GLACIAL GEOLOGY OF KANE COUNTY, ILLINOIS

BY

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THESIS

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY DAVID LEE GROSS

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BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOLOGY

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INTRODUCTION

Purpose

This study was supported by the Illinois State Geological Survey as part of its environmental geology program. Frye (1967) explained that the geologist's role in the environmental sciences falls into four broad categories: to provide physical data on the terrain itself, data for management and disposal of wastes, data for water resource development and management, and data on the full range of usable rock and mineral materials and subsurface fluids.

Kane County, Illinois, has been repeatedly glaciated and is covered by up to 300 feet of glacial drift. Therefore, in this area, all of the aspects of environmental geology mentioned above are directly dependent on a thorough knowledge of the glacial deposits of the county. This study is a description of the character, sequence, and distribution of the glacial deposits of Kane County.

Kane County was chosen for study for two reasons. It is an area of extremely complex glacial geology, thus, particularly interesting from a geologic point of view; and, it is located on the western fringe of the rapidly expanding Chicago metropolitan area.

Location

Kane County is located in northeastern Illinois (Figure 1). It is the second county south of the Illinois-Wisconsin state line and the third

county west of Lake Michigan. The major cities of the area are Elgin, in the northeastern part of the county, and Aurora, in the southeastern part. Topographic maps which cover the area include all or most of the Pingree Grove, Elgin, Elburn, Geneva, Sugar Grove, and Aurora North 7 1/2' Quadrangles, and parts of the Aurora South, Yorkville, Streamwood, Barrington, Crystal Lake, Huntley, Sandwich NE, Sycamore NE, Sycamore SE, Genoa NE, and Genoa SE 7 1/2' Quadrangles (the last five listed are unpublished, but are available in preprints).

The area lies within the Central Lowlands Physiographic Province (Figure 1) and includes portions of the Bloomington Ridged Plain, the Wheaton Morainal Country, and the Rock River Hill Country. As is obvious from these names, if one used the simple moraine versus till plain classification of glaciated terrain, all of Kane County would be described as having morainic topography.

Most of the area is within the Fox River drainage basin, except for T. 41 and 42 N., R. 6 E., which are part of the Kishwaukee River drainage basin (Pickels and Leonard, 1929). The bedrock (early or pre-Pleistocene) drainage system, now filled with drift, drains south to join the Mahomet valley, except for T. 41 and 42 N., R. 8 E., which drain eastward to the Lake Michigan Basin drainage system.

Previous Work

The literature on the glacial geology of northeastern Illinois is very extensive. Horberg (1953) studied the pre-Wisconsinan drift of

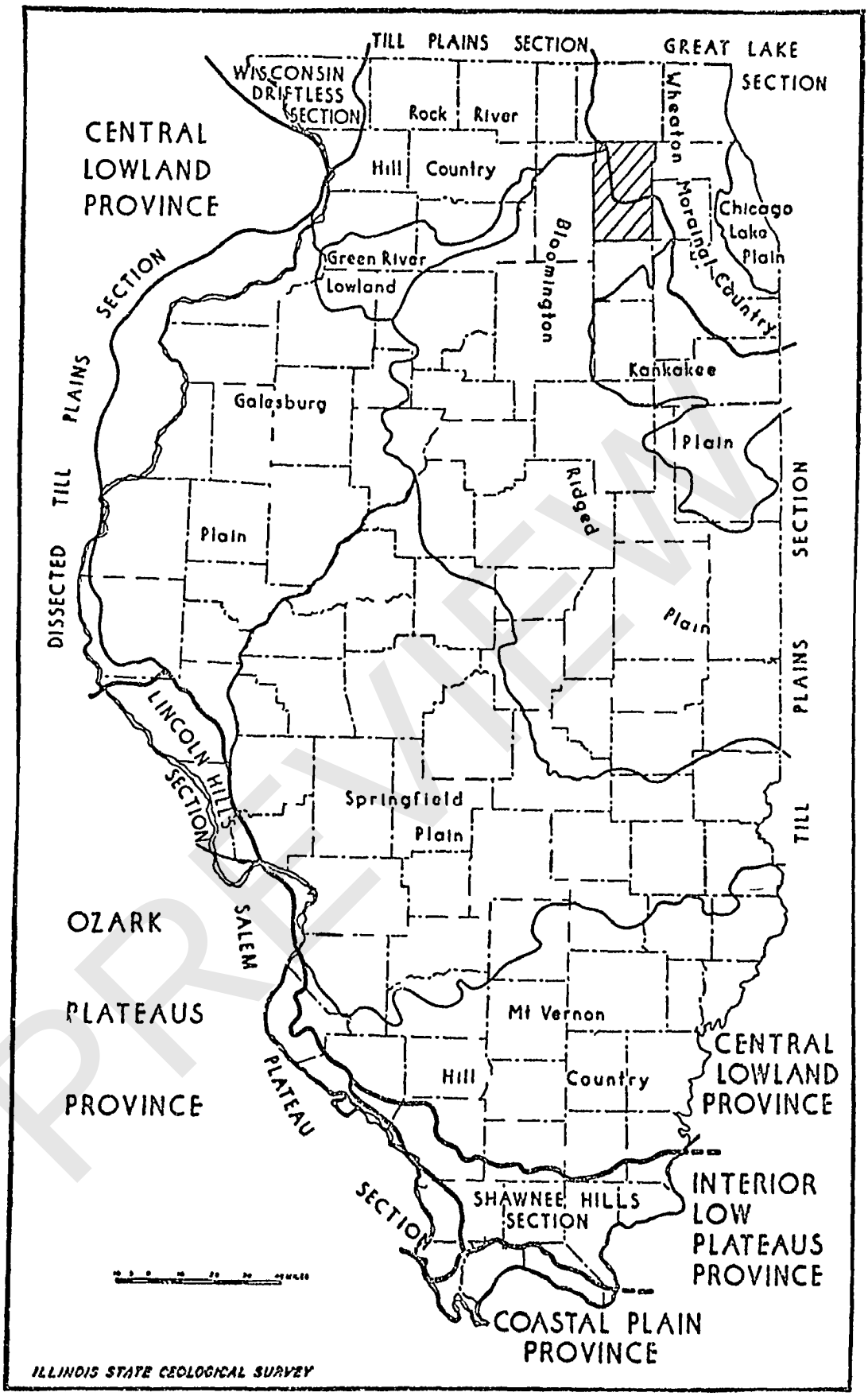

Figure 1. Location of Kane County and Physiographic Divisions of Illinois (after Leighton, Ekblaw, and Horberg, 1948)

northeastern Illinois; Ekblaw (1959) mapped the six county Chicago metropolitan area on a scale of 1/250,000; and Leighton, Powers, Workman, and MacClintock (1931) described the geology of the Barrington, Elgin, and Geneva Quadrangles.

Earlier studies of the glacial deposits of northern Illinois are included in reports by Chamberlin and Salisbury (1885), Leverett (1898a, 1898b), Hershey (1901), and Alden (1909, 1918) The truly classic work is the monograph by Leverett (1899) on the Illinois glacial lobe. Many of the names for the drift units currently in use in northern Illinois were first introduced by Leverett.

The terminology for the classification of glacial deposits of northern Illinois was introduced by Frye and Willman (1960), and amplified by Frye and Willman (1962, 1963a, 1963b), Frye, Willman and Black (1965), Frye, Willman, Rubin, and Black (1968), and Frye Glass, Kempton, and Willman (1969). Other classifications have been proposed by Zumberg (1960), Leighton and Willman (1950), and Leighton (1957, 1958a, 1958b, 1960, 1964, 1965).

Large scale maps of northeastern Illinois, which include Kane County, can be found in Ekblaw (1941), Flint and others (1959), Frye and others (1965), and Suter and others (1959). The loess deposits of northern Illinois have been described by Smith (1942), Frye, Glass, and Willman (1962, 1968), and Frye and Willman (1963a). The mineralogy of the glacial tills of Illinois has been described by Willman, Glass, and Frye (1963, 1966). The soils of this area have been described by Wascher and others (1960) and Hopkins and others (1917).

The glacial geology of the adjacent area to the west has been described by Kempton (1963, 1966), and Kempton and Hackett (1964, 1968a, 1968b).

The sand and gravel resources of the area have been described by Block (1960), Lamar and others (1934), Littlefield (1925a, 1925b), and Ekblaw and Lamar (1964). The peat resources have been described by Soper and Osbon (1922) and Hestor and Lamar (1969). A unique feature of the area, the Kaneville Esker, was first noted by Leverett (1899) and described in more detail by Lukert and Winters (1965). Mastodons found in the area are reported by Wilber (1861), F. Anderson (1937), N. C. Anderson (1905), Bagg (1909), Powers (1936), and Smith (1936).

The environmental geology program in this area has been discussed by Hackett and Hughes (1965), Larsen and Hackett (1965), Hughes (1967), and Frye (1967). The drillers' logs from a series of test borings in Kane County were published by Lund (1965).

PRE-PLEISTOCENE GEOLOGY

Introduction

Although the original work in this report is concerned only with the glacial geology of Kane County, an understanding of the lithology, stratigraphy, structure, and erosional history of the bedrock is essential background information.

Paleozoic sedimentary rocks of Cambrian, Ordovician, and Silurian Systems underlie the glacial deposits in Kane County (Figure 2). Late Ordovician and Early Silurian rocks crop out below the glacial deposits and are locally exposed at the surface along the Fox River in the southern and eastern parts of the county (Figure 3).

The total thickness of the Paleozoic rocks underlying Kane Couny is not known precisely because no wells in the county have penetrated the basement. About 17 wells in the State of Illinois have reached Precambrian rocks, including one well in Sec. 36, T. 41 N., R. 5 E , in DeKalb County, and extrapolations from these wells indicate that the Precambrian surface in Kane County slopes to the southeast, from 2600 feet below sea level in the northern part of the county to 3800 feet below sea level in the southern part. Thus, the Paleozoic sedimentary rocks are estimated to range in thickness from 2500 feet in the northern part of the county to 4500 feet in the southern part. The Precambrian basement probably consists of medium- to coarse-grained granite (Buschbach, 1964, p. 21).

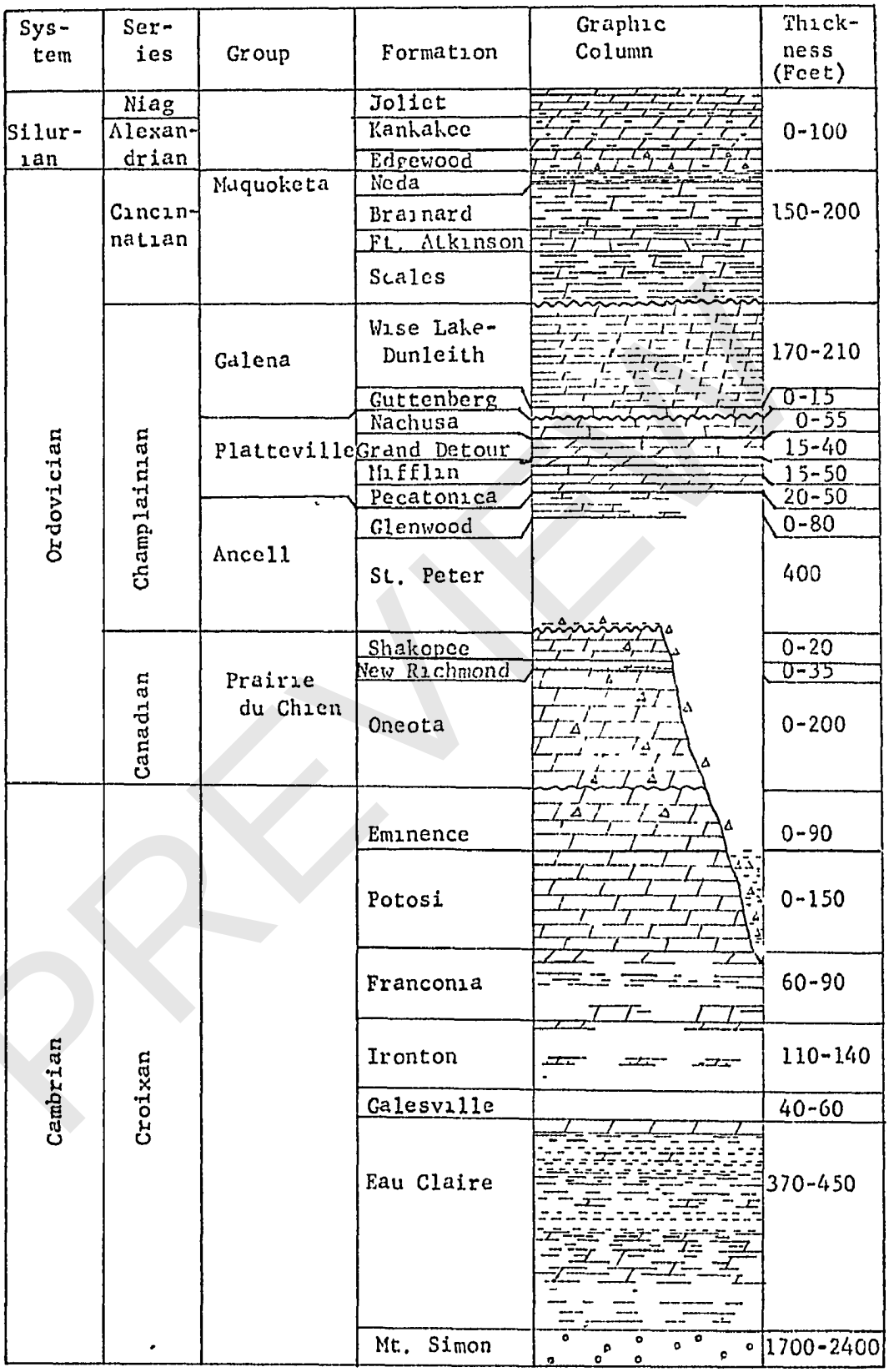

Figure 2. Generalized Columnar Section of Bedrock Strata in Kane County (compiled from Buschback, 1964, Buschback and Willman, 1968, and Zeizel and others, 1962)

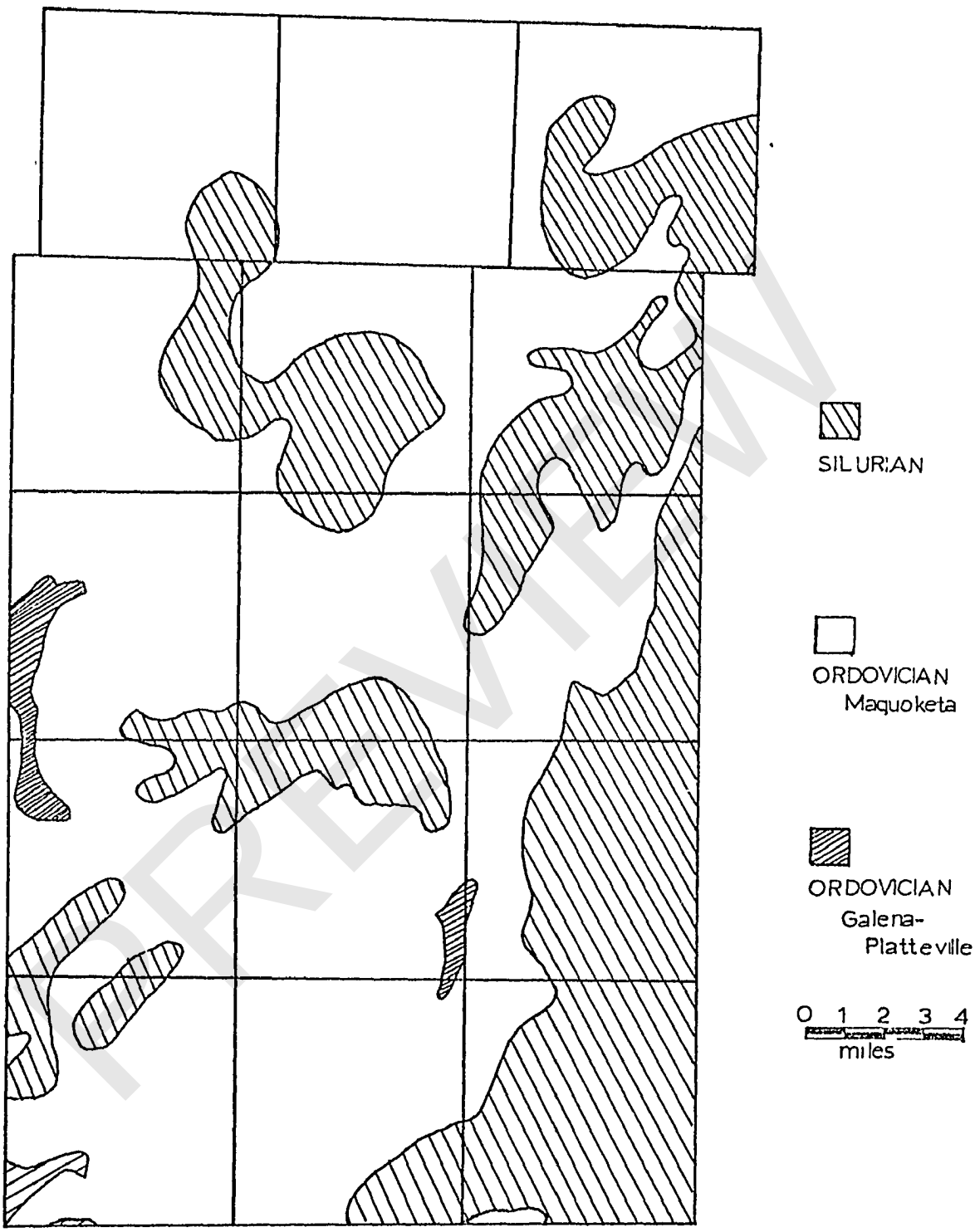

Figure 3. Bedrock Geology of Kane County (after Willman and others, 1967)

The Cambrian and Ordovician rocks of northeastern Illinois have been studied in considerable detail by Buschbach (1964). The Silurian rocks of Kane County have not been studied in detail, although Zeizel and others (1962) described the Silurian of adjacent DuPage County. Other reports of the bedrock geology of this region include Anderson (1919), Ball (1940), Buschbach and Willman (1968), Gutstadt (1958), Suter and others (1959), Thwaites (1923), Templeton (1950), Workman (1950), and Willman and others (1967). The following discussion is summarized in large part from the reports of Buschbach (1964), Zeizel and others (1962) and Willman and others (1967).

Bedrock Stratigraphy

Cambrian System

The Mt. Simon Sandstone consists largely of medium-grained sandstone and unconformably overlies the Precambrian basement. No wells penetrate the full thickness of the Mt. Simon Sandstone in Kane County, but its thickness has been estimated (Buschbach, 1969, personal communication) to range from 1700 to 2400 feet, being thickest in the southern part of the county. The Mt. Simon Sandstone is the second most productive of the Cambrian-Ordovician aquifers although the water hardness increases downward (Suter and others, 1959, p 25).

The Eau Claire Formation overlies the Mt. Simon and consists of fine-grained sandstone, siltstone, shale and dolomite. It is about 400 feet thick in Kane County. Hydrologically, the lower part of the Eau Claire

Formation usually is grouped with the Mt. Simon Sandstone. The upper and lower contacts of the Eau Claire Formation are gradational.

The Galesville and Ironton Sandstones are commonly grouped together and are the major bedrock aquifers of this region. Together they total about 175 feet of sandstone, the lower Galesville Sandstone consisting of about 40 feet of fine-grained, well-sorted sandstone and the upper Ironton Sandstone consisting of about 140 feet of medium-grained, generally poorly sorted, dolomitic sandstone. The contacts above and below are generally considered to be conformable and slightly gradational.

The Franconia Formation consists of argillaceous and glauconitic sandstone or dolomite lying between the rather clean sandstone of the Ironton below and the fine-grained dolomite of the Potosi above (Buschbach, 1964, p. 38). It averages 75 feet in thickness and conformably overlies the Ironton Sandstone. It is conformably overlain by the Potosi Dolomite except in the east-central part of the county where it is unconformably overlain by the St. Peter Sandstone.

The Potosi Dolomite consists of fine-grained dolomite with some drusy quartz and glauconite. It thickens southward, from 50 feet in the north to 150 feet in the south. In the northern part of Kane County, the Potosi Dolomite has been partially truncated by pre-St. Peter erosion.

The Eminence Formation, the uppermost Cambrian formation, is composed of sandy dolomite with beds of sandstone near its base. It is a maximum of 90 feet thick in southern Kane County, but is absent in the northern part of the county. Both the upper and lower contacts are disconformable (Buschbach, 1964, p. 41).

Ordovician System

The Oenota Dolomite, the lower-most Ordovician formation in Kane County, is medium to coarse-grained and cherty. It ranges up to 200 feet thick in the southern part of the county, but has been partially or completely removed by the Pre-St. Peter erosion in the rest of the area The Oneota overlies the Eminence Formation with a slight disconformity and is conformably overlain by the New Richmond Sandstone.

The New Richmond Sandstone is a medium-grained, partly dolomitic sandstone that contains oolitic chert It is present only in the southern part of the area, having been removed by erosion elsewhere, where it reaches a maximum thickness of 35 feet It is conformable with both the underlying Eminence Formation and the overlying Shakopee Dolomite

All but the lowermost 20 feet of the Shakopee Dolomite is removed by the pre-St Peter Sandstone erosion. It is a fine-grained dolomite with beds of sandy dolomite, sandstone, and shale These five dolomite formations (Potosi through Shakopee) are crevassed locally and may yield large quantities of water

The St. Peter Sandstone is a clean medium-grained sandstone which ranges from 100 to 400 feet in thickness. It overlies the Shakopee, New Richmond, Oneota, Eminence, Potosi, and Franconia Formations with the most significant erosional unconformity present in this area. It underlies all of the area and is a significant aquifer although the water is harder than water from the Ironton-Galesville aquifer. The St. Peter Sandstone is conformably overlain by the Glenwood Formation.

The Glenwood Formation, ranging from 0 to 80 feet in thickness, is a dolomitic sandstone and shale. It usually is not distinguished from the underlying St. Peter Sandstone in this area. The upper contact with the Platteville Group is sharp.

The Platteville Group, consisting upward of the Pecatonica Dolomite, Mifflin Formation, Grand Detour Formation, and Nachusa Formation, is chiefly dolomite with some limestone The group thickens slightly to the south, averaging 120 feet, and consists entirely of carbonate rocks which locally may overly unconformably the Ancell Group. The basal contact is the change from dolomite or limestone above to dolomitic sandstone or green shale below There may be an unconformity between the Platteville Group and the overlying Galena Group.

The Galena Dolomite Group consists of medium-grained dolomite that overlies the finer-grained dolomite of the Platteville Group and underlies the shale of the Maquoketa Group. The lower part of this group, the Guttenberg Formation, consists of 0 - 15 feet of red-speckled dolomite. The upper part of the Galena Group, the Dunleith and Wise Lake Formations, consists of 180 feet of buff dolomite. The Galena Group is unconformably overlain by the Maquoketa Group. The upper part of the Galena Group is the oldest rock cropping out under the drift in Kane County. Along the western edge of T. 39 and 40 N., R. 6 E., and in the southeastern corner of T. 39 N., R. 7 E , (see Figure 3) the Galena Group is known from well records to be the uppermost Paleozoic rocks. Both of these areas are manteled completely by the glacial drift. Where they are not

capped by the Maquoketa Group, the Galena-Platteville Groups are together a fairly permeable aquifer

The Maquoketa Shale Group consists of 150 to 200 feet of dolomitic shale, except in the two previously mentioned areas where it has been removed by erosion. This group includes four formations, in ascending order, the Scales Shale, Fort Atkinson Dolomite, Brainard Shale, and Neda Formation. The Neda Formation is described by Workman (1950). Only the dolomite or limestone of the Fort Atkinson Dolomite normally is distinguished in this area. The Maquoketa Shale Group is rather impermeable and acts as a ground water barrier between the underlying and overlying dolomite groups. The Maquoketa Group is the uppermost bedrock over most of Kane County and is exposed at many localities along the Fox River. An exposure at the NE corner of Sec 9, T. 40 N., R. 8 E., shows 12 feet of Silurian Kankakee Dolomite overlying 15 feet of Ordovician Maquoketa shale (Lamar and others, 1934, p. 90).

Silurian System

The earliest Silurian rocks of the area are Edgewood and Kankakee Formations. The lower of the two, the Edgewood Formation, is an argillaceous- to fine-sandy, light gray to gray-brown, finely crystalline dolomite. At some places it is quite similar to the dolomite of the Maquoketa Group. It is overlain by the Kankakee Formation, which is a light gray to buff, cherty, finely crystalline dolomite. These rocks are thin in this area and occur as erosional outliers in the central and western parts of the county, when they total only a few tens of feet.