249	CIN2 1925	PDC 3206
N-SE	CLN 1620	CIN1 1949	
El. 609 - TD 3752 (GRL)	CAT 1636	UTC 2015	
Opr: Penn.Salt Mfg.Co.#14	DND --	CIN5 1910	TRN 2504
Farm: None	DTR --		
PN: None			
Sec. 6, T4S, R11E			
SE			
El. 600 - TD 3368 (SDR)	CAT 1794		